



**An Elicitation Method for Technology-Assisted  
Goal Setting: Combating Problematic Social  
Networks Use as a Case Study**

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requirements of Bournemouth University for the  
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## ABSTRACT

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Now that digital media has become an integral part of our everyday lives, people spend significant time using it for various purposes, including social networking and gaming. There is increasing acceptance in the literature of the link between obsessive, compulsive, and excessive usage of social media, e.g. social networks, and the wellbeing of users, whether personal, economic, or social. Despite the research on the negative experiences linked to problematic social networking usage, the work on how to regulate such an effect is at a preliminary stage. In the literature on *behavioural change*, technology-assisted solutions that utilise the concept of behavioural goals have started to appear, such as gamification and persuasive technology, mainly to increase motivation for change. Also, the literature has revealed that social networks can be augmented with functionalities to assist those seeking to regulate their problematic usage.

When technology is used to assist behavioural change, e.g. apps for diet and smoking cessation, requirements become behavioural. While there are established methods for capturing business requirements in organisational information systems, characterised mainly by being a desired and declared state of the system, capturing behavioural requirements, such as goals, requires a different approach to the entire engineering lifecycle. Behavioural requirements gathering and validation would require dealing with issues of unreliability and denial present in problematic behaviours. Therefore, this thesis aims to provide a method expressly tailored to the elicitation of behavioural requirements. The method will be supported by the goal setting strategy and its associated elements.

In order to attain this aim, this thesis followed a qualitative research approach with experts, practitioners, and end-users who self-declared having problematic social networking usage and seeking help. This process includes literature reviews, focus group sessions, experts' and practitioners' interviews, user interviews, and analysis of extended survey comments. Research conducted resulted in reference checklists for common goal setting elements, a taxonomy of the negative life experiences associated with problematic usage, and users' perceptions of the use of technology to assist goal setting. The results of the studies helped to propose a method to support users in specifying their goal-setting design requirements. The thesis then evaluated the proposed method with representative users who self-declared having problematic social network usage. The evaluation aimed to investigate the method's effectiveness, whether it covers all the goal-setting elements, and how communication should work between study participants.

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## 1. CHAPTER 1: INTRODUCTION

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Now that digital media has become an essential part of our everyday lives, people spend a considerable amount of time using it for different reasons, including social networking and gaming. However, as stated by Freeman (2008), a recognised problem emerges as people spend a considerable amount of time using digital media, which might cause difficulties in various aspects of their lives. In certain situations, overdependence on such media may be attributed to emotional escapism, such as relief from stress, depression, and other real-life problems (Alblwi et al. 2019; Altuwairiqi, Kostoulas, et al. 2019). Such overdependence has brought about problematic usage of digital media. Problematic digital media usage exhibits symptoms similar to substance addiction, e.g. salience, mood modification, tolerance, withdrawal symptoms, and relapse. Problematic digital media usage can be described as a high degree of behavioural dependence caused and facilitated by the use of software products (Ali et al. 2015).

Problematic digital media usage is becoming a globally recognised problem. For example, within five minutes of waking up, 40 per cent of adults in the UK look at their phones, and 37 per cent of adults check their phones five minutes before turning the lights out (Ofcom 2018). Also, the UK tops the list of the prevalence of internet addiction among university students at 18.3 per cent, followed by Poland at 16.2 per cent and Taiwan at 15.1 per cent (Kuss et al. 2013), while in (Müller et al. 2014), the prevalence of internet addiction in the general German population was 2.1 per cent. Surveys in the United States and Europe found that 1.5–8.2% of the general population used the internet excessively (Weinstein and Lejoyeux 2010). We note here the different, perhaps subjective, metrics used in these tests. However, problematic social networking usage is still not recognised as a mental disorder by the Diagnostic and Statistical Manual of Mental Disorders (DSM 5) (American Psychiatric Association 2013). In 2018, the World Health Organisation recognised gaming disorder, meaning approaches to combating it are now necessary.

Although problematic social networking usage is becoming a significant issue in many countries, it is seen as a problem with the users rather than the software or software developers. Therefore, it is not considered within the boundaries of the software engineering community (Alrobai et al. 2014). Thus, existing research on problematic social networking usage is mainly from other disciplines, such as psychology and sociology. The focus is on the motive for the problem behaviour and personality traits linked to the usage. For example, people with low self-esteem use social networks, e.g. Facebook, to increase their online self-esteem (Zywica and James 2008). The software engineering community is not mandated to find a solution to problematic social networking usage and the problems related to it, unlike in substance addiction, such as addiction to alcohol and tobacco products, where clear rules and regulations on how to manufacture, advertise, and sell them to consumers are set.

Technology-assisted solutions have been created for various health behavioural change purposes, including applications for dietary behavioural change, physical fitness, and smoking cessation. The realisation of the role of technology and the possibility of using persuasive techniques such as gamification have led to an increasing interest in employing technology-assisted interventions to manage problematic digital behaviour such as social networks (Alrobai et al. 2019).

The authors (Alrobai et al. 2014; Ali et al. 2015; Altuwairiqi, Jiang, et al. 2019) have made the case that technology is a medium that facilitates problematic behaviour. Still, it can also be part of the solution by accommodating better designs that are not distractive and obstructive to users and delivering behaviour change techniques quickly and contextually. Usually, such systems motivate people to regulate their behaviour by employing strategies such as goal setting and persuasive messages that can assist in the behaviour change process. Torres-Rodríguez et al. (2017), created a software intervention system to help reduce online video game addiction symptoms and enhance adolescents' well-being. The initial study results revealed a reduction in various areas, i.e. the time spent on video games, symptoms related to problematic internet gaming, and enhancement in their day-to-day activities. Also, Taylor et al. (2014), suggest that using short informational videos, e.g. stories of other users' experiences related to internet addiction, can help reduce problematic usage of the internet. Their findings revealed that such videos enhanced users' attitudes towards the reduction of their internet behaviour.

Given the argument that technology can be designed to sense and respond to problematic use types (Ali et al. 2015), the work on how this can be realised is in its infancy. Classic software engineering would fall short here, despite the special mission of software to alter a user's behaviour. Hence, software requirements here are behavioural and potentially in conflict with the users' present mental and psychological state. Current methods for digital behavioural change, such as Apple iOS Screen Time (<https://support.apple.com/en-gb/HT208982>) and Google Digital Wellbeing (<https://wellbeing.google.com/>), concentrate on conscious interaction with technology to help users avoid viewing repetitive content; setting limits, e.g. in terms of time spent and break times; preventing interruptions, e.g. by muting notifications; and improving health, e.g. by advising users. Such tools focus on user-device interaction and can be used to a large degree as tools for optimising use. The behaviour change will involve a much more in-depth analysis of the interaction material, not just the amount and frequency, but also the profound reasons why the individual may become over-dependent.

Goal setting is a crucial element of different behavioural change interventions. As far as Fogg's mechanisms are concerned, target setting relates to reduction and tunnelling, where smaller measures contribute to a greater objective; self-tracking, where achievement of the objective is monitored and enforced; feedback, where peer monitoring can place pressure on the attainment of the goal; surveillance, where peer monitoring can put pressure on goal achievement; and

conditioning, where failure or achievement of the targets is sufficiently rewarded (Fogg 2002). Fogg mechanisms refer to methods that can be employed to persuade users to perform a behaviour by reducing the time taken to perform the behaviour. Simplifying actions has a strong persuasive impact on performing the behaviour. To put it another way, persuasion design is strongly reliant on the power of simplicity. All these things work together to reduce the cognitive burden of users and obstacles to performing a behaviour.

In terms of Cialdini's principle of influence (Cialdini 1984), goal setting is well correlated with the principles of commitment and consistency, where people remain driven to uphold a behaviour that helps or helps them achieve the goal of improving behaviour.

The use of technology to facilitate goal-based behaviour change is on the rise, but we still have little understanding of how it should be engineered. When we take elicitation, as an example, such goals are not necessarily aligned with the desired status of the user. However, they may be against their current interests and propositions, but motivated by achieving a bigger goal in the long term. For example, reducing smoking by 20% a day would not be a goal in itself, but rather a behaviour investment towards achieving another behavioural gain in smoking cessation. These goals are also different from business goals because they are highly subjective and influenced by intense human factors. Behavioural goals relate to properties inherent in personality and the perception of self-efficacy and self-esteem, which are not typically the primary focus of classic business information systems requirements. This means behavioural goal elicitation processes and specification methods may need a dedicated and specialised approach.

Several mobile apps use goal setting for behavioural change purposes, including apps for fitness purposes, smoking cessation, and managing problematic phone usage. An example of such an app is presented in **Figure 1** below. Space is a behavioural change application designed to help people reflect on how they use their mobile phones and how such usage affects them and others around them. Space focused only on goals relating to time and frequency of usage and not on the content of the usage. Users have the right to see the content on social networks, such as how many comments and shares they have made. They did not consider factors such as peers supporting each other to achieve their goals, and deviation countermeasures to help prevent deviations or potential deviations from the set targets.

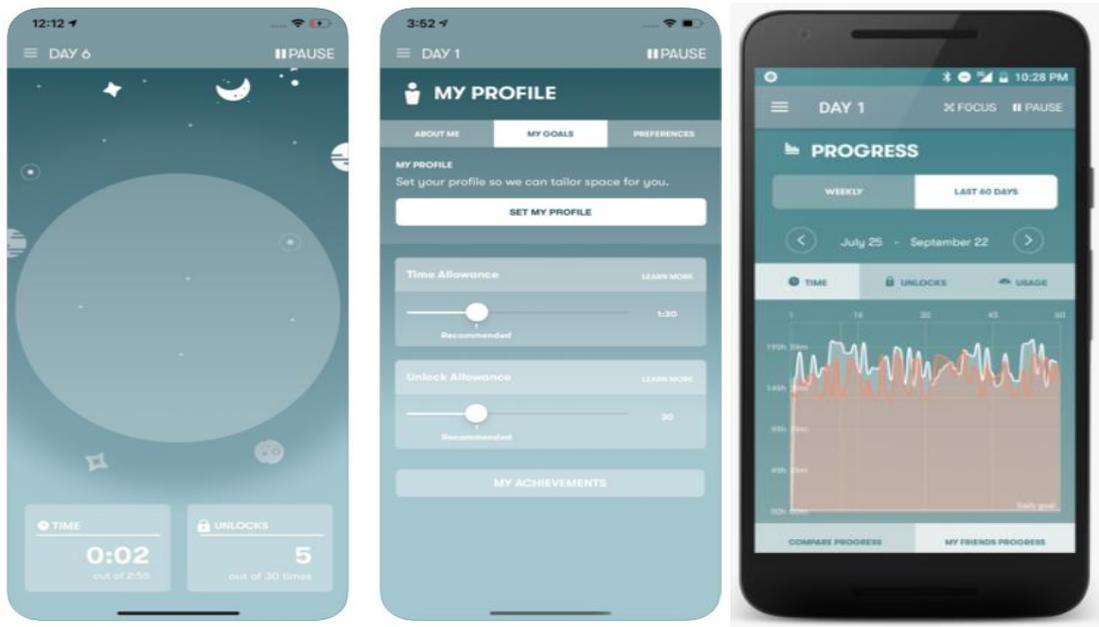


FIGURE 1: GOAL SETTING INTERFACES OF SPACE APP (SPACE 2020)

In the case of social network usage, both the behaviour and the proposed intervention occur online, enabling the setting of goals, monitoring of goal progress, traceability of usage, and the delivery of countermeasures for deviations in real-time. Despite the popularity of the goal setting strategy in other disciplines, to the best of the researcher’s knowledge, there is a lack of specific and structured approaches on how to elicit, specify, and manage behavioural goals.

The lack of a method for eliciting goal-setting design requirements prompted the need for this research thesis. This thesis proposes an elicitation method that will enable the elicitation of goal setting design requirements, including performance monitoring, feedback preferences, and deviation countermeasure strategies to manage problematic social network usage. The method is for developers of social network applications who would like to augment their platforms with a goal-setting tool to help users who are seeking to regulate their problematic usage. The proposed method can be used as an interview template for gathering the goal-setting requirements. To the best of the researcher’s knowledge, this research will be the first of its kind, and it will lay the foundation for further research in this area. Goal setting and its elements and user story format are employed to build elicitation templates to aid a process expressly tailored to the elicitation of users' preferences for various goal setting elements.

## 1.1 THESIS AIM

This thesis aims to explore goal setting as a mechanism to combat problematic social network usage and propose an elicitation and design method that aids the design of a software-assisted solution to host or support the goal setting process. This method will enable a person experiencing

problematic usage, with the help of a system analyst, to specify their goal setting design requirements. This thesis will take social networks as an exemplary case, e.g. Facebook.

## 1.2 THESIS QUESTIONS

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Based on the thesis aim, the questions below are developed to set the boundary of this research.

- **RQ1**-As the literature on goal setting is distributed across different disciplines, the first question is, what are the various facets of goal setting and how can they be applied to problematic social networking usage?
- **RQ2**-What role could software play in helping reduce the negative life experiences linked with digital addiction?
- **RQ3**-As goal setting has been proposed mainly for in-person use, what are the opportunities, challenges, user acceptance criteria, and design recommendations for technology-assisted goal setting?
- **RQ4**-How can the findings of **RQ1**, **RQ2**, and **RQ3** be used to develop an elicitation method for specifying goal setting design requirements to combat problematic social network usage?

## 1.3 THESIS OBJECTIVES

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In order to answer the thesis research questions, the following objectives were formulated.

- **Objective 1: Conduct a literature review on problematic social networking usage and related areas.**

The research will perform a literature review around problematic social media usage from the psychology, healthcare, and computing communities. Furthermore, this review will look into other elements, including behaviour change theories and technology-assisted behavioural change, requirements elicitation techniques, and software design approaches. The review aims to gain background knowledge and further understand relevant concepts related to this research. Achieving this objective will help inform the studies to be conducted in the thesis and the design of the thesis solution.

- **Objective 2: To provide a taxonomy of goal setting elements**

The first part of this objective will explore the literature on goal setting and its current practise in different disciplines, including how goals are set, how to monitor deviations from behaviour goals, and how to provide feedback on goal performance. Conducting an interdisciplinary review of the literature would help synthesise a taxonomy of goal setting. In the second part, focus group sessions will be held to instantiate and refine the goal setting elements gathered from the literature, such as types of goals, the source of goals, and how deviation could occur in the case of problematic social networking usage. The aim will be to gather insights into how people perceive

technology-assisted behavioural goals and whether additional elements could be found in the literature. Consequently, five reference checklists will be created, which will serve as a reference point in persuasive and motivational systems for researchers and practitioners. The purpose of creating the reference checklists is to consolidate the knowledge in this area and present a structured presentation of the common facets and elements of goal setting. The five reference checklists were created because our literature review findings showed that when research is done on goal setting, these are the main facets of goal setting that people talk about. Therefore, after gathering the goal setting elements, we classified and presented them into five categories in relation to the five dimensions, i.e. sources of goals, goal identifiers, monitoring and feedback, deviation causes, and deviation countermeasures.

**Objective 3: To provide taxonomy of the negative life experiences associated with problematic social network usage**

A literature review will be conducted in order to provide that taxonomy. The research will then conduct focus group sessions to elaborate and describe the findings from the literature review based on participants' experience with problematic social networking usage; this will help classify the negative life experiences into various categories. This is meant to provide a comprehensive view of the negative experiences for researchers and help inform the exploration of the role of technology-assisted solutions in facilitating healthier styles of social network usage and reducing such negative experiences.

- **Objective 4: To explore technology-assisted goal setting to combat problematic social networking usage.**

This research will conduct a multi-stage empirical study to explore users' views on the use of technology-assisted goal setting to help regulate problematic usage of social networks. The focus will be on the opportunities and challenges encountered when technology is used to facilitate the goal setting process. Also, users' acceptance criteria will be investigated, looking into the perceived usefulness and ease of use of the technology. In order to help achieve the aim of this objective, the thesis will first conduct a focus group session to explore users' views on technology-based interventions in assisting behavioural change and, second, semi-structured interviews with experts and practitioners on warning labels. Third, semi-structured interviews with users who self-declared having problematic social media usage and acknowledged the significance of using technology to help manage their problems; and fourth, building on a previous survey on digital warning labels in terms of the number of participants and the comments they provided, and then analysing the comments.

- **Objective 5: To create, evaluate, and refine a method for eliciting the design requirements of technology-assisted goal setting as an additional layer to social networking**

The findings from Objectives 2, 3, and 4 will be used to develop templates for eliciting goal setting design requirements. The elicitation method is meant for system analysts and design teams who would like to augment/extend their social media platforms with an additional layer for goal setting. The proposed method will enable help seekers, system analysts, and other stakeholders to be involved in the elicitation of the goal setting design requirements that would allow users to manage their problematic social network usage. The system analysts involved in the process guide users to express their goal-setting requirements and provide specific good design practices.

The evaluation will follow a case study approach. The evaluation will be performed from both experts' and users' perspectives to assess the ability of the method to aid the elicitation of goal setting design requirements and refine the elicitation template and its accompanying documents. The method will be evaluated, focusing on the clarity of the templates by assessing the understandability, efficiency, and completeness of the elements in the templates, i.e. the extent to which the elements cover all goal setting aspects, and the relevance of the various elements. Chapter 3 is not included in **Table 1** because it is the methodology chapter.

TABLE 1: MAPPING THE THESIS RESEARCH QUESTIONS, OBJECTIVES AND CHAPTERS

<b>Research Question</b>	<b>Objectives Outcome</b>	<b>Chapters</b>
What are the various facets of goal setting and how can they be applied to problematic social networking usage?	<b>Objective 1</b> <b>Objective 2</b>	<b>Chapter 2</b> <b>Chapter 4</b>
What role could software play in helping reduce the negative life experiences linked with DA?	<b>Objective 3</b>	<b>Chapter 5</b>
As goal setting has been mainly proposed for in-person use, what are the opportunities, challenges, acceptance criteria, and design recommendations for technology-assisted goal setting?	<b>Objective 4</b>	<b>Chapter 6</b>
How can the findings of RQ1, RQ2, and RQ3 be used to develop an elicitation method for specifying goal setting design requirements to combat problematic social networking usage?	<b>Objective 5</b>	<b>Chapter 7</b> <b>Chapter 8</b>

#### 1.4 THESIS ASSUMPTION

The literature has identified three main stages of addiction, i.e. early, intermediate, and advanced/severe stage. In each step, individuals exhibit a different degree of self-control and specific behaviours and mindsets. Despite the degree to which individuals display addictive behaviour, they can be guided through the stages of change as indicated by the behaviour change model's stages (Prochaska et al. 1998).

- While technology-assisted behaviour change interventions aim to assist individuals with different addiction severity levels, those in the moderate addiction stage will be the key focus for this research thesis. The reason is that technology-assisted solutions are self-regulatory systems, so one cannot expect people who are at the severe stage of addiction to set up their own behavioural goals as they will require constant support throughout the process.
- Also, it is assumed that the software-assisted solution is meant for those who self-declared to have problematic social network usage and are seeking help to regulate their usage. These people are assumed to have a degree of control over their usage, and they do not have a fundamental problem. Hence, if there is problematic behaviour, it is a habitual one, and the aim is to prevent them from losing control entirely and recovering to healthier usage.
- It is assumed that the software where the problematic usage occurs is open to new functionalities, e.g. through public APIs, and the design team would like to augment such software with a layer for goal setting to assist people in self-regulating the problematic usage.
- It is assumed that the elicitation method is meant to be used by an interdisciplinary team of software engineers.

## 1.5 THESIS METHODOLOGY OVERVIEW

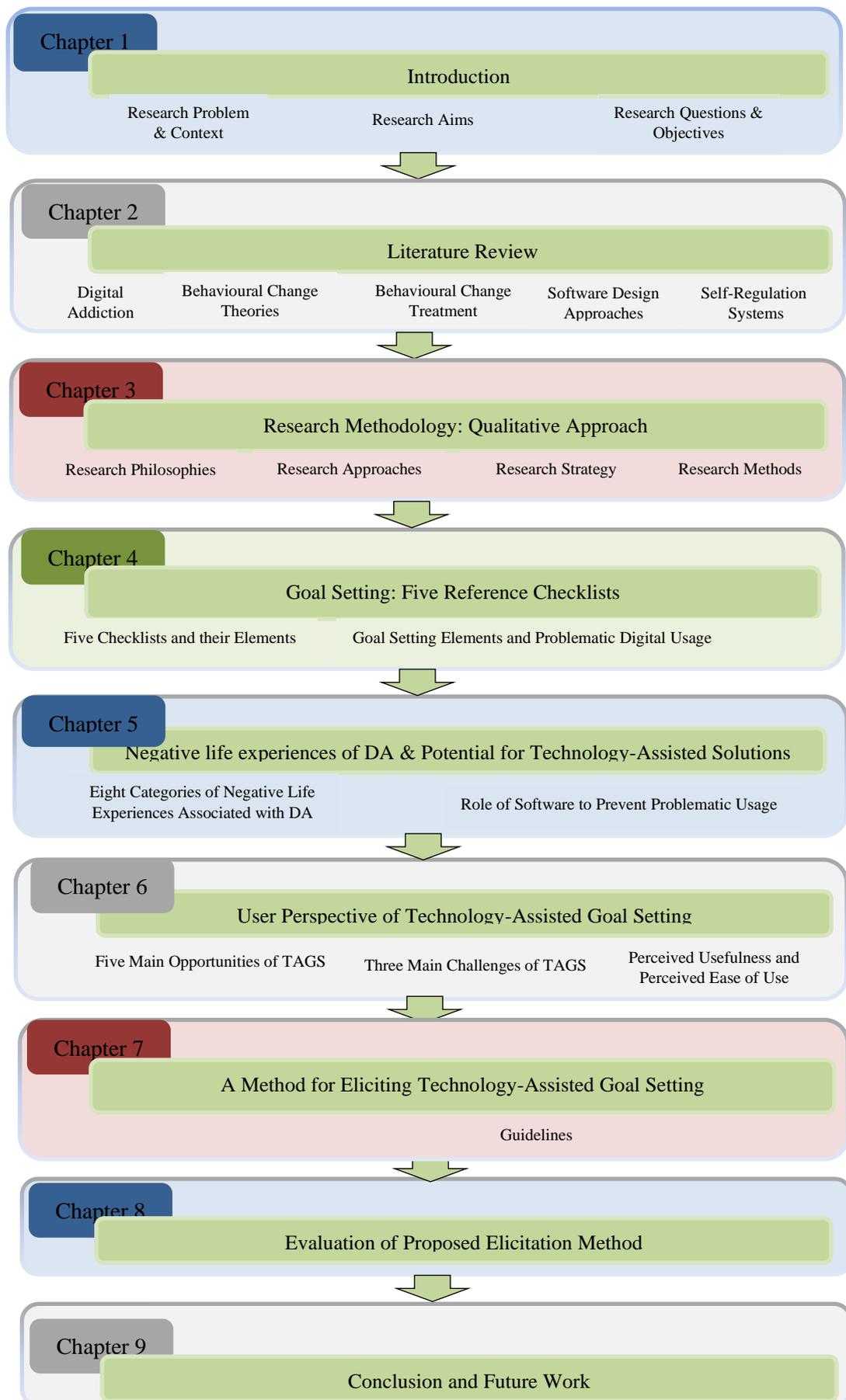
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In order to help attain the aim of the thesis, various methodological approaches will be adopted to aid the attainment of each research objective. The research methodology defines the activities to be followed to collect data to inform the thesis findings. A brief explanation of the thesis methodology will be provided in this section. A detailed description of each research method will be presented in their respective chapters. This research study requires a focus on the users' perspective. Since the research problem requires investigation into users' perceptions of technology-assisted goal setting, this thesis will adopt a pragmatic paradigm approach. Since users are the ultimate target regarding such technology, their perception is paramount. The pragmatic paradigm enables researchers to select the most suitable research methods to address the research problem (Saunders et al. 2009). Pragmatism philosophy frequently utilises multiple methods of research and does not consider a single outright process as a solution to the problem (Creswell 2003). Finally, a case study approach will be conducted to evaluate the method and its CASE tool for eliciting goal-setting design requirements. This thesis's research methodology is discussed in Chapter 3, exploring various methods, potential options for this research thesis, and the correct methodological approach.

## 1.6 THESIS STRUCTURE

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This thesis is structured as follows, and the sequence of the chapters is illustrated in **Figure 2** below. **Chapter 2** presents the literature review for the research. This chapter addresses various relevant topics in problematic social networking usage and other related fields to help identify and solve the research problem. This thesis's research methodology is discussed in **Chapter 3**, discussing various research approaches, potential choices, and the methodological approach suitable for this thesis. In **Chapter 4**, results from the exploratory study on goal setting and its elements are presented in reference checklists displaying the aspects that are commonly mentioned when people talk about the goal setting strategy. **Chapter 5** presents eight categories of negative life experiences linked with problematic digital media usage gathered from the literature and elaborates on the findings through two user studies. **Chapter 6** presents user study findings focusing on the opportunities, challenges, and users' perceived acceptance factors of technology-assisted goal setting (TAGS) to enlighten the design team of such technology and inform a better design process. A systematic approach to eliciting goal-setting design requirements to inform a better elicitation process is proposed in **Chapter 7**. In **Chapter 8**, the TAGS method is evaluated for understandability, usefulness, and completeness in gathering the goal-setting design requirements for problematic social networking usage. Finally, in **Chapter 9**, a summary of the research thesis, i.e. thesis contributions, and future research work, is presented. **Chapters 4** and **5** are published in the International Conference on Persuasive Technology 2019 and the World Conference on Information Systems and Technologies 2019 (see **Section 1.7** for full paper titles and conference details).



## 1.7 PUBLICATION ARISING FROM THIS THESIS

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Cham, S., Algashami, A., McAlaney, J., Stefanidis, A., Phalp, K and Ali, R. *Goal Setting for Persuasive Information Systems: Five Reference Checklists. 14th International Conference on Persuasive Technology*, Limassol, Cyprus 9-11 April 2019. LNCS Springer. DOI: 10.1007/978-3-030-17287-9\_20.

Cham, S., Algashami, A., Aldhayan, M., McAlaney, J., Phalp, K., Basel Almourad, M., Ali, R. Digital Addiction: Negative Life Experiences and Potential for Technology-Assisted Solutions. *WorldCIST'19 – 7th World Conference on Information Systems and Technologies*, La Toja Island, Galicia, Spain 16-19 April 2019. Springer AISC Series. DOI: 10.1007/978-3-030-16184-2\_87.

### **The author contributions, as a co-author, in related research:**

Algashami, A., Cham, S., Vuillier, L., Stefanidis, A., Phalp, K., and Ali, R., 2018. Conceptualising Gamification Risks to Teamwork within Enterprise. *The Practice of Enterprise Modelling*. Cham: Springer, Cham, 105–120. DOI:10.1007/978-3-030-02302-7\_7.

Aldhayan, M., Cham, S., Kostoulas, T., Basel Almourad, M. and Ali, R., 2019. Online Peer Support Groups to Combat Digital Addiction: User Acceptance and Rejection Factors. *In: WorldCist'19 - 7th World Conference on Information Systems and Technologies*, La Toja Island, Galicia, Spain 16-19 April 2019. DOI: 10.1007/978-3-030-16187-3\_14.

McAlaney, J., Aldhayan, M., Almourad, B., Cham, S., Ali, R., 2020. Predictors of Acceptance and Rejection of Online Peer Support Groups as a Digital Wellbeing Tool. *Conference: WorldCist'20 - 8th World Conference on Information Systems and Technologies*, Budva, Montenegro 7 - 10 April 2020. DOI: 10.1007/978-3-030-45697-9\_10.

McAlaney, J., Almourad, B., Aldhayan, M., Cham, S., Ali, R., On the Need for Cultural Sensitivity in Digital Wellbeing Tools and Messages: A UK-China comparison. *Conference: WorldCist'20 - 8th World Conference on Information Systems and Technologies*, Budva, Montenegro 7 - 10 April 2020. DOI: 10.1007/978-3-030-45691-7\_68.

## 1.8 DECLARATION OF AUTHORS CONTRIBUTION

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The author of this thesis was the first author of the publications derived from the thesis. The contribution of the first author was as follows:

- Establishing and articulating the idea and the research aim of each paper.
- Deciding upon suitable research methodology to be employed in each paper (e.g. qualitative mixed-method approach).
- Designing and implementing the empirical studies presented in each paper (e.g. developing interview transcripts, recruiting study participants, and collecting and transcribing the data).
- Analysing and interpreting the collected data and drawing conclusions (e.g. qualitative analysis).
- Reporting the study findings and completely writing each paper.

The co-authors contributed to each published paper in terms of verifying and validating the studies' findings by comparing them against the actual responses from the participants. They also

provided guidance and feedback on the structure and overall articulation of the papers' message. In addition, they gave insights on the research methodologies and also checked the quality of the papers in terms of the writing style and ideas presented, and suggested modifications to some parts of the text. Furthermore, the co-authors enhanced the papers with the appropriate terminology in certain places, especially those related to the venue where the papers were published.

## 1.9 CHAPTER SUMMARY

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This chapter introduced the context of the thesis. In addition, the chapter includes the research aim and research questions, research objectives, as well as a brief explanation of the research methodology, publications resulting from the thesis, and the thesis structure. The next chapter will provide a literature review of relevant research on digital addiction and related topics.

## 2. CHAPTER 2: LITERATURE REVIEW

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The term “addiction” can be classified into two categories, i.e. addiction to a substance and addiction to a particular behaviour (Alavi et al. 2012). Behavioural addiction, for example, internet addiction, online gaming, online gambling, or online shopping addiction, is like alcohol or drug addiction. Besides that, in the former, the person is not dependent on a substance but on their behaviour or the gratification brought about/experienced by performing the appropriate behaviour (Alavi et al. 2012). Similar to substance addiction, behavioural addiction incorporates the experience of the ‘classic’ addiction characteristics, namely salience: when digital media usage is a critical task for the user; mood modification: when digital media is used as a coping strategy for users; and compulsion. Intolerance: increased use of digital media over time; withdrawal symptoms: behaving uncomfortably if one is unable to connect or communicate with digital media as one wishes; conflict: interpersonal or intrapersonal problems linked to digital use; and relapse: quickly returning to the old digital habits of usage after a period of abstinence (Griffiths 2005).

This chapter aims to provide an outline of the research conducted on behavioural addiction, with a specific emphasis on addiction to digital space, such as digital addiction. This chapter commences by presenting background research on behavioural addiction and then presents digital addiction and various prevention and treatment approaches for behavioural addiction. Finally, because of the multidisciplinary nature of digital addiction, this chapter will also cover aspects associated with technology adoption and the main behavioural change theories that provide a foundation for understanding human behaviour, which could help aid the behaviour change process.

### 2.1 BEHAVIOURAL ADDICTION BRIEF BACKGROUND

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For many years, the concept of addiction solely referred to the ingestion of substances such as drugs or alcohol (Griffiths 2015; Pinna et al. 2015), and reduced control over substance use (Potenza 2006). Marlatt et al. (1988) described addiction as a monotonous habit pattern that raises the danger of disease and related individual and social issues, which eventually affects other areas important to the individual. According to Potenza et al. (2010), several behaviours, other than consuming psychoactive drugs, produce short reinforcement that can trigger persistent behaviour despite awareness of negative consequences, i.e. decreased behavioural control. Recently, the concept of addiction is used to describe behaviours that do not include the taking of substances, such as pathological gambling (McLachlan and Starkey 2011). This stems from the perception that the main components of addictive behaviour can be seen in several behaviours that are not associated with substance use. These main components include preoccupation with the behaviour,

craving or continual desire to engage in the behaviour, reduced control over the drive to engage in the behaviour, repeated unsuccessful attempts to reduce or discontinue the behaviour, tolerance, withdrawal symptoms, and continued engagement in the behaviour despite the adverse consequences related to the behaviour. These behaviours include gambling, compulsive sex, video gaming, Internet and social media use, exercise, computer use, and compulsive buying, i.e. shopping (Griffiths 1996; Pinna et al. 2015). According to Griffiths (1996), behavioural addiction should not be treated any differently from substance addiction, a more established form of addiction. In addition, the author recommended the need to educate people from various walks of life about the probable addictiveness of any activities that deliver continuous and instant rewards.

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### 2.1.1 DIGITAL ADDICTION

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The recent technological revolution, i.e. the introduction of the internet and digital devices such as smartphones, has favourably impacted the work and personal lives of many in various domains. The appropriate use of various online applications could enhance people’s productivity, but productivity could be negatively affected when online usage becomes problematic. Montag and Walla (2016) argued that productive technology usage becomes unsustainable when users start to be distracted from their main duties on a minute-to-minute basis, for example, by receiving notifications from various social media applications, as seen in **Figure 3** below. The authors assumed that frequent interruptions contribute to the highest loss of productivity compared to the total time people spend on their phones. This can be associated with individuals’ lack of deep focus on their present tasks. As depicted in **Figure 3**, users’ productivity continues to fall as their phone usage increases.

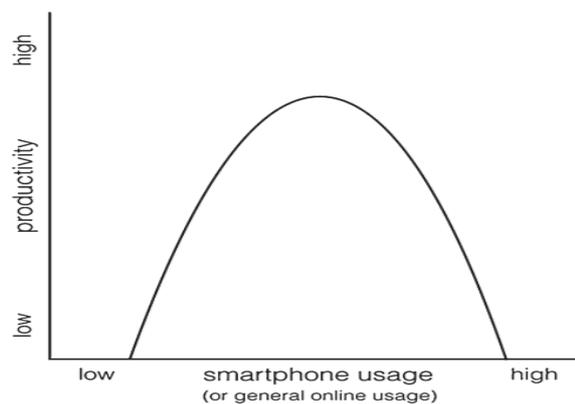


FIGURE 3: SMARTPHONE USAGE AND PRODUCTIVITY (MONTAG AND WALLA 2016)

The positive and negative impacts of the technological revolution have resulted in extensive research efforts to describe and address issues related to internet addiction, a sub-area of digital addiction (Young 1999; Camardese et al. 2015). The term “digital addiction” (DA) can be defined as a high degree of dependent behaviour due to software product use (Alrobai et al. 2014).

The prevalence of internet addiction differs from country to country. For example, Lu et al. (2011) reported a 30% prevalence of internet addiction amongst Japanese employees. In another study conducted in an Indian context, the authors reported an internet addiction of 1.3% in people between 18-65 (Sharma and Sharma 2018). Also, Younes et al. (2016) reported an internet prevalence rate of 16.8%. (Young 1999) classifies online addiction into five types: addiction to computer games, information overload, net compulsions, cyber-sexual addiction, and cyber-relationship addiction. While this classification is still used, it is out of date.

Some factors are considered to make digital technologies more appealing to users and contribute to their addictive nature. According to Greenfield (2011), there are five key factors that make software or digital technologies attractive. These are: content, access/availability, reward, social factors, and gen-D factors. Furthermore, Ali et al. (2015) identified four categories in which the software features that cause DA fall: achievement, exploration, socializing, and killing. They also identified the software's ease of use and its real-time nature as features that reinforce its addictive nature.

According to Nadkarni and Hofmann (2012), social networks are directly linked to people's most intimate needs, such as being part of a group, being recognised, cherished and special. Addiction to social networks, e.g. Facebook, can be regarded as a particular type of digital addiction (Andreassen et al. 2012). Social networks help find old friends and keep in touch with remote people, and their use has increased exponentially over the past decade, see **Figure 4** (Ortiz-Ospina 2019). However, with the increasing popularity of social networks, there is a rise in reports of individuals hooked on such applications, both in the media and in existing literature (Elphinston and Noller 2011), which negatively impacts their real lives. Such dependency increases isolation from real life, which may cause damage to real-life relationships, such as marital or partnership problems. Also, the abusive usage of social networks can cause other negative impacts, such as lack of self-regulation of usage (Sofiah et al. 2011), avoiding other personal tasks, and procrastination (Sheldon 2008). The terms “DA” and “problematic social network usage” will be used interchangeably.

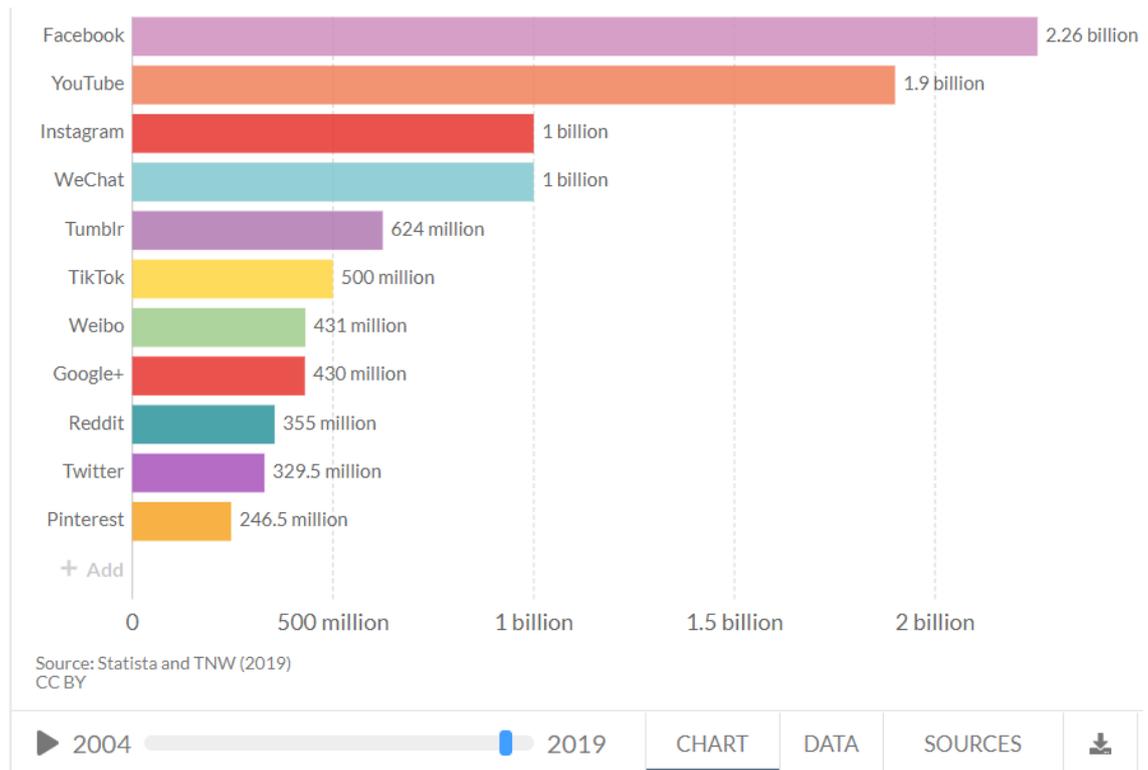


FIGURE 4: NUMBER OF SOCIAL MEDIA APPLICATIONS USERS (ORTIZ-OSPINA 2019)

### 2.1.2 TEST AND MEASUREMENT OF INTERNET ADDICTION

Problematic internet use tests have changed in terms of their validity, target users, dependability, and completeness. There are many instruments used to measure internet addiction, and **Table 2** below outlines some of the measurement scales that are commonly used. Some of the instruments are one-dimensional, i.e. based on one dimension, such as the Compulsive Internet Use Scale (CIUS), while others are multidimensional instruments, i.e. based on more than one dimension, such as the Generalized Problematic Internet Use Scale (GPIUS) and the Online Cognition Scale (OCS). The measurement scales are based on the five behavioural symptoms of internet addiction, e.g. salience, tolerance, conflict, mood modification, withdrawal symptoms, and relapse. The discrepancies in the criteria, scales, cut-off scores, individuals studied, and procedures used to distinguish between problematic and non-problematic internet use have been argued to make assessing problematic internet use difficult (Meerkerk 2007). To overcome these discrepancies, researchers have employed qualitative and clinical interview approaches. A self-reported assessment is another method for determining problematic internet use. Although it lacks the benefits of qualitative assessments, self-report assessments are often used by academics in the field since they provide a quick and easy way to examine internet usage patterns. A summary of some of the measures will be provided in this section. Kimberly Young created the Internet Addiction Test (IAT) to determine which aspects of a person's life may be impacted by their excessive Internet use. The diagnostic questionnaire included eight items that were modified from the DSM-IV criteria for problematic gambling, and 12 new items were also included (Widyanto

et al. 2010). Young proposed a cut-off score of five, which corresponds to the number of diagnostic criteria for problematic gambling. The DSM-IV criteria for substance addiction and compulsive gambling are used to create the CIUS (Meerkerk et al. 2009). Another measurement instrument is the Online Cognition Scale (OCS). The OCS, Davis et al. (2002), was used to assess pathological internet use and has 36 items that can be rated on a 7-point Likert scale.

Of the measurement scales mentioned, the CIUS could be a good choice for running a study measuring internet addiction. The CIUS is useful for online research because of the clarity of its questions, its ease of administration, and its short length (14-item with a 5-point scale). Also, because the CIUS is short, it has been claimed that it can be combined with additional/other measurement scales in an online setting without jeopardising the rate of replies (Meerkerk 2007). The CIUS has a one-dimensional structure that describes compulsive internet use as an inability to refrain from using the Internet. Internet addiction, according to the CIUS, is defined as an addiction to specific online behaviours or activities and describes compulsive internet use as users' inability to refrain from using the internet. This can be linked to one of the elicitation templates that would be proposed in the thesis, as the aim is to collect the aspects that users struggle with when using social networks.

TABLE 2: INTERNET ADDICTION MEASUREMENT SCALES

<b>Internet Addiction Measurement Scales</b>	<b>Authors</b>	<b>Theoretical Basis</b>	<b>Number of Items</b>
Chen Internet Addiction Scale (CIAS)	Chen et al. 2003	Substance dependence and pathological gambling	26
Compulsive Internet Use Scale (CIUS)	Meerkerk et al. 2009	Substance dependence and pathological gambling	14
Generalized Problematic Internet Use Scale (GPIUS)	Caplan 2002	Cognitive-behavioural theory	29
Internet Addiction Test (IAT)	Young 1998	Pathological gambling	20
Online Cognition Scale (OCS)	Davis et al. 2002	Cognitive-behavioural theory	36
Problematic Internet Use Diagnostic-Interview (PIUD-I)	Beard and Wolf 2001	Substance dependence	8
Problematic Internet Use Questionnaire (PIUQ)	Demetrovics et al. 2008	Pathological gambling	18
Thatcher's Problematic Internet Use Questionnaire (TPIUQ)	Thatcher and Goolam 2005	Pathological gambling	20
Virtual Addiction Survey (VAS)	Greenfield 1999	Pathological gambling	10
Questionnaire of Internet use related problems (PRI)	De Gracia Blanco et al. 2002	Substance dependence and pathological gambling	19

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### 2.1.3 TREATMENT AND PREVENTION OF BEHAVIOURAL ADDICTIONS

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According to (King et al. 2011), the continuing debate and lack of consensus on the clinical status of internet addiction in many countries around the world has not stopped the increasing demand for treatment related to internet-related issues. From a clinical perspective, internet addiction is taken seriously, and particular forms of treatment have been introduced in various countries (King et al. 2011), thereby affirming the need for medical assistance for those affected. For example, the government of South Korea has supposedly set up a network of more than 140 internet addiction treatment centres and presented various treatment programmes at nearly 100 hospitals (Kim et al. 2006). Similarly, clinics focused on computer-based addiction psychological treatment have appeared in western countries. Many of these treatments use programmes and approaches used in the psychosocial and pharmacological treatment of chemical addictions. Other authors advised that providing educational materials and training on the negative effects of internet addiction could alleviate many problems related to the internet (Young and Case 2004).

Considering the available methods for internet addiction treatment could help the thesis researcher develop a profound understanding of the techniques employed and how they can inform a better TAGS design to help regulate problematic social network usage.

#### 2.1.3.1 PHARAMACOTHERAPY

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In pharmacotherapy, problematic users are assisted in beating their addiction problems by taking a drug (Yellowlees and Marks 2007; Griffiths 2015). This intervention approach is usually targeted at people with chemical addictions. However, it has also been used to support other individuals with behavioural addictions, such as internet addiction and addiction to gambling. In the study by (Shapira et al. 2000), pharmacotherapy intervention was adopted, and excessive internet treatment involved giving users a mixture of mood-stabilizing and antipsychotic drugs. The results indicate that many users have reduced their use of the internet. Previous work has shown that in people who had internet issues, mood stabilisers appeared to be more useful than antidepressants (Shapira et al. 2000). The authors reported a substantial or considerable reduction in problematic internet use in five of fourteen antidepressant single trials (35.7 percent) (Shapira et al. 2000). In the study, twenty subjects, i.e. nine women and eleven men, participated in the study. Twelve out of twenty subjects replied to newspaper advertisements for problematic internet usage, and eight subjects were clinically referred for problematic internet usage as their primary complaint (Shapira et al. 2000). A semi-structured interview was used to assess demographic data and the scope of internet use, including time spent on work or education-related usage versus usage for pleasure or enjoyment purposes.

#### 2.1.3.2 COGNITIVE-BEHAVIOURAL THERAPY

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Cognitive-Behaviour Therapy (CBT) can be defined as

“a structured, directive therapeutic approach that has clear, well-defined goals, is focused on the present time” (Young and de Abreu 2011, p.156).

CBT has been seen as a successful therapy for internet addiction. CBT was also used to treat mental health problems and substance use disorders. The techniques assume addiction is a means to deal with challenging circumstances, dysphoric moods, and social pressure. Treatment is designed to assist addicts in recognising and either avoiding or coping with high-risk situations without using addictive behaviour (Griffiths 2015).

A specialised version of CBT, known as Cognitive-Behavioural Therapy for Internet Addiction (CBT-IA), was created by Young (2011) specifically to be used for the treatment of internet addicts.

### **Phases of the CBT-IA**

The CBT-IA comprises of three phases:

- **Phase 1** – the computer and non-computer behaviour of users or problematic users is examined.
- **Phase 2** – cognitive restructuring, which addresses dysfunctional cognitive processes that lead to addictive behaviour.
- **Phase 3** – harm reduction therapy which helps reduce the negative impact of addiction (Marlatt et al. 2001). Young (2013) performed a study using CBT-IA to explore the effectiveness of the therapy. The study's findings show that addicts treated using this technique performed better when it came to sticking to their structured internet usage schedules than those who did not.

#### **2.1.3.3 PSYCHOTHERAPY**

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Psychotherapy can incorporate everything from Freudian psychoanalysis and transactional analysis to more modern innovations such as drama therapy, family therapy, and minimalist intervention techniques. The therapy may happen as an individual, as a team, as a family or as a group and is fundamentally seen as a ‘talking cure’ comprising of ordinary sessions with a psychotherapist over a given timeframe. Most psychotherapists see maladaptive actions as a side effect of other underlying issues. If the issue is solved, the addiction should vanish. Nevertheless, this is the therapeutic opposite of pharmacotherapy and behavioural therapy, which treat the symptoms instead of the fundamental reason for the problem (Griffiths 2015).

#### **2.1.3.4 MOTIVATIONAL INTERVIEW**

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Motivational interview (MI) has been defined as:

“a directive, client-centred counselling style for eliciting behaviour change by helping clients to explore and resolve ambivalence” (Rollnick and Miller 1995, p.325).

The MI technique was created to assist people in giving up addictive behaviours by using techniques such as “open-ended questions, reflective listening, affirmation, and summarization” (Miller 2010, p.247), to allow people to express why they are worried about change.

The MI has been used in health-related behaviours such as diet adjustment (Vanwormer and Boucher 2004). The technique has been recognised as an incredibly viable technique that health service providers may use to aid pre-contemplators and contemplators (Diclemente and Velasquez 2002). An essential aspect of that strategy is working closely with a client. This is because the counselling process usually starts with great uncertainty about the expectations and the willingness of a client to reach them from both sides (i.e. the counsellor and the client) (Heather and Stockwell 2004). MI is typically goal-oriented, motivational, patient-related and highly dependent on the counsellor's ability to handle the process (Young and de Abreu 2011). Key principles of MI include (i) a client is required to seek support, (ii) assume responsibility, (iii) seek alignment with individual goals and values, and (iv) improve self-esteem (Miller 1983).

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#### 2.1.3.5 *SETTING GOALS*

Due to the vague plans made by people to reduce the number of hours of internet usage, many attempts made by people to reduce their internet or digital usage failed (Young 1999). To prevent relapse, scheduled recovery plans should be arranged for the user by, for example, specifying realistic and achievable targets of 15 hours instead of 30 hours of internet usage. Then, plan those fifteen hours in particular time slots and record them down on a calendar or weekly scheduler. Web sessions should be kept short but regular by the client. That will help to prevent longings and withdrawal. Incorporating a measurable Internet use plan would give the client a sense of being in charge, rather than allowing the Internet to take over.

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### 2.1.4 *MODES OF DELIVERY OF ADDICTION TREATMENT*

Various approaches to treating addictive behaviours are discussed in the literature. The approaches show the environment in which a treatment technique is delivered.

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#### 2.1.4.1 *FAMILY THERAPY*

The family therapy technique could help problematic users who have encountered or are encountering disrupted familial relationships due to their problematic internet usage (Young 1999). In treating problematic internet behaviour among the young, it is essential to involve their families. They can be provided information on methods that they could adopt to help the problematic user. This type of intervention should focus on key areas, including educating the family on how the internet can be addictive, the importance of not playing the blame game,

encouraging family members to assist with the recovery process by helping find new hobbies to undertake as a family, e.g. taking family holidays, or hearing the problem user's feelings (Young 2009). Also, family education should cover elements including how to deal with rage issues and lack of confidence from the problematic user, understanding the recovery process, causes of relapse, and the significance of sustaining healthy internet usage limits (Huang et al. 2010).

Family therapy can be beneficial. However, the idea of family therapy might not appeal to everyone. Therefore, this thesis offers the option for the therapist and the participants to configure the peer support group or the technology-assisted solution so that it may include or may not include the family members of the problematic user, so we are not interfering with their decision, but we offer them functionality to do that if they want. Therefore, if the problematic user prefers their family not to know about the issue or be involved in the treatment, then the therapist can give the individual the option of doing group therapy. Then, at the advanced stage of treatment, i.e., when the problematic user has progressed well in the treatment and has commenced implementing the recommended treatment techniques, the therapist can talk to them again and educate them about the importance of involving their family, especially if the problem affects other members of the family, and also stress the fact that including the family could help reduce relapse. According to Shaw and Black (2008), family therapy can be beneficial when the problematic user's behaviour has interrupted the family.

#### *2.1.4.2 GROUP THERAPY*

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Group therapy appears to be the primary method for treating addictive behaviours (Cao et al. 2007). This strategy could enable a person to find proper support for their problematic internet behaviour. Intervention within a group setting enables group members to reduce the negative life experiences associated with their problematic internet behaviours, such as loneliness, shame, and guilt. They can openly discuss their feelings and gain awareness and knowledge from other group members who are receptive, caring, have experience or are experiencing a similar situation. The group strategy could be influential in assisting members' action recovery plans and their commitment (Huang et al. 2010). The 12-step recovery programs can be adopted to regulate addictive internet behaviour (Young 1999).

#### *2.1.4.3 COUNSELLING THERAPY*

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In counselling therapy, an individual with problematic internet behaviour privately meets with a trained behavioural addiction therapist. During sessions, the counsellor prompts the individual to talk about their problems and how they feel. The counsellor attentively listens and finds areas to further explore with their client. The counsellor would try to help the individual balance their online presence and time spent on other real-life activities. Compared to group therapy, one-on-one counselling allows people to express issues that might otherwise be difficult to voice in a group environment. Compared to family therapy, Shaw and Black (2008) argued that marriage or

couples counselling can be useful when the problematic internet behaviour affecting one member has interrupted their relationship. According to Young and de Abreu (2011), counselling therapy can follow various techniques, e.g. Motivational Interviewing and Cognitive-Behavioural Therapy.

#### *2.1.4.4 SELF-HELP THERAPY*

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Self-help can be described as utilising written documentation or personal computer programs or sound/videotapes to increase understanding or acquire behavioural interventions (Matcham et al. 2014). The self-help modality can be delivered in various forms, including self-support guides, internet-based treatments, disease self-control instruction, and patient advice, with or without expert assistance (Chamberlain et al. 2008). The technique focuses primarily on strengthening the trust of individuals in their ability to attain their goals, i.e. self-efficacy (Watkins and Clum 2008). Self-help can be implemented in various ways, for example, multimedia resources for personal access and use by problematic users. Lancaster and Stead (2005) have indicated that certain values will help to customise this style. According to the Transtheoretical Model, for instance, action-oriented interventions could be slightly successful for people in the pre-contemplation stage (Prochaska et al. 2013).

#### *2.1.4.5 INTERNET-BASED INTERVENTION*

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Internet-based therapy (e-therapy) has appeared as a new method of treating/delivering mental health services through the internet. It is an evidence-based strategy which consists of organised, internet-based programs that integrate a certain degree of interaction with a therapist (Abbott et al. 2008). The therapist and client can communicate in a synchronous manner, such as online chats, virtual reality technology (Rochlen et al. 2004), or in an asynchronous manner, such as emails. In some cases, Internet therapy is improved via telephone or short-face-to-face support from the therapist, while most of the client work is done using the internet. Inquiries about finding internet therapy are more straightforward than in-person interventions since direct personal interaction is not needed. It allows people at various stages of change (Prochaska et al. 1982) to explore treatment options without any shame or guilt linked with disclosing a problem or failing to complete the therapy program.

Internet-based therapy provides several advantages for clients, such as the option to approach a therapist anytime without special arrangement, an improved sense of privacy, and accessibility for marginalised and stigmatised groups (Griffiths 2001; Manhal-baugus 2001; Castelnuovo et al. 2003; Rochlen et al. 2004). Also, it provides affordable, easy therapy for those who are unable to attend in person, e.g. due to geographical location, time or childcare restrictions (Gainsbury and Blaszczyński 2011). Also, for those who cannot seek therapy due to modesty, fear of stigma or a desire to change with minimal help.

In some existing studies, outcomes suggest that e-therapy is more relaxed and less challenging (Riva et al. 2016). Furthermore, in terms of efficiency, e-therapy is strongly supported where interactive interventions, e.g. gamification systems, therapy networking, and online support groups, are proposed (Barak and Grohol 2011). Nevertheless, these studies are not in the field of problematic social network usage, where the contribution of this thesis fits.

Certain obstacles to internet therapy have been established in the literature. For example, people with limited technical experience and knowledge may not be suitable for this strategy (Suler 2001). This could lead to users experiencing problems when using the e-therapy. However, Yuen et al. (2012) claimed that with e-therapy, it is unavoidable that technical issues will develop from time to time. The authors argued that certain technical issues, such as erroneous video or sound settings, are caused by human mistakes, emphasising the importance of adequately training therapists and clients on how to use the computer applications and equipment correctly, and also how to resolve technical issues. In Yuen et al. (2012) internet-based therapy practice, the authors found that giving patients illustrated step-by-step guidelines and scheduling conferences before the treatment in order to teach clients how to use the required application and handle technical issues has been beneficial. As therapists and clients develop experience with and expertise in the programme, technical challenges during e-therapy sessions should decrease (Yuen et al. 2010). The clients' literacy level may also be a limit for the strategy, particularly those from a different ethnic background compared to the therapist (Suler 2001; Mallen et al. 2005).

## 2.2 BEHAVIOURAL CHANGE THEORIES

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The theories of behavioural modification are employed to attempt to understand why individuals' behaviour changes. Different behavioural change theories are explored and proposed in literature which software developers should follow to help build successful behavioural change intervention systems (Davis et al. 2015). The effectiveness of behaviour change intervention can be enhanced by drawing upon a wider range of theories that include social, cultural, and economic variables influencing behaviour. According to (Michie et al. 2008), there is increasing awareness that interventions aimed at changing a person's behaviour should use suggested behavioural change theories in their development. In this section, a discussion of well-known theories and models to aid the understanding of behaviour change will be presented.

### 2.2.1 GOAL SETTING THEORY

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The theory of goal setting refers to the relationship between individuals and set targets. It involves how individuals specify targets, how they respond to them and how they use them to bring about behavioural change (Locke and Latham 2002). Goal Setting Theory can be described as how people react to various kinds of goals, and thus how goals can be set to motivate their behaviour change (Consolvo et al. 2009). Goal setting is a key component of different persuasive

information systems paradigms, e.g. gamification (Landers et al. 2017) and persuasive systems (Lin et al. 2006; Consolvo et al. 2009). Goals can be self-set, assigned or set collaboratively. Self-set or agreed goals need dedication that increases the level of goal pursuit (Oinas-kukkonen and Harjumaa 2009).

According to Locke and Latham (2002), the goal setting theory focuses on the principal attributes of an effective goal. These attributes include goal specificity and goal difficulty level, goal proximity, i.e. distal or proximal goals, and the moderators of the goals, such as commitment, feedback, and task complexity. Also, the effect of goal source, e.g. assigned goals vs. self-set goals vs. participatory set goals. The important elements of goal-setting theory are outlined in **Figure 5** together with the high-performance loop model.

- **Specificity** refers to the degree to which a goal that indicates the type and number of tasks required is well defined. Setting a specific goal and providing feedback on goal progress could help avoid deviating from the target.
- **Goal complexity** refers to the amount of effort needed to accomplish a task relative to the ability of an individual. To set goal difficulty, it is important to evaluate factors such as personality, skills, dedication, and self-efficacy.

Goal setting is a source of motivation that works by comparing the current and a desired future state (van Houwelingen and van Raaij 1989). It is a fundamental technique for changing work-related behaviour and is part of digital motivation systems such as gamification and persuasive technology, e.g. setting a timer and a progress bar to encourage a speedy resolution of an issue in a customer support centre and having a leader board that motivates people to perform better than others.

In the existing literature, when people set goals, they talk about the source of the goals, performance feedback and deviation countermeasures. Therefore, the goal setting theory is the foundation upon which the proposed TAGS method for eliciting goal setting design requirements will be based.

Individuals who use the goal setting theory set themselves appropriately challenging goals, and this theory is popular when trying to change problematic behaviours such as digital addiction. Setting goals has been argued to be an efficient state variable (Locke and Latham 1990). Bouskila-Yam and Kluger (2011) claimed that it is one of the powerful management tools available, because the theory can be used for motivating workers to accomplish tasks quickly and effectively. The goal setting theory literature provides S.M.A.R.T way of setting targets, which may help prevent setting irrelevant goals. In terms of software interventions, the authors (Whitlock et al. 2004) studied behavioural counselling strategies for substance consumption management, such as alcohol abuse, and the authors found that interventions were only effective

if they included at least two of the three main elements, i.e. advice, feedback, and goal-setting. Meanwhile, others used goal setting strategies to inspire individuals to exercise as part of their efforts to quit smoking (Ussher et al. 2003). However, a weakness of the theory is that the application of the theory can be subjective and can be challenging. The theory requires skills in setting goals and mistakes that might be devastating. For example, setting goals that are difficult and complex could encourage or increase problem behaviour. Also, if individuals lack the ability and know-how to carry out the actions or tasks required to achieve the goals, the goal-setting process may fail, resulting in poor goal performance.

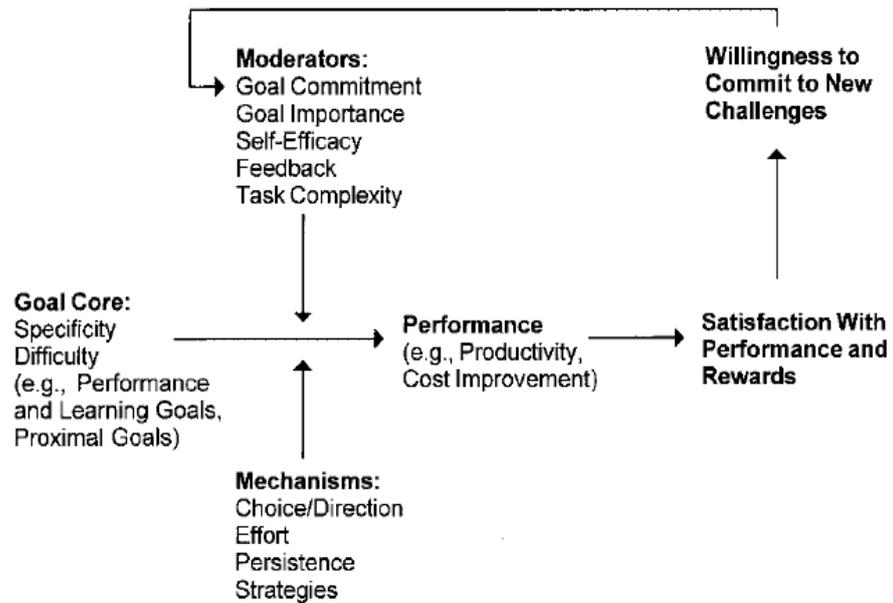


FIGURE 5: IMPORTANT ELEMENTS OF THE GOAL SETTING THEORY FROM (LOCKE AND LATHAM 2002)

### 2.2.2 CONTROL THEORY

The control theory is a method used to help understand the self-regulation process, which is useful in human behaviour analysis. The theory suggests that having agreed goals, monitoring behaviour, and considering the feedback provided are vital in behavioural control and self-management. The control theory proposes that once goals have been agreed, they serve as a reference point, which can be regarded as the desired output. The reference point is then fed into a control system that then compares the present rate of change in behaviour with the reference point (Webb et al. 2010).

When the control system detects a difference (discrepancy) between the current behaviour and the reference point, the system then informs the user that there is a need for a change in their behaviour to reduce or eliminate the discrepancy between the reference point and their behaviour, as shown in **Figure 6** (Gardner et al. 2010). According to this theory, having agreed goals, performance feedback and revising the goals by taking into consideration that feedback is

necessary for regulating behaviour. In relation to addiction, some components of the control theory have been studied. Although the theory has rarely been used to develop interventions for addictive behaviours on its own, nonetheless, the concept of monitoring behaviour has been used in addictive behaviour interventions such as self-regulating systems. The problem with regard to addictive behaviour in this theory is the difficulty of setting targets (Webb, Sniehotta, et al. 2010). Nonetheless, the authors argue that the control theory can be useful for integrating other self-regulation processes and theories. For example, the monitoring component of this theory has been used in various research in relation to addiction interventions, such as in (Quinn et al. 2010).

According to Sayette (2004), problems with setting targets can hinder the behavioural change process. The complexity arises from distorted targets, for example, enhancing mood through smoking, and conflicting goals, such as quitting smoking and losing weight.

One of the strengths of the control theory is that individuals seek feedback on their activities. If the feedback is satisfying, the goals will be satisfied, which can lead to a straightforward and successful conclusion. Because of the very basic concept of how feedback changes employees' goals, which may eventually lead to the abandonment of those goals, and according to Redmond and Prawl (2016), this control is a fairly practical theory to implement in the workplace. An individual's desire for feedback on their behaviour can be a weakness as well. If the feedback provided is not satisfactory, then individuals may become disheartened (Redmond and Prawl 2016). As a result, both motivation and production will be affected. One of the flaws of the Control Theory is that it fails to explain why someone who is loosely tied to society and hence able to deviate will choose one deviation conduct above another.

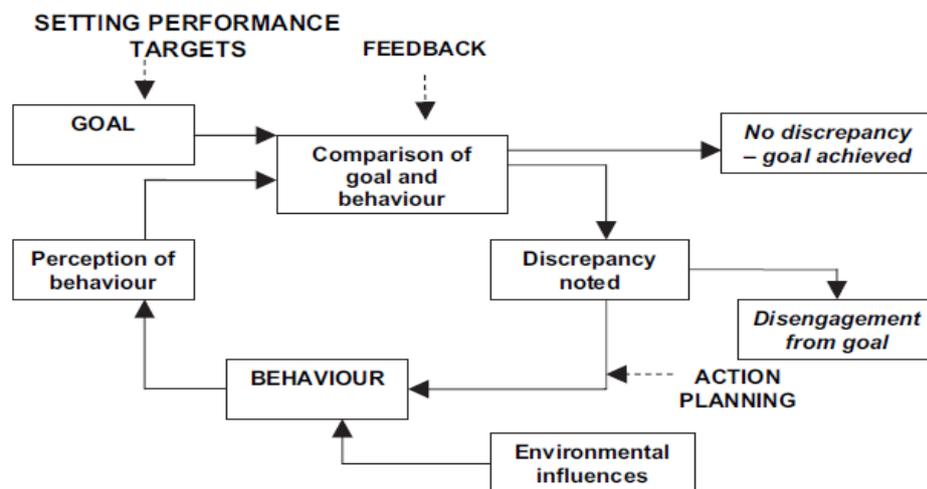


FIGURE 6: CONTROL THEORY WITH INCLUDE BEHAVIOUR CHANGE TECHNIQUES ADAPTED FROM (GARDNER ET AL. 2010)

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### 2.2.3 HEALTH BELIEF MODEL

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This is a cognitive model that indicates that the actions of a person are affected by their assumptions about potential threats to their well-being and health and behavioural outcomes (Morris et al. 2012). The beliefs of the individual are complemented by extra stimuli known as cues to action, which cause the behaviour to be actually adopted. The health belief model consists of two sets of assumptions about a person's apparent exposure to a specific threat and the seriousness of the negative effects that are potentially expected as a result of the threat that the individual is exposed to (Morris et al. 2012). The perceived benefits linked with a behaviour, which is its possible efficacy in mitigating the impact, are evaluated against the perceived costs and adverse effects which arise from it (perceived obstacles), such as aftereffects of treatment, in order to assess the overall degree to which a behaviour is helpful. An additional core component of the model is the perceived ability of the individual to adopt the behaviour (their skills). Ultimately, the health belief model describes two forms of 'call to action'; internal, which involves signs of ill health, and external, which involves advertising campaigns or other information being provided. These signs affect the view of threat and can cause or sustain behaviour. See **Figure 7**.

One of the strengths of the health belief model is that it divides a person's beliefs into four groups, i.e. perceived susceptibility, perceived severity, perceived benefits, and perceived barriers, which provides an in-depth technique to investigate a person's attitudes toward health care in a more comprehensive way (Hahm et al. 2008). Hahm et al. (2008) argued that a weakness of the model is that there is a lack of explanation as to how people with serious mental illness cope with the anxiety of seeking medical help. The HBM's lack of clarity on the distinctive emotional reactions of people with mental illness when looking for treatment: the influence of fear and stigma on health care behaviours is one flaw in the context of understanding health care use by people with mental illness.

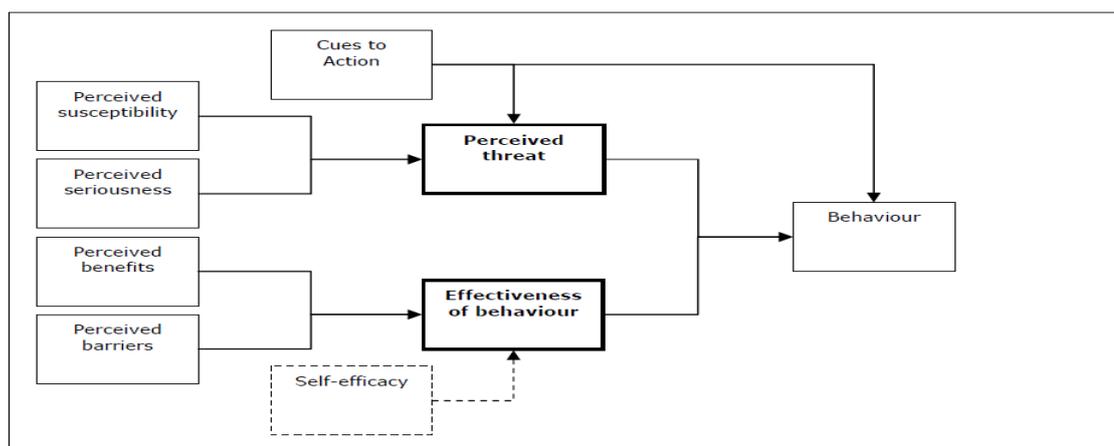


FIGURE 7: THE HEALTH BELIEF MODEL (MORRIS ET AL. 2012)

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## 2.2.4 TRANSTHEORETICAL MODEL

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The Transtheoretical Model, often called Stages of Change, is commonly employed to differentiate between people who have not yet planned to change their behaviour but are thinking about it, those who plan to change, and those who are already in the change process. The model is widely used by numerous researchers in health care (Weinstein et al. 1998). The model's five stages are pre-contemplation, contemplation, preparation, action, and maintenance (Prochaska et al. 1982). The model was originally created to describe the smoking cessation process and psychotherapy. The model is now being extended routinely to other fields of addiction, such as behavioural addiction or addictive behaviours (Prochaska et al. 1982). For individuals to move through all the stages of the model, certain information or abilities are needed, and if any of these are lacking, there may not be any progression from their existing stage. An essential characteristic of the stage model is the concept that various elements affect movement at different stages. This model proposes that individuals at the same stage should be faced with the same kinds of obstacles and must be supported by the same form of intervention (Nisbet and Gick 2008).

For the model to relate to concepts from various theories, it uses the stages of change as a basic outline. It maps the critical processes of behavioural change, e.g. environmental re-evaluation, self-re-evaluation, and contingency. **Figure 8** below shows the processes and the stages they belong to, and some processes reside in more than one stage.

Precontemplation	Contemplation	Preparation	Action	Maintenance
Consciousness Raising Dramatic Relief Environmental Reevaluation	Self-Reevaluation		Self-Liberation	Contingency Management Counterconditioning Stimulus Control

FIGURE 8: STAGES OF CHANGE IN WHICH PARTICULAR PROCESSES OF CHANGE ARE EMPHASISED (PROCHASKA ET AL. 1982)

Change processes are a second main dimension of the transtheoretical model that helps one to understand how such changes occur. Change processes are 'covert' and 'overt' practices and interactions that people participate in when attempting to change problematic behaviours (Prochaska et al. 1982). Each process is a wide category that includes several strategies, procedures, and approaches historically linked with theoretical differences. The ten processes of change that (Prochaska et al. 1982) primarily focus on are presented in **Table 3**.

The Transtheoretical model offers a framework for comprehending how people change their behaviour through their actions and processes (O'Brien 2002). Individual decision-making is the focus of the Transtheoretical Model, while other strategies for health promotion mainly emphasize social influences on behaviour or biological influences on behaviour (Velicer et al. 1998). The model is a multilevel model that seeks to synthesise a person's existing problematic behaviour with their goal of changing the behaviour (willingness to change); the use of approaches to

advance behavioural change (processes of change); confirmation of the benefits and drawbacks of engaging in the behaviour (decisional balance); and the ability to refrain from engaging in the behaviour, as well as the temptation to do so (self-efficacy) (O'Brien 2002).

TABLE 3: DEFINITIONS OF THE PROCESSES OF CHANGE (PROCHASKA ET AL. 1982)

<b>Process</b>	<b>Definitions: Interventions</b>
Consciousness raising	Increasing information about self and problem: observations, confrontations, interpretations, bibliotherapy
Self-reevaluation	Assessing how one feels and thinks about oneself with respect to a problem: value clarification, imagery, corrective emotional experience
Self-liberation	Choosing and commitment to act or belief in ability to change: decision-making therapy, New Year's resolutions, logo therapy techniques, commitment enhancing techniques
Counterconditioning	Substituting alternatives for problem behaviours: relaxation, desensitization, assertion, positive self-statements
Stimulus control	Avoiding or countering stimuli that elicit problem behaviours: restructuring one's environment (e.g., removing alcohol or fattening foods), avoiding high risk cues, fading techniques
Reinforcement management	Rewarding oneself or being rewarded by others for making changes: contingency contracts, overt and covert reinforcement, self-reward
Helping relationships	Being open and trusting about problems with someone who cares: therapeutic alliance, social support, self-help groups
Dramatic relief	Experiencing and expressing feelings about one's problems and solutions: psychodrama, grieving losses, role playing
Environmental reevaluation	Assessing how one's problem affects physical environment: empathy training, documentaries
Social liberation	Increasing alternatives for non-problem behaviours available in society: advocating for rights of represses, empowering, policy interventions

The Transtheoretical Model can help with a more accurate outcome evaluation. Interventions should be assessed in terms of their impact, which is calculated by multiplying the recruitment rate by the efficacy. Interventions based on the Transtheoretical Model have the potential for great efficacy as well as a high recruitment rate. Therefore, it has been claimed that such interventions dramatically boost our possible effect on large communities of people with behavioural health problems (Velicer et al. 1998). A weakness of the model relates to stage measurement, i.e. people cannot always correctly reply to questions that would place them in one of the stages, and they can move between stages during the course of research or intervention, as well as between measuring occasions, making stage measurement unreliable (Brewer and Rimer 2008).

### 2.2.5 SOCIAL COGNITIVE THEORY

The Social Cognitive Theory (SCT) as recommended by Bandura (1986) was used in a variety of settings to understand the causes of various human behaviours. The SCT has been used to establish effective addictive behavioural interventions, see **Figure 9**. According to Webb,

Sniehotta, et al. (2010), the SCT shares some main factors with other social cognition models, e.g. intention, but the theory puts more emphasis on the self-efficacy element (Bandura 1997). It suggests that behavioural change is influenced by the interaction between internal elements relating to the person, external elements relating to their environment, and the characteristics of a person's behaviour itself. According to the theory, individuals acquire positive actions which they consider useful by seeing other people in a similar situation executing the behaviour (Yoon et al. 2014), and achieving the required results, which enhances motivation and raises the likelihood of behavioural change (Mark et al. 2011). As such, changing some people's perspectives and attitudes can promote behaviour change for others within the group. It can be concluded that these behavioural change theories share some variables with the aim of providing effective and maintainable behavioural change. Methods of behaviour change derived from SCT have been applied widely and successfully, mainly amongst people seeking help for problematic behaviour, which can include help for information, emotional support, and scoping strategies to manage, reduce, prevent, or combat problematic behaviour (Hardeman et al. 2010). The following are key social cognition theory constructs that are important for health behaviour change interventions: self-efficacy, self-control, and observing and learning.

One of the strong points of social cognitive theory is that it allows for the integration of examples from real life. It also has the strength to be used swiftly and easily. A limitation is that, according to this theory, changes in the environment should lead to changes in the individual, but this is not always the case (Davis 2019). Another weakness of the theory is that it is loosely structured, focusing solely on the interaction between the individual and their behaviour and the environment (Davis 2019).

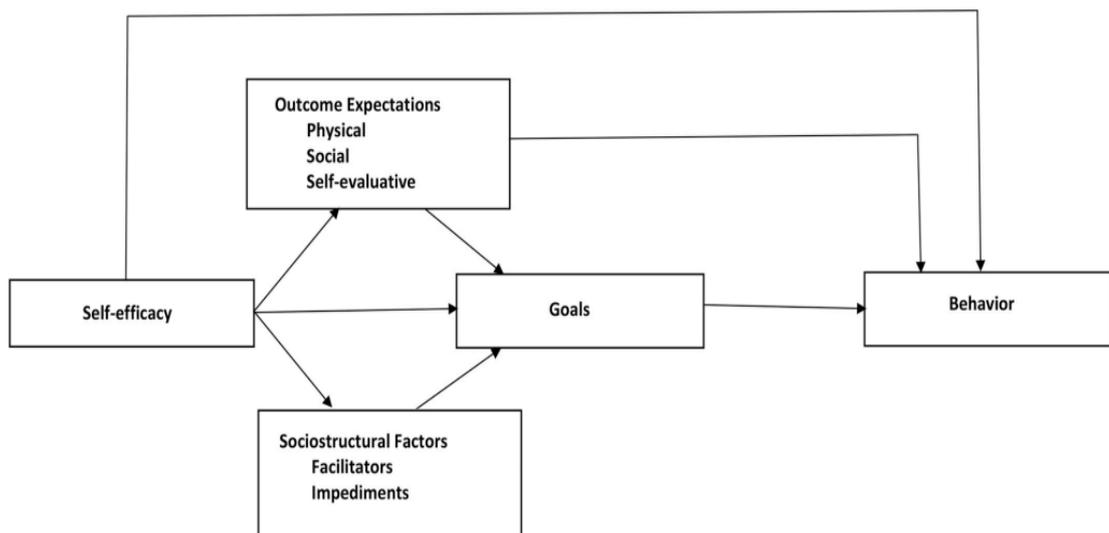


FIGURE 9: HEALTH PROMOTION BY COGNITIVE MEANS (BANDURA 2004)

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## 2.2.6 THEORY OF PLANNED BEHAVIOUR

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The Theory of Planned Behaviour (TPB) was developed by (Ajzen 1991). According to this model, a person's behaviour is determined by his intent to perform the behaviour. The theory proposes that three elements influence the intention to action any behaviour. See **Figure 10**. First, is one's attitude towards the behaviour and relates to their expectations of performing the behaviour. Second, is the subjective norm, it relates to the peer pressure resulting from peers' expectations and the person's motivation to act or conform to such expectations. Third, is perceived behavioural control that relates to one's ability to execute the behaviour. Also, the TPB suggests that unforced human behaviour is a function of intent to conduct the behaviour and perceived behavioural control (Sniehotta et al. 2014).

This theory derived from the theory of reasoned action (Fishbein and Ajzen 1975) by introducing a new element termed perceived behavioural control that theoretically parallels self-efficacy (Webb, Sniehotta, et al. 2010). The TPB was used to predict the significance of a wide variety of behaviours, including technology-related ones (Pelling and White 2009). Pelling and White (2009) used an expanded model of the theory of planned behaviour, incorporating additional factors of self-identity and belongingness, to forecast increased social networking website (SNW) behaviour and intentions. Also, the effect of self-identity and belongingness on young people's addictive tendencies toward SNWs was explored. The findings show that the increased use of SNWs is affected by factors of attitude, normative beliefs, and self-identity. These results can be employed to inform techniques aimed at controlling the high level of use or addictive behaviour of SNWs among young people.

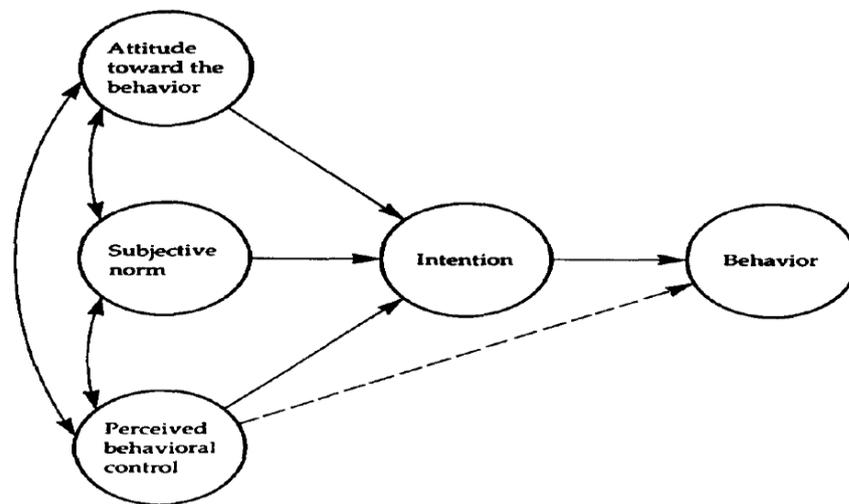


FIGURE 10: THEORY OF PLANNED BEHAVIOUR (AJZEN 1991)

The TPB provides a mechanism for systematically identifying the issues that are most relevant to a person's decision to engage in certain activities. Many essential ideas and attitudes may be changed, making them good targets for future interventions. The TPB's measurement methods, while effective for prediction, are difficult to implement in practice (Brewer and Rimer 2008). They rely on substantial pilot work, which may include interviewers conducting human

interviews, and they can involve more items than many modern surveys can feasibly include. Although eventually beneficial, Brewer and Rimer (2008) argued that this can be a time-consuming and expensive process that reduces participation rates. When systems must be built fast, collecting more detailed pilot data can be difficult. The TPB's emphasis on the specificity of the targeted behaviour, on the other hand, is both core to the model and one of its most important qualities.

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### 2.2.7 FOGG'S MODEL

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The Fogg behaviour model (FBM) for persuasive design (see **Figure 11**), provides a logical approach to considering the factors necessary for effective behaviour change.

Persuasive technology plays a crucial role in human well-being (IJsselsteijn et al. 2006). Fogg (2009a) described persuasive technology as a category of technologies intended to help change attitudes or behaviours. Technologies that can be employed to inspire and promote healthy lifestyle choices linked to exercise, smoking, television and internet use, stress reduction, and preserving social relationships may postpone or even avoid a variety of medical problems and thereby enhance the quality of life of individuals (IJsselsteijn et al. 2006). The primary goal of TAGS is to help to regulate their problematic social network behaviour, therefore, the significance of this chapter discussing persuasive technology.

Designing a new persuasive technology can be a daunting job, and it can be a frustrating experience when the persuasive technology we wish to build is a new product with no clear prototype to implement (Fogg 2009a). To help address this, the author proposed and explained an eight-step method of developing efficient persuasive technologies that concentrates on early stage design. The eight steps are: choose a specific action to target, choose a receptive audience, figure out what stops the target behaviour, choose a common technology platform, and quickly identify appropriate examples of convincing technology, test and iterate, and build on progress. Integrating some of these steps into the design of technology-assisted solutions can be helpful in their success. Big design objectives may be attained effectively when academics and practitioners as a community comprehend how to do the tiny things well (Fogg 2009a). For example, when designing persuasive technologies, start by setting small goals and building on the progress of those goals.

The FBM recognises three elements required to convince individuals to act: motivation, ability, and trigger (Fogg 2009a). The model helps designers of a system establish an understanding of users' experience/behaviour in terms of what does not work or impedes behaviour. In the FBM, it is argued that to attain a set goal, an individual need to have adequate motivation, the required level of ability, and effective triggers (see **Figure 11**). According to the FBM, individuals who have high levels of motivation and ability have a greater chance of performing/achieving the

target behaviour. This implies that when an individual has a high motivation to perform a behaviour but has limited ability, the chance of achieving the behaviour will be minimal, e.g. setting up a new system with limited knowledge of technology. Equally, individuals with the required ability to perform a behaviour but have limited motivation, the likelihood of attaining the behaviour is low, e.g. an individual stopping online usage while feeling happy about their online behaviour. Hence, when you have high levels of both skill and motivation, the likelihood of attaining a goal is maximised. The final element of the FBM is the trigger. The behaviour will not happen without a suitable trigger, even if both ability and motivation are high. An example of a trigger can be a reminder of a goal or goal-related task (Fogg 2009a).

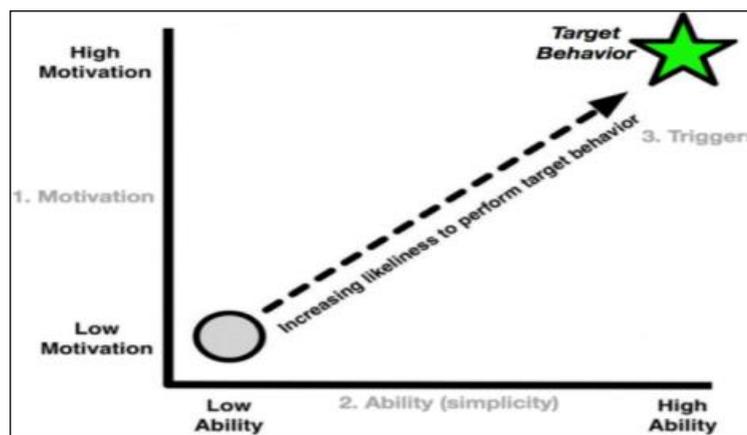


FIGURE 11: THE FOGG BEHAVIOUR MODEL ADAPTED FROM (FOGG 2009A)

## 2.2.8 CIALDINI'S PRINCIPLES

Cialdini et al. (1999) identified core evidence-based persuasive concepts used to influence behaviour. Such concepts help people establish an understanding of the psychology of persuasion. The model comprises six different components:

- **Reciprocity** – this principle includes two strategies. The first strategy talked about the obligation people felt to repay kindness. Reciprocation acknowledges that individuals feel obligated to others who do something for them or offer them a gift, no matter how small. The second strategy is called reject, then retreat or door-in-the-face. This strategy comprises of first putting in an overstated request to a person (e.g. asking for an enormous favour) after it is refused, then following this up with a less demanding request which is likely to be accepted. In goal setting, this can be related to the setting of complex goals that are less likely to be attained then re-strategies and re-set the goals to be accepted and attained by people.
- **Commitment and consistency** – places emphasis on people's continual motivation to maintain a behaviour which supports or has supported them to attain a behaviour.

- **Social proof** – people are affected by what others are doing. It can refer to the social identification process and trying to avoid being excluded from a group, or the need to relate to others (e.g. peers or colleagues) by watching their actions and trying to do the same.
- **Liking** – people feel indebted to the demands of those they like, compared to others they do not like. Liking can result from several principal characteristics that define how we see other people, including attractiveness, resemblance, and connection.
- **Authority** – people feel obligated to conform to those of higher authority, for example, supervisors, government policies, and parents.
- **Scarcity** – people tend to be more cautious when they feel that loss is imminent compared to when there is a potential.

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### 2.2.9 SOCIAL ECOLOGICAL MODEL

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The social ecological model aids in the understanding of elements that influence behaviour as well as the development of successful social environment-based interventions (Stokols 1996). Multiple layers of influence (such as individual, interpersonal, organisational, community, and public policy) are emphasised in the social ecological model, as well as the premise that behaviour shapes and is shaped by the social environment (McLeroy 1988). The ideas of social ecology models are aligned with concepts from social cognitive theory, which proposes that building a change-friendly environment is critical to making it simpler to acquire healthy habits (Bandura 2001).

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### 2.2.10 SOCIAL LEARNING THEORY

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Expectations and incentives, according to social learning theory, determine behaviour: Expectancies may be divided into three types: (i) expectancies about environmental prompts, i.e. beliefs about how events are connected, (ii) expectancies regarding the effect of one's own behaviour, i.e. opinions about how individual actions are likely to impact results, i.e. outcome expectancy, and (iii) expectancies regarding one's own ability to carry out the conduct required to impact outcomes. This is known as efficacy expectation (also known as self-efficacy) (Rosenstock et al. 1988). An incentive or reinforcement is described as the value of a certain object or result. The result could be a change in health, physical appearance, social acceptance, financial gain, or other factors. Behaviour is influenced by its consequences, but only to the extent that the individual interprets and comprehends those repercussions.

According to Nabavi (2012), based on previous research, the strengths and limitations of the social learning theory can be divided into two categories. The first category relates to positive reinforcement, which indicates that the observer's replicated behaviour is a positive one, thus the action may be rewarded or complimented by others. The second category relates to punishment,

which is used when the activity repeated by the observer is negative and could offend or hurt others, resulting in a sort of punishment.

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#### 2.2.11 INFORMATIONAL MOTIVATION BEHAVIOURAL SKILLS MODEL

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The informational motivation behavioural skills model (IMB) has three primary assumptions. First and foremost, people want reliable avoidance information concerning the behaviour change in focus. Second, people must be inspired to engage in the desired health behaviour, and third, with the right knowledge and inspiration, people will employ the behavioural skills (Tuthill et al. 2017). The IMB model is based on an earlier health behaviour theory that involves cognitive factors of HIV risk and prevention, such as AIDS awareness, personal attitudes, and behavioural intent to practice prevention (Ajzen and Fishbein 1980). According to the IMB model, AIDS prevention behaviour is determined by knowledge of transmission and prevention, desire to lower risk, and behavioural ability to practise prevention (Ndebele et al. 2012).

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#### 2.2.12 SELF-REGULATION THEORY

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Self-regulation theory presents the notion of self-regulation systems, which are information systems for responsive individual management that entail the process of regulating one's own ideas, behaviours, and feelings toward a goal (Baumeister et al. 2007). Self-regulation systems can be advocated to avoid problematic digital behaviour because of the nature of the medium, which enables many solutions when conventional and forceful measures are used, such as utilising a new device or account. Self-regulation enables people to alter their conduct in order to comply with others' norms and, as culture evolves, with the group's abstract standards such as ethics and regulations. These self-regulation systems can also benefit from the online medium itself by monitoring behaviour, for instance, user interaction with a website, and employing technologies to avoid or mitigate addiction, for example, warning labels and persuasive techniques, e.g. avatars (Ali et al. 2015).

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#### 2.2.13 IMPLEMENTATION INTENTIONS

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According to Gollwitzer (1999), successful goal attainment is enabled by a second act of will that provide the goal intention with an if–then plan describing when, where, and how the individual will initiate reactions that enhance goal attainment. These strategies are called implementation intentions. Implementation intentions seem to be useful in increasing the chances of achieving a goal. Implementation intentions should improve an individual's capacity to start, sustain, withdraw from, and pursue new goals, increasing the chances of strong goal intentions being realised satisfactorily (Gollwitzer 1999). Implementation intentions plan connects favourable opportunities to act with cognitive or behavioural reactions that are useful in achieving one's goals. It has been claimed that to establish an implementation intention, a person must first pick

a reaction that will help them achieve their goals and then predict a good time to start that reaction (Gollwitzer 1999). For example, a likely implementation intention in support of the goal intention to socialise more would link acceptable behaviour (such as meeting in person instead of chatting on social media) to an appropriate situational setting (such as opening the phone to use social media).

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#### 2.2.14 SELF-MONITORING THEORY

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According to the self-monitoring theory, people's willingness and ability to monitor and manage their expressive actions and public appearances vary systematically (Fuglestad and Snyder 2009). Individuals with good self-monitoring abilities are especially aware of and receptive to social prompts. High self-monitors are consistent in how they modify their conduct to meet the demands of various scenarios. Low self-monitors, on the other hand, place a premium on consistent behaviour that reflects what they believe to be true about themselves. Low self-monitors have been argued to be consistent in displaying conduct that expresses inner feelings, attitudes, and beliefs when it comes to self-monitoring (Mehra et al. 2001). According to Fuglestad and Snyder (2009), self-monitoring is linked to a number of distinct behavioural domains, including expressive control, attitude-behaviour consistency, responsiveness to various types of persuasion and advertising, organisational behaviour, and interpersonal relationships. In a group setting, i.e. when group set or collaborative goal setting are selected as the source of goals, cooperation between group members is essential for goal attainment. High self-monitors' social skills and abilities could help them to do better than low self-monitors.

One of the strengths of self-monitoring is that individuals are motivated to think more critically about their behaviour and to make better choices. Orji et al. (2018) claimed that self-monitoring has the potential to identify problematic behaviours and make individuals assume liability for their health and wellness rather than blaming it on things beyond their control. One of the weaknesses of many applications that use the self-monitoring strategy is that they are labour-intensive and, as a result, difficult to use.

### 2.3 PROBLEMATIC SOCIAL NETWORKS USAGE AND TECHNOLOGY RELATED AREAS

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In this section, a review of the literature on different areas that may relate to the engineering of software-assisted behavioural change is presented.

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#### 2.3.1 REQUIREMENTS ENGINEERING FOR BEHAVIOURAL CHANGE TOOLS

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Requirements engineering is clearly defined by (Zave 1997, p.315) as

“the branch of software engineering concerned with the real-world goals for, functions of, and constraints on software systems. It is also concerned with the relationship of these factors to precise specifications of software behavior, and to their evolution over time and across software families”.

Other authors define Requirements Engineering (RE) as the process of gathering, evaluating, documenting, and testing out what the system should do (Sommerville 2001) and identifying stakeholders and effectively communicating these requirements amongst various stakeholders (Nuseibeh and Easterbrook 2000). RE comprises of all the events that took place when creating and maintaining the system’s requirements documentation, including conducting a system feasibility study, and evaluation of the gathered requirements. Requirements for systems define the functionalities or services that the systems are expected to offer (Sommerville 2001).

Non-functional requirements (NFR) are viewed as quality features in RE that serve as measurements of a system or system configuration's degree of excellence. Given their significance, the request and expectation of fast delivery of software systems that meet the functional requirements, such as the operational requirements, will lead to disregarding particular quality features. This could result in software that might be less usable, reduce acceptance or even be harmful to users.

This thesis has a chapter on TAGS, which is an emerging family of behavioural change software, which is distinguished from other software in terms of its requirements, nature, and spirit. The requirements are not typical, they are about usage, about what people do not want to see, but they regard them as factors that would aid the behavioural change process. While requirements are seen typically as desired states of the world, wanted by the users, requirements, in the case of behavioural change software, may conflict with the current behaviours, attitudes, and intentions of the users. This is mainly because the software is meant to help users change them. Therefore, it is essential to understand the elicitation and configuration of such technology, i.e. the requirements, to enhance the successful implementation of such technology.

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### 2.3.2 THE FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS

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There is wide agreement in the literature on how Functional Requirements (FR) should be described; such definitions follow two angles, which essentially overlap (Glinz 2007). On the one hand, the stress is on the functions that the system has to execute (Paech et al. 2002), what a product has to do (Robertson and Robertson 1999) and what the product may do (Robertson and Robertson 1999) and what the product may do (Sommerville 2004). On the other hand, the emphasis is on behaviour, i.e. FR describes the behavioural elements of a system.

On the contrary, there is a lower consensus on the definition of non-functional requirements (NFR). The low-level agreement can be due to problems related to the description of the term,

classification and representation (Glinz 2007). First, there exists a conflict in the terminology and conceptualisation of the NFR, e.g. there is no agreement on the meaning of the terms used to describe the NRF, such as features, properties, qualities, limitations, and performance qualities. The second relates to the different sub-classifications adopted by various authors. Finally, third is the unclear representation of NFR, which when further refined could be seen as FR. To fulfil the system requirements, it must be ensured that they are elicited and documented thoroughly without any ambiguities, mistakes or inconsistencies. Glinz (2005) proposed a structure for the classification of requirements with the aim of overcoming the classification and definition problems, (see **Figure 12**) where the terms FR and NRF no longer exist. Such a classification has various advantages. For example, the representation aspect of the requirement classification defines how we can verify a particular requirement. Also, the classification gives precise and complete guidelines: the more qualitative requirements there are the less precise and comprehensive a requirements specification becomes (Glinz 2005).

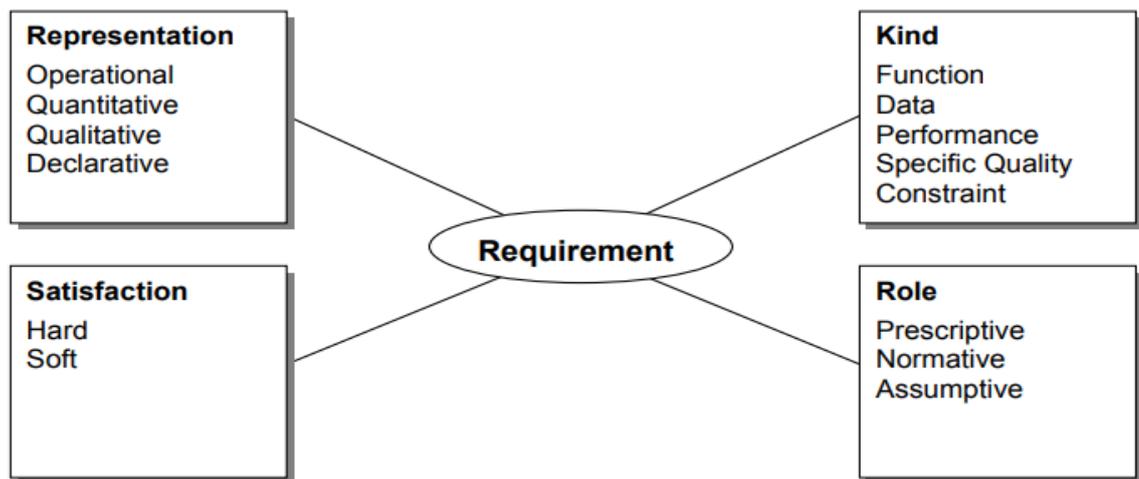


FIGURE 12: 2A FACETED CLASSIFICATION OF REQUIREMENTS (GLINZ 2005)

The author then suggested a framework for overcoming these issues and offered a systematic approach for the study and clustering of different NFRs. A set of classification rules were proposed to address these problems and create a new taxonomy of requirements outlined in **Figure 13**. Glinz (2007) described the taxonomy of terms based on the notion of concerns, which makes them independent of the representation chosen. The author assumes an engineering context for requirements, where the system is the entity whose requirements must be specified.

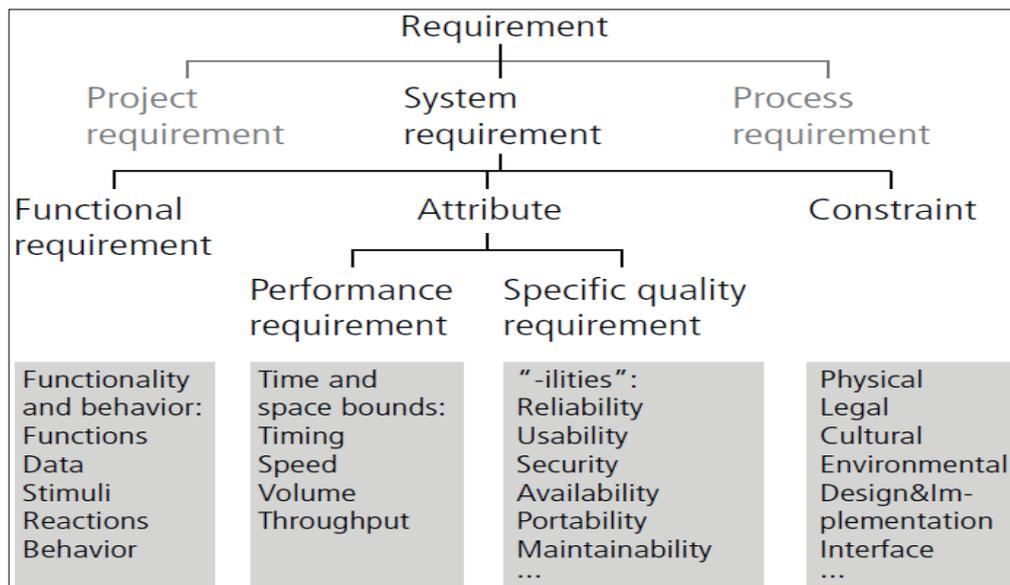


FIGURE 13: CONCERN TAXONOMY OF REQUIREMENTS (GLINZ 2007)

The entities mentioned above define the functional and non-functional requirements. However, for behavioural change interventions such as TAGS, it is important to review FR because the aim of the proposed method is to help users specify their goal setting requirements for the new technology. Knowing the category of requirements would enable the design of features/functions for the new goal setting layer.

### 2.3.3 GOAL-ORIENTED REQUIREMENTS ENGINEERING

Goal-oriented requirements engineering (GORE) has received much attention in requirement engineering research as a method for understanding the fundamental need for system requirements, which could help assure that the correct system is built to address the right issues (Horkoff and Yu 2011). Goals have long been acknowledged to be a significant part of the requirements engineering phase. GORE refers to using goals for gathering, evaluating, elaborating, organising, identifying, analysing, negotiating, recording, and adjusting system requirements (van Lamsweerde 2001).

The concept of goals is well-established in business information systems analysis and design, e.g. in goal-oriented approaches (van Lamsweerde 2001). Goals have for quite some time been perceived to be a fundamental element involved in the requirements engineering process. Goals additionally cover various kinds of issues: functional issues related to the services to be delivered, and non-functional issues related to service quality, such as health, security, efficiency, performance, among others. The extensive research in GORE has led to the development of two frameworks for goal-based requirements engineering, a formal framework (Dardenne et al. 1993) and a qualitative framework (Rolland et al. 1998). Goals have for quite some time been perceived to be a fundamental element involved in the requirements engineering process. Goals additionally cover various kinds of issues: functional issues related to the services to be delivered, and non-

functional issues related to service quality, such as health, security, efficiency, performance, among others. The extensive research in GORE has led to the development of two frameworks for goal-based requirements engineering, a formal framework (van Lamsweerde 2004). A goal is a declaration of intent which should be accomplished by the system. There are a variety of reasons why goals are essential in the requirements engineering process: Goals give a precise standard for completing a satisfactory requirement specification document. The specification document can be regarded as complete when all the set goals can be proved to be attained and the properties identified in the area are considered.

1. Goals give an exact measure of requirements relevance. A requirement is pertinent in relation to the collection of goals in the area under investigation if its definition can be used to prove the achievement of one target.
2. Helping stakeholders understand the requirements is another vital issue. Goals give the justification for the system requirements, in a manner comparable to design goals in design processes (van Lamsweerde 2001).
3. Goals have been known to give the roots for recognising inconsistent between systems requirements and for solving the conflict in the end.

Goals refinement gives a natural way of organising complex requirements documentation for better understanding (van Lamsweerde 2001).

The GORE is not utilised in this thesis as it does not fit behavioural requirements elicitation, but the aim of reviewing GORE is to look at the existing techniques for requirements engineering. In the business information systems context, goals are either required by stakeholders or assigned to them, as part of their expectations or contractual role. Behavioural goals are different because they are against what people actually want and require a new way of thinking about how to gather and set them up, how to track deviations from these goals and how to ensure that they are accomplished.

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## 2.3.4 REQUIREMENTS ELICITATION PROCESS

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The gathering of requirements includes a collection of activities which must enable all relevant participants to communicate, prioritise, negotiate and collaborate on the requirements. Below, a discussion of these activities is provided.

### 2.3.4.1 UNDERSTANDING THE APPLICATION DOMAIN

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It is essential to analyse and evaluate in depth the situation or environment in which the device must ultimately be placed before beginning the requirement phase (Jackson 1995, Zave and Jackson 1997). The existing environment, including the political, operational, and social factors

associated with the system, must be thoroughly examined. Present work processes and the associated issues to be solved using the system must be defined with regard to the core business goals. In relation to this thesis, the researcher has identified social networks as applications that facilitate users' problematic usage, and the developers of such applications would like to augment their platforms with a new goal setting layer to help regulate their problematic usage.

#### *2.3.4.2 IDENTIFYING THE SOURCES OF REQUIREMENTS*

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A range of potential sources of requirements can be found in all software development projects. These include the stakeholders, existing systems and processes, and current system documentation, in addition to the new system specifications and their rationale and significance. In relation to TAGS, the stakeholders, e.g. the problematic users, are the main source of the goal setting requirements.

#### *2.3.4.3 ANALYSING THE STAKEHOLDERS*

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An overview and participation of all relevant stakeholders is also one of the first steps in the elicitation of requirements. The stakeholder analysis process also frequently involves identifying core representatives of users and supporters of the goods. Step one of the TAGS elicitation method will describe the sampling of stakeholders.

#### *2.3.4.4 SELECTING THE TECHNIQUES, APPROACHES, AND TOOLS TO USE*

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The choice of methods to be utilized is reliant on the particular situation of the project and is regularly a crucial element in the accomplishment of the elicitation process (Nuseibeh and Easterbrook 2000). According to Hickey and Davis (2002, 2003), a specific elicitation method can be selected for different reasons, including (i) the system analyst knows only the selected method, (ii) the analysts likes the selected method, and (iii) the research project method recommended the selected techniques.

#### *2.3.4.5 ELICITING THE REQUIREMENTS FROM STAKEHOLDERS AND OTHER SOURCES*

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After the sources of requirements and the stakeholders are established, the next step is the actual gathering of key requirements utilising the preferred elicitation methods, approaches, and tools. During the process, it is important to set up the boundary for the system and explore in detail the stakeholders' desires, particularly the users.

#### *2.3.4.6 ROLE OF THE SYSTEM ANALYSYTS DURING ELICITATION*

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The system analyst can play a variety of roles and undertake various tasks during requirements elicitation. These tasks and roles depend on different factors, including the research project at hand, the individuals involved, the context involved, and the organisation involved. A massive part of elicitation includes investigating the problem domain and the requirements that are established in such a domain. Moreover, system analysts regularly need to execute some common

project management tasks. In addition to managing the elicitation process, they have to convey it successfully to the stakeholders. This includes, in addition to other things, decision-making, prioritisation, and negotiation (Zowghi and Coulin 2005).

System analysts regularly play the critical part of facilitators. When gathering requirements through group work sessions, they are not required to ask questions and record the responses but must direct and aid the participants in addressing the pertinent issues so as to attain the right and complete requirements information. The system analyst is also responsible for guaranteeing that participants feel comfortable and assured about the elicitation process and are given an adequate opportunity to contribute. The system analysts are responsible for documenting the gathered requirements. They are frequently needed to take the different roles of the development team during elicitation. This includes ‘designers’ and ‘programmers’. This is often due to the fact that, at the requirements elicitation phase, these stakeholders have not yet been allocated to the project.

## 2.4 SELF-REGULATION

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Self-regulation is defined as

“controlling oneself through self-monitoring, goal-setting, feedback, self-reward, self-instruction, and enlistment of social support” (Glanz et al. 2008, p.171).

According to Glanz et al. (2008), self-regulation systems will be built on the basis of the required self-acquired skills to improve self-management, rather than depending on willpower.

In self-regulation systems, monitoring is a vital design aspect. It presents a useful groundwork for effective intervention design by allowing users to monitor and support their overall success in attaining their objectives while preserving their controlled behaviour (Torning and Oinas-kukkonen 2009). Addictive behaviour intervention programmes fail due to poor implementation of goal-setting theory, such as difficulties in setting expectations and inadequate consideration of conflicting targets like managing smartphone use and appreciating the moment, and distorted targets, e.g. a user browsing the internet to modify their mood (Baumeister and Vohs 2004).

Self-regulation systems are complicated and multidimensional. As such, it is hard to attribute failure to one source. Generally, there are three major reasons for their failure: inadequate standards, improper tracking, and ignoring users' lack of ability (Baumeister and Heatherton 1996).

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### 2.4.1 SELF-REGULATION AND REFLECTION ON PROBLEMATIC SOCIAL NETWORKS USAGE

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A self-regulation system can either track behaviour, e.g. a user sharing 50 posts on Facebook this week, or track behavioural improvement, e.g. a user sharing fewer posts than last week (Maitland and Chalmers 2010). It is essential to explore which form of tracking would inspire users.

While there are some effective intervention cases, they are frequently short-lived, resulting in interventions that are costly and difficult to sustain (Green-demers et al. 1997). Developing long-term interventions can be challenging due to the denial of reality, which is regarded as a characteristic of problematic social network users. This indicates the need for additional approaches to support lifelong interventions and to decrease the risk of relapse.

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## 2.5 SOFTWARE DESIGN APPROACHES

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In this section, a discussion of various software design approaches is provided. The main design approaches indicate different ways users can be involved in the system design. Gathering data on users' problematic social networking usage could help to explore their addictive usage style and how software-assisted goal setting may be implemented to help control it. As the proposed method is meant for the elicitation of goal setting design requirements which will ultimately lead to the design of the new software, knowledge of key design approaches is essential. Understanding users' goal setting design requirements for the new layer would help to analyse how the software would be designed and how this may impact them. To attain this, representative users' active involvement in the requirements elicitation and design stages would help to increase their acceptance, adoption and reduce the side effects of such software.

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### 2.5.1 USER-CENTRED DESIGN

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User-centred design (UCD) is a technique that involves the user in the design process and pays very close attention to the desires, expectations, and shortcomings of a product's end users and measures the product's efficiency in the real world (Abrams et al. 2004). UCD tries to prevent pressuring users to modify how they interact with a product; instead it makes sure the end product fits user needs (Wever et al. 2008). The UCD design could help designers achieve the target of a software product planned for its users. From the beginning, users' requirements are considered and included in the product cycle. A UCD approach includes incorporating the user viewpoint into the software development process to enable the development of a system which meets user requirements and increases system acceptance (Johnson et al. 2005). Essentially, the objective of the UCD method is to create systems that are designed in accordance with future users' characteristics and activities (Teixeira et al. 2012).

UCD highlights the association between HCI and design practices where user engagement is the key factor in ensuring their requirements are met (Marcus and Wang 2017). Nevertheless, user participation is not meant to offer a 'retail experience' (Lowdermilk 2013). In reality, users could

be directed to make effective use of their information/knowledge by their involvement. However, user involvement can lead to severe mistakes/issues. The designer not only discusses the technical possibilities and business characteristics of a product during the analysis process, but also looks at primary user needs, behaviour, and preferences (see **Figure 14**) (Wever et al. 2008).

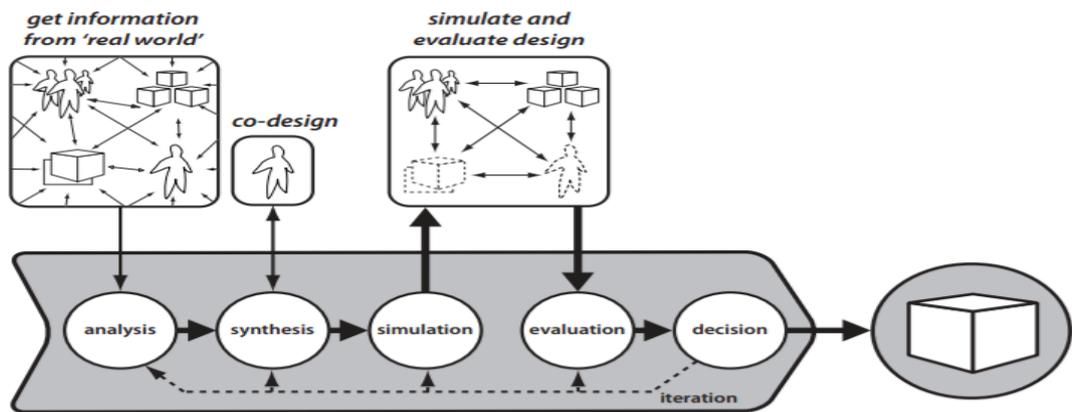


FIGURE 14: THE USER CENTRED DESIGN CYCLE (WEVER ET AL. 2008)

The authors (Abrams et al. 2004) provided a collection of guidelines about how and when users could be included in the design and what kind of information should be collected:

- A sequence of interviews and questionnaires on the design to capture the desires and expectations of the users.
- More interviews and questionnaires to explain the flow of research at the early phase of the design.
- More interviews and questionnaires explaining the research flow at the early design stage.
- A number of focus groups and on-site assessments were conducted during the early design process to gather environmental conditions and knowledge about where the proposed system would be installed.
- Role playing, walkthrough, and simulation at the beginning and middle of the design process (e.g. prototyping) to promote assessment and gather more information.
- Usability testing, interviews, and final-stage questionnaires to determine usability and evaluate satisfaction through the collection of qualitative and quantitative data.

Various groups of users are the target for the TAGS. Thus, working with the users in order to gather their requirements for the new goal setting layer can result in increased system acceptance. Involving the representative users will help to reflect the views of the default collection of users, leading to a better design of TAGS which could help people maintain a healthy usage style.

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## 2.5.2 PARTICIPATORY DESIGN

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Participatory design (PD) stresses user involvement in the design process so that they can directly influence the system. Under PD, the user becomes an integral part of the design process (Sanders 2002). In PD, the behaviour and needs of users, and their understanding of software usability, drive the design process. In the literature, several tools and techniques for implementing the PD approach have been developed. A model for user engagement in online behaviour change interventions design was developed by (Short et al. 2015). Their model suggests that for such interventions to greatly appeal to the users, they need to be properly tailored to the characteristics of the users. In this design approach, system users are brought together from an early stage in order to solve a design issue in a manner that they would understand. This will enable the system designers and developers to gather the features, elements, factors, and functionalities that are significant to the users.

The aim of the PD is to incorporate all partners into each phase of the design. Examples of these stakeholders include system designers and developers, clients, system users, and others (Kang et al. 2015). System users are particularly important stakeholders when it comes to designing for people in general. Moreover, PD enables users to have a feeling of ownership, acceptance, and, in the end, the best result. PD can be executed from various perspectives, including workshops, ethnography, agreeable prototyping, card sorting, and user design (Kang et al. 2015). The outcomes of these techniques produce a design that can be utilised to the full advantage of each stakeholder.

Spinuzzi (2005) suggested a methodology for the PD approach. The author categorised the PD process into three main phases:

- **Phase 1** Exploration of work: In this phase, researchers meet the users and become acquainted with how they work in their natural setting. Examples of research techniques used in this stage are ethnographic methods such as observations and interviews.
- **Phase 2** Discovery process: In this phase, the emphasis is on cooperative interaction between the users and the researchers in order to identify and prioritise the goals, principles, and expected outcomes. Also, this stage should consider defining concepts which guide the design of the software, e.g. interfaces and adaptivity.
- **Phase 3** Prototyping: this phase involves a number of techniques for iteratively finalising the final design artefacts. Prototyping can be performed on-site or in a laboratory; it requires one or more users; and it can be done on-the-job when the prototype is a working prototype (Spinuzzi 2005).

The PD method should be employed with caution in the design process of intervention programmes. Kujala and Väänänen-vainio-mattila (2009) have clarified that the values of representative users who took part in the design process might clash with the values of individuals.

As a result, actual user interest and commitment would not be sustained. Nonetheless, it is necessary to create approaches and guidelines that are supported by best practices to manage user participation, particularly problematic users who might show a denial of the problem. Therefore, more research is still needed to investigate how to use user-centred and participatory approaches when designing technology that manages problematic social networking usage.

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### 2.5.3 VALUE-SENSITIVE DESIGN

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Value-sensitive design is an approach that can be employed if the goal is to work with or consider human values when designing technology. This is based on the perception that the software people interact with has a strong influence on their ability to achieve our goals in return. Value is defined as "what a person or group of people considers necessary" (Friedman et al. 2008, p.70). Value-sensitive design researchers believe that a collective effort to recognise and take care of human values implied by the use of software could considerably enhance technology design. Also, if we neglect the impact of the use of technology on user experience, the resulting experiences are more likely to have a variety of unintended, negative effects on the users' lives (Nathan et al. 2007). A significant problem for designers is deciding which principles are of specific importance in the design of systems.

A system's values can be derived from different sources. According to Shilton et al. (2014), those include individual and collective meanings originating from families, colleagues, social groups and institutes, or a group of people belonging to the same demographic. The root of values is essential to be taken into account by researchers as they assist in setting the research boundaries and other aspects relevant to the study. Shilton et al. (2014) addressed seven methods of collecting values in social computing studies, for example, content analysis, surveys, interviews, design practices, values advocacy, and ethnographies of computer design and use.

The design of TAGS that manages problematic social network usage needs to consider stakeholders' goals, including users' motivation, needs, and values that could influence their experience with the technology. Users are the key target in the designing and creation of TAGS and knowing their values for a system like this would be crucial to its success. In order to understand the value perspective of consumers, it is, therefore, essential to describe what is valuable to them and what motivates them to interact with technology (Kujala and Väänänen-vainio-mattila 2009). User perception of value in HCI, psychology, marketing, and management science to differentiate from targets, needs, and motivations was explained in (Kujala and Väänänen-vainio-mattila 2009). The authors then proposed the term 'user values' to explain the meaning of value from the user's viewpoint and its relationship to people's behaviours and system usage. The goals and values of users vary fundamentally in that the values are 'cognitive representations' of the targets and can maintain positive emotions concerning technology design for users (Schwartz and Bilsky 1987). In the literature and practice, values from the perspective

of the users are not taken into account clearly (Kujala and Väänänen-vainio-mattila 2009). Considering the user values in TAGS is essential as it puts their view into the design of the technology to provide further clarification of users' usage style. For example, to establish an understanding of users' privacy requirements when designing functionality for peer monitoring.

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#### 2.5.4 USER STORIES

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User stories are mainly used together with agile approaches and are considered useful by software engineers as a tool for gathering and representing system requirements and are a well-known technique for depicting software requirements. User stories follow a straightforward template, and a set of guidelines for use when completing the template. The findings from the study by (Lucassen et al. 2016) showed a strong association between user stories and scrum, the view that user stories assist experts in outlining software requirements, the vital role of clarifying why a requirement is communicated, and the positive assessment by those who used the quality framework.

A user story defines features that may be beneficial to a system user or buyer. There are three dimensions to user stories.

- A detailed outline of the story is employed when preparing and as a reminder for later discussions.
- Discussions about the story help to bring out the specifics of the story.
- Checks can express and record information which could be used to assess the completion of a story.

According to Cohn (2004), getting more stories is better than having stories that are too big. The author continues, when a story is simply too massive, it's typically called an epic. Epics may be split into two or smaller stories. Yet, we do not continually break down user stories till we reach a story which contains all the details. Likewise, the story needs not be enhanced in the traditional documentation style for requirements. Instead of writing the stories in a requirements documentation form, the best method is for the design and development team to discuss such information with the user. That is, when the details are relevant, discuss them, and make notes on the user story card. The best way to make sure that each story is worthwhile for the customer or users is to have them write the stories. The customer team should comprise of representatives of as many of these user groups as possible. During a story writing workshop, preliminary stories for a project are always written, but stories may be written anywhere along the project at any time. Everybody brainstorms as many ideas as possible during the story writing workshop.

The user story approach would provide an additional format for the representative users to follow when expressing their goal setting design requirements to help simplify the process. The stories

would show users' requirements reflecting elements and features relating to the new goal setting layer, e.g. providing feedback messages reflecting the user's goal progress.

## 2.6 TECHNOLOGY-ASSISTED BEHAVIOURAL CHANGE

Behavioural change technology, also referred to as E-Health, is a software-based tool developed to provide a vast number of services and facilitate comprehensive management of health care, particularly for those who are unable to access health care services. The services offered range from basic reminders and tracking to complex management and intervention software (Bennett et al. 2010).

### 2.6.1 TECHNOLOGY ACCEPTANCE MODEL

The Technology Acceptance Model (TAM) has been typically used to envisage user intention to embrace and use information systems based on two criteria: perceived usefulness and perceived ease of use (Venkatesh and Davis 1996; Turel and Yuan 2007). **Figure 15** presents the technology acceptance model. Perceived Usefulness is defined as the subjective probability of the possible user that the use of a specific system will enhance their behaviour. Perceived Ease of use refers to the degree to which the potential user expects effortless use of the system (Davis 1989). Other factors referred to in TAM as external variables influence an individual's beliefs about the programme. Since TAM considers acceptance of technology and user acceptance paramount for TAGS to be successful, knowing the factors that shaped users' intentions to use the new goal setting layer would allow the developers to employ those elements in the design to encourage acceptance, and thus increase the use of software.

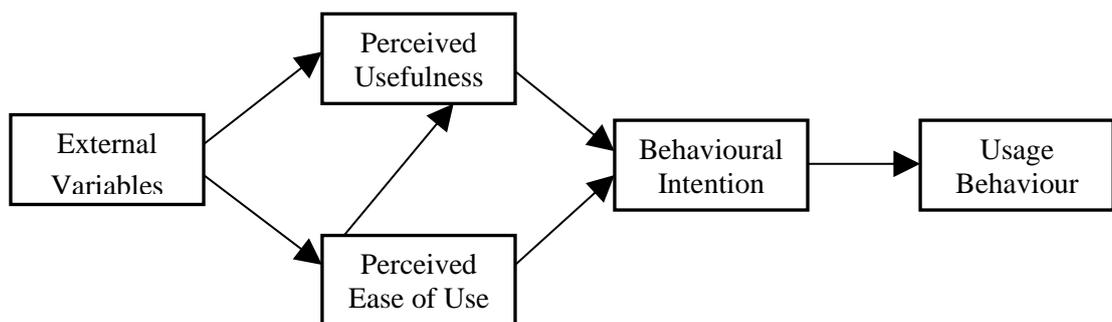


FIGURE 15: TECHNOLOGY ACCEPTANCE MODEL (VENKATESH AND DAVIS 1996)

### 2.6.2 THE ADOPTION OF TECHNOLOGY IN HEALTH CARE

Research has shown that alternative approaches to providing health interventions are increasingly needed in mental health practice. This is because of the inadequate resources available for psychological services (Leigh and Flatt 2015). The influx of Information Technology solutions to the management of health care has brought in technical advances with the potential to overcome this limitation. With advances in digital and mobile technology, etherapy (eHealth) and mobile

health (mHealth) have become another fast-growing option for promoting mental health and well-being as well as providing extra treatment options for mental health issues (Lam and Lam 2016). One of those advances is e-health technology for behavioural change, which offers the opportunity to facilitate clinical interventions and promote health and well-being. A number of current review studies have also shown the efficiency of an approach to eHealth or mHealth in terms of a positive clinical result in mental health/wellbeing (Davis et al. 2015; Vallury et al. 2015).

Behavioural change e-health technology is a developing topic where its employment is rapidly increasing in several addiction-related fields. For example, internet-based solutions are being employed for problem drinkers to encourage responsible drinking (Cunningham et al. 2009). The developments in information technology and Web 2.0 have also allowed a broad variety of possibilities, including smarter, context-conscious, continuous, and online social interventions. For example, as evidence, the use of mobile apps to change behaviour has become a trend, e.g. to stop smoking cessation (Lüscher et al. 2019), and adherence to medication (Dayer et al. 2013). Within the context of computer-facilitated communication and networked digital media, the term Web 2.0 refers to a wide range of functional properties. They not only emphasise the enhanced options for publication (as opposed to past web generations), but they also encourage and facilitate user participation in the uploading and sharing of digital artefacts (Conole and Alevizou 2010). Also, it has forums, social media connections, and is about communication of content, e.g. multi-media content, so it is not only about content but communication of content and networks of content.

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### 2.6.3 E-HEALTH TECHNOLOGY AND PROBLEMATIC SOCIAL NETWORK USAGE

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Previously, problematic social media usage research has been primarily carried out from the perspective of social science (Ryan et al. 2014), including studies by (Çam and İsbulan 2012). Furthermore, previous research has shown that many problematic social media studies focus on developing social networking site measurement scales, for example (Andreassen et al. 2012; Şahin 2018), suggesting that more research into software design practices (e.g. Requirements Engineering and HCI) is needed, especially in the field of problematic social media intervention software (Ryan et al. 2014).

The authors (van Velthoven et al. 2018), reviewed 21 apps and identified digital/persuasive techniques currently used by various apps to regulate/control smartphone use. Also, Ko et al. (2015) reviewed 41 smartphone use intervention apps. These apps were then grouped into four themes: (i) treatment of mobile addiction, (ii) overuse intervention, (iii) control of children's use, and (iv) reduction of task interruption. The apps reviewed in both studies employed different persuasive strategies, such as self-monitoring, social comparison, tracking usage, blocking access

to certain features, and usage reminders. Ko et al. (2015) proposed using "self-regulation" techniques using social cognitive theory (i.e. peer comparison and surveillance) to reduce mobile phone use. There are three elements to this approach, i.e. the intervention system: self-tracking, setting targets, and social learning and competition.

The cumulative interest in the role of software and the possibility of using persuasive techniques such as gamification have led to an increasing interest in employing technology-assisted self-regulatory systems to manage problematic social media behaviour (Alrobai et al. 2019). Usually, such systems persuade people to take responsibility for regulating and controlling their behaviour by employing strategies such as goal setting and persuasive messages that can assist in the behaviour regulation process. Such systems are seen as a means of support and stress that problematic users play an active role in controlling their own usage. Ali et al. (2015) explored software interventions as a countermeasure to digital addiction. The authors argue that the software has the capacity to raise awareness and implement a range of persuasive techniques to keep users in control, interactively and in real-time. The authors suggested the use of interactive warning labels with timers and avatars in these systems. To increase the success of software-based interventions, they should be user-driven (Andreasen 2002).

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#### 2.6.4 TECHNOLOGY-ASSISTED PERSUASIVE TECHNIQUES

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Persuasive techniques are used in behavioural change solutions, e.g. changing problematic smartphone usage (Ko et al. 2015). The core concepts of persuasive system design are the primary task, support for discussion, system integrity, and peer support (Oinas-kukkonen and Harjumaa 2009). Implementing these design principles when designing a persuasive system can help enhance the system quality and support users through the behavioural change process. A summary of these principles is provided below:

**Primary task:** The concepts in this group facilitate the performance of the primary task for the user. In this group, the design concepts are reduction, tunnelling, tailoring, personalization, self-tracking, simulation, and rehearsal (Oinas-kukkonen and Harjumaa 2009).

**Dialogue support:** These are design concepts that include the implementation of support for computer-human interaction in a way that helps users continue to progress towards achieving their goal or desired behaviour, e.g. rewards and reminders.

**System credibility:** The design concepts in this group explain how to design a system in such a way that it is more efficient and, therefore, more persuasive.

**Social support:** The design concepts in this group explain how the system can be designed to empower users through the use of social influence, e.g. comparing with others and normative influence.

The Persuasive System Design Model (PSD) proposed by Tarning and Oinas-kukkonen (2009) is a commonly accepted framework for specifying system requirements and conceptualising/designing persuasion mediated by technology. The PSD supports the categorisation and mapping of persuasive elements. The PSD is comprised of two primary pillars: *context* and *persuasion*. The context element consists of intention, events and techniques as depicted in **Figure 16**. Persuasion describes how an application can be operationally persuasive. Persuasion describes four dimensions, as discussed in (Oinas-kukkonen and Harjumaa 2009).

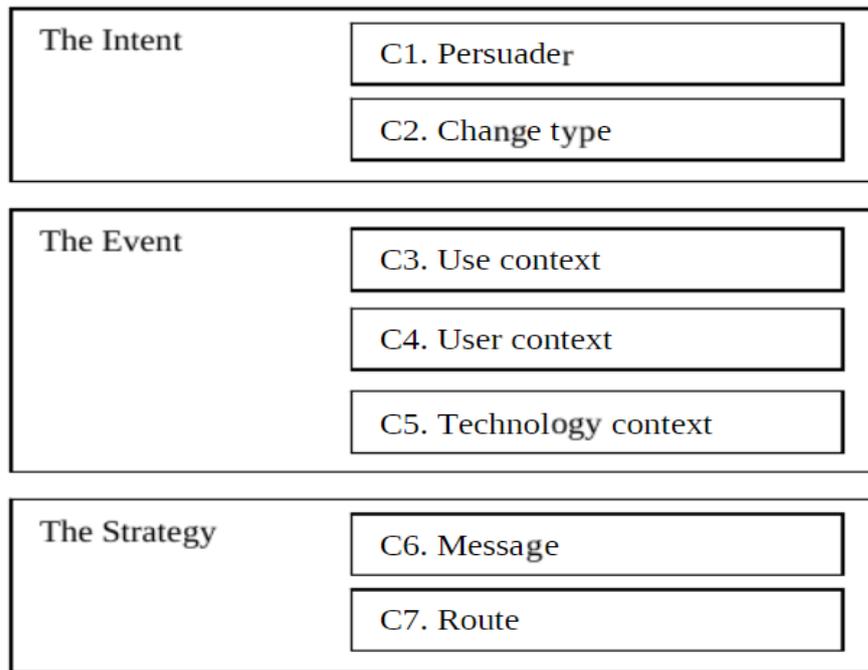


FIGURE 16: MAIN ELEMENTS OF THE PSD MODEL (TORNING AND OINAS-KUKKONEN 2009)

### 2.6.5 INTERACTIVE PERSUASION

The introduction of the internet has resulted in a rapid increase in websites designed to convince or encourage individuals to alter their actions and attitudes (Chatterjee and Price 2009). For example, Facebook not only allows users to browse through the newsfeed, but the site attempts to persuade users to add more people as friends. The framework depicted in **Figure 17**, illustrates how persuasive technologies may affect healthcare. The three circles characterise: (i) technology that needs to be designed with care in order to influence health care; (ii) persuasion techniques that must be used with intent to change behaviour; and (iii) the areas in health care where we see possible illness, lifestyle or natural cycle developments from birth to death (Chatterjee and Price 2009).

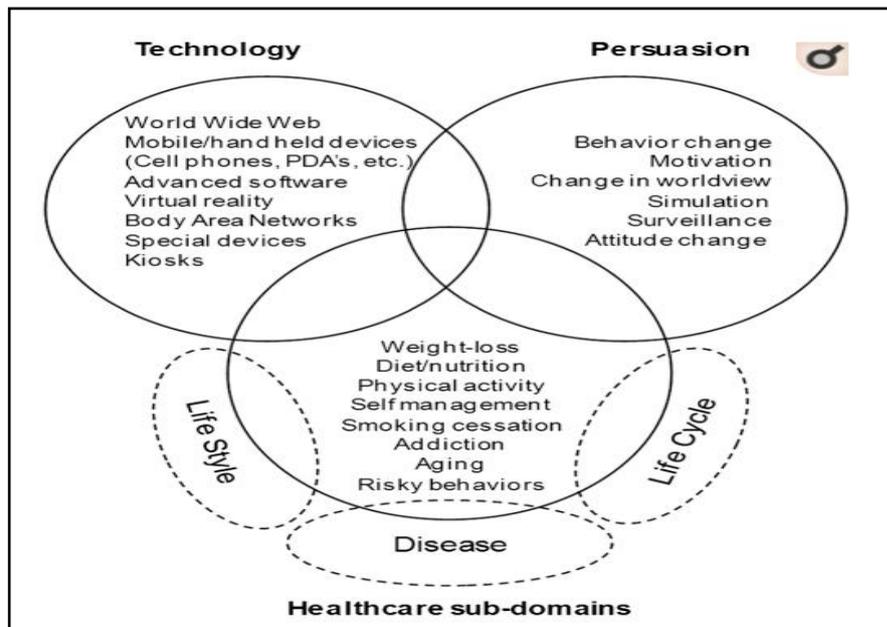


FIGURE 17: A FRAMEWORK DEPICTING HOW PERSUASIVE TECHNOLOGIES CAN IMPACT HEALTH CARE (CHATTERJEE AND PRICE 2009)

Interactive computing technologies may play three parts: as tools, as the media, and as social actors (Fogg 2002). Interactive software technology can persuade by simplifying target behaviour, leading people through a loop or carrying out motivational calculations as a medium. As a tool, interactive computer technology can be informative by motivating people to look at the relationship between cause and effect, providing motivational stimuli to individuals, or endorsing behaviour in practice to individuals. As a social agent, interactive technology can be convincing by providing positive feedback to people, modelling a desired behaviour or attitude, and building a social support network. To develop effective persuasive-based computing technology (PBCT), it is necessary to know the various techniques that a researcher may use when establishing a PBCT function as a tool, media, or social agent. **Table 4** below lists some persuasive techniques that can be employed by researchers or practitioners for each role provided. It is extremely rare to have all three elements used in one interactive technology.

Within problematic social networking usage, it is expected that interactive technologies can play various roles at any particular time. For example, interventions can measure usage time, and at the same time, reward goal progress. Also, peer groups can be formed, which could have an influence on peer motivation and enhance behaviour change. In most cases, one common interactive application is a combination of these three functions to create a whole user experience.

TABLE 4: COMPUTING SYSTEM ROLES AND CORRESPONDING PERSUASIVE STRATEGIES PROPOSED BY (CHATTERJEE AND PRICE 2009) ADAPTED FROM (FOGG 2002)

Persuasive-Based Computing Technology Role	Persuasive Technology or Strategy
As tools	Reduction—simplify by making target behaviours easier by reducing the complexity of activity

As media	<p>Tunnelling—lead users through a step-by-step sequence of actions or events getting them highly engaged in the process</p> <p>Tailoring—provide customized information that is relevant</p> <p>Suggestion—intervene at the right time and place</p> <p>Simulate cause—and—effect scenarios—provide the ability to convey the effects in a vivid and credible way</p> <p>Simulate environments—create new and immersive environments for user engagement</p> <p>Simulate objects—provide tangible context that fits into a person’s everyday life</p>
As social actors	<p>Influencing via physical cues</p> <p>Psychological influence—support feelings, empathy, emotions, etc.</p> <p>Social dynamics—support taking turns, praise for good work, answering questions, reciprocity, etc.</p> <p>Social roles—support various roles (e.g., doctor, nurse, rehabilitator, teacher, coach, guide, etc.)</p>

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### 2.6.6 GAMIFICATION

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Gamification is defined as “*the use of game design elements in non-game contexts*” (Deterding et al. 2011). Software systems belonging to this family are known as "gamified" applications (Deterding et al. 2011, p.1). Advertisers and website product managers originally introduced gamification as a method to improve customer engagement. Due to its success, gamification quickly became popular and spread to other fields, such as employee performance management and training (Dubois and Tamburrelli 2013). Considering its recentness, the primary focus of many gamification approaches is on the gaming elements. According to Zichermann and Cunningham (2011), it would be incorrect to concentrate on gaming aspects, since a huge part of gamification is about psychological problems. This means that the behaviour of a person and the cultural context as depicted in **Figure 18** need to be recognised in order to get the most out of gamification and its implementation in industry, healthcare or education. Since the main objective of gamification is to sway user behaviour, understanding actions and what factors influence behaviour is important. This process includes behavioural change techniques, as well as cultural and social factors (Almarshedi et al. 2015).

Motivation is a significant factor in gamification (Nicholson 2012). Understanding it could lead to creating a successful gamified design, especially as it controls human actions (Xu 2011). Motivation takes two forms; (i) intrinsic motivation, which is described as an internal need to do stuff for fun, and (ii) extrinsic motivation, which is to perform activities purely for their outcome (Ryan and Deci 2000). Motivation is currently the subject of a range of gamified applications and services, especially in their extrinsic form (Bhadoriya and Chauhan 2013). Extrinsic motivation does not, however, on its own, have an effect on sustainable gamification due to the fact that the need or desire to perform a behaviour, providing gamification elements such as rewards, may not have a significant/long-term effect on the intended behaviour, or because extrinsic motivation such as rewards could undermine intrinsic motivation, which is also needed for a successful

gamified system. Hamari et al. (2014) suggested that it cannot be one aspect employed to modify behaviour. Hence, it is essential to consider the difference between extrinsic motivation and intrinsic motivation when designing gamified applications and services.

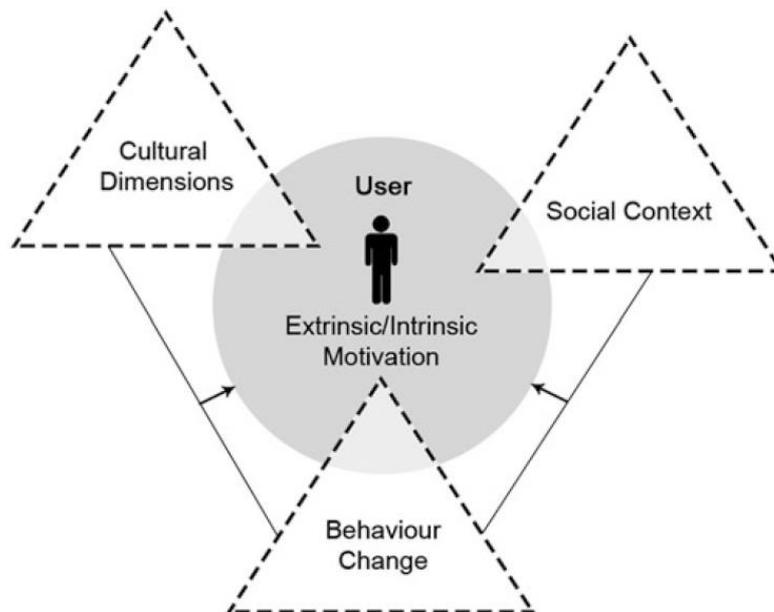


FIGURE 18: FACTORS THAT DRIVE MOTIVATION IN GAMIFICATION (ALMARSHEDI ET AL. 2015)

In order to implement gamification, developers need to be aware of game design elements and also the significance of including these elements into the intervention design (Cugelman 2013). An obstacle faced by developers is that there is often no among between gamification researchers on these design elements (Cugelman 2013). Technology is only convincing when it uses elements to change a specific behaviour. These persuasive elements presented in **Table 5** are the elements that apply persuasive force to individuals, inspiring them to change their values, attitudes, and behaviour (Cugelman 2013). If those elements are taken out, the behavioural change system is no more persuasive (Cugelman 2013). Gamification's persuasive architecture is the blending of elements which make a system enjoyable and engaging and make gamification addictive. When designing gamification for technology-assisted solutions to help maintain/regulate social network behaviour, it is vital to consider/combine these three factors: social, cultural, and external factors into the design.

TABLE 5: SEVEN PERSUASIVE TECHNIQUES OF GAMIFICATION (CUGELMAN 2013)

**The persuasive architecture of gamification and its 7 persuasive strategies.**

1. Goal setting: Committing to achieve a goal
2. Capacity to overcome challenges: Growth, learning, and development
3. Providing feedback on performance: Receiving constant feedback through experience
4. Reinforcement: Gaining rewards, avoiding punishments
5. Compare progress: Monitoring progress with self and others
6. Social connectivity: Interacting with other people
7. Fun and playfulness: Paying out for an alternative reality

2.6.7 CAPTOLOGY

Captology is defined as “*the study of computers as persuasive technologies*” (Fogg 1997, p.129). As depicted in **Figure 19**, the area where computers and persuasion overlap describe captology. Captology is relevant to software products that are intended for many aspects of human life. Various domains have utilised this technique, including preventive health care, personal management and improvement, and commerce (Fogg 2009a). One core concept of captology is to see that persuasion occurs on two stages: the macro stage and the micro stage. On the macro stage, software applications are developed to be persuasive, because persuasion and motivation are the fundamental reasons for the development of these products, e.g. the Amazon.com website. On the micro stage, products are not intended to have a persuasive outcome as their overall goal. However, the product will use minor components of persuasion to achieve other objectives. For example, users may be encouraged to spell check documents using a word processing tool, but this type of influence is on the micro stage (Fogg et al. 2007).

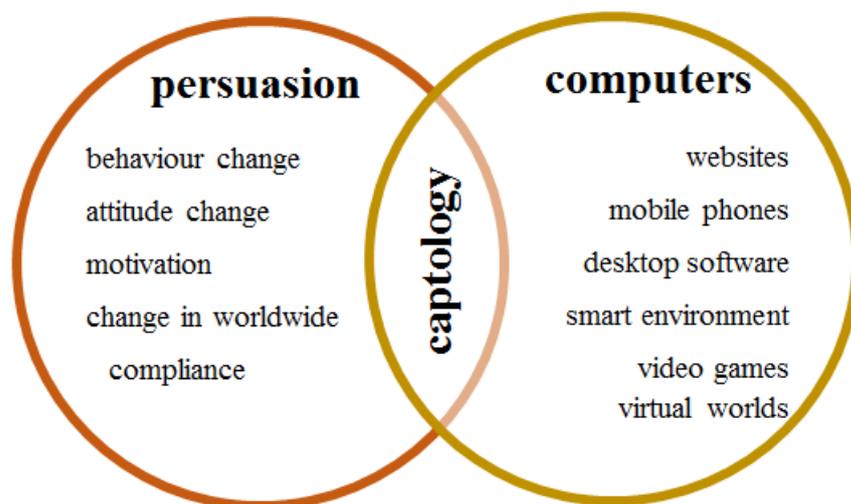


FIGURE 19: CAPTOLOGY (FOGG 1997)

In captology, the Functional Triad, see **Table 6**, is valuable because it aims to demonstrate how software products can use various strategies to change people’s attitudes and behaviours (Fogg 2009a). The three aspects of the functional triad are shown in **Table 6**, and are described in detail in (Fogg 2009a). In behavioural change interventions such as technology-assisted solutions, the persuasive capability of the functional triad elements would help remind people of their behavioural targets, monitoring and tailoring feedback information for effective behavioural change.

TABLE 6: CAPTOLOGY SUMMARIES THREE WAYS THAT COMPUTERS INFLUENCE PEOPLE (FOGG 1998)

<b>Function</b>	<b>Essence</b>	<b>Persuasive affordances</b>
Computer as tool or instrument	Increases capabilities	<ul style="list-style-type: none"> <li>• Reduces barriers (time, effort, cost)</li> <li>• Increases self-efficacy</li> <li>• Provides information for better decision making</li> <li>• Changes mental models</li> </ul>
Computer as medium	Provides experiences	<ul style="list-style-type: none"> <li>• Provides first-hand learning, insight, visualization, resolve</li> <li>• Promotes understanding of cause/effect relationships</li> <li>• Motivates through experience, sensation</li> </ul>
Computer as social actor	Creates relationship	<ul style="list-style-type: none"> <li>• Establishes social norms</li> <li>• Invokes social rules and dynamics</li> <li>• Provides social support or sanction</li> </ul>

## 2.7 HUMAN COMPUTER INTERACTION ASPECTS

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(Kim 2015, p.1) defined human computer interaction as

“a cross-disciplinary area (e.g. engineering, psychology, ergonomics, design) that deals with the theory, design, implementation, and evaluation of the ways that humans use and interact with computing devices”.

The main goal of human computer interaction (HCI) is to design interfaces to increase user-to-system interaction.

User experience (UX) is the main concept in HCI that includes not only the functional completeness, high usability, and visual appeal of the interactive artefact, but also its seamless incorporation into people’s lives or the creation of a new lifestyle around it (Kim 2015), unlike the traditional usability framework, which focuses primarily on the performance of the user (Law et al. 2009). UX is described as the views and reactions of an individual arising from the interaction or expected interaction with a product, application, and so on (ISO 2008). Essentially,

it is a user's overall perception during a system interaction and after a system interaction (Interaction design foundation). UX is not static because user experience with the interface develops over time because of changes in various aspects, including user engagement with the platform, competitive technologies, and peer reviews, among others. Hence, UX changes overtime and needs continual long-term monitoring. Consequently, considering the 'what' and 'why' of experience changes over time would aid the collection of these elements (Vermeeren et al. 2010). According to Kujala and Väänänen-vainio-mattila (2009), the beliefs of users (e.g. comfort, loyalty, and health) that aid developers recognise desirable features must always be taken into account in order to enable successful investigation.

In HCI, it is essential to reflect on the conceptual similarity between usability and UX in terms of users' gratification and, additionally, assessment approaches. Even though UX and usability are dissimilar, they are not entirely separated. Usability is, in reality, a component of UX (Punchoojit and Hongwarittorn 2017). Other key elements of UX, apart from usability, include suitable and required content, availability, reliability, visually pleasing, and satisfaction. Several studies found that while social applications like Twitter and YouTube do not comply with usability standards, user experience is not adversely affected (Hart et al. 2008). Considering user experience in the design and implementation of the new goal setting layer is essential to help increase acceptance of the technology. This could be achieved by establishing an understanding of the representative users' perceptions of their skills to understand and use the technology, which could help reduce the effort required for interaction and usage of the new goal setting layer, hence reducing usage frustration.

## 2.8 CHAPTER SUMMARY

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In this chapter, a state of the art review in relation to problematic social networking behaviour is provided. Additionally, this chapter discussed possible methods that might guide the development of strategies, approaches, and mechanisms for developing structures that can help control problem behaviour. The next chapter will address the research methodology, assumptions, and options for achieving the objectives of the thesis.

### 3. CHAPTER 3: RESEARCH METHODOLOGY

In this chapter, a discussion of the methodological approach and justification of the research methods adopted in the thesis will be provided. Also, this chapter will look at other available methodological options, as it is important to find all possibilities for data gathering for any study (Creswell 2003). This chapter commences by discussing research approaches, research methods for collecting data, and then methods for analysing and interpreting the gathered data. In (Creswell 2003), three approaches to research are summarised, i.e. qualitative, quantitative and mixed method approaches. These approaches are distinguished by their particular data collection methods, analysis and interpretation.

The research methodology and research methods adopted in this thesis will be structured based on the framework commonly referred to as the research onion (Saunders et al. 2009). The research onion is presented in **Figure 20**. The framework clarifies the phases of the research process, e.g. the philosophies, methods of theory development, methodological choices, methods and techniques that can be pursued to accomplish the primary goals of the research. The underlined components represent the choices that have been made in this thesis and will be described in subsequent sections.

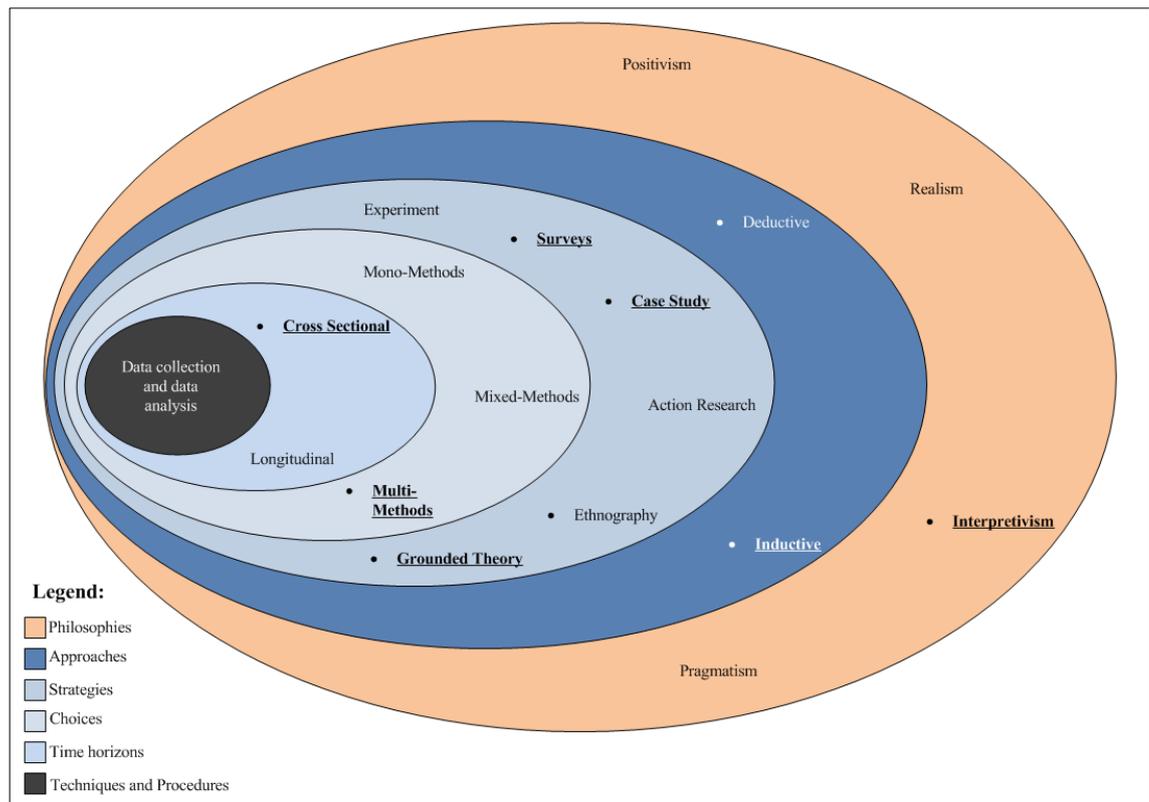


FIGURE 20: RESEARCH ONION (SAUNDERS ET AL. 2009)

#### 3.1 RESEARCH PARADIGMS

A description of four research paradigms that are widely discussed in the literature and well presented in the research onion is given in this section. Those paradigms are positivism, realism, interpretivism, and pragmatism. Knowing these paradigms will aid the formulation of the research beliefs and relevant assumptions that would guide the research. The research philosophy followed holds vital assumptions on which the research technique and the approaches chosen for the technique are based. Researchers need to be conscious of the philosophical dedication we make on the basis of our research strategy, because this has a vital impact on what we do as well as what we are investigating (Johnson and Clark 2006).

Three primary types of research assumptions are employed by research scholars to help differentiate research philosophies (Saunders et al. 2019):

- **Ontology** refers to assumptions people make in relation to the nature of reality, i.e. what people believe about the nature of reality. These assumptions define the research choices for the research assignments undertaken.
- **Epistemology** refers to assumptions about how we acquire the knowledge we know and use, what makes such knowledge satisfactory/acceptable, reliable and legitimate enough to use and therefore help with our decision making, and how we relate such knowledge to other people (Burrell and Morgan 2005). Epistemology is concerned with the "how" and raises questions about the reliability of the sources of knowledge, what are the actual sources of knowledge, and how to find out if the knowledge is accurate.
- **Axiology** refers to the aspect of beliefs and ethics concerning the topic under research. Here, the researchers' task is to establish how they deal with their values and the values of those the research is about. The research philosophy and data collection strategies adopted reflect the researcher's values for research.

The research assumptions that are used to distinguish the research philosophies largely depend on the research tools adopted for the research. For example, when the HARP tool is chosen, structured and agency assumptions are used to distinguish the research philosophies.

Heightening your Awareness of your Research Philosophy (HARP) is a self-reflective instrument that was created to assist researchers in discovering their research philosophy (Saunders et al. 2019). It is merely a starting point for researchers to ask themselves more specific questions about how they think about research. The tool will not present a definitive response to the question, i.e. what research philosophy to adopt? Instead, it will show the researcher where their beliefs align with and differ from those of the five main philosophical traditions. HARP is divided into six sections, each with five statements. Each section focuses on a different facet of philosophical convictions, i.e. ontology, epistemology, axiology, purpose of research, meaningfulness of data, and structure/agency (Saunders et al. 2019). In the HARP, the various philosophies are

represented through distinct questions. You can uncover your parallels and discrepancies with various components of each research philosophy by marking your agreement or disagreement with each statement, then adding up the responses for each philosophy.

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### 3.1.1 POSITIVISM

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Positivism holds that scientific strategy is the best way to establish the truth and impartial reality. This philosophy involves working with observable social reality, e.g. social entities in an organisation, and adopting measurements that can be confirmed. Positivism provides assurances of clear-cut and precise knowledge (Saunders et al. 2009). According to Saunders et al. (2009), positivism is value-free research in which the investigator is autonomous, isolated, and impartial about what they are researching. In practice, a positivist is not involved in the environment they are studying, whereas researchers in other paradigms need to be involved to enhance understanding of the properties of the environment they are studying (Saunders et al. 2009).

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### 3.1.2 REALISM

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Realism philosophy means that reality is independent of the investigator's mind, that is, outside reality exists (Bhaskar 2008). Realism adopts a scientific method to obtain knowledge (Saunders et al. 2009). This presumption supports the gathering of data and the understanding of the collected data. The meaning and importance of realism in research can be made more explicit when we compare two kinds of realism (i) direct realism and (ii) critical realism. The first kind, direct realism, states what you observe is what you get; the world is portrayed exactly by what we perceive through our senses. The second kind, critical realism, centres on clarifying the things we see and experience, and argues that what we feel are impressions, pictures of real-world things, not those things directly (Saunders et al. 2009), see **Figure 21**. Critical realism states that there are two phases to understanding the world: (i) are the feelings and actions we encounter, and (ii) depicts the mental process that takes place at some point after the experience.

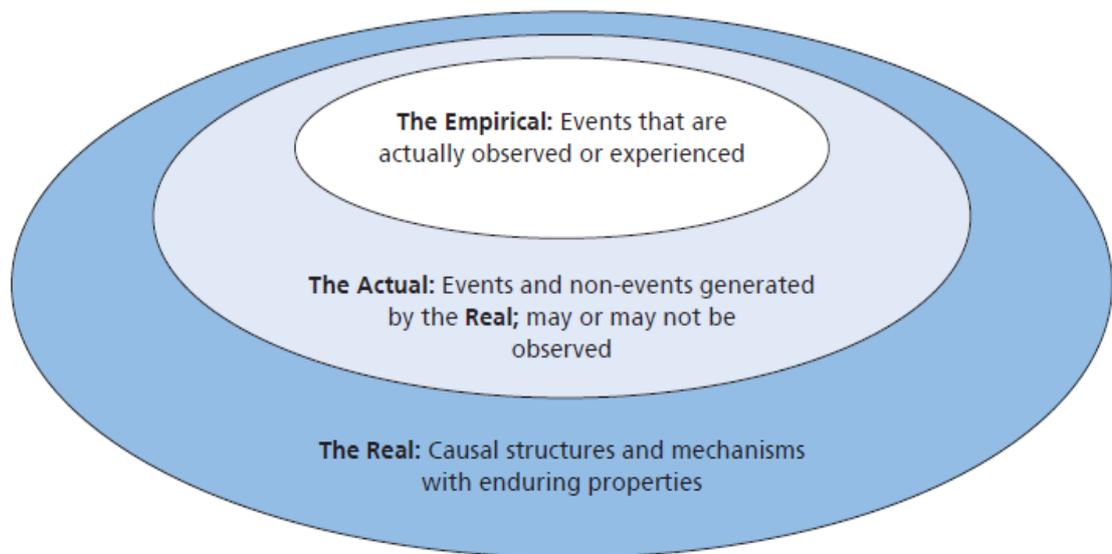


FIGURE 21: CRITICAL REALIST STRATIFIED ONTOLOGY (SAUNDERS ET AL. 2009)

### 3.1.3 INTERPRETIVISM

Interpretivism, also known as interpretivist, researchers prefer to develop a better awareness of an area under investigation and its complexity in its particular context, rather than trying to generalise the awareness basis for the entire population (Creswell 2007). In this philosophy, the objective of research depends on as much as possible the study participants' understanding of the situation being investigated. Often, qualitative research is associated with an interpretive philosophy (Denzin and Lincoln 2011).

Interpretivism claims that individuals and their social environments cannot be observed in the same way as things are experienced physically. Because various individuals of different cultural backgrounds make different interpretations under different conditions and at different times, and thus establish and experience various social realities, interpretivism is critical of the positivist efforts to realise concrete, universal 'rules' applicable to everyone. Interpretivism research aims at developing new, deeper understandings and insights into social environments and situations, and this means exploring the research project from different groups of people's perspectives, i.e. collecting the factors that are meaningful in relation to the project (Saunders et al. 2009). Different elements of interpretivism put somewhat different weight on how to perform this in practice, by focusing on ambiguity, diversity, and multiple meanings. This philosophy is specifically subjective. Vital to interpretivism is that the researcher has to employ an empathetic position. An issue that can be encountered here is penetrating the study participants' social world and considering the world from their viewpoint.

This research adopts the interpretivism philosophy for the following motives: (i) its ability to support the understanding of the human experience of the world, and this thesis centres on understanding TAGS to help regulate problematic social network usage by exploring users' perceptions of such technology. (ii), interpretivism enables the use of multi-method qualitative

data collection to help increase the chances of exploring a wide range of users' views relating to TAGS. Therefore, this thesis has employed different qualitative data gathering techniques, e.g. interviews and focus group studies.

Strength of the interpretivism philosophy is that, with a diverse perspective on a topic, interpretivist researchers may not only describe objects, people, or events, but also profoundly comprehend them in their social settings. Furthermore, researchers can perform these types of studies in a natural context by employing essential techniques such as grounded theory, ethnography, or case study to acquire interviewees' views on the research objects and provide more genuine information about the research objects (Wellington and Szczerbinski 2007). Second, researchers can examine an interviewee's thoughts, values, beliefs, attitudes, emotions, and perspectives using the essential approach of interactive interview, which enables researchers to explore things that we cannot perceive. As a result, the vital information gathered will equip researchers with greater ideas for future action. A weakness of the interpretivism philosophy is that it is a personal rather than an independent ontological perspective (Mack 2010). As a result, the author claimed that research findings are undeniably influenced by the researcher's personal interpretation, beliefs, methods of thinking, or cultural preferences, resulting in many biases. One of these constraints is that interpretivists want to get a deeper insight and knowledge of a topic inside the complexity of its setting rather than extrapolating their findings to other people and settings (Cohen et al. 2011). As a result, it probably leaves a void in validating the effectiveness and use of study findings utilising scientific techniques.

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#### 3.1.4 PRAGMATISM

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The pragmatism research philosophy is problem-centred, and researchers utilise all possible research methods to establish an understanding and gain knowledge about the research problem. Pragmatist researchers are “free” to select the research strategies and methods that best address their needs and purposes. Likewise, mixed methods researchers look at numerous ways to deal with gathering and analysing data instead of adopting just one single way, i.e. quantitative or qualitative (Creswell 2003). This does not imply that pragmatists always utilise different techniques; rather, techniques which allow the gathering of trustworthy, factual, and related data to progress research (Kelemen and Rumens 2008). The pragmatism research philosophy seeks to integrate both objectivism and subjectivism viewpoints into various contexts (Saunders et al. 2009).

### 3.2 RESEARCH APPROACHES

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The research approach outlines the entire process of research, including plans and study techniques ranging from general premise to detailed data gathering and analysis methods. The literature distinguishes three types of approaches to research, which are the deductive approach,

the inductive approach, and the abductive approach. Below, a discussion of the two approaches is presented, see **Figure 22**.

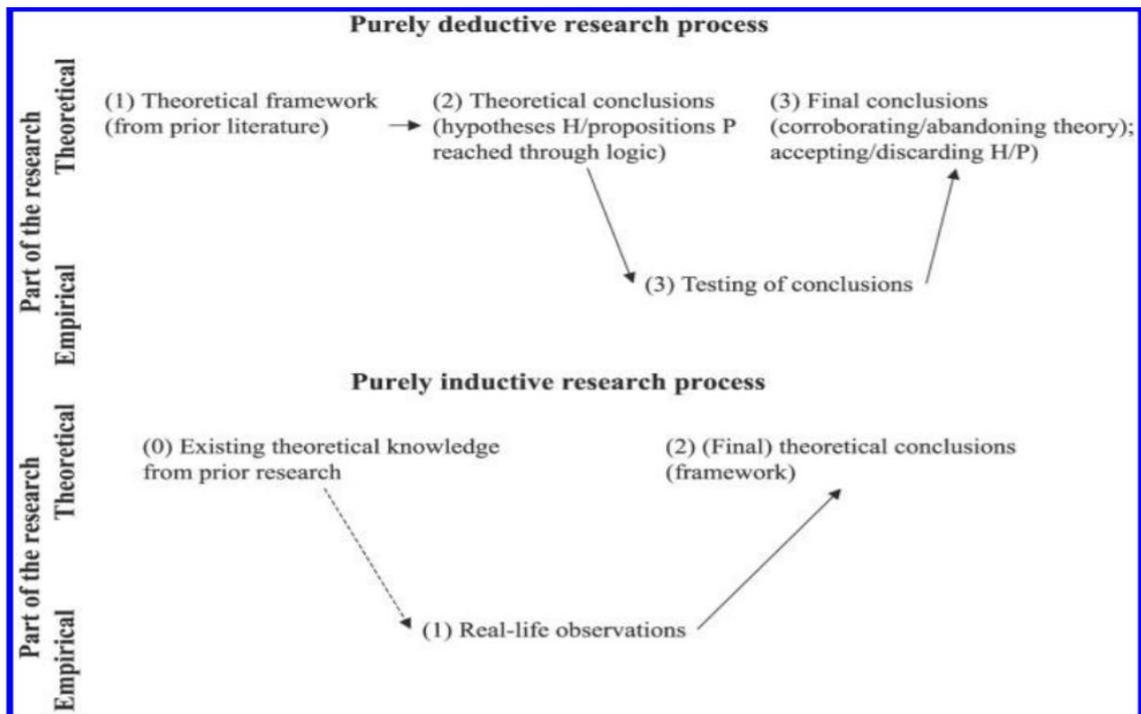


FIGURE 22: PURE DEDUCTIVE AND INDUCTIVE RESEARCH PROCESSES ADOPTED FROM (KOVÁCS AND SPENS 2005)

The *deductive research approach* includes the testing of theories developed before the start of the research. The steps in the deductive approach are depicted in **Figure 23**. The deductive approach is described as beginning with the general and finishing with the specific. The deductive approach has different characteristics: (i) there is a search for an explanation for causal relationships between ideas and variables, (ii) ideas need to be operationalised in such a way that the evidence can be quantified, often numerically, and (iii) the remaining attribute of deduction is generalisation, which involves careful sampling and sufficient sample size (Saunders et al. 2009).

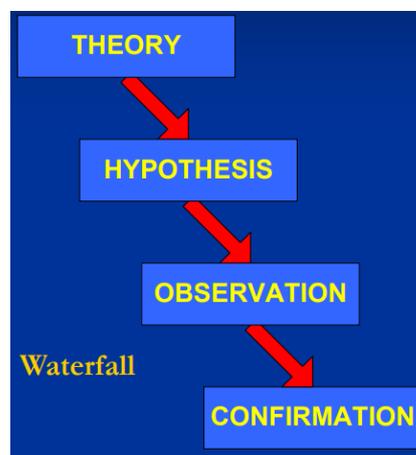


FIGURE 23: THE DEDUCTIVE RESEARCH APPROACH (BURNEY AND SALEEM 2008)

The *inductive research approach* does not start with the development of theories. Instead, this approach commences by collecting data to learn about a phenomenon and ends by developing a theory (Saunders et al. 2009). A theory is built based on data gathered and analysed as outlined in **Figure 24** (Burney and Saleem 2008). Before generating theory/theories, several research activities are undertaken, including interviewing and analysis of the interview data. Overall, the inductive approach is commonly explained as beginning from the specific towards a wider generalisation and theory building. Inductive research allows for flexibility, since the researcher is not limited to following any predetermined information. It encourages the development of new theories. Some critics argue that inductive research would produce improper results if observations were inaccurate. The process of conducting research following the inductive approach can also take a considerable amount of time.

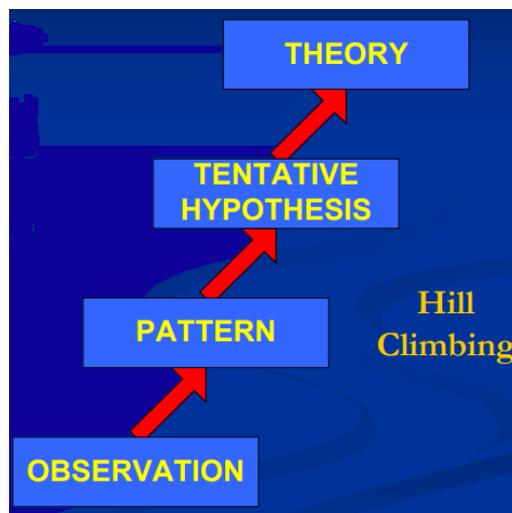


FIGURE 24: THE INDUCTIVE RESEARCH APPROACH (BURNEY AND SALEEM 2008)

The *abductive approach* combines the techniques of both deductive and inductive approaches by moving between the two approaches (Suddaby 2006). In this research approach, the study process commences with the observation of startling facts and proceeds to investigate these facts that are outlined at the start of the research process. An abductive approach is more effective if the goal of the researcher is to find out new things, different variables, and other relationships (Dubois and Gadde 2002). In comparison to inductive and deductive reasoning, abductive research may explain, establish, or alter the theoretical framework before, in the course of, or after the research process. The principal difference between the deductive and inductive research approaches is the significance of their theories to the research. Also, the deductive approach investigates the effectiveness of the on-hand assumptions or theories, while the inductive approach adds to the results of a study and the enhancement of new theories. **Table 7** presents the three research approaches.

TABLE 7: RESEARCH APPROACHES (SAUNDERS ET AL. 2009)

	<b>Deduction</b>	<b>Induction</b>	<b>Abduction</b>
<b>Logic</b>	In a deductive inference, when the premises are true, the conclusion must also be true	In an inductive inference, known premises are used to generate untested conclusions	In an abductive inference, known premises are used to generate testable conclusions
<b>Generalisability</b>	Generalising from the general to the specific	Generalising from the specific to the general	Generalising from the interactions between the specific and the general
<b>Use of data</b>	Data collection is used to evaluate propositions or hypotheses related to an existing theory	Data collection is used to explore a phenomenon, identify themes and patterns and create a conceptual framework	Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth
<b>Theory</b>	Theory falsification or verification	Theory generation and building	Theory generation or modification; incorporating existing theory where appropriate, to build new theory or modify existing theory

The qualitative research approach is primarily inductive, with the researcher extracting significance from data gathered in the field. Therefore, the inductive approach is used in Chapter 6. The need to explore users' perception of TAGS and the various aspects required when eliciting behavioural goals and abstraction of the various features and functionalities required in the new TAGS layer underlines the significance of using an inductive approach, which could benefit from an inductive approach.

### 3.3 RESEARCH STRATEGY

The research strategy can be described as a methodological plan for how research is conducted to achieve its aims and objectives. This is the methodological interface between the chosen philosophy and the selection of methods for data gathering and analysis (Denzin and Lincoln 2011). One of the research philosophies mentioned in Section 3.1 could be related to particular research strategies, such as deductive or inductive research methods. A fundamental aspect of selecting a research strategy is that it supports the researcher in solving the questions under investigation and achieves the research goals (Saunders et al. 2009). Therefore, the research strategy selection will be guided by various factors, e.g. the research questions, research goals, research approach and purpose, plus other research obstacles, including the degree of researchers'

knowledge, time and resources available to researchers, and access to study participants and other data sources (Saunders et al. 2009). Research strategies should not be perceived as mutually exclusive, such as using a survey technique in a case study (Saunders et al. 2009). The following sections present an outline of the research techniques, including grounded theory, case studies, experiments, ethnography, surveys, and action research.

### 3.3.1 GROUNDED THEORY

Grounded theory refers specifically to a theory that is grounded in or created inductively based on the data gathered from research participants' explanations (Saunders et al. 2009). It is an effective strategy for explaining and exploring individual behaviour. This approach is suitable when a phenomenon is little understood, to create or build an explanatory theory that exposes a mechanism inherent in the substantive field of investigation (Tie et al. 2019). In this research strategy, the researcher tries to develop an overall understanding of people's daily experiences in a particular setting based on the opinions of the participants in a study. This research approach is a qualitative-based strategy. The grounded theory offers a structured approach for gathering and analysing qualitative data. The process of performing grounded theory research is not linear but iterative and recursive (see **Figure 25**).

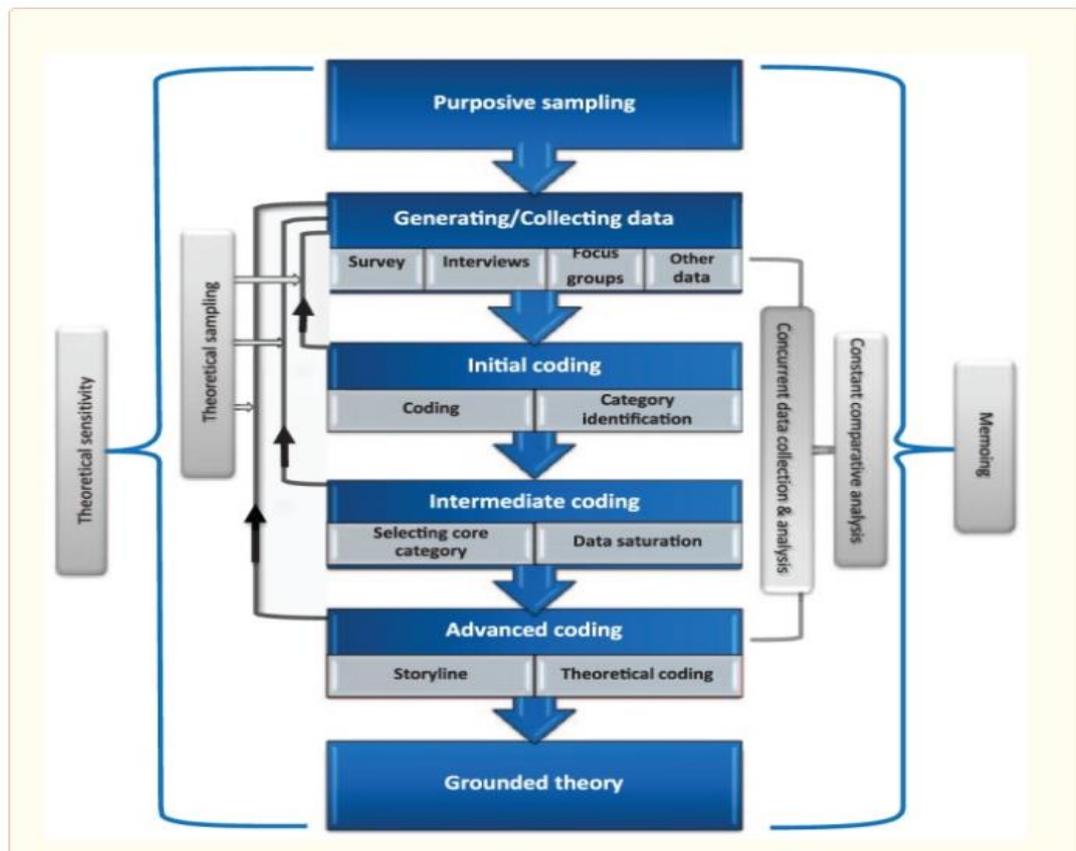


FIGURE 25: A SUMMARY OF THE RELATIONSHIP GROUNDED THEORY METHODS AND PROCESSES (TIE ET AL. 2019)

In a grounded theory strategy, different qualitative data gathering approaches can be employed, e.g. focus groups, observation and interviews (Strauss and Corbin 1998). It is also an effective technique in the absence of a theoretical framework to direct the process of data gathering, analysis, and understanding (Saunders et al. 2009). Employing grounded theory as a research strategy leads to other issues and consequences, such as those related to data collection; the use of current theory; the selection of a key group or groups to concentrate work on; the development of theory; and the amount of time needed to pursue this technique (Saunders et al. 2009).

Grounded theory research strategy commonly emphasises inductive reasoning (Saunders et al. 2009). Since there are wide-ranging theoretical frameworks that can describe the mechanisms behind the addictive usage style of users, grounded theory strategy has inspired the analysis of the studies conducted in **Chapter 5** and **Chapter 6** to shape a better awareness of technology-assisted behavioural change such as TAGS. This thesis cannot assert a complete implementation of the grounded theory as this requires more in-depth questions and theoretical/philosophical commitment (Braun and Clarke 2006).

One of the major advantages of grounded theory is the systematic and sequential gathering and analysis of data. This allows the research procedure to collect all potentially significant elements of the research topic as soon as they are perceived. The strength of the grounded theory method is largely due to this process. Furthermore, it prevents the researcher from interfering with the research study. A weakness of the grounded theory is that it is a time-consuming process. Additionally, it does not necessarily result in a theory since, in the end; the research focuses on a particular social setting rather than a broad range of issues.

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### 3.3.2 CASE STUDIES

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Case studies can be defined as an

“empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (Yin 1981, p.98).

Selecting the case to be studied, e.g. an individual, software application, an organisation, and deciding the scope of the study is a core element in describing a case study (Saunders et al. 2009). The case study method is a way of attaining a clear understanding of a research situation (Saunders et al. 2009). Case studies can be used for exploratory as well as for descriptive and explanatory research purposes (Yin 2014).

Studying a case in its current setting or environment helps to differentiate between the case study and other strategies. The case study method provides researchers with the opportunity to gather both qualitative and quantitative data. In a case study research method, the researcher can benefit

from combining multiple data collection techniques, including existing documentation, questionnaires, interviews, focus groups, and different types of observation (Saunders et al. 2009). Yin (2014) acknowledges that case studies can be employed for exploratory as well as descriptive and explanatory reasons.

Case studies are a common preference for evaluating research findings in the real environment. Case study methods are even quite commonly found among program evaluation studies, for example (Kennedy 1979). In order to attain objective five, this thesis employed the case study approach in **Chapter 8** to evaluate the findings of the thesis.

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### 3.3.3 EXPERIMENTS

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The experiment research strategy aims to research the likelihood of a change in an independent variable inducing a change in a dependent variable (Saunders et al. 2009). The significance and side effects of a transition would be studied in complex experiments. The experiment strategy is a method of study that is significantly connected to the natural sciences, though it is deeply associated with psychological and social science studies. The researcher gauges this by offering a precise treatment to one variable and withholding it from the other, and then determining how each variable scored on an outcome. Predictions, known as theories, are used in an experiment rather than study questions. This is because the researcher expects there will be a relationship between the variables being studied. Experiments are often carried out in laboratories instead of on the ground, including those in domains closely related to business and management, e.g. organisational psychology. This ensures the researcher has better control over parts of the research process, for example, the collection of samples and the environment in which the experiment takes place. Although this increases the experiment's internal validity, i.e. the degree to which the results may be related to the interventions rather than to any study design flaw, it would therefore be more challenging to determine authenticity (Ross and Morrison 1996).

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### 3.3.4 ETHNOGRAPHY

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The ethnography research strategy is structured to study and collect detailed qualitative records about communities' common variables in their unregulated usual setting. The ethnography method employs both deductive and inductive approaches. In this strategy, the researcher investigates the typical behaviour patterns, language, and movements of existing ethnic groups in their natural environment over an extended period of time (Creswell 2014). Data collection in the ethnography strategy frequently involves observations and interviews (Creswell 2014).

In an ethnography strategy, the researcher might experience some challenges due to (i) time and preparation required for the researcher to be wholly immersed in the social communities that are under investigation, (ii) the information collected can be subjective, and (iii) the researcher needs

to find a group of people capable of fulfilling the principal focal point of the research. Also, researchers must find the right way to gain access to such groups in their environment. Accordingly, this also requires the researcher to establish a high degree of trust with the people concerned with the research field. This requires having a full-time personnel member embedded in the environment. The researcher needs to make notes to expand on some key points and have some follow-up discussions and interviews to investigate further essential aspects that the researcher observed during the observations (Delamont 2007).

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### 3.3.5 ACTION RESEARCH

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Action Research is an innovative and iterative enquiry method intended to find answers to specific organisational issues following a participatory and collaborative process, using various forms of knowledge and having consequences beyond the research project for participants and the organisation (Coghlan 2011; Coghlan and Brannick 2014). This description defines five themes that are briefly considered in this order: purpose, method, involvement, awareness, and implications. Action research aims to promote organisational learning by defining problems, preparing actions, taking actions and assessing actions to achieve practical results. An action research strategy starts with a research question within a specific context. However, since it operates following various phases, the emphasis of the question might shift as the research progresses. Due to its clear emphasis on multi-stage action, action research differs from other research approaches in identifying and assessing responses to organisational issues and facilitating progress within the organisation.

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### 3.3.6 SURVEYS

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The survey is a popular and commonly used strategy because it allows a highly economical way of collecting data from a large population when it is intended to be self-administered. However, the questionnaire is not the only data-gathering tool that is part of the survey approach, but it also involves organised observations and structured interviews (Saunders et al. 2009). Also, people commonly see the survey strategy as authoritative and reasonably easy both to describe and to comprehend. Given that surveys are typically deductive and may include limited questions, they are unable to offer detailed knowledge of the topic under investigation. The survey strategy is also insufficient if it is intended to remember experiences in the past, e.g. user feelings, which can result in biased answers (Lazar et al. 2010).

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## 3.4 RESEARCH CHOICES

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Research choices, in general, refer to qualitative and quantitative research methods (Saunders et al. 2009). Saunders et al. (2009) distinguish between the two research choices. Qualitative research is non-numeric data such as pictures and words, and quantitative research is numerically

dependent. In this way, quantitative is frequently used for any technique of data gathering, e.g. a questionnaire, or process of data analysis, e.g. statistics which produce or utilise numerical data. By comparison, qualitative is frequently used for any method of data gathering, interviews, or data processing procedures such as classifying data that produces or employs data that is not numeric. The research choice could include one data-gathering technique and subsequent data analysis, or the choice could encompass more than one data gathering and analysis method to address the questions under investigation fully. According to Saunders et al. (2009), research choices are categorised into two categories:

- **Mono method:** Refers to when the research study employs one data gathering technique, e.g. structured interviews or a questionnaire with an equivalent data analysis method.
- **Multiple methods:** Refers to when the research employs different methods, for data gathering purposes, e.g. qualitative or quantitative methods and uses the corresponding method for analysing the data.
- **Mixed methods:** This is a subset of multiple methods that incorporate quantitative and qualitative data gathering methods and analytical processes. For example, semi-structured interviews are combined with questionnaires to confirm the interview findings.

The difference between the mono and multiple methods is that with the mono, the research study uses only one data collection technique, e.g. semi-structured interviews with thematic analysis, or the research can use a questionnaire and analyse the data quantitatively. Whereas, with multiple methods, the research study employs various qualitative methods, such as interviews and focus groups, and analyses the data gathered qualitatively, or the study can employ different quantitative procedures, such as questionnaires and structured observations, and analyse the data gathered using statistical analysis methods.

In this thesis, the qualitative multi-method is mainly adopted, e.g. semi-structured interviews and focus groups as outlined in **Chapters 4, 5, and 6**. The reason being, the need for the same research study to employ different data gathering techniques to help explore the primary research problems initially and then more in-depth exploration to expand and concretise the initial findings.

### 3.5 TIME HORIZONS

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According to Saunders et al. (2009), a time zone is concerned with the specific time that the research is performed. The authors identified two types of time zones, (i) cross-sectional time zone and (ii) longitudinal time zone (Saunders et al. 2009). The time zone to be adopted should depend on the research question under investigation. Also, the adopted research choice and associated techniques will influence the choice of a suitable time zone.

- **Cross-sectional:** Refers to the study of subject matter over a particular time period. Cross-sectional frequently adopts surveys as a research technique. An example of such studies can be when a study investigates a given phenomenon, e.g. research skills of computing students, or to demonstrate how various aspects are linked in dissimilar contexts, such as studying the relationship between problematic social networking usage and various factors that influence the usage, such as mood modification, peer pressure, and entertainment. Nevertheless, qualitative research techniques may also be used in cross-sectional studies, for example, interviews conducted in a short time.
- **Longitudinal:** This requires a longer time period to answer the questions under investigation, such as the diary study strategy. The principal characteristic of longitudinal studies is their ability to investigate change and development. This time of study can also deliver some degree of control over some of the elements being studied.

This thesis adopted a cross-sectional time zone. This is because the research aims to investigate users' perceptions of TAGS and how they can be used to help regulate their problematic social networking usage. Also, as the thesis does not develop TAGS as one of its contributions, the cross-sectional time zone is suitable.

## 3.6 ADOPTED RESEARCH METHODS

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Data collection and analysis is the core of the research onion (Saunders et al. 2009). This part of the research onion focuses on various methods and processes that can be adopted to gather data and analyse the data gathered. The data collection methods include interviews, questionnaires, and non-statistical analysis methods and statistical analysis methods. The data collection and data analysis techniques employed in this thesis are discussed below.

### 3.6.1 DATA COLLECTION

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Since the thesis follows a bottom-up approach (to help move from research data collection to analysis of the data to the theoretical level), qualitative data collection methods were adopted to help achieve the research aim and objectives outlined in **Chapter 1**. Although a survey initially conducted by the authors (Ali et al. 2015) was extended in this thesis, this does not qualify the research to adopt a mixed method approach, because the author only extended the survey participants, the comments they provided, and analysed only the qualitative part of the survey, i.e. the comments. A general description of the data collection methods will be provided in this section, while a detailed description of how the methods were applied to help obtain the research study outcomes will be given in the respective chapters.

#### 3.6.1.1 INTERVIEWS

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The interview research technique is a purposeful dialogue concerning two or more individuals in which the interviewer is required to develop a relationship with the interviewees, ask brief and precise questions, and listen carefully (Saunders et al. 2009). The interview method is the most popular technique for data gathering in qualitative research studies (Jamshed 2014). Using interviews will help the researcher collect valid, reliable, and relevant data to address the research question and target. Interviews may also be employed to help enhance the researchers' ideas, where a research topic and expectations have not yet been completely developed. According to (Seaman 1999; Chism et al. 2008), the interview technique is used to collect individuals' views about a particular subject.

Typically, the interviewer develops the interview questions based on defined goals which will help address the research question. According to Patton and Cochran (2002), interviews mimic daily discussions as they concentrate on the data needs of the interviewer. The interview approach allows the researcher to select individual participants and gather data from that group, using the interview questions as a guide to concentrate the attention of the interviewees on a particular subject. Based on the results of the literature, the interview method will be implemented for the study's qualitative research stage as the primary goal is to understand various users' views of TAGS to help regulate problematic social networking usage. Various kinds of interview techniques may be adopted in qualitative research, such as semi-structured, structured and unstructured, and very complicated ones, e.g. life histories (Seaman 1999; Patton and Cochran 2002). We adopted the semi-structured method for this research where the interview is driven by TAGS and open-ended questions were created to try and develop an understanding of this subject.

We arranged our interview by taking account of the following points (Patton and Cochran 2002):

**Reproducible-** that is, another researcher can employ the same topic guidance to produce similar data.

**Systematic-** to make sure we do not just select interview participants or data that helps our prior ideas about the responses.

**Credible-** the questions we ask, for example, and how the questions are asked should be fair for producing valid explanations of the research questions/topic.

- **Structured interviews** – in order to collect precise information, structured interviews are performed using prearranged questions. The success of structured interviews depends primarily on knowing the type of questions to ask, the time the questions should be asked/timing of the questions and asking the right participants. Structured interview questions can be designed as open-ended, e.g. using words such as what and why, or closed-ended, e.g. using words such as when, where, and so on. Although structured

interviews tend to restrict research into new ideas, they are generally regarded as thorough and successful.

- **Unstructured interviews** – These types of interviews are conversational in nature, in which only minimal control over the course of conversations is exercised by the interviewer. This is because they do not observe a set plan or question list; there is a possibility that some areas could be overlooked entirely. Another frequent issue with unstructured interviews is focusing a lot on some areas, and not enough details in others (Zowghi and Coulin 2005). This style of interview is best used for investigation if there is a narrow understanding of the subject under investigation or as an antecedent to greater focused and comprehensive structured interviews (Zowghi and Coulin 2005).
- **Semi-structured interviews** – This interview technique is usually a combination of structured and unstructured interview techniques. Semi-structured interviews can be conducted using predetermined questions, although the sequencing of the questions can differ. Also, this interview technique allows some flexibility in both the sequence in which questions are asked and the materials used to stimulate discussion, ask for elaboration, or create new questions.

Applying the semi-structured interviews technique to this research thesis enables the researcher to gather data and develop an in-depth understanding of the TAGS. Prior to conducting the interviews, the author prepared an interview document which includes the interview questions and other materials related to the topic under investigation to guide the process and help the participants gain a better understanding of the study. Ethical approval was obtained before the interviews began and other ethics-related documents, such as the study information sheet and participant consent form, were prepared and provided to the interview participants. This technique was used in Chapters 5 and 6 to explore various questions relating to the main research questions.

In Chapter 5, the core research question was (what are Experts' perceptions of the inclusion of warning messages and labels for software such as Social Networks and Games?) The questions associated with the main question included asking participants their initial thoughts about this idea and what would motivate them to accept or consider labelling and addictive warning messages? These and the remaining questions were asked by experts and practitioners from various backgrounds, including human factors in computing, Usability Engineering, Requirements Engineering, Digital Addiction and Social Psychology (see Table 15). The participants included academics, PhD research students and counsellors. The experts and practitioners were interviewed to help gather their views on warning messages and labels in order to manage or provide warnings against digital addiction focusing on social networks and games. Also, interviews were performed face-to-face, and each interview lasted about 60 minutes. For further information on the interview participants, ethical information and how the interviews were

conducted (see Chapter 5, Section 5.6.1). In Chapter 6, the main research aim was to explore users' perceptions of the use of technology-assisted goal setting to assist the behavioural change process. Questions created to help gather participants' views relating to the main topic included asking study participants their initial thoughts about the use of technology to assist the management of problematic online behaviour and the aspects that need to be put into consideration when technology is used to assist the management of behavioural goals. In total, eleven questions were asked. The participants' academic background or fields of study include Management, Cyber Security and Human Factors, Psychology, Media and Communication, and Computing and Informatics. For more information, (see Chapter 6, Section 6.3.1). The participants were eighteen in number, including eleven males and seven females. Before the interviews began, the participants were sent documents explaining the aim of the study and various aspects of goal setting elements. The researcher booked a seminar room, and all interviews were conducted face-to-face. For further information on the interviews, refer to Chapter 6, Section 6.3.1.

The semi-structured interview method is useful for having in-depth discussions with the interview participants. The method enables researchers to ask probing questions and helps them to learn about each interview participant's autonomous thinking. Employing a semi-structured interview technique could help researchers obtain better findings. Ritchie and Lewis (2003) state that almost all the time, a researcher can check up on all spoken and non-spoken replies, such as feelings, laughter, body language, and silence, to uncover hidden information that could be useful in the final analysis of the various themes extracted from the discussion. A weakness of semi-structured interviews is that they can take a considerable amount of time to prepare and conduct; they require a lot of labour from the interviewer and demand a high level of interviewer expertise. Preparing for interviews, setting up interviews, performing the interviews, and analysing the interview data is not as simple as it may appear. It has been argued that to do everything correctly using this method, you'll need to invest a lot of time and effort.

According to Saunders et al. (2009), various kinds of interviews can be employed to gather data for each type of study, as summarised in **Figure 26**.

	Exploratory	Descriptive	Explanatory	Evaluative
Structured		✓✓	✓	✓
Semi-structured	✓		✓✓	✓✓
Unstructured	✓✓			✓

✓✓ = more frequent, ✓ = less frequent

FIGURE 26: VARIOUS TYPES OF INTERVIEW FOR THE RESEARCH PURPOSE (SAUNDERS ET AL. 2009)

- **Exploratory study:** To help find out what is going on and to understand the study setting, unstructured interviews can be very beneficial. It is also possible to use semi-structured interviews in an exploratory study. These two types of interviews can give the study relevant background or contextual information.
- **Descriptive study:** In this type of study, structured interviews can be used to find common patterns.
- **Explanatory study:** Semi-structured interviews can be employed in an explanatory study to establish the associations among elements, such as those shown in a descriptive study. Structured interviews can also be employed in statistical terms in relation to an explanatory study.
- **Evaluative study:** In this type of study, one can find it helpful to utilise one interview technique, or a mixture of various techniques, based on the nature of the research. Semi-structured interviews may be used in many situations to clarify the associations between the evaluation and the criteria for effectiveness.

This thesis adopted the semi-structured interview method for the studies conducted in **Chapter 5** and **Chapter 6** to establish an understanding of the users' perception of TAGS. This technique was useful in gathering data related to thesis Objectives **3** and **4**. In **Chapter 5**, semi-structured interviews were conducted in the fields of well-being, addiction recovery, and human factors in computing with experts and practitioners. The main aim of the interviews was to investigate users' views of online labelling and warning messages, interactive, to regulate digital media addiction focusing on social network applications and games. Also, in **Chapter 6**, semi-structured interviews were conducted with users to gather their perspective concerning the opportunities, challenges, and acceptance factors of TAGS.

### *3.6.1.2 FOCUS GROUPS*

Focus groups are group interviews that focus on an explicit issue, product, service, or topic by facilitating participant dialogue and sharing of opinions in an open and tolerant atmosphere (Krueger and Casey 2009). Study participants' discussion is a core element of focus groups. The success of the focus group approach is closely linked with the rise of participatory research (Nyumba et al. 2018).

The person running a focus group session is called the facilitator. The facilitator's role is to ensure that the participants stay within the scope of the topic under investigation and encourage group discussion. The study participants are recruited based on specific characteristics related to the research topic. The number of focus group participants can vary depending on the research topic. Generally, 6 to 8 participants are enough (Krueger and Casey 2009), and sometimes as many as 12 participants can be selected for a focus group session. Focus group sampling usually follows

a non-probability method, for example, people who have the right experience as well as an understanding of particular research topics (Saunders et al. 2009). The challenges in implementing focus groups include (i) dominant participants influencing others, (ii) ensuring all participants contribute to the discussions, (iii) side discussions, and (iv) prolonged discussion on specific questions.

In this thesis, the focus group method is used in **Chapter 4** to validate the goal setting reference checklists and for instantiating the goal setting elements for the case of problematic social networking usage. The method is also utilised in **Chapter 5**, i.e. to refine the results of the literature review on the negative consequences of DA, and **Chapter 6**, i.e. to explore users' views on software-based interventions. Lastly, **Chapter 8** used a focus group in the case study design to evaluate the proposed TAGS method. This process fulfils the second part of **Objective 5**.

Focus groups differ from interviews in that they allow you to get the opinions of a large number of individuals in a relatively short amount of time and cost. One of the weaknesses of the focus group is that it adds to the difficulty of maintaining confidentiality since not only the researcher but also group members have access to information. Researchers recognise that focus groups are engaging and conversational events that do not always go as planned, even for the most experienced and knowledgeable researchers. Ryan et al. (2014) claimed that due to the dynamic nature of focus groups, they may produce results that are incompatible with the intended goals of the study. Other difficulties, including access to people who fit the selection criteria and their availability, may limit the type and depth of data gathered.

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### 3.6.1.3 *EXTENDED SURVEY*

A survey initially conducted in (Ali et al. 2015) was extended in terms of survey participants and encouraged participants to provide comments in the comment sections. Also, the aim of this phase of the survey is to gather more comments from participants. According to Ritter and Sue (2007), the minimum number of responses in any survey is 30. The extended survey was utilised in **Chapter 5**. In **Chapter 5**, the survey comments on the proposed software intervention were analysed.

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## 3.6.2 *DATA ANALYSIS*

Data analysis refers to the methods employed to analyse and evaluate the data gathered using the techniques defined in the above section. Since the studies conducted in this thesis primarily utilised qualitative data collection methods, the thesis will employ qualitative data analysis using thematic analysis and content analysis techniques.

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### 3.6.2.1 *QUALITATIVE CONTENT ANALYSIS*

Here, a discussion of the strategies employed to interpret and assess the gathered data using the methods stated in the prior section is provided. Since the data collected in this thesis was primarily qualitative, e.g. interviews and focus groups, this research thesis employed qualitative analysis using the methods of content analysis and thematic analysis. These two analysis techniques are usually used in qualitative analysis. Qualitative analysis is the method of analysing the data collected in preparation for a more comprehensive study by sorting and coding or marking data according to predefined themes or categories (Ritchie et al. 2013).

Qualitative content analysis can be applied generally to any recorded communication, such as interview transcripts and other forms of communication, observation material, videotapes, and written documents. Qualitative content analysis is a method used to make a replicable and substantial deduction from the gathered data into its context, with the goal of providing information, new understandings, a representation of facts, and a realistic guide to action (Krippendorff 1980). The objective is to provide a summary and extensive description of the phenomenon, and the finding of the analysis is ideas or classifications that describe the phenomenon. Typically, the motive behind ideas and classes is to develop a model, conceptual system, or classification (Elo and Kynga 2008). Qualitative content analysis offers a set of rule-based measures for performing systematic analysis of the data. The core qualities of content analysis are the flexibility and ability to manage complexity, integration of various materials from different places, and the integration of the context of study into the analysis of the material (Kohlbacher 2006). Also, qualitative content analysis is strictly controlled, systematically processed and data is analysed in a step-by-step method. In most cases, it is difficult to avoid the researcher's interpretations influencing the coding manual. Another disadvantage of this strategy is that it is impossible to avoid some interpretation from the coder throughout the coding process (Graue 2015). When conducting a content analysis, the integrity of the materials to be used must be ensured. As a result, they must be examined for authenticity, credibility, and representativeness (Graue 2015).

According to Braun and Clarke (2006), thematic analysis is a principal technique for qualitative analysis. Thematic analysis is a qualitative analysis technique which is described as a “tool for identifying, analysing, and reporting patterns (themes) within data” (Braun and Clarke 2006, p.6). One of the advantages of the thematic qualitative approach is that it is flexible and accessible. If researchers do not clearly state how their data analysis was conducted, this can delay others from conducting related work (Attride-stirling 2001). The thematic analysis process was outlined in six key stages (Braun and Clarke 2006). These stages are listed below.

- ❖ Familiarising oneself with data
- ❖ Generating initial codes
- ❖ Searching for themes

- ❖ Reviewing themes
- ❖ Defining and naming themes
- ❖ Producing the report

Despite the various connections between qualitative content analysis and thematic analysis, including cutting through the data and scanning for themes, their primary distinction lies in the probability of data quantification. This means that in content analysis, the calculation of the occurrence of different classifications and themes is possible (Vaismoradi et al. 2013), while thematic analysis gives a detailed and rich interpretation of the data.

In this thesis, both content analysis and thematic analysis were used. In **Chapter 4**, content analysis was employed to analyse collected data from the focus group sessions aimed at instantiating goal setting elements for the case of digital media addiction. In **Chapter 5**, the data gathered from studies was analysed through the six phases of the thematic analysis approach to identify ways that technology could be used to regulate the negative life experience of problematic digital media usage. In **Chapter 6**, thematic analysis was used to investigate users' perceptions of the opportunities, challenges, and acceptance factors that would influence their acceptance of TAGS.

### 3.7 ETHICAL CONSIDERATION OF RESEARCH DESIGN

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Ethics is defined as

“the standards of behaviour that guide your conduct in relation to the rights of those who become the subject of your work or are affected by it” (Saunders et al. 2009, p.239).

Researchers face ethical challenges at all phases of research, from design to writing the study findings. When conducting a qualitative research study, specific issues need to be considered, such as anonymity, confidentiality, and informed consent (Richards and Schwartz 2002), as well as researchers' potential influence on the participants (Sanjari et al. 2014). The overall ethical problem here is that research subjects ought not to be exposed to the risk of humiliation, discomfort, damage or any other kind of difficulty. To help address this, the research methods, risks and issues relating to their inclusion in the research should be communicated explicitly to the study participants. Study participants should, therefore, be informed about their data rights and how they will be protected during the study. An organisation's research ethics committee creates an ethical code that researchers are expected to adhere to. Also, they are responsible for reviewing and approving research ethics. A researcher is, therefore, required to obtain ethical approval from their respective research ethics committee for the proposed research before commencing any activity related to the research.

Accordingly, the researcher's conduct is probably driven by the code of ethics or ethical recommendations of their university, demonstrating what is ethical and what is not. Therefore, for all the studies conducted in this thesis, the Bournemouth University Online Ethics Checklist was completed. The ethics checklist was reviewed and approved by the Bournemouth University Research Ethics Committee (BUREC). The ethics ID is 15170. The research studies for this thesis are all below the minimum risks as outlined in the ethical code document, and this means there were no specific risks for taking part in the studies. Ethical documentation, including a study information sheet and a study agreement form, will be created and disseminated to participants before the study date. The agreement form was signed, showing participants' consent to participate in the studies. The information sheet will help familiarise participants with the details of the study, and the agreement form with detailed information regarding participants' rights during and after the study. The information sheet includes the study aim, the expectations of participants, and confidentiality. The data collected through the studies is anonymised and well protected.

Figure 27 below shows a mapping between the thesis objectives and the adopted research method.

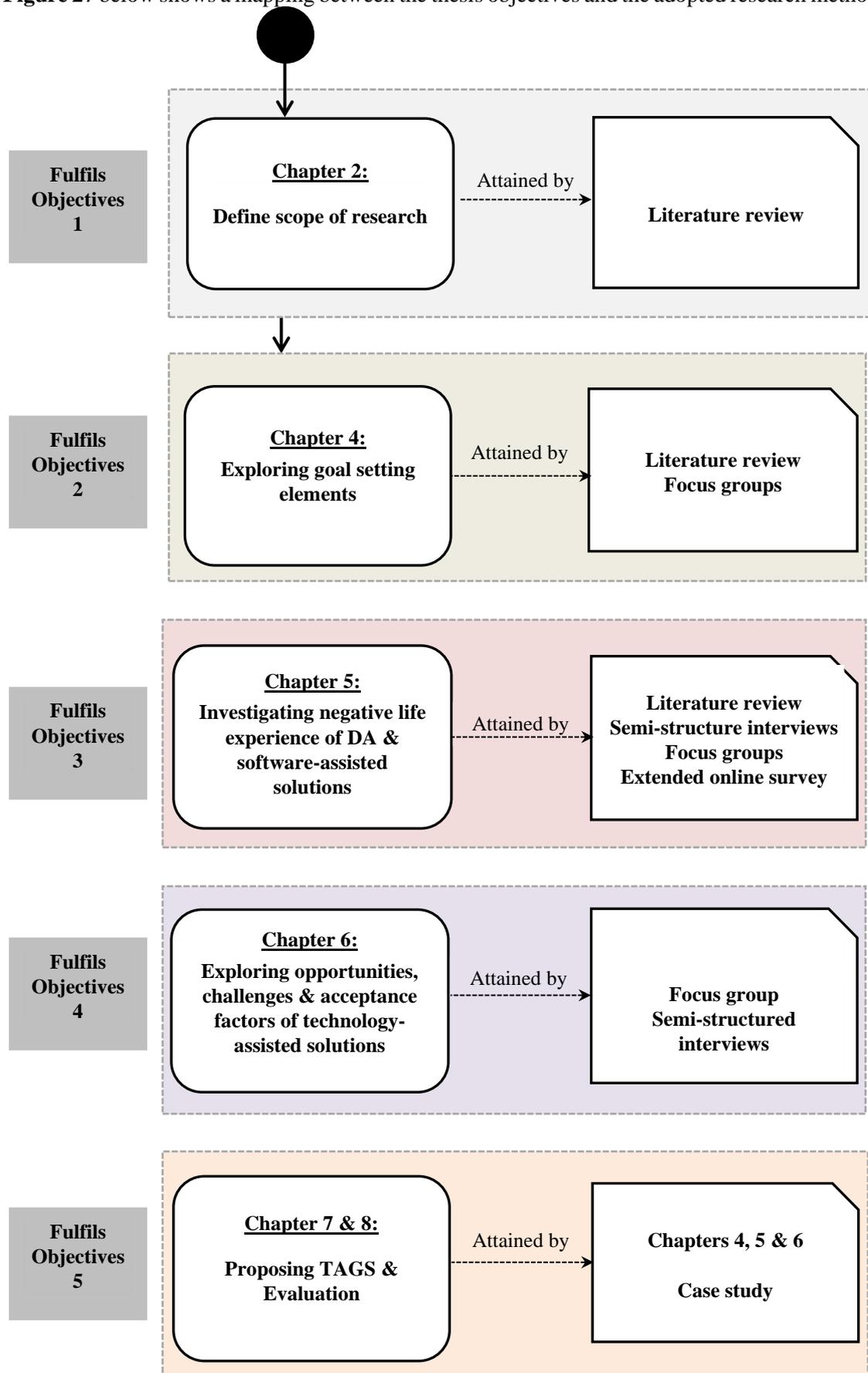


FIGURE 27: THESIS OBJECTIVES AND RESEARCH METHODS

### 3.9 CHAPTER SUMMARY

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This chapter provides a summary of research paradigms, research approaches, and strategies as choices that might be followed by this research. The details of all the steps and processes involved in each approach and design adopted are not provided in this chapter. Such specifics are given in their respective chapters to provide the information linked to the activities taken towards enforcing every step and process employed in the research methodology. The next chapter reviews goal setting literature and its associated elements and presents a detailed classification of goal setting and the properties and elements associated with it.

## 4. CHAPTER 4: GOAL SETTING: FIVE REFERENCE CHECKLISTS

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Goal setting is a core element of various techniques and principles within persuasive technology. A persuasive system is an information system intended to strengthen, change, or shape states of mind or behaviours, or both, without using pressure (Oinas-kukkonen and Harjumaa 2009). An information system can aid both in monitoring performance and also in motivation through feedback and rewards.

Goal setting has been applied in various domains, including healthcare (Strecher et al. 1995; Bodenheimer and Handley 2009), and learning and education (Boekaerts and Corno 2005). Examples include improving the dietary behaviour of low-income women and helping learners perform better through positive reinforcement achieved when they attain their goals. The technique has also been applied to physical fitness, e.g. to encourage people to adopt a healthier way of life by being more physically active (Consolvo et al. 2009). Also, the theory is used for sustainability and reducing energy consumption, where goals have both personal and societal value (van Houwelingen and van Raaij 1989; Abrahamse et al. 2007).

Goal setting research is informed by cognitive psychological theories, which demonstrate how a person's perception of their skills, and the usefulness and ease of achieving a specific goal play a vital role in being successful in meeting that goal (Bandura and Simon 1977). The notion of goals and goal analysis is common in the literature of information systems analysis (Mylopoulos et al. 1999; van Lamsweerde 2001). However, in business information systems, the focus has been on business goals driven by contractual or agreed roles of personnel in the organisation. Behavioural goals are different as the attitudes and perceptions of users influence them. They relate to properties inherent in personality and the perception of self-efficacy and self-esteem, which are not typically the primary focus of business information systems goals.

Research on goal setting can be found across a wide range of disciplines. This includes literature in management and business administration where the emphasis is on productivity and supporting business or strategic goals (Steers 1975). It can also be found in social psychology, e.g. the use of goal setting within groups, in which social relationships become an integral part of goal definition and achievement (Oettingen et al. 2001). Goal setting can also be informed by cognitive psychology research, which has demonstrated how a person's perception of their skills and the usefulness and ease of achieving a certain goal play a vital role in how successful they are in meeting that goal (Bandura and Simon 1977). Similarly, targeted behaviour in theories of reasoned action by Fishbein (1980) and planned behaviour by Ajzen (1991) can be defined as a goal. These theories highlight that self-perception of the ability to meet a goal affects the commitment and adherence to plans to achieve such goals.

## 4.1 RESEARCH GOAL OF CHAPTER

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There is a lack of specific and systematic approaches to how to elicit, specify and manage behavioural change goals in persuasive information systems. Current methods for specifying goals in information systems, such as scenario-based and user stories, and agile methods (Rolland and Salinesi 2009; Sen and Hemachandran 2010), would not apply to behavioural goals, which introduce new factors affecting their elicitation and management, such as the unreliability and inability of users to express realistic and attainable goals, the importance of personalisation in designing feedback and reward systems, and deviation prevention. Taking the user stories method as an example, asking a user or group of users who are in denial or unreliable what their goals are may not lead to effective behavioural change.

In this chapter, we contribute towards filling this gap in the literature and provide foundations and benchmarks to support future methods of eliciting and managing behaviour goals in software-assisted solutions. We present five reference checklists developed based on reviewing the literature on goal setting theory and its application in various domains (**Section 4.3**). In the broader sense, this chapter is intended to provide foundations and a reference point for managing a new category of requirements, behavioural requirements, typically characterising the requirements of persuasive systems, including gamification and software-assisted solutions.

## 4.2 RESEARCH METHOD

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At the start of the research, we made a proposition that behavioural change goals introduce the need for a new mindset when dealt with as requirements in persuasive systems. Informed by goal-setting theory (Locke and Latham 2002) and the literature on goal-oriented requirements engineering (van Lamsweerde 2001), five main pillars of behavioural goals are defined to guide our investigation. These pillars are *sources of behavioural goals*, *goal identifiers*, *goal elicitation*, *monitor and feedback*, *deviation and countermeasures*.

After setting the initial template, we reviewed the relevant literature to inform our approach to constructing the five goal setting reference models. We reviewed the literature on goal setting in various communities, including behavioural economics, persuasive technology, and health and environmental sciences. We only considered papers which adopted goal setting as their primary research strategy and provided a description of how it was used. Studies which did not elaborate on the concept and studies that did not provide enough details of their procedure were excluded from the final selection. We used the following strings and then did snowballing, ‘goal setting OR goal-setting’, ‘behaviour change interventions AND (goal setting OR goal-setting)’, ‘behaviour change OR behavior Change’, ‘behavioural change OR behavioral change’, ‘self-regulation AND persuasion’, ‘goal setting AND persuasive technologies’, ‘gamification AND persuasive techniques’, ‘goal setting AND self-monitoring’, ‘self-regulation AND goal setting’,

‘goal setting AND behavioural change interventions’, ‘behavioural change goals AND software interventions’ and ‘self-regulation AND self-monitoring’.

Our main review strategy was based on a progressive snowballing approach, starting with influential papers in the field, which led to further references (Jalali and Wohlin 2012). In total, we reviewed 65 papers. This study is not meant to be a systematic literature review but rather an elicitation of common facets and elements of goal settings used when describing the concepts. The commonality of the findings in over sixty papers would qualify them to be common enough in the wider literature.

### 4.3 BEHAVIOURAL GOALS: FIVE REFERENCE MODELS

In this section, we discuss the five reference checklists for goal setting and their associated elements, derived from the literature review.

#### 4.3.1 FIRST REFERENCE MODEL: SOURCES OF BEHAVIOURAL GOALS

The source of goals represents the party who sets the goal. Based on the literature review findings, we identified five sources of goals. **Table 8** provides a brief description of each source of behavioural goals. By *experts*, we mean a behavioural change expert. By *subjects*, we mean the people who are to achieve goals.

TABLE 8: SOURCES OF BEHAVIOURAL GOALS

Source	Description
Self-set	Goals are designed and chosen solely by subjects
Assigned	The experts designed goals with no subjects input
Participatory	Goals are designed jointly by subjects and experts
Guided	Subjects are given directions by experts on how to choose a goal, but the choice is left for them to make
Group-set	Goals are designed and chosen within a group, typically facilitated by an expert

There are some factors to consider when deciding the suitability of each source of goal in the behavioural change process. These include:

##### 4.3.1.1 PROBLEM ORIGIN

This aspect plays a vital role in the decision about the subjects’ level of involvement in the goal specification process. Farahat (2012) argued that a subject’s behaviour could be influenced by factors relating to social and individual context. The social context refers to the social influence and peer pressure on a subject’s behaviour. If the social context is the origin of the problem, then the behavioural goals would need to be set collaboratively, agreed and committed to by the subjects, with help from an expert. If the problem originates from individual factors, such as the subject’s personality, or the pleasure derived from performing the behaviour, consideration would

be necessary to assess variables such as personality, the stage of change, and treatment levels before selecting a source for the goals.

#### *4.3.1.2 SELF-EFFICACY*

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Self-efficacy refers to the belief that one has the necessary skills required to achieve goals. Subjects with higher self-efficacy tend to be more committed to their goals, as they are likely to come up with better strategies and put in more effort toward goal attainment (Latham and Seijts 1999). When goals are to be set collaboratively, the selection of subjects should be based on their skills and abilities to attain the goals. When the behavioural goals are set collaboratively, it is crucial to consider the subjects' self-efficacy levels, as involving subjects with varying levels of self-efficacy could lead to less commitment from those with low self-efficacy, which could in turn demotivate others. If the source of the goal is assigned or participatory, it is important to know the clients', their needs for setting a goal, their interest in the goal, as well as their ability to achieve the goal. In relation to the source of goals, an individual's self-efficacy to achieve their goals could play a key role in the attainment of those goals. For example, when self-set goals are selected, participants with higher self-efficacy are more likely to set their own goals and attain them. Whereas if the source of the goal is assigned or guided, the experts involved in setting the goals can help those with low self-efficacy to achieve their goals. Subjects' self-efficacy can be increased by employing specific persuasion techniques, such as providing information about the required approaches for goal-related tasks.

It is, therefore, essential to assess this variable using appropriate methods in order to help classify subjects into different groups, estimate the possibility of goal attainment, and reduce the loss of interest in pursuing goals, which could lead to total goal abandonment.

#### *4.3.1.3 BEHAVIOURAL CHANGE STATE*

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Behavioural change state affects the ability of participants to set goals and their receptiveness to external goal sources. For users in the contemplation stage, self-set goals could be avoided as they may be defensive about their behaviour and may be in denial or biased when expressing goals (Prochaska and Diclemente 1983). When this is the case, we might consider choosing participatory, guided, group-set or even assigned goals. Self-set goals would fit those in the advanced stages of change, i.e. users who have already started to implement behavioural change.

#### *4.3.1.4 STAKEHOLDERS*

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Stakeholders play a vital role in the setting and ultimate success of the behavioural goals. When choosing the source of a goal, the set of stakeholders and their level of participation and how they contribute to expressing the goals should be considered. In some cases, goals may not be known and require specialists in behaviour and persuasion to break through denial and aid subjects to recognise their goals. Relevant stakeholders may include help seekers (one who recognizes their problematic behaviour and seeks help without external persuasion), self-changers (one who

believes in their ability to change their behaviour), self-regulators (one who has the capability to initiate and sustain a behaviour change process), experts (one who assists people in their behaviour change journeys) and addicts (one who is addicted to a particular behaviour, in this case, online behaviour).

#### 4.3.2 SECOND REFERENCE MODEL: BEHAVIOURAL GOALS IDENTIFIERS

Goals are described by various properties and influenced by specific moderating variables in relation to the person or their group context. **Table 9** provides a summary.

TABLE 9: BEHAVIOURAL GOAL IDENTIFIERS

Goal Properties	Description
Proximity	The time by which the goals is to be achieved; Distal (goals set on a long-term basis) or Proximal (goals based on short-term goals).
Goal specificity	The precision and granularity of what is to be achieved.
Goal difficulty	The effort required from a subject for goal attainment.
Goal Moderators	Description
Commitment	The importance of goal attainment and an individual's determination to achieve the goal defined by subjects': <ul style="list-style-type: none"> <li>• Self-efficacy or believing in one's ability to achieve the goal.</li> <li>• Perception of usefulness, and the significance of achieving the goal.</li> </ul>
Feedback	The knowledge of performance progress in relation to attaining goals
Task complexity	The complex nature of a task defines the level of effort, skills, and also the strategy required to attend the goal.

##### 4.3.2.1 PROXIMITY

Proximity refers to how far into the future goals are set. Setting proximal goals, in addition to distal goals, could enhance performance (Locke and Latham 2002) and self-efficacy (Seijts and Latham 2001), because they provide a relatively quick sense of achievement in the short-term, leading to sustained performance. For example, a distal goal of spending less time online this month could be attained by setting proximal goals such as reducing the time spent online by 20 minutes a week. Also, goal proximity could help reduce the loss of goal interest, increase motivation and confidence toward goal attainment.

##### 4.3.2.2 GOAL SPECIFICITY

This refers to the extent to which a goal is well defined, showing the type and number of tasks required. Setting a specific goal and providing performance feedback could help prevent deviations from the goal. For instance, Aunurrafiq et al. (2015) argued that setting specific goals together with other variables could increase managerial performance. Based on the preferred source of the goal, the experts involved in setting the goal could support subjects to understand the nature and reality of their problem. In doing so, they can set specific, measurable, and realistic goals which are likely to be met, leading to sustained and effective behavioural change.

#### 4.3.2.3 *GOAL DIFFICULTY*

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Goal difficulty refers to the amount of effort required to perform a task in relation to a person's capability. Assessing factors such as personality, ability, commitment, and self-efficacy is needed to set goal difficulty. Setting well-specified and challenging goals that are still within the subject's skill level could help enhance goal performance (Seijts and Latham 2001). When the difficulty level exceeds a person's capability, performance tends to decrease in those with low self-esteem, compared to those with higher self-esteem. Hence, self-esteem is a crucial variable in determining goal difficulty.

#### 4.3.2.4 *COMMITMENT*

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Commitment refers to the status of a person dedicated to a goal. According to Locke and Latham (2002), these factors are found to influence commitment; (1) the importance of goal attainment, and (2) self-efficacy. Whereas in (Locke et al. 1988), external influences (peer influence, authority), interactive influences (participation and competitiveness), and internal factors (expectancy and internal rewards) are outlined as elements which could define commitment. To improve commitment, when goal setting is performed collaboratively, the individuals involved could make a collective commitment to attaining the goals. On the other hand, it has been argued that self-efficacy could be improved by persuasion and providing information about the required strategies for goal accomplishment (Locke 1996).

#### 4.3.2.5 *FEEDBACK*

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Feedback is the mechanism used to track and inform subjects about their goal achievement process. Feedback could enable individuals to review the goal and re-strategise by directing effort and time where it is most needed (Locke and Latham 2002). For example, if the goal is to lose or gain 0.5kg in a week, being aware of the progress made by the middle of the week will enable the subject to make any necessary adjustments. When providing feedback, the timing, content, and delivery method need to be considered.

#### 4.3.2.6 *TASK COMPLEXITY*

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This refers to the complex nature of the tasks required to achieve goals. When the complexity of the task increases, the skills needed for achieving the task may increase proportionally. The attainment of such goals may depend on the ability to discover the necessary task-related skills and strategies (Locke and Latham 2006).

### 4.3.3 *THIRD REFERENCE MODEL: BEHAVIOURAL GOAL ELICITATION*

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Goal elicitation refers to the process of gathering data required for setting goals by its sources. Adopting the right elicitation method could lead to goals that reflect the subject's needs, hence increasing the chance of effective behavioural change. The main techniques for eliciting

behavioural change goals are listed in **Table 10**. Comments on the main types are provided in the following sub-sections.

TABLE 10: BEHAVIOURAL GOAL ELICITATION METHODS

Elicitation Method	Description
Interview	Used when in-depth understanding is required.
Diary Study	Used for capturing events as they happen.
Group discussion	Used for discussing barriers and strategies for alleviating them.
Counselling	Used for helping subjects understand their behavioural change needs.
Brainstorming	Used for discovering bespoke strategies for reaching the goal.
Observation	Used for assessing behaviour in a natural setting.
Algorithms	Used for understanding a subject's behaviour from their historical data.

#### 4.3.3.1 INTERVIEWING

Interviewing as an elicitation method could be used at the initial stages of implementing the system. The technique can capture in-depth information relating to a subject's behaviour. During the interview process, subjects could be encouraged to reflect on their emotional state, the behaviour which needs to change and how they plan to change such behaviour. The findings from this activity could then be used to determine the correct behavioural change goals, but also assess the eligibility of subjects pursuing a behavioural change goal as employed in (van Houwelingen and van Raaij 1989).

#### 4.3.3.2 DIARIES

Diaries could enable the capturing of events as they happen. This information may be used to help identify adverse behavioural issues and possible techniques to act as countermeasures. In the study by (Boekaerts and Corno 2005), diary entries were used to gather student motivation strategies, employed for improving their school work, demonstrating a self-regulatory process for managing learning.

#### 4.3.3.3 COUNSELLING

*Counselling* could be employed when goal setting is to be done collaboratively. During the counselling session, the expert or therapist could explain to the subjects the benefits of setting behavioural change goals and how this could assist them to achieve their desired online behaviour. The subjects could be encouraged to talk about their current online behaviour, behavioural issues and how such issues have affected their emotional state. This could help them to understand their situation and emotional state. During the session, subjects could be asked to specify an area of their online behaviour or specific behaviour that they are willing to change. They could then be asked to draw the strategies that they intend to follow to achieve the set goals. Also, barriers to goal attainment could be identified, discussed and countermeasures for such obstacles set if they are encountered. During this process, the subject's ability and confidence to succeed in changing

their behaviour could be assessed using, for example, a scale of 0 to 5, where 5 is the highest confidence level.

#### 4.3.3.4 *CONSULTATION*

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For behavioural change goals, conducting a *consultation* process with users or potential users of the intervention system could give the opportunity to present the idea to them, gather their views regarding the system implementation, and establish an understanding of their current behaviour, behavioural change needs, and preferences for the behavioural intervention system and intervention techniques. This process could increase users' trust and commitment towards the intervention system.

#### 4.3.3.5 *BRAINSTORMING*

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*Brainstorming* could be used for idea generation about how the behavioural change goal could be accomplished, especially when the goals are set within a group setting. Brainstorming could be employed to help establish an understanding of subjects' behaviour change needs and expected goal outcomes, such as spending more time on school work and improving grades. In relation to behavioural change, during the brainstorming exercise, subjects could be asked to state their online planned behaviour, and then asked to brainstorm strategies to attain such behaviour, feedback preferences, and perceived deviation from the goal, and list deviation countermeasures.

#### 4.3.3.6 *OBSERVATION*

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Observation captures an individual's actions while they are happening, compared to having them recall these actions. This might include visual observations or, more broadly, observations in the form of the analysis of digital data that is generated by an individual, such as the time spent on each call in a call centre, or the time spent using certain features on social media. Observation can give valuable insights into users' behaviour in the context of social media, e.g. activities performed, and their general social media usage approaches, as well as the ability to investigate their problematic use and the potential for goal setting. In Butler (1997), observations were used during pre and post-test sessions to assess common changes in students' learning approaches based on the strategic content learning intervention model.

#### 4.3.3.7 *ALGORITHMS*

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*Algorithms* are used to understand a subject's behaviour from their historical data. This method could be used to learn users' behaviour models or perform behaviour analytics on users' online data. Results from this technique could help develop a better understanding of users' online behaviour by learning their behaviour patterns and activities during online interaction. The data gathered could then be used to assess individuals' need for potential behaviour change and set goals that could enhance users' online behaviour change. The algorithm was used to calculate and suggest weekly step count goals for users based on their historical data.

#### 4.3.4 FOURTH REFERENCE MODEL: BEHAVIOURAL GOALS MONITORING & FEEDBACK

Our fourth model is related to the monitoring and feedback strategies used to assess and enhance behavioural goal attainment. **Table 11** provides a summary.

TABLE 11: BEHAVIOURAL GOALS MONITORING & FEEDBACK

Monitor and Feedback	
Monitor	Self-monitoring; Peer monitoring; Automated
Feedback Content	Motivational feedback; Learning feedback; Outcome feedback; Performance feedback; Comparative feedback (Self-comparisons; Social comparisons)
Feedback Timing	Reflection during the behaviour; Reflection after the behaviour
Feedback Framing	Gain frame; Loss frame; Formal; Informal

##### 4.3.4.1 MONITOR

Monitor refers to the agent who collects behavioural metrics and progress status. Monitoring can be performed by the subjects, by peers or be computerised.

- Self-monitoring* refers to the responsibility of a subject to observe and reflect on their own behaviour and goals. This is done by recording goal-related activities, and by evaluating the progress made. Reminders and journaling, in the form of a progress bar or timer, could help individuals perform self-monitoring and increase their awareness of their behaviour (Munson and Consolvo 2012). To implement self-monitoring, whether the goals are self-set or assigned, the behavioural change intervention system could include features used for recording and tracking goal-related activities. For example, Consolvo et al. (2009) used Houston to monitor a step count goal based on information users entered into their phones, and Ubitfit combined automatic tracking with user self-journaling of their physical activities (Consolvo et al. 2009). When subjects are in the early stages of treatment or the problem is at a severe level, self-monitoring could be avoided, as subjects might be defensive of their behaviour and might not be reliable. When this is the case, other forms of monitoring should be considered, such as software-based or automated monitoring.
- Peer monitoring* refers to other individuals observing a subject's behaviour, possibly on mutual understanding. Peer-to-peer monitoring could lead to social relationship breakdown if the feedback method implemented is not carefully *designed, as it may be viewed as spying* (Alrobai et al. 2016). Peer monitoring could be useful in relation to behavioural change when goal setting is done collaboratively. Hence, surveillance is seen positively as part of behaviour awareness and change. When peers conduct monitoring, a feedback method needs to be considered and prevent relationship breakdown within the social setting carefully.

- *Automated monitoring* is based on the use of sensors and communication technology, e.g. geographic location and heart rate monitoring via a smartwatch. The accuracy and intensity of monitoring could empower individuals to gain insight into their behaviour or their pattern of behaviour. However, the lack of privacy and anxiety could have negative consequences. Also, automated monitoring may fail to capture the intention and context of the behaviour. This may necessitate a blended approach, putting together self-monitoring or peer monitoring with an automated one. When the monitoring required the capture of intention and context of use, advanced techniques could be adopted.

#### 4.3.4.2 FEEDBACK CONTENT

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Feedback content refers to the central theme of the feedback informational content.

- *Motivational feedback* informs subjects how well they perform towards their goals and encourages them to continue in the same way or perform better. Goal performance could be rewarded by employing gamification elements such as points, badges, and avatars. Competitive rewards and game mechanics, such as the leader-board, need to be avoided as they may distract from the primary goal or the spirit of the ultimate behavioural change goal, especially when goals are set collaboratively.
- *Learning feedback* helps subjects to learn the consequences of specific committed or avoided behaviours (van Houwelingen and van Raaij 1989). This feedback needs a clear rationale. For example, in regulating printing behaviour, when a subject prints ten articles daily while the goal is to not exceed four articles a day, the feedback should clarify how the deviation from the goal occurred and show the subject how this manifested in their printing behaviour. For example, a subject set a goal of spending 30 minutes online a day. If the user spends one hour instead of the 30-minute goal, then the feedback information should include the subjects' exact actions which led to the deviation of 30 mins. With this knowledge, subjects may try to avoid or reduce such actions in future online interactions. The subject's ability and skills to interpret the feedback data could be considered to ensure that the information provided is processed and well understood by the subjects.
- *Performance feedback* shows a subject's performance toward their goal and could be used to help determine the chances of attaining behavioural goals. This feedback could help persuade subjects who are committed, motivated, and have the right ability to put in more effort and time when a discrepancy is detected between the feedback provided and their behavioural goal.
- *Outcome feedback* represents the knowledge of results; subjects should be able to have the skills required to evaluate whether the outcome feedback represents good or poor performance toward the goal.

- *Comparative feedback* compares subjects to their past goal performance (self-comparison) or to the performance of their peers when collaborative goal setting is adopted (social comparison). *Self-comparison* may work better when self-monitoring is employed and may work well for those subjects with lower self-esteem. *Social-comparison* works by comparing goal performance within a social circle to motivate individuals to attain their goals. It may also lead to competition and conflict between subjects within the same group or between groups if an inter-group comparison is adopted. This could negatively impact self-esteem and self-efficacy. Taking the stages of change model as an example (Prochaska and Diclemente 1983) a subject who is in the contemplation stage could not be compared to other subjects who are in the action stage as this could lower their self-esteem. Comparison of a group structure could also affect the social relationship.

#### 4.3.4.3 FEEDBACK TIMING

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**Feedback timing** is concerned with the right timing of feedback messages so that they are seen as a motivational tool and their acceptance is increased. Feedback can be delivered while the behaviour is taking place (reflection during usage) for real-time awareness or afterwards (reflection after usage) for off-line learning and future planning. Constantly providing feedback information could demotivate subjects and could lead to total goal abandonment.

- **Reflection during usage**

Reflecting during usage refers to the provision of feedback while the behaviour is happening, i.e. in real time. This could provide an awareness of an individual's behaviour, and could make a person review and perhaps make changes to some behaviour. When feedback is provided while the user is performing an action, it is essential to consider how the feedback is presented to the user. It should be presented in a way that avoids obstructing or interrupting users' behaviour. The feedback should be presented in a less obstructive manner to avoid interrupting users' activities/behaviour. Interrupting users' activities could lead to rejection of the feedback. For example, if a user is using a screen, providing feedback that blocks their screen view might not be taken well by the user.

- **Reflection after usage**

Reflection after usage does not happen while the user is performing an activity, rather the feedback is provided after the activity is completed. This means the feedback is provided in an unobtrusive manner. Although providing feedback in this manner is uninterrupted, the question is how effective the feedback will be. Will users act on the feedback information or will they simply ignore it? The feedback is then provided to the user at a different time, usually when they have more time and resources available to properly engage with the feedback information (Ploderer et al. 2014).

#### 4.3.4.4 FEEDBACK FRAMING

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**Framing** refers to the language used in the message content of the feedback in style and orientation. The language used in the message content of the feedback is also crucial. The feedback may not have the desired effect when the subjects view it as strict or consisting of threatening messages (Locke 1996). The language used relates to what extent the feedback is consistent with the subjects' attitudes and preferences, e.g. whether the message is a gain or a loss frame, strict, precise, or personal. The loss frame refers to feedback which shows a negative impact, e.g. smoking can cause cancer, whereas the gain frame refers to feedback which indicates a positive impact of healthy behaviour, e.g. quitting smoking makes sleep quality better.

#### 4.3.4.5 PRESENTATION

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The feedback could be presented (1) graphically using charts or (2) textually via email or text messages. The presentation does not only relate to how the feedback is visualised, but also to what degree the feedback is consistent with the subject's preferences and behaviour. It is, therefore, vital to assess and elicit subjects' preferences for the style of presentation. For example, for feedback to be successful when the goal is group-set, subjects should have the same or similar preferences for the presentation of feedback. Some subjects might be good at receiving and processing graphical information, whilst others are good at processing textual data.

#### 4.3.4.6 COMPARISON

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To help measure participants' progress towards goals, monitoring and feedback methods should implement some form of comparison. The comparison could be conducted by the participants themselves, i.e. comparing one's present and past goal performance or goal-related activities. It could also be performed by peers in a group setting. While comparing performance towards a goal within a social setting could help motivate individuals and lead to positive behaviour change, it could also lead to competition within a social setting or team competition between social settings (Morschheuser et al. 2018). This competition element can have a negative impact on users, thereby lowering their self-esteem and self-efficacy levels. For example, when a user who is in the early stages of behaviour change treatment is compared to other users in the advanced stages of treatment, by comparing the performance of goal progress to peers, individuals could face stressors because of the comparison made between users in different stages of the behaviour change treatment (Fogg 2009b). Comparisons within a group structure could also affect or damage social relationships. Therefore, when comparing goal progress within a social setting, it is essential to consider the stages of behaviour change treatment, i.e. whether treatment is at the early or advanced stages. When the source of goals is participatory or group-set, a social comparison technique could be more appropriate for comparing users' progress towards the goals.

For comparison, to be effective, users should be involved in the design phase of the behaviour intervention system, for example, adopting a user-centred design or participatory design approach

to establish users' preferences and what would work best for various users (Morschheuser et al. 2018). Another important factor to consider in the comparison process is the visualization of comparison results or information. For faster and easier understanding of such information, it could be presented to users in a numerical or quantified form.

#### 4.3.5 FIFTH REFERENCE MODEL: DEVIATION AND COUNTERMEASURES

Deviation refers to the difference between the desired behaviour of a person and their actual behaviour (Reese and Leveson 1997). Deviation consists of different types, and various facilitators can trigger it. Reducing or preventing deviation is achieved by employing a series of countermeasures, as summarised in **Table 12**.

TABLE 12: DEVIATION FROM BEHAVIOURAL GOALS: TYPES, TRIGGERS AND COUNTERMEASURES

Type	Time-related; Frequency-related; Communication-related
Triggers	Goals that combined, conflict or compete with other goals
	Source of the behavioural goal
	Social influence or peer pressure on the subject pursuing the goals
	Setting ambiguous goals with limited skills or time to attain the goals
	Lack of commitment to the set goals; Lack of proper timing of the goals
	Setting complex goals that do not match subjects' ability to attain them
	Lack of self-efficacy to achieve the goal; Environmental influence
	Lack of a structured method for goal setting
	Inaccessibility to resources to aid goal attainment
	Not understanding users' needs for the goals
	Over-estimating participants' self-efficacy level to achieve goals
	Lack of understanding of barrier to gain attainment
	Timing of the behavioural goals; Frequency of executing the set goals
Countermeasures	Detect and resolve goal conflict
	Discuss barriers to goal attainment and ensure subjects could adequately handle them
	State a clear goal outcome
	Assess subjects commitment and self-efficacy levels
	Assess complexity of goal and analyse complex goals into series of sub goals
	Review goals, re-strategise and analyse complex goals into series of sub-goals
	Monitor goal-related activities
	Reminders
	Perform manipulation checks to assess whether subjects understand the goal or task
	A proper explanation of the goal-related task
	Task familiarisation by asking subjects to try out a task similar to the goal
	Persuade subjects to verbally commit to the goal; Set unambiguous goals
Rewards	

**Deviation triggers** capture the various factors that can trigger deviation.

- *The timing of the goal* refers to the improper timing of goals which could lead to conflicting, combined or competing goals. For instance, a smoking cessation goal may conflict with other goals, such as a weight loss goal or a stress coping goal (Bodenheimer and Handley 2009). Similarly, individuals who have a heavy workload in conjunction with their goals could easily deviate due to their busy lifestyle (Lin et al. 2006). The timing of the goals could also be an issue when goals are set collaboratively, due to subjects' lack of openness with one another about other life commitments or problems. It is, hence, vital to set goals so that their timing does not coincide with other personal activities.
- *The frequency of executing the goal* is essential for ensuring that the execution of goal-related actions does not overwhelm the subjects. If the rate of goal execution is not ideal for the subjects, they may lose interest in pursuing their goal. For instance, in the study by (van Houwelingen and van Raaij 1989), the energy-saving effects of users in the self-monitoring group were slightly lower than those in the other groups, such as those provided with daily or monthly electronic feedback. This difference can be attributed in part to the difficulty of motivating users to continue to fill out their monitoring charts on a daily basis.
- *Inaccessibility to resources* needed to achieve a goal, even temporarily, may affect the attainment of the goal. Examples of such resources include devices such as mobile phones and personal computers, or software applications. To illustrate this point, a study by (Gasser et al. 2006), showed the difference in application usage between mobile phone application users and web application users, which may be based on the lack of internet access and the restriction of mobile phone usage in the workplace, both being resources needed to accomplish the given goal.
- *A complex task* perception depends on the subject's self-efficacy, i.e. their perception of their ability to come up with the right strategies to achieve the task (Locke and Latham 2002). When the behavioural goals are set collaboratively, the experts can help subjects overcome the challenges that come as a barrier to attaining the goal. They can also help them develop the required skills needed to continue pursuing their goals. The experts could elicit, evaluate and assess the subject's skill level at the initial stage of the behavioural change process. Herrmann et al. (2016) proposed an algorithm to recommend personal short-term goals, considering factors that could motivate the users and steadily increase goals into long-term goals to help them attain the acclaimed physical activity goals.

- *Not understanding users' needs* when setting a goal is a primary deviation facilitator and can be avoided by supporting users to comprehend their current behavioural patterns. To understand subjects' behaviour, change needs, in addition to direct elicitation, a model of users' historical online activities could be created and analysed by adopting behavioural analytic software applications. The subjects' goals could then be based on their past online behavioural data. The ideation technique used in (Morschheuser et al. 2018) could be adopted in the initial stages of the goal-setting process, to help understand the users and their needs. Ideation includes listing ideas and concepts, usually by conducting a brainstorming exercise with users. During the exercise, the focus should be on meeting the needs of users, intended behaviour, and preferred outcome. Involving users during the ideation stage is important, so that their needs are prioritized.
- *Setting ambiguous goals for subjects with little or limited skills and time required to attain such goals* could lead to reduce goal performance. When goals are concrete, specific, and realistic, performance could be higher compared to when they are vague and extremely ambiguous. Setting specific goals could lead to clarity and reduce ambiguity regarding what is expected from goal attainment. If people are given a chance to select the amount of time they would like to put toward goal attainment, then setting an ambiguous goal will increase the amount of time that will be required to attain the goal (Loock et al. 2013). The goals that are set for or by an individual should be something they are interested in pursuing, challenging, yet attainable by the individual (Landers et al. 2017).
- *Goal source and self-efficacy* when the source of the goal is assigned, group-set or participatory set, deviation could be attributed in part to insufficient communication between subjects and experts involved in the process. As a result, the experts may not understand the subjects and their needs and, subsequently, may set goals that may not be attainable. When goals are assigned, subjects' lack of participation in the process could affect their interest, commitment, or motivation towards the goals, which could lead to deviation from the goal or total goal abandonment. To prevent this, a trust relationship should exist between the experts and the subjects. People are more likely to accept the guidance provided to them by individuals they trust and believe (Bandura 1986).
- Participation in coming up with practical goal attainment strategies could improve users' self-efficacy. Self-efficacy is an important factor in influencing effort toward goal and goal performance. Not accurately stating subjects' self-efficacy required to attain goals could also affect goal attainment. For instance, a person with a high self-efficacy or capability level could formulate and apply appropriate strategies to attain their goals by confidently responding to goal attainment barriers (Louvigne et al. 2012; Kwasnicka et al. 2016). Attaining the goals could further enhance subjects' self-efficacy, which could

also increase the probability of goal attainment. The success experienced from the achievement of proximal goals may increase self-efficacy and can be used as a motivational factor toward the accomplishment of distal goals.

- *Social influence and peer pressure* occur when a person's feelings, emotional states, and behaviour are affected by others' actions or behaviours (Bandura 1986). When behaviour change goals are set collaboratively, social influence could either have a positive effect, for instance, group members motivating each other toward goal attainment, or it could have a negative effect, leading to people sliding away from their goals. This variable could affect factors that are vital to goal attainment, such as the effort required to execute the goal-related task, and the commitment required to continue pursuing the goal. In a social setting, individuals' actions are driven by group norms, which are most often than not agreed upon by the group members. When goal setting is performed collaboratively, it is essential that the group's commitment and motivation are at the same or similar level. When a group member has a slightly lower value in one of the above factors, it could affect the group's goal performance. Due to the fear of negative evaluation, or loss of social identity, influence from other members of the group could force people to deviate from their goal. For example, a user from the printing focus group commented, "seeing others printing puts me under pressure to print even though I do not want to, but I feel that if I do not print, people might think that I am not working hard compared to them". This could particularly affect those subjects with low self-esteem (Kocovski and Endler 2000). When goals are set collaboratively, people with similar treatment levels and in the same stage of change phase should work together. For example, those in the advanced stages of their treatment could be more motivated and committed than those in the early stages, and this could scare those in the early stages, leading to a shift from the goal.

#### 4.3.5.2 *DEVIATION COUNTERMEASURES*

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The applicability of the countermeasures largely depends on the deviation type and its facilitator. Some of the identified countermeasures are discussed here.

- *Review goals, re-strategise and analyse complex goals into a series of sub-goals.* When goal performance is lower than expected; then the goal could be reviewed to develop better attainment strategies. Poor performance could be the result of task complexity, low skill level, and not tackling other barriers to goal attainment. When people find their performance below target, they usually increase their effort (Matsui and Okada 1983) or try a new strategy. Goal performance could be enhanced by adopting barrier counselling and skill development approaches (Ries et al. 2014).
- *Monitor goal-related activities.* This technique involves monitoring and tracking the difference between the desired and actual behaviour, which could be facilitated by an

action-oriented approach, where subjects document their actions in pursuit of the goal. Action planning is considered necessary during the early stages of behaviour change, while coping planning is assumed to be useful in the advanced stages of behaviour change, i.e. the action or maintenance stage (Sniehotta et al. 2005).

- *Verbal commitment obtained from subjects.* When subjects commit verbally to the setting of goals, this could help prevent deviation, especially when goal setting is performed collaboratively. Subjects tend to adhere to the group goal once a verbal commitment is obtained due to fear of being socially, which could lead to loss of group identity, negative judgement, and blame for the group's failure to attain their behavioural change goals.
- *Detect and resolve goal conflict.* The work environment could influence conflicting goals, i.e. the social setting of subjects. The conflict could be detected and managed so that the subjects can progress toward attaining their behavioural change goal. Goals could be prioritised to help resolve conflicts among goals.
- *State a clear goal outcome.* Setting a clear goal outcome could motivate individuals to continue pursuing their goals by focusing their efforts, time, and attention on goal attainment. It is vital to avoid attaching negative reinforcements, such as punishment, to poor goal performance, as this could de-moralise and de-motivate subjects, causing them to deviate or abandon their goal.
- *Assess individual self-efficacy and commitment.* Assessment of a subject's self-efficacy could be administered by using a self-efficacy scale. In (Zimmerman et al. 1992), students' perceived self-efficacy level toward their academic grade goal expectations was assessed using the self-efficacy scales included in a questionnaire. To elicit honest responses from the students, they were assured of anonymity and that only the researcher would have access to their answers. Commitment is the degree to which a person is genuinely attached to and determined to achieve their goals (Smith et al. 1990). Subjects may also be asked to fill out questionnaires describing their degree of goal commitment. The goal commitment could also be assessed using a five-item scale (items 1,4,5,6, and 7), such as the HWK scale developed by (Klein et al. 2001). When subjects select collaborative, group-set or guided as sources of goals, they could be asked to confirm their goal commitment level verbally. This might not be an effective way to assess commitment, as some subjects' responses might be influenced by the answers given by others in the group.
- *Conduct manipulation checks.* These checks are conducted to detect whether the subjects are paying attention to the set goals and goal-related tasks. In (Landers et al. 2017), to ensure the study participants understand their goals and instructions related to goal attainment, those in the goal condition were given a list with four options, including one

option with no goal. The participants in the leaderboard conditions were asked to point out the leading scorer on the leaderboard from a list of possible options. This technique was used in (Brusso and Orvis 2013), where participants' eligibility for the study was assessed by ensuring that they understood the provided goal range.

- *Task explanation and task familiarization.* Concerning task explanation, before executing the goal-related task, a session could be conducted to explain to the subjects the task that they are expected to perform to ensure that they understand what is expected of them. This process could be regarded as the induction phase of the goal setting process. Understanding the task at an early stage could help prevent deviation from the goal, which could result from a lack of understanding of the goal-related task. As well as establishing an understanding of the task, subjects could be asked to perform a task that is similar to the goal task to help them become familiar with what they are expected to do when they commence executing the behaviour change related task.

#### 4.4 STUDY INTRODUCTION

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Goal setting as a process has been used in many studies as a method to encourage positive behaviour change. Since much of the research described in the papers, we reviewed tackled real-world behaviour goals and interventions and focused on goal setting approaches without the assistance of software, we conducted additional studies investigating goal setting when managed and assisted by software and also explored additional facets and nuances when goal setting is assisted by technology. The aim was to investigate whether the goal setting elements can be used for social networks as well as the factors that need consideration when designing technology-assisted solutions. This would help to offer an in-depth knowledge of the users involved and properly handle the behaviour change goals. This ultimately aims to increase the chance of achieving an effective behaviour change and sustaining it. When technology is used to assist in managing behavioural goals, new aspects need to be put into consideration, mainly due to the new characteristics of automation and technology. Relapse and lack of interest are common and cannot be handled by traditional commitments and contractual settings typically found and enacted in business information systems.

##### 4.4.1 STUDY RESEARCH METHOD

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The study was based on two focus group sessions aimed at instantiating the elements of goal setting derived from the literature for the case of regulating digital usage via technology. The aim was to gather insights on how people see software-assisted behavioural goals and whether there could be additional elements that we have not found in the literature. In the focus group studies, 14 participants were recruited; eight males and six females aged between 20 and 40 years. All the study participants were regular users of social networking sites. In total, fourteen participants took

part in the sessions: six females and eight males. Seven participants participated in the first focus group and seven participated in the second focus group, i.e. three females and four males in each session. The participants included both postgraduate and undergraduate students. Nine postgraduate students and five undergraduate students participated in the sessions. The postgraduate students have good research experience and knowledge (multi-disciplinary background, including digital motivation, requirements engineering, persuasive technology, digital addiction, digital wellbeing, and human computer interaction) in gamification, online peer support groups, problematic social media, and social media design in facilitating problem use, among others. Ten participants have a computing research background or are studying a computing related field, and two participants have experience and a research background in gamification, and the other two participants have experience and knowledge in social informatics. The undergraduate students' fields of study included computing and computing-related fields.

As part of the recruitment process, pre-selection questions were created based on the CAGE (Cut down, Annoyed, Guilty, and Eye-opener) questionnaires (Ewing 1984). Participants completed this before the study date. The questionnaires served as a form of self-assessment. The CAGE questionnaire is designed to serve as a screening tool used for detecting alcoholism and can be customised and used to detect any addictive behaviour. The participants were also provided with relevant study information, and all ethical procedures were followed prior, during, and after the study. All the participants demonstrated their eligibility for the study by selecting at least one option on the list.

The participants were asked to install a commercial goal setting application for familiarisation purposes and to inform our discussion. Participants were provided with the findings from the literature review (reference checklists depicting an overview of goal setting together with five scenarios, each presenting problematic usage of social networks). Participants were then asked to relate the elements on the model to the scenarios. A general group discussion was held after each scenario was completed. The session was audio-recorded and transcribed to aid our analysis. The data gathered as part of our studies was content analysed through the six phases of thematic analysis as proposed in (Braun and Clarke 2006).

#### 4.5 RESULTS: INSTANTIATION OF GOAL SETTING ELEMENTS AND THE CASE OF PROBLEMATIC DIGITAL USAGE

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In this section, a discussion of some of the goal setting elements and how they can be instantiated in the case of problematic digital usage will be provided. The discussion will focus on factors that need to be considered when applying these elements. The findings of the user studies showed that most of the goal setting aspects presented in the reference checklists could be instantiated in the case of problematic digital usage. However, additional elements were not discovered. Participants highlighted new types of concerns or recommendations around the elements. These findings will

pave the way for providing theoretical foundations for the next steps of this research and the design of TAGS.

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#### 4.5.1 SOURCE OF BEHAVIOURAL GOALS

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When technology is used to assist goal setting, whether in an automated process, or as a facilitator in the process, it could make the goal setting process faster and more accessible for people. This is particularly useful when self-set and participatory options are employed. The use of technology could aid the goal selection process and reduce the time spent by the user and the professional during goal implementation (Bodenheimer and Handley 2009). Selecting a source of goals should depend on other factors, as participants commented, *“it depends on the context that the usage is affecting, e.g. sitting with my wife and the use of the phone is affecting that, so if the problem involves you and others, then go for group set or participatory”*. Another participant added, *“it all depends on the impact it is having on my life”*.

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#### 4.5.2 GOAL MONITORING

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The effectiveness of a monitoring option could depend on the adopted source for the goals. For example, when goals are group-set or participatory set, peer monitoring could be useful. When peers conduct monitoring, a feedback method needs to be considered carefully to prevent relationship breakdown within the social setting. For example, when a user changes their behaviour contrary to what the group agreement was, this could potentially affect the group norm and relationship. For peer monitoring to be effective, an assessment could be conducted to ensure that peers can reliably monitor and report their peers' goal performance. It is also crucial to consider the timing of the monitoring. Users' behaviour could be monitored periodically at various time intervals or continually. The type of goal could determine the monitoring and feedback techniques to be adopted. For example, when time-based goals are set, peer-to-peer monitoring and social comparison could be useful, as the motive for time-based goals may be to gain approval from others. For moderation-based goals, using the self as a monitoring agent could be more productive. For example, adopting techniques such as self-monitoring and self-evaluation as such goals are set to improve an individual's self-ability.

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#### 4.5.3 COMPARISON AND FEEDBACK

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- Comparing goal progress and providing feedback information can be regarded as significant aspects of goal attainment. *“I would like to have a reminder about goal progress to help me reflect on my achievements, and this could help increase motivation towards the goal.”*

The findings of the user studies showed that users have different preferences in terms of feedback, i.e., timing, format, and presentation styles. The choice of feedback content could depend on the

progress of users towards goal attainment. Users' personality, i.e. motivational messages, could help introverts and boost their desire to achieve the set goal. For those whose commitment is high, providing outcome feedback could improve their commitment level and determination towards goal attainment. Whereas those users whose commitment is low and have low self-esteem, this could further reduce their commitment or lead to rejection of the feedback or total goal abandonment. To help overcome this effect, providing gentle motivational messages with the feedback could help encourage users to continue pursuing their goals. Motivational feedback information could improve commitment towards goal attainment, especially if the message has a reward function to it (Becker 1978). For performance feedback to be useful, the timing of the feedback is crucial. Providing feedback during the execution of the goal could enable people to re-evaluate their efforts and actions to increase their performance. At the same time, care should be taken to ensure that feedback during goal execution is not obstructive to the user.

Participants show different preferences regarding the various feedback delivery methods. A participant commented, "*I would prefer it to be a small text showing my goal progress during usage and not after*" and another commented, "*A visual progress that keeps me in line with what I decided to develop in my life*". Whether text or graphical representation, it is essential to consider where on the interface we display the feedback. The risk is choosing the wrong method and timing for delivering the feedback. What needs to be considered here is to elicit user input about the different delivery options.

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#### 4.5.4 DEVIATION FACILITATORS AND COUNTERMEASURES

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The challenge here is how to recognise factors that may lead to deviation, such as lack of required skills and abilities to attain the requirements, peer-pressure and environmental influence. This is similar to the concept of *obstacles* in goal-oriented requirements engineering. Within behaviour change, individuals may have conflicting feelings about the goals they are attempting to achieve, especially if this behaviour has a habitual or compulsive element. Assessing the effect of these factors is also a question, e.g. based on a questionnaire, objective measurement or users' verbal assurance, or the assumption made by the analyst or expert. Deviation from goals needs to be accommodated during the goal setting process. As an initial step, for each named behaviour or system goal, it is essential to identify factors that could facilitate deviation from the goals and hence hinder their successful attainment. Once a deviation or a potential deviation is detected, it is important to evaluate or determine the likelihood of the deviation happening, the severity level, and the impact it could have on successful behaviour change. Identifying the deviation or factors that could facilitate the deviation could help in implementing mitigation actions or countermeasures for the deviation. Forming and categorising patterns for deviation would facilitate monitoring techniques, suggestions and personalised feedback about the goals.

## 4.6 TECHNOLOGY-ASSISTED GOAL SETTING

When technology is used to assist in managing behavioural goals, new aspects need to be put into consideration, mainly due to the new characteristics of automation which enable real-time behavioural monitoring and behavioural judgement, interactivity, intelligence, transparency, and personalisation. The use of technology to manage the behavioural change process provides an opportunity to manifest various facets in different ways and actively involve users in the process. **Table 13** below presents a summary of various aspects to consider when technology is used to facilitate the goal setting process.

TABLE 13: TECHNOLOGY-ASSISTED GOAL SETTING ESSENTIAL CONSIDERATION

Goal setting elements	Aspects to consider
Source of behavioural goals	<p>Before assigning goals, surveillance techniques can be implemented by experts using technology to help understand the problem.</p> <p>The technology could be used to provide an environment where users can actively engage with each other, encourage openness about obstacles that might delay or prevent goal attainment.</p> <p>Advanced intelligent techniques could be implemented to capture contextual data indicating intention and mental and emotional states before selecting a source for a goal.</p>
Goal monitoring	<p>The technology could be designed to enable user profiling based on age, addiction severity, online activities/behaviour and daily usage time.</p> <p>Technology provides an opportunity for tracing, comparing actual and intended behaviour, and delivering goal achievement in real-time.</p> <p>The technology could be used to assess users' ability to reliably perform monitoring activities before grouping them in the case of peer monitoring.</p>
Comparison and feedback	<p>User mood could be considered by analysing their activities, such as comments, videos made or videos watched, and so on, before delivering feedback information.</p> <p>Technology could be used to provide accurate social norms usage information by collecting, analysing and creating personal usage and actual social norms data.</p>
Deviation facilitators and deviation countermeasures	<p>The technology could be used to track user location before delivering deviation countermeasures. For example, a student in a lecture can be blocked when they access their social networks for a continuous 10 minutes.</p> <p>The technology could be used to track user behaviour to help understand factors that could lead to deviation from their goals.</p>

## 4.7 DISCUSSION

In this work, we elaborated on the concept of goal setting and its elements when managed and supported using technology for behavioural change purposes. The nuances and peculiarities of these goals were discussed with the aim of providing theoretical foundations for requirements engineering for behaviour change software systems. The results of the user studies revealed that

the majority of the goal setting elements discussed in **Section 4.3** may be used in the situation of problematic digital usage. These systems are typically concerned with changing perceptions and leading to new attitudes and behaviour towards a certain aspect of a person's daily or work activities. They usually take motivational approaches, including some game elements, especially when facilitated by software where the existence of human experts is limited.

We argue that designing such motivational techniques could result in unexpected effects, such as lowering self-esteem when failure happens repetitively, creating clusters amongst peers based on their degree of performance, and encouraging workarounds when monitoring is only metrics-based (Shahri et al. 2019). A major part of the problem, as well as the solution, relates to the way goals are set as desired behaviours, and then monitored and enforced. We elaborated on the various ways of eliciting and specifying goals and explained some of the common countermeasures for dealing with deviations from goals. Transparency in software of such a nature would be a major requirement. The transparency in the design of software for behaviour change may be detrimental to its success at times. For example, some behaviour change techniques require a degree of secrecy about their design as they could be built around surprises and uncertainty from the user perspective. However, individuals may still demand transparency about other aspects of such systems, e.g., how their personal information is managed in a behaviour change system. Therefore, the involved stakeholders, the information communicated amongst them, and the quality and actionability of the information in such systems will all need to be investigated in order to provide meaningful, useful transparency (Hosseini et al. 2018).

The findings from the user studies showed that the source of goals could be applied in the case of problematic digital usage. The question here is what factors should be put into consideration when using these options. The source of the goal depends on four factors: (i) the context or situation that the usage is affecting, (ii) addiction severity, (iii) user personality, and finally (iv) the impact on users. User personality needs to be assessed before selecting a source of goal, as different personalities could respond differently to a different source of a target. According to McCalley and Midden (2002), a user who is more self-oriented could react better to self-set goals, and users who are socially oriented will react better to guided, group-set or participatory goals. Also, the personality of users may be considered when deciding the source of the goal, as this could help identify those at risk of losing interest in pursuing the goal, primarily when goal setting is performed collaboratively.

The addiction severity level is another aspect that needs to be considered when selecting a source for a goal. The severity level could dictate whether goals should be participatory, group-set or assigned. Also, when treatment is in the early stages, users are more likely to be biased, in denial of reality, or less transparent about their problems. At this stage, goal setting could be more

effective if users are assisted by experts or professionals. At this stage, participatory and assigned were the preferred options.

With respect to goal monitoring, the study participants highlighted certain factors to take into consideration. For example, the reliability of peers to monitor and report other peers' goal progress, the timing of monitoring activity, and the type of users' goals should be considered before selecting a type of monitoring. The feedback technique is another key aspect of the monitoring system that should be considered to help prevent negative effects within a group. In terms of detecting and counter measuring deviations, technology can be used to facilitate these processes effectively due to the real-time nature of such technology.

#### 4.8 CHAPTER SUMMARY

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This chapter presented five reference models of goal setting. It elaborated on the various ways of eliciting and specifying behavioural goals and explained some of the conventional countermeasures for dealing with deviations from goals. We also presented a discussion on how some of the goal setting elements could be represented in the case of problematic digital usage. The next chapter reviews the literature on digital addiction and presents eight families of negative life experiences linked with DA. Also, the next chapter presents ways in which technology could be used to alleviate the negative life experiences linked to digital addiction.

## 5. CHAPTER 5: NEGATIVE LIFE EXPERIENCE OF DA & POTENTIAL FOR TECHNOLOGY-ASSISTED SOLUTIONS

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As digital media has become an integrated part of our daily lives, people are spending a considerable amount of time using it for various purposes, including social networking and gaming. The term Digital Addiction (DA) can be described as a high degree of behavioural dependence on software products (Alrobai et al. 2014). Griffiths (2005), described six symptoms or characteristics of behavioural addiction, including DA, namely; *salience*: when the use of digital media becomes a vital activity for a user; *mood modification*: when used as a coping strategy for users; *tolerance*: increasing and diversifying digital usage over time to achieve the same effect; *withdrawal symptoms*: behaving unpleasantly when unable to access or interact with digital media as wished; *conflict*: interpersonal or intrapersonal issues caused by digital usage; and *relapse*: quickly falling back to a user's old digital usage habits after a period of abstinence.

Studies have linked DA to various negative life experiences, including lower grade points among students (Young and Case 2004), marital discord, social isolation, reduced work performance and job loss (Young 1999) and parent-child relationship issues (Grüsser et al. 2007). The last decade has witnessed a considerable increase in the treatment of behavioural addictions, including DA, most of which share approaches similar to the treatment of substance-related addictions, including counselling, pharmacotherapy, self-help therapy (Griffiths 2015), cognitive-behavioural therapy and psychotherapy (Young and de Abreu 2011; Khazaal et al. 2012) and motivational interviews (Corrigan and McCracken 2001).

Amid the growing research on negative life experiences around the problematic usage of digital media, creating a reference model which puts the various findings into taxonomy is needed. The taxonomy would act as a reference point for researchers from different disciplines, e.g. software engineers and psychologists, and would be used for debates and initiatives towards combatting the negative life experiences of DA. The authors (Ali et al. 2015; Alrobai et al. 2019; Altuwairiqi, Jiang, et al. 2019), argued the capability of technology to increase awareness and apply a variety of persuasive strategies, interactively and in real-time, to keep users in control. Still, the content of messages, as well as the various modalities of intervention, need to be investigated and concretised. For any intervention to be effective, it is essential first to detect the precise nature of the negative harm linked with problematic behaviour. Also, the effectiveness of technology-assisted solutions to combat DA may depend on individuals' social norms and normative beliefs, particularly when implemented in social settings such as peer support groups (Aldhayan et al. 2019; Alrobai et al. 2019).

Social norms and normative beliefs are an integral part of people's problematic digital behaviour, mainly because they tend to conform to norms and be subject to online peer pressure and social influence to be interactive and responsive and, also, to satisfy their social needs, such as gaining

popularity and consolidating social identity. We discuss social norms as influencing factors for problematic digital behaviour, and at the same time, as potential countermeasures for DA. Besides the benefits of using technology-assisted solutions to disseminate accurate social norms, the inappropriate application of these techniques can cause certain risks that software designers need to be aware of to inform better design of such technology. Finally, we provide an initial discussion on some of the risks that may be introduced when technology provides factual social norms.

## 5.1 RESEARCH GOAL OF CHAPTER

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There is an increasing acceptance of the link between obsessive and excessive usage of digital media, e.g., social network applications, and the users' wellbeing, including personal and social. While specific causal relations between such DA and negative life experiences can be debated, we argue in this chapter that, however, technology can play a role in averting or raising awareness of its pathological or problematic usage styles, such as monitoring usage. Also, comparing peers, i.e. how users observe themselves in contrast to other users, i.e. when a user observes that their peers are doing better than them, based on the information their peers provide online. At the same time, we argue that the real-time nature of technology-assisted solutions can be used to help deliver accurate peer-comparison information and correct these misunderstandings.

## 5.2 RESEARCH OVERVIEW

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We conducted multi-stage research through (i) a literature review on the range of negative life experiences associated with DA, (ii) two focus groups to help gather users' perception of the key findings from the literature; (iii) interviews with experts and practitioners around DA warning labels; and finally, (iv) analysis of comments from a user survey on DA interactive warning labels.

The research stages are described in **Figure 28** below.

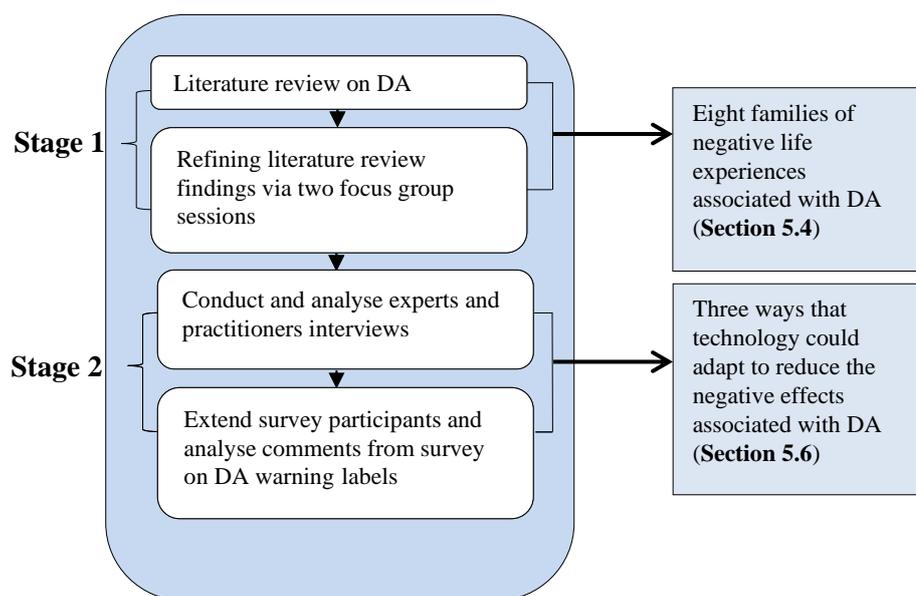


FIGURE 28: OVERVIEW OF THE RESEARCH METHOD AND STAGES

We performed a literature review on DA as an umbrella term for a range of terms, such as internet addiction, online addiction, problematic internet usage, and online gaming addiction. Besides searching for journal articles and conference papers in these areas, we applied online search using Google Scholar and the main digital libraries such as ACM, IEEE Xplore, and DBLP. As search criteria, we used combinations of keywords related to digital media, such as ‘social media’, ‘games’, ‘gaming’ ‘internet use’, ‘smartphone’, ‘social networks’ as well as, addiction-related terms such as ‘addictive’, ‘excessive’, ‘compulsive’, ‘addiction’, ‘problematic’, ‘pathological’. We used a snowballing approach to review relevant references from reviewed studies so that we could expand the search results (Jalali and Wohlin 2012). The literature review was not meant to be a systematic review but rather an elicitation of the primary and common negative life experiences linked to the concept of DA.

After identifying the negative life experiences from the literature, we worked on classifying and categorising them. In addition, the findings from the follow-up focus groups informed the process of detailing the experiences and introducing additional elements. We came up with eight families of negative life experiences and listed related elements under each family. The findings are presented in **Section 5.4**.

### 5.3 STAGE 1: PART 2

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Addictions, whether to a substance or behaviour, are typically associated with consequences which could cause physical or mental damage to the individuals or their surroundings, e.g. family members and friends. In comparison to substance addiction, where the consequences of use are visible and quantifiable, the consequences of behavioural addiction, in particular digital addiction, are not of the same nature and could be different for each user and each software and usage pattern. Here, the focus will be on the negative consequences of digital addiction, seen as an obsessive, excessive and hasty use of software. It emphasises the high level of uncontrollable engagement in some encounters made possible by software. Anxiety, depression, distraction, lack of sleep, and poor social skills are all linked to digital addiction. The over-dependency on software products could lead to emotional escape and lead to some feelings of pleasure, but sadly, in a way that can cause personal, social, or psychological harm to an individual (Ha et al. 2006). Estimates of digital addiction differ depending on the country and the definition of DA under consideration. According to estimates, 6 percent to 15% of the general population test positive for signs of addiction; this figure rises to 13-18% among university students who have been identified as being most at risk for DA (Young and de Abreu 2011). The second part of the first stage of the study involved two focus group sessions. The focus groups aimed to elaborate and explain the results of the literature review based on the participants’ experience with DA.

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#### 5.3.1 STAGE 1: PART 2 RESEARCH METHOD

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**Table 14** presents the focus group participants. The participants (i) were familiar with the research area, and (ii) had prior experience working in the field of digital, internet, or behavioural addiction, and (iii) were frequent users of social networks such as Facebook, Twitter, and LinkedIn and declared varying levels of problematic usage of them. As a starting point and to help guide the discussion, some examples of the consequences were provided. The participants were provided templates showing a classification of factors and a list of elements under each category which could be associated with the concept of digital addiction. The focus of these sessions was to have participants discuss the various findings from the literature, mainly to explain them, and to help their organisation into categories so that we reduce redundancies and flatness of the literature review outcome. For example, while we initially considered *skipping meals* and *forgetting meals* to be similar, the focus groups highlighted a subtle difference between them, which is around *intentionality*.

Participants were recruited by sending email invitations to their work and university email accounts with a brief explanation of the research. All ethical requirements were properly taken care of according to the university’s ethical procedures. The study information sheet and participants’ agreement form (containing a detailed description of the study and informing participants about their rights during and after the study) were sent to the participants by email prior to the study date, giving them a good amount of time to decide whether to partake in the study or to opt out. Each of the focus groups lasted about two hours. The researcher facilitated the sessions.

TABLE 14: FIRST STAGE FOCUS GROUP PARTICIPANTS

Participants	Gender	Academic Background
<b>Participants are university students with varying levels of problematic usage of social media (normal to problematic)</b>		
F	Female	Facilitator (researcher)
P1	Male	Computer and Human Factors
P2	Female	Computing
P3	Male	Computing and Security
P4	Male	Computing and Informatics
P5	Male	Psychology
P6	Female	Computing and Human Factors

#### 5.4 RESULTS: DIGITAL ADDICTION AND ASSOCIATED NEGATIVE LIFE EXPERIENCES

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Existing research associated DA with a wide range of negative life experiences, including lowering self-esteem, preoccupation, irregular sleeping patterns, reduced face-to-face communication, invasion of privacy of others, and erratic dietary behaviour. **Figure 29** presents eight families of such negative life experiences, and the elements listed under each family. The main elements from each family are written in *italic* text and underlined. Due to the space

limitation in this paper and given that some of the negative effects are self-explanatory, we will only elaborate on the primary elements from each category and include comments from the users' study, i.e. the two focus groups which followed the literature review stage.

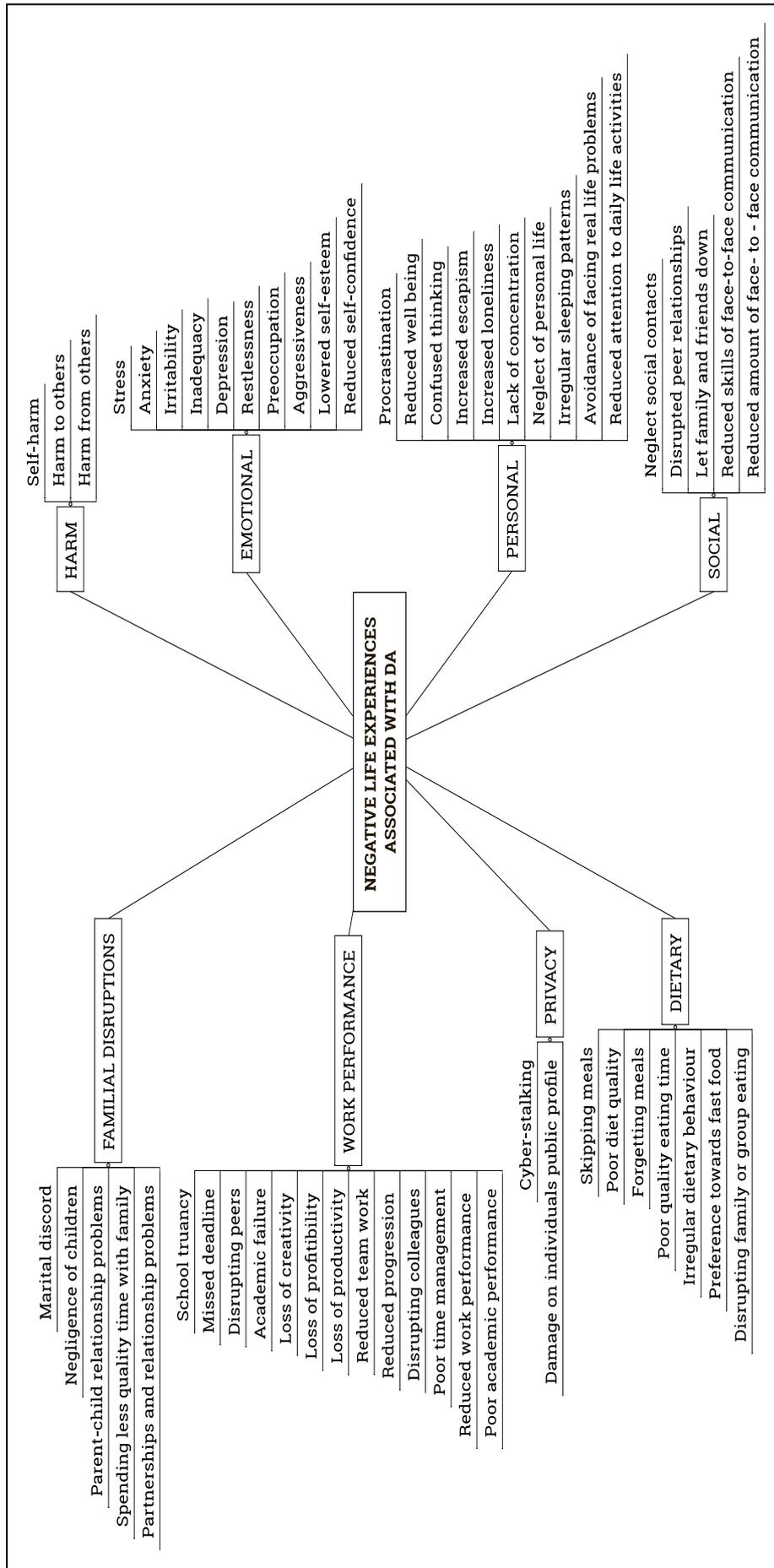


FIGURE 29: DIGITAL ADDICTION AND ASSOCIATED NEGATIVE LIFE EXPERIENCES

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#### 5.4.1 EMOTIONAL PROBLEMS

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Emotional problems refer to problems that affect the psychological well-being of users. The interaction activities of some contacts could increase *depression*, especially for those with low self-esteem; “*seeing online contacts posting perfect pictures, whether holiday pictures or pictures of a social function, could facilitate depression.*” *Irritability* is another related emotional problem, i.e. when a user feels annoyed or impatient when they are unable to engage in online interaction for technical or social and other contextual reasons (Abel et al. 2016). Furthermore, users with DA could overly feel *Inadequate*, which may lead to reduced self-worth; “*you feel incompetent and inferior when you see a posting of an event on social media from your contacts which you were not invited to.*”

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#### 5.4.2 DISRUPTED FAMILIAL RELATIONSHIPS

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Familiar disruptions resulting from DA can be linked to the unconscious and hasty disclosure of sensitive personal information online, cyber-stalking and online surveillance of loved ones. For users with DA, this can happen unconsciously and irresistibly. It could lead to family breakdown, partnerships and relationship problems. *Partnerships and Relationship problems* can be affected when one chooses to spend time online and neglects their partners, which may lead to relationship conflict, separation, and divorce in some cases (Beutel et al. 2011). *Parent-child relationship depth and strength* can be affected when “*parent-child communication and engagement in other family activities are overpowered by their engagement in the virtual world, e.g. social networks*”. Online immersion could distract and lead people to spend *less quality time with family*; “*being on the phone when other members of the family are together catching up after school, work or watching TV together as a family.*”

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#### 5.4.3 PERSONAL PROBLEMS

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The continuity and real-time nature of online interaction, the attractiveness of games and social media features, and the unlimited access to these features could lead to neglect of other important aspects of a person’s life. For example, excessive usage can lead to reduced attention to daily life activities, e.g. not cleaning the house or doing the needed shopping, and not taking proper care of loved ones. Access to a variety of content online may *confuse* the way people think; “*disorientation, confusion and anxiety, tunnelling when shopping online, and being unable to control how one thinks as a result of prolonged usage sessions*”. The *lack of concentration* while driving resulting from social media usage and notifications could cause accidents and annoy other drivers. Another experience is *procrastination*, e.g. putting off personal chores that need to be

completed or delaying the start of a task for other social online activities (Kirschner and Karpinski 2010).

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#### 5.4.4 SOCIAL PROBLEMS

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Social problems may be related to situations when users feel the need to be online at all times and therefore neglect their social contacts, such as peers, colleagues, family and friends in the physical world. Neglect of connections could affect *real-life relationships and the face-to-face* engagement of users with DA. For example, when a user chooses to spend all their time using online software, their family and friends may feel let down, especially during special occasions where their presence is highly expected, such as the case when gamers may "*turn down an invitation from family or friends or not show up to social events such as birthday parties, wedding ceremonies, and other special celebrations*". Also, spending too much time online may lead to a *loss or reduction of social skills* required for real-life communication, such as confidence and concentration levels needed to engage in a meaningful conversation. As a counter-argument, some users argue that real-life communications are both slow and more inhibitive, hence the difficulty.

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#### 5.4.5 WORK PERFORMANCE PROBLEMS

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The urge for students or employees to be excessively online for non-academic or non-work-related purposes could affect their academic and work-related performance (Müller et al. 2014). It is also about preoccupation. For example, an employee who posts on social media and becomes worried about the reactions of other contacts could have a reduced attention span on work duties, which may affect the *profitability* of an organisation. A user commented that uncontrolled and hasty "*employees' online software activities might lead to disciplinary, suspension, and even job loss, in extreme cases, leading to a reduction in the workforce*". A reduction in work performance could *reduce one's work-profile*, which could reduce the chances of employment *progression* and this could in turn *lower other job opportunities*. Also, DA could be contagious where staff with DA may be putting pressure on colleagues to respond to their online posts, and this could *disrupt* colleagues from their routine daily work. Effects on *academic performance* can happen when students cannot completely focus on a task such as coursework due to their immersive digital media usage. Students' multitasking, e.g. joining a conversation on social media while working on an assignment, could affect their performance level, causing decreased productivity (Li et al. 2015). *Loss of creativity* could be attributed to "*the variety of content that users can access and the number of activities that can be performed while online*". The ease of finding and sharing content on social media, rather than creating it, can be argued to reduce the creativity level.

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#### 5.4.6 INVASION OF PRIVACY OF OTHERS

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Online software applications provide an opportunity for users to disclose personal information. This information can be assessed and used by others in a negative way, such as the aforementioned *cyber-stalking* (Kuss and Griffiths 2011). The sharing of sensitive information in a hasty and less thoughtful manner, which is often the case for users with DA, could lead to *damage to individuals' public profile*. For example, sharing pictures and tagging contacts in a post that can be accessed and used by employers and others for judging professional ability could affect one's reputation.

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#### 5.4.7 SOURCE OF HARM

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Harm could be personal or financial, e.g. gaming addicts buying items and neglecting health and hygiene. Users can suffer from physical injuries which develop over a period of time, e.g. headaches, pain in the wrist, text-neck or poor vision. The skills users learn and develop as a result of watching or being exposed to violent games could cause *harm to others* "if a user practices a fighting scene from an online game on other people" and when users steal money from their partners to finance their gaming or online gambling addiction. The *financial harm* could lead to issues such as family breakdown due to a divorce or separation resulting from job loss, and this may lead to debts, impairment of assets or even personal bankruptcy. Such harms are more noticeable in the case of online gambling, in particular.

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#### 5.4.8 DIETARY-RELATED PROBLEMS

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Dietary problems refer to those factors that could affect users' diet quality. For example, playing games or using social networks continuously for hours and forgetting to eat or drink. The real-time nature of the interaction, continuity of software usage, and variety of information content could entice users into spending a considerable amount of time using software. This could lead to not having meals or not preparing good quality meals, leading to missing or deliberately skipping meals, and poor diet quality, e.g. the tendency to eat fast food or junk food in the case of gamers.

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### 5.5 DISCUSSION

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In the second part of this stage, focus groups were conducted to help gather users' perceptions of the key findings from the literature. We explored the negative life experiences associated with DA. The templates of negative life experiences provided to the study participants were revised based on their suggestions and comments. After reviewing the templates, some participants highlighted that some elements appear to be redundant while others need to be classified under a separate category. For example, academic problems and work performance problems were recommended to be grouped together into one category and named 'work performance problems'. Also, cyber stalking was initially proposed under 'social problems' and damage to individuals' public profile and under 'personal problems'. Some participants suggested removing the elements from these categories. A new category was then created named 'privacy' for the two elements.

Elements that were redundant, e.g. reduced attention to daily life activities under personal problems, and this was addressed by the researcher. Some element names were shortened for readability purposes. For example, the elements affecting parent-child relationship depth and strength were changed to parent-child relationship problems, letting down friends and family to letting friends and family down, and missing important work deadlines to missed deadline. Reviewing the templates and refining the families of negative life experiences and their associated elements led to a more concise taxonomy.

After gathering the negative life experiences of digital addiction from the literature, the author then classified and categorised these effects into eight families of negative life experiences, i.e. emotional problems, disrupted familial, personal problems, social problems, work performance problems, invasion of privacy of others, harm and dietary-related problems. Having the eight families of negative life experiences presented in this chapter would act as a reference point and an initial step towards their more in-depth understanding, which would benefit researchers and practitioners from different disciplines working in the area of behavioural addiction, e.g. computing and psychology. According to Johnstone et al. (2018), the advantage of developing an ontology that gathers and builds up information from related literature is to give a solid knowledge base for use in future work such as tool construction. All the study participants agreed that categorising negative life experiences and presenting a discussion on the different elements is vital to help improve the understanding and awareness of readers. Also, providing a discussion on the main elements of each category of negative life experiences and adding comments from the users who self-declared having problematic usage helps establish an understanding of the negative effects and the context in which they could happen.

Previous studies have identified or determined the impact of digital media addiction on problematic/heavy users, and their findings seem to be comparable. Such an impact relates to problems, including psychological issues resulting from long-term Internet use, such as inability to manage one's emotions and way of thinking (Alam et al. 2014). Our study participants emphasised that emotional issues, such as depression, could be elevated due to the amount of time spent on the Internet, while the authors Young (2006) and Yang and Tung (2004) reported that, in addition to raising depression, long-term use of the internet lowers self-esteem. Users tend to enhance their internet usage time while removing their predefined schedule relating to professional or academic work. In a work environment where employees collaborate, if some employees fail to follow their set schedule due to online activities, this could affect others' progress. According to Alam et al. (2014), when a work-related problem has an impact on the people who work together as well as the company where the individual works, the situation becomes alarming (Alam et al. 2014). Also, in terms of academic performance, group or individual assignments could be affected if some students fail to meet deadlines for their allocated tasks. Landers and Lounsbury (2004) reported that the negative link between the drive to work

and Internet usage could simply reflect the fact that Internet users who spend a considerable amount of time on the Internet do so at the price of time spent studying hard and putting in extra effort to earn good grades. Yang and Tung (2004) stated that physical issues could occur as a result of heavy or problematic use of the internet, for example, migraines or headaches. This is in line with our study findings where some participants mentioned factors relating to physical problems, such as headaches. In addition, our findings revealed pain in the wrist, text-neck or poor-vision. Other researchers reported physical problems, such as backaches (Shuhail and Bergees 2006).

In addition to the above, there are other negative issues with digital addiction highlighted by researchers. For example, the authors Shuhail and Bergees (2006) conducted a study on the negative effects of internet addiction and reported that half of the participants had to rearrange their activities to accommodate online use, and they skipped meals to do so. This is similar to one of our findings, i.e. 'skipping meals', discussed in the dietary-related problems section. We also found additional elements in this category, such as forgetting meals and poor diet quality, among others. Another study by Kubey et al. (2001) established that heavy Internet use for leisure among a sample of 572 college students was linked to other issues such as late-night use, social isolation, sleep disorders, and a drop in academic performance. Sleep disorders are altered as a result of excessive internet use or late night use, resulting in extreme exhaustion, reducing academic or professional performance, and possibly lowering the immune system, leaving the addict vulnerable to disease (Young 2004). Li and Chung (2006) stated that those who use the Internet for social reasons for a long period may experience issues such as obsessive use, disengagement from social activities, time management issues, relationships and health issues. Some of these elements are similar to our findings, e.g. relationships problems, when people spend a considerable amount of time online and therefore forget to honour invitations for social celebrations from close friends and family members.

Our literature review and the studies conducted focused on the negative life experiences of digital addiction. The results identified eight families of negative effects of digital addiction and their associated elements. Thus, further empirical research on combatting such negative life experiences employing various techniques or mechanisms is needed.

## 5.6 STAGE 2

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This research study aims to understand experts' perceptions of best practice for raising awareness of digital addiction. We are interested in understanding people's perceptions of the inclusion of warning messages and labels for software such as Social Networks and Games, in order to help raise users' awareness and help them regulate their obsessive, excessive, impulsive, compulsive, or hasty usage behaviour and to encourage behaviour change. The findings of this study will support the correct design of the above-mentioned warning labels and this will, in turn, help

enhance awareness of users and avoid the negative life experiences of DA, such as relationship breakdown and poor academic performance, which might be associated with their excessive and hasty usage styles. This research aims to explore how the families of negative life experiences of problematic online behaviour and their associated elements could shape goal setting and its elements with the help of software. Also, the study aims to investigate users' thoughts on technology-assisted goal setting (TAGS) and the aspects that need to be considered when technology is used to assist the goal setting process.

Eliciting users' requirements or getting them involved at the early stages of intervention design could help to identify the factors that would help increase the acceptance of the technology. More specifically, (Bos et al. 2013) states that intervention techniques should be based on establishing an understanding of user experiences, values, and requirements, which could lead to users' acceptance of the intervention techniques. Therefore, it is important to consider behaviour change interventions from a user perspective as well as from a social perspective during their design (Bos et al. 2013). Reactance theory (Brehm 1966) proposes that low levels of acceptance towards an intervention enable users to embrace or reinforce a behaviour that is contrary to the desired behaviour, thus developing more resistance to implementing the desired behaviour. In contrast, high levels of acceptance cause users to be more likely to accept the interventions and to achieve the desired behaviour (Laurin et al. 2012).

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### 5.6.1 STAGE 2: RESEARCH METHOD

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The second stage of the study consisted of two activities with the aim of investigating the role of software in combatting DA and reducing negative life experiences. First, we conducted semi-structured interviews (**Stage 2 Figure 28**) and analysed data collected from ten experts and practitioners in the areas of well-being, addiction recovery, social and cyber psychology, and human factors in computing (see **Table 15**). The interview participants were given questions and expected to give their opinion on these questions to the best of their ability. The primary goal of the interviews was to explore the perception of online labelling and warning messages, interactive and multimedia ones issued by software reactively or proactively, to reduce or warn against DA with a focus on social networks and games. Also, interviewing experts in one of the main addiction centres in the UK enabled us to develop an understanding of their practices and how we may use them in developing interactive software interventions. This interview will last 30 – 40 minutes. All interviews were recorded and transcribed verbatim.

All ethical approvals were obtained according to the university's procedures. The interviews commenced with a short introduction, and participants were encouraged to freely speak their minds and they were made aware that there were no right or wrong answers. The interviews were recorded and transcribed. The data collected through the interviews was analysed through the six

phases of thematic analysis as proposed in (Braun and Clarke 2006). Also, all those who participated in the studies were informed about the research aims prior to the scheduled dates and asked for their consent to take part in the studies.

In the second part, we built on a survey initially conducted in (Ali et al. 2015) and extended it in terms of the number of participants and the comments received. The purpose of the initial survey, which was part of a mixed method approach, was to confirm the findings of previous interviews with people who self-declared to have DA. The authors explored the design of digital warning labels from the perspective of the users, which is vital to their successful implementation. Their goal was to introduce researchers and developers to the need for labelling and provide them with a list of questions to consider when dealing with this type of requirement. The previous study presented the percentage of users and their preferences in terms of the message content of the labels and how they should be presented, and the control the users would like to have over the labels, among others. There was no need to conduct another survey on the same topic. Instead, what was needed was to investigate and gather additional information on users' selected options in order to have a better understanding of how they want the design to consider these features for effective behaviour change purposes. The author thought this information would be beneficial for successful implementation of the warning labels. The total number of the extended survey participants was 146. 68 were male and 80 females, mainly coming from the UK and Europe, with an age range between 18 and 64. This doubles the initial survey participants. We analysed the survey comments on the proposed software intervention techniques, e.g. progress bars, timers relating to digital media usage and timing, frequency, tone and content of feedback relating to negative life experiences and the effect DA may have on the users and their significant others. The results of the analysis of the interviews as well as the qualitative part of the survey were meant to provide insights on how future software tools can help in combatting DA as a professional responsibility requirement.

TABLE 15: SECOND STAGE INTERVIEW PARTICIPANTS

Participants	Gender	Research Background and Expertise
<b>Participants are experts and practitioners who have more than five years of experience in their respective fields</b>		
P1	Male	Usability Engineering and Human-Computer Interaction
P2	Male	Usability Engineering
P3	Male	Social Psychology
P4	Male	Communication Science and Media Psychology
P5	Female	Psychology and Team Supervisor in Addiction Recovery Unit including gaming and gambling addiction.
P6	Male	Counsellor for substance and behavioural addiction
P7	Male	Counsellor for substance and behavioural addiction
P8	Male	Counsellor for substance and behavioural addiction
P9	Male	Psychology and Counselling

P10	Male	Usability Engineering, Requirements Engineering, Digital Addiction
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## 5.7 RESULTS: SOFTWARE-ASSISTED PREVENTION AND AWARENESS OF DIGITAL ADDICTION

To help people combat the potential negative life experiences presented in **Section 5.4**, we argue the need for the tech industry to play a key role and provide or enable others to provide tools that augment their digital media and enhance users' online well-being and help prevent unhealthy usage behaviours. To investigate our proposition, we conducted and analysed the interviews and survey comments described in **Section 5.6.1** through the six phases of thematic analysis as proposed in (Braun and Clarke 2006). Below, we present and discuss the mechanisms identified through the data analysis of the interview data and users' comments in the survey (see **Figure 30**). The design of these studies was based on a set of arguments we made about the role of software in monitoring and solving the problem and its unique features of interactivity and reactivity and real-time (Ali et al. 2015; Alrobai et al. 2016).

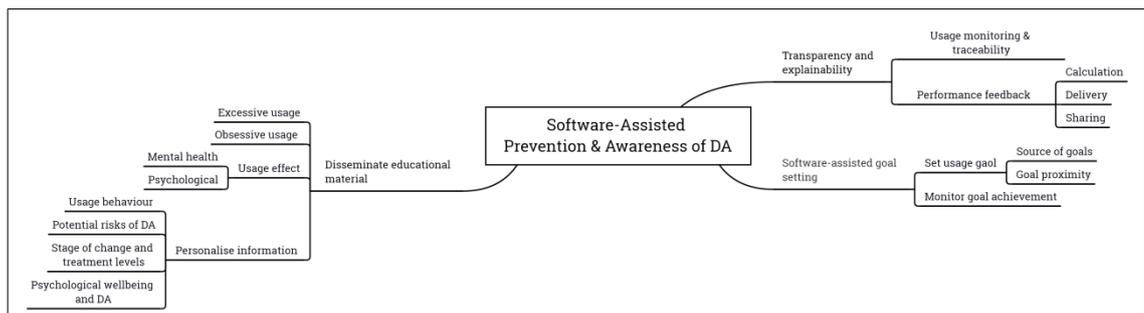


FIGURE 30: DIGITAL ADDICTION AND SOFTWARE-ASSISTED PREVENTION AND AWARENESS

### 5.7.1 SOFTWARE AS TOOL TO DISSEMINATE EDUCATIONAL MATERIAL

Research evidence has linked excessive digital media usage to an increased level of psychological arousal, which often leads to a lack of sleep, forgetting to eat or drink, psychological harm and a reduction in physical activity (Young 1998). There is a growing interest in the possible use of addiction-awareness software solutions to help maintain the mental and social-wellbeing of users (Kim et al. 2006). The analysis demonstrates the need for software to provide educational materials relating to obsessive and excessive users' online presence and the effects this may have on their psychological and mental health status and also on other aspects of their lives; *“Providing psychological and mental health information could be good and may help some users consider their usage before it gets serious and turns into something addictive.”*

The participants also emphasised the need for such information to be tailored and personalised based on their needs and preferences. One expert stated that *“education materials should be personalised to the needs of users and only displayed to them at the right time”*. Based on the

analysis and our practical expertise in the field, we conclude that such personalisation might be based on four main factors, (i) usage behaviour, (ii) potential risks of DA, (iii) knowledge of psychological wellbeing and DA, and (iv) stage of change and treatment levels to help planning and relapse prevention. AI techniques could be used here to help predict future usage behaviours, risks associated with usage, and to deliver appropriate materials at the right point, to reduce their effect early on (Lino et al. 2017). Another factor to consider is the nature of the materials, i.e., should they be based on real-life user stories, scientific facts, or usage history and context?

The challenge here would be how to design software to deliver such information in a timely and acceptable manner, specifically: (i) how to monitor users' digital behaviour and intentionality, (ii) how to ascertain users' preferences regarding the nature of the materials, their presentation and delivery modes given the nature of people with problematic usage and their characteristics, e.g. denial and trivialisation of the problem, and (iii) how to design the educational material in a progressive and phased way in response to the change of behaviour. An approach would be to ask for input from the users, e.g. similar to interactive recommender systems, but this may also be challenging given the characteristics of people with problematic behaviour, e.g. subjectivity, flight into health, and ambivalence.

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## 5.7.2 SOFTWARE-ASSISTED GOAL SETTING

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Participants reported that they would like the software to provide the opportunity to set goals around digital usage and style of living. The real-time nature, the traceability and tractability of software usage would facilitate goal setting, and the provision of goal performance feedback may enable users to make informed decisions about their usage behaviour (Alrobai et al. 2016). Based on the interviews and survey comments, it is evident that users would like some degree of control when setting goals; *“giving users some control would lead to some sense of involvement, which can help encourage people and improve their overall acceptance of the goals”*. Others commented that giving control should be minimal to avoid bias and the *“flight-into-health”* when people achieve spontaneous improvement but without enough resilience to sustain it. An assessment questionnaire could be used to determine users' preferences for the level of involvement, such as (i) Passive or consultative, (ii) Representative, (iii) Participative or decision-maker (Rocha and de Vasconcelos 2004). Another option may be to solicit the expertise of a mediator, e.g. a therapist who is an expert in the area, who can assess a user's emotional state and issues and help them to choose the right goal settings and provide data-driven feedback with the help of data analytics tools.

When setting goals, the proximity of the goals needs to be considered. Setting proximal goals may help reduce the loss of goal interest, boost motivation and confidence in goal attainment. It is essential to *“encourage users to set proximal goals, as users only have the main goals and not sub-goals. Having little sub-goals motivates people to keep doing what they are doing, and the*

*program can help them set these sub-goals and reward or remind them when they attain the sub-goals*". The software interface that will be used to set up the goals should be concise; it should only contain a few questions or options which are easy to interpret and "*fast and no-fuss to set up, i.e. clean interface*". The software can monitor goal achievement in real-time and this is a bonus in comparison to human-based counselling.

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### 5.7.3 TRANSPARENCY AND EXPLAINABILITY

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The software provides new opportunities for timely, interactive and personalised transparency with users. For example, it could demonstrate to users how real-time monitoring and traceability of their usage is performed and how goal performance feedback information is determined. A practitioner commented; "*focus on a message that is very clear and genuine for all users. It needs to be transparent with the users on how such information was derived*". Providing this information at the right time may improve users' belief and trust in the software. Because users exhibit different skills and self-esteem levels, transparency concerning the delivering and sharing of performance feedback collectively should be considered by all parties involved (Algashami et al. 2017, 2018) in case group therapy approach or online peer support groups are applied (Alrobai et al. 2018). Delivering such transparency information without consideration of these factors may lower some users' self-esteem and reduce their motivation and commitment towards their goals and, in the worst cases, may lead them to abandon their goals.

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### 5.7.4 CARE SERVICE PROVISION

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The question that needs to be addressed here is about the party who should be responsible for the implementation of DA awareness and prevention mechanisms. Should it be an in-house job for software companies, i.e. where technology companies think about how their software might affect users during system design and development, and provide tools and support that would help combat any negative effects resulting from its usage, or should software companies delegate this responsibility to third parties and enable them to do that through the form of Application Programming Interfaces (API's)? In addition, users should be assured that all ethical considerations have been considered and that the companies will only use data to raise awareness and to alleviate any negative effects that might be linked to addictive software usage. It has also been argued that software companies may choose to democratise the process by enabling users to allow access to their data by their own third-party services. With the General Data Protection Regulation (GDPR) in Europe, such data *portability* is a right of citizens where the real-time and automation aspects are still not mandatory for software companies.

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## 5.8 COMBATING DA IN GROUPS

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Central to why people develop negative digital behaviour is peer comparisons, i.e. how people perceive themselves in contrast to others. For example, when a user thinks that their peers have a better life than they do, based on the information they see about their peers online. At the same time, we argue that technology-assisted solutions can be used to correct these misconceptions due to their real-time nature, by providing objective data about the users' actual digital behaviour and their peers, for example, by saying 90 per cent of people do not check their mobile phones after going to bed. The use of software solutions is a new avenue for challenging normative misperceptions. In this section, we discuss social norms and look at how technology-assisted solutions could be used to correct these misconceptions by facilitating the dissemination of accurate normative information to help change people's digital usage behaviour.

As individuals, we are strongly influenced by what we perceive to be the social norms of our group (Festinger 1954). As has been demonstrated in social psychological studies, we often make errors in these processes, perceiving our peers to behave more riskily and to hold more harmful attitudes than is the case (McAlaney et al. 2011). It has been argued that social norms are a crucial element in behaviour change interventions (Reynolds et al. 2014). In developing technology-assisted solutions, there is a need to consider social norms and normative beliefs and their effect on the behaviour change process. Social norms can be considered in terms of descriptive norms, which refer to the perceived frequency and magnitude of behaviour amongst peers, and injunctive norms, which refer to the perceived attitudes towards behaviour amongst peers (Dempsey et al. 2018). The social norms approach is based on the premise that challenging and correcting normative misperceptions, using persuasive messages, will align the individual with the actual, healthier norms. This approach has been demonstrated to be an effective method for behaviour change across several behavioural domains, including substance misuse (Dempsey et al. 2018).

Digital media uses influence principles such as the liking and social proof principles of influence (Cialdini 1984) to persuade people to act in a certain way, which could contribute to problematic digital behaviour. Some social media users may be influenced to behave in a certain way by the people they perceive as important. If normative misperception can be challenged, the peer pressure on individuals to actively participate in the behaviour can equally be reduced, resulting in a reduction of problematic online behaviour. For example, a teenager who believes that their peers spend a considerable amount of time socialising online may equally choose to be online due to such a belief. If this teenager is made aware that the majority of their peers are online for two hours a day, this might help them manage their problematic digital behaviour.

Such strategies can be undermined if the target population is sceptical about the validity of the social norm data with which they are presented, which may in part be influenced when they know that the social norm data has been collected through self-report (McAlaney et al. 2011). Technology can address this through the automated collection of data from digital devices such

as smartphones, and then create personal usage and social norms data which the target population is more likely to see as being more objective and reliable than self-reported data. Given its real-time nature and the ability to trace and perform continuous behaviour monitoring, technology can shape social norms by providing accurate behavioural norm data (Faraj et al. 2011).

Such strategies can be undermined if the target population is sceptical about the validity of the social norm data with which they are presented, which may in part be influenced by the knowledge of the population that the social norm data has been collected through self-reporting.

Helping users to be aware and understand the current social norms of their peer group may prompt them to change their behaviour positively. In **Table 16**, we present examples of some injunctive and descriptive norms that could be used to achieve this.

TABLE 16: NORMATIVE MESSAGES AS COUNTERMEASURE STRATEGIES FOR PROBLEMATIC ONLINE USAGE

Examples of Normative Messages	Message Type
You said that you think most of your contacts believe messages should be responded to immediately – actually, 72% of your contacts reported that they do not expect an immediate response to messages.	Injunctive message
You said that you think most of your contacts are satisfied with how much they use social media – actually, most of your contacts reported that they would like to reduce their social media use.	Injunctive message
You said that you think most of your contacts place very high importance on getting likes on their posts – actually, 67% of your contacts reported that getting likes is not important.	Injunctive message
You said that you think most of your contacts expect you to like their posts and will be offended if you do not – actually, 75% of your contacts reported that they do not expect everyone to like every post that they make.	Injunctive message
You said that you think you post on social media less per day than most of your contacts – actually, on average you post on social media twice as often per day compared to most of your contacts.	Description Message
You said that you think you spend less time a day browsing social media than most of your contacts – actually, on average; you spend 2 hours more a day on social media than most of your contacts.	Description message
You said that you think you check social media less often than most of your contacts – actually, on average, you check social media 50 times more per day than most of your colleagues.	Description message
You said that you think you post on social media less often while on holiday than most of your contacts – actually, on average, you post on social media five times more status updates than most of your contacts while on holiday.	Description message

## 5.9 DISCUSSION

Despite a range of research on the negative life experiences associated with DA, there is limited research on how technology could help users to mitigate against an addictive usage style (Ali et al. 2015; Alrobai et al. 2016). This research investigated such negative life experiences, and the possibility of technology-assisted solutions, i.e. using technology to help manage unhealthy digital usage and improve users' well-being in the digital space. To help answer the research aims, we conducted two-stage research, resulting in (i) discerning eight families of negative life experiences, and (ii) advocating three ways for software to adapt to help manage the adverse effects of DA, i.e. software as a tool to disseminate educational materials, software-assisted goal setting, and transparency and explainability. We also discussed the impact of social norms and their effect on users' digital behaviour and examined how technology could facilitate the dissemination of normative information to help alleviate the effects of normative beliefs and social pressures. Furthermore, by providing an initial discussion on the ways that software could be used to manage the negative experiences associated with DA, we aim to foster discussions on the role the tech industry could play and the software solutions that can be provided.

The software-assisted solutions provide an opportunity to be transparent with individuals. Although transparency about peers' performance can countermeasure a person's perceived social norms regarding their peers' digital behaviour, various ethical and moral issues may emerge as a result of it (Raftopoulos 2014). The relationship between technology design and its application is complicated and unforeseeable. According to (Albrechtslund 2007; Berdichevsky and Neuenschwander 1999), overall ethical and design concepts can thus play a critical role in establishing high-level standards and transparency mechanisms to ensure that human rights are maintained, especially when persuasive systems are used. There is a distinction between transparency as an enabler for helping people establish accurate social norms, which may lead to increased trust in the system, and transparency that pressurises some members in a group setting. For example, showing how many times each member of the group posts on social media a day or displaying the usage time for each group member on social media may encourage others to increase usage to align with the norms of the group.

Motivational strategies such as points and badges and other gamification elements may be applied to a group environment to engage, persuade, and track users' engagement in their individual and collective goals, e.g. being offline for night hours. The digital nature of the motivational factors adds more effective features such as real-time tracking and performance feedback of users' behaviour (Algashami et al. 2018). This mirrors our findings where the participants pointed out the importance of real-time monitoring and provision of goal performance information attributed to the digital nature of technology. However, according to (Algashami et al. 2018, 2019), such gamification factors can also present risk factors. Below, a discussion of these risk factors is provided.

Rewarding the performance of group members can lead to risks in the behavioural change system. Such risks can originate from the *strategy* used in the reward system. Group members may have various preferences about how they want their performance to be rewarded, which makes this aspect a possible risk in a peer group setting. If peers are rewarded based on application usage time without any consideration for other usage time, i.e. passive usage, e.g. including the time between closing the application and the locking of the user's screen (Alrobai et al. 2016). Also, not rewarding users due to the amount of time they spend using certain applications for work-related purposes. Regarding the *ability to win the reward*, group members with low self-efficacy might have problems partaking in group-related activities when the reward is solely based on their performance. This could be mitigated by categorising group members into two categories, i.e. those peers who would like to be rewarded based on task difficulty level, and those who perceive that the difficulty of the task would prevent them from winning the rewards due to their low ability levels. *The timing* relates to the time at which performance is rewarded. Performance can be rewarded in real-time, i.e. during the time users are performing the behaviour, or offline, i.e. after the behaviour is completed (Liu et al. 2011). In a group setting, displaying real-time rewards might de-motivate and negatively affect group members' performance, especially those with low self-esteem and self-efficacy levels, to attain the task.

*The value* – the value attached to the reward might de-motivate some group members and reduce their commitment to the goal-related tasks, which might affect their goal performance. In a group environment, where collective tasks are set, group members' motivation and contribution towards achieving the group task might be affected due to how they perceive the value of the rewards. Algashami et al. (2018) stated that some group members might participate less in tasks because of their perception of low-value rewards.

*The nature of the reward* – the effect of the nature of the reward is closely related to the individual's personality. Group members can have different preferences about the nature of the rewards, which may cause risk, which could affect group performance. Some group members might be less motivated to partake in group tasks because of the nature of the performance reward.

## 5.10 CHAPTER SUMMARY

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In this chapter, the researcher explored and discussed the negative life experiences associated with DA. After discussing these effects, we advocated the need for tech companies developing such potentially problematic products to use mechanisms that would help users to be aware of their patterns of use and maintain healthier online behaviour. From the analysis, we defined as an initial step three ways that software might adapt to help prevent unhealthy usage by disseminating user behaviours to others, allowing goal setting and transparency. We also discussed who should be responsible for such mechanisms. For example, should they be an in-house job for software firms, or should they delegate the task to third-party companies? Given the impact of social norms

and normative beliefs on people's behaviour, we also provided an initial discussion on how technology-assisted solutions could be used to help reduce the effect of people's normative beliefs on their usage styles. The next chapter presents users' perceptions of the opportunities, challenges, and acceptance factors in terms of perceived usefulness and perceived ease of use of TAGS.

## 6. CHAPTER 6: USER PERSPECTIVE OF TECHNOLOGY-ASSISTED GOAL SETTING

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The problematic usage of online applications such as social media, gaming and online shopping is becoming a global problem. Such a usage style can be associated with a variety of negative life experiences, such as work performance problems (Young 1999) and parent-child relationship problems (Grüsser et al. 2007). Problematic online usage exhibits characteristics similar to behavioural addiction, such as alteration of mood, conflict, salience, tolerance, symptoms of withdrawal and relapse (Griffiths 2005). There is an increasing interest in software used to assist the behavioural change process. Software-based interventions have been applied to improve the dietary behaviour of various individuals, e.g. improving the dietary behaviour of low-income women (Bodenheimer and Handley 2009) and smoking cessation (Bricker et al. 2014).

The recognition of the role of technology and the likelihood of using persuasive techniques has led to an increasing interest in using technology-assisted solutions to regulate problematic digital behaviour (Alrobai et al. 2019). Generally, such systems are based on the principle of people taking responsibility for managing and controlling their digital behaviour by using techniques such as goal setting and persuasive messages. Goal setting is a crucial aspect of different persuasive information systems paradigms, including gamification (Landers et al. 2017) and persuasive technology, i.e. technologies developed to support behaviour change in our daily lives (Fogg 2002; Oinas-kukkonen and Harjuma 2009). Cham et al. (2019a), developed reference checklists for goal setting that can be used by practitioners and researchers in persuasive and motivational systems to aid the attainment of better software and support for behavioural goal automation.

Persuasive technologies can play a positive and supportive role by persuading individuals to engage in healthy behaviours, and rewarding such behaviours promptly when they happen (Intille et al. 2003; IJsselsteijn et al. 2006). For example, Lee et al. (2014) performed a smartphone addiction study and developed a smartphone addiction management system. The intervention system has four key functions: tracking the use, archiving data, analysing data, and diagnosis and intervention. Effective intervention is provided by tracking, analysing smartphone usage and giving feedback (van Velthoven et al. 2018). Also, (Ali et al. 2015; Alrobai et al. 2016) investigated software interventions as countermeasures for problematic digital media usage. The studies demonstrated how technology could be used to provide interactive, real-time behaviour change strategies. This is in contrast to past behaviour change strategies such as mass media poster campaigns, which are primarily static and asynchronous.

Goal setting as a behaviour change strategy has been proved to be useful for behaviour change purposes in various domains. In the case of online usage, such a digital space can empower goal setting, i.e. the behaviour and the proposed intervention take place online, which could enable the

monitoring, interactivity in real-time and the delivery and enforcement of countermeasures for deviation in real-time. TAGS enables users to engage in behavioural change goal enforcement actively, i.e. to check goal performance while the behaviour is happening and make important decisions about the usage. Also, it facilitates the monitoring and comparison of the usage and delivery of feedback information in real-time. Since these technologies have become available at an increasing pace, the challenges and opportunities they may offer need to be carefully considered. Despite their increased use, research that explores users' views on the use of TAGS is still in its infancy. There is a need to assess whether users would be willing to see such a new generation of technology implemented independently from digital media or integrated within them. Therefore, conducting a study to gather users' views about TAGS is necessary to inform better design decisions. This will be important for correct tracing and monitoring of behaviour, comparison and provision of performance information.

To the best knowledge of this researcher, research that explores users' viewpoints on the opportunities and challenges associated with TAGS is limited. This is an important consideration. Research into behaviour change has demonstrated that the most effective strategies are often those that the target population engages with and finds acceptable (Davis et al. 2015). A technology-enabled behaviour change strategy that fails to do this risks suffering from the reactance effect, in which the target population either ignores the campaign or worsens their behaviour (Imhoff and Erb 2009). This chapter explores users' views of TAGS, reports on the opportunities and challenges they may introduce, and also their acceptance. Based on our findings, we developed thematic maps of these factors and their associated elements. Knowledge of these elements would play a vital part in the engineering of effective TAGS. Also, an initial discussion on some management techniques for the identified challenges is provided, which paves the way for further research in the area.

## 6.1 RESEARCH GOAL OF CHAPTER

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This study investigates users' perspectives on TAGS to help combat problematic social network usage. Also, it explores users' views on elements that technology should have to assist the behavioural change process. The aim is to explore the opportunities and challenges that TAGS may offer, as well as identify some strategies to manage these challenges. This is an initial phase before investigating users' acceptance factors of TAGS. The findings will help the researcher to establish an understanding of the challenges TAGS may introduce, and the techniques that would help the management of these challenges during system design. For such technology to be useful, its intended users need to accept it. Knowledge of the factors influencing users' acceptance of technology is thus crucial. We explore users' acceptance factors in terms of perceived usefulness and perceived ease of use. Regarding the materials that facilitate data collection in these studies, see **Appendix 3**.

## 6.2 STAGE ONE

Stage one was designed in order to explore staff and students' views on the use of software interventions to assist the behavioural change process, e.g. goal setting. The focus at this stage was to see whether the idea of software based intervention would appeal to the users and what persuasive techniques, i.e. self-monitoring and reminders, they would like the intervention system to have in order to help manage their problematic printing behaviour. Its goal was to study persuasive techniques, e.g. self-monitoring and conditioning, concerning software-based monitoring of printing behaviour, and enforcement of printing reduction goals.

### 6.2.1 STAGE ONE RESEARCH METHOD

To achieve the goal of the research, a qualitative research method, i.e. focus group, was used to obtain a detailed understanding of users' views of TAGS. A summary of the adopted data collection techniques is presented in **Table 17**.

TABLE 17: STAGE ONE DATA COLLECTION TECHNIQUE

<b>Stage One</b>
<b>Focus Group</b>
Ten participants with various qualifications take part in the session: <ul style="list-style-type: none"> <li>• Four, university lecturers</li> <li>• Three, university lecturers and PhD students</li> <li>• Three, full-time PhD students</li> </ul>

In stage one, a focus group session was held to explore users' views on software-based interventions. The focus of the session was on software-based monitoring of printing behaviour, and enforcement of printing reduction goals. In order to stimulate participants' thinking and aid the discussion, some printing awareness materials were provided (see **Appendix 3, part C**). There was no specific criterion for participant selection. Staff and students from Bournemouth University who self-declared that they needed to reduce their printing behaviour were recruited. Recruitment emails were emailed out to nearly 50 people, both staff and students, and 10 expressed their interest in partaking in the study by replying to the invitation email (see **Table 18**). The session participants included four females and six males. The study documents were then sent to each participant, including the study information sheet, consent form and other study materials. The focus group session lasted an hour and thirty minutes.

TABLE 18: FIRST STAGE FOCUS GROUP PARTICIPANTS

<b>Participants are university Lecturers and PhD students who have more than four years of experience in their domains</b>			
<b>Participants</b>	<b>Research Experience</b>	<b>Age</b>	<b>Gender</b>
P1	Computer and Human Factors	30-40	Female
P2	Computing and Security	40-50	Male

P3	Computing and Gamification	30-40	Female
P4	Computing and Security	30-40	Male
P5	Computing and Social informatics	30-40	Male
P6	Psychology	30-40	Male
P7	Computing and human factors	30-40	Female
P8	Software engineering	30-40	Female
P9	Informatics	30-40	Male
P10	Business management	30-40	Male

### 6.3 STAGE TWO

Stage two was intended in order to explore users' perception of the opportunities and risks factors TAGS may introduce and provide some recommendations on how such challenges may be addressed. Also, the focus will be on those elements that are most likely to influence users' acceptance of technology-assisted solutions. A preliminary investigation, through exploratory based study, was conducted. As a first step, the study seeks to investigate users' thoughts on the use of technology to help the management of problematic online behaviour and the aspects that need to be considered when technology is used to assist the behavioural change process in domains like problematic social media usage, problematic gambling, and problematic online gaming.

#### 6.3.1 STAGE TWO RESEARCH METHOD

To achieve our research aim, we employed a qualitative research method, i.e. interviews, to understand in-depth the users' views of technology-assisted goal setting. A summary of the adopted data collection techniques is presented in **Table 19** below.

TABLE 19: STAGE TWO DATA COLLECTION TECHNIQUE

Stage Two
Interviews
Interviews with eighteen university students who self-declared to having problematic social networks usage: <ul style="list-style-type: none"> <li>• Eight postgraduate students</li> <li>• Ten undergraduate students</li> </ul>

In this stage, two semi-structured interviews that aimed to further explore the main findings from the focus group session were conducted. The interviews investigate users' perceptions and requirements of technology-assisted behavioural change around DA. The interviews were conducted with 18 students who self-declared that they have problematic digital usage and acknowledge the significance of using technology to help manage their problematic digital media usage (see **Table 20**). The interviews lasted an average of 40 minutes. The participants were recruited through the dissemination of email invitations to their university email accounts and

convenience sampling. Seven females and eleven males participated in the interviews. The interviews commenced with a short introduction, and participants were encouraged to freely speak their minds, and they were made aware that there were right or incorrect answers. Also, participants had information about the research aims before the study dates, and their consent was elicited. The interviews were recorded and transcribed verbatim.

TABLE 20: SECOND STAGE INTERVIEW PARTICIPANTS

Participants	Gender	Field of study/ Academic Background
<b>Participants are university students self-declaring to have problematic digital media usage</b>		
P1, P2, P3, P5, P6, P16, P17, P18	Male	Computing and Informatics including HCI, Social Informatics and Human Factors
P4	Male	Business Management
P7	Female	Computing and Informatics (online learning and social networks)
P8	Female	Media and Communication
P9, P11	Male	Management, Cyber Security and Human Factors
P10, P12, P14, P15	Female	Psychology
P13	Female	Management, Cyber Security and Human Factors

#### 6.4 DATA ANALYSIS

Data collected during the studies was analysed through the six thematic analysis phases as suggested by (Braun and Clarke 2006). First, the audio recording was transcribed, and the additional comments made on the note-taking sheets were typed and inserted into the transcribed notes where appropriate. The transcripts were then cleaned up by reading through the notes and removing redundant data, comments unrelated to the focus of the study, and nonessential comments. Alongside cleaning the data, a colour coding scheme was used to code participants' comments or contributions. When coding the participants' responses, the researcher considered the key idea that stands out in a sentence or particular paragraph. Each participant was identified by a unique number, i.e. participant 1, participant 2, participant 3, and so on, which was used to mark their comments in the transcripts.

The data analysis followed the steps in (Braun and Clarke 2006). The first analysis conducted on the data led to various codes which reflect the participants' replies to software-based monitoring and the different elements of software-based interventions in aiding behaviour change. The next step was to review the generated codes and, during the process identify redundant codes. Codes that were regarded as redundant were deleted and codes that were similar in meaning were merged to form a single code. This reduced the number of codes. The remaining data was then reviewed. After this procedure was completed for each interview and focus group transcript, codes generated were merged into various categories based on commonalities in their properties, which led to a

further reduction in the total number of codes generated. This led to five main categories of TAGS opportunities and three main categories of TAGS challenges and their associated sub-themes presented in the thematic maps below. The activities discussed above correspond to the first five phases of the thematic analysis (Braun and Clarke 2006). These thematic maps reflect the main aspects that the users considered would support them through the behavioural change journey and the main factors that they considered would hinder the behaviour change process.

## 6.5 RESULTS: OPPORTUNITIES AND CHALLENGES OF TAGS

When technology is used to assist behavioural change, opportunities and challenges are introduced. This is mainly due to real-time behavioural monitoring and judgement, interactivity, traceability and accessibility. The findings revealed enhanced user well-being, transparency, user profiling, accessibility, and time management as TAGS opportunities and social-related factors, technology-related factors, and personal-related factors as TAGS challenges. In this section, we discuss these opportunities, challenges and their associated elements, and also provide an initial discussion on how such challenges may be addressed. Elements associated with each factor are underlined and written in *italic* text.

### 6.5.1 TAGS: OPPORTUNITIES

Despite their significance, the development of effective behavioural interventions has been slow (Michie et al. 2008). Adopting technology to help users manage their problematic digital usage provides a number of opportunities that would aid the behavioural change process. After analysing the collected data, five primary factors were identified as opportunities associated with TAGS, i.e. enhanced user well-being, user profiling, transparency, time management, and accessibility. **Figure 31** presents these factors and the elements listed under each. We will only elaborate on the primary factors and some of the elements and include comments from the users' study, i.e. the user interviews and focus group.

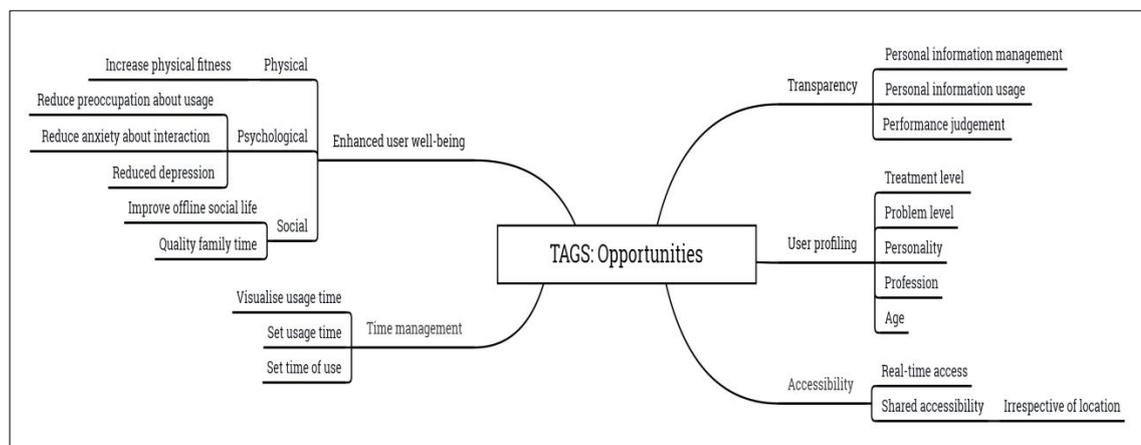


FIGURE 31: TECHNOLOGY-ASSISTED GOAL SETTING: OPPORTUNITIES

### 6.5.1.1 ENHANCED USER WELL-BEING

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Research has suggested that various psychological and well-being issues can be linked to problematic online usage, including stress (Çam and İsbulan 2012), depression (Lin et al. 2016), mental preoccupation and anxiety (Kuss and Griffiths 2011) and reduced physical well-being (Blaszczynski 2006). Based on the study findings, TAGS provide an opportunity to improve well-being issues linked to problematic social network usage through techniques such as suggesting offline activities that users would like to try, among others. Below, a discussion on how TAGS can be used to help improve users' well-being is provided.

*Psychological well-being* – A limited but increasing amount of empirical research has revealed that online usage, e.g. the use of social networks, is potentially addictive and that this behavioural addiction may result in serious negative consequences (Kuss and Griffiths 2011). Cham et al. (2019b) discussed a range of negative life experiences linked to social networks and other online usage styles. Some of these consequences relate to psychological issues, such as depression and anxiety. People with problematic online usage may encounter depression resulting from excessive engagement. An example can be found in the study by (Frison and Eggermont 2016). Various factors can contribute to such feelings, such as social comparison, and, in particular, upward social comparison, where people compare themselves to others who are believed to be better than them (Collins 1996). TAGS can aid individuals to form online groups to peer support each other, and this could alleviate the *depressive mood*. Also, technology can match users to enhance the comparison process. Participant (P8) commented, “*I would like to be compared with people in the same age group, same academic level, same usage, and same psychological state of mind. So, if I can see that other people in the group are making better progress, this would motivate me to try and reach them*”.

According to Kontos et al. (2010), individuals who use social networks experience increased psychological distress, e.g. *anxiety*, compared to non-users of such sites, which can be attributed to their popularity on these sites, their content, and how other users perceive them. Also, users can become anxious when their interaction is restricted, blocked or ceased suddenly. As participant (P14) commented, “*I think with social media, people are fed too much information and content quickly, so I think that could sort of translate into real-life where people could become more impatient and more unable to sit without that sort of stimulus*”. TAGS can warn individuals about the consequences of particular behaviour by sending reminders that may help them think before executing certain activities, e.g. reacting to conversation.

Problematic social network users can become *preoccupied* with what is happening online as well as how other contacts are reacting to their presence and social networking interactions (Beyens et al. 2016). As a participant (P2) commented, “*people say that when you are not using social media, then you keep thinking about what is happening there because maybe there*

*is something important that everybody is talking about and commenting on*". When this is the case, users may experience both conflict and interpersonal issues. TAGS could be used to help users *reduce their preoccupation* with social network applications by involving them in the monitoring of their usage, e.g. by defining the monitoring metrics such as the features accessed in one application or across various applications. Also, TAGS can deliver timely awareness messages relating to preoccupation to help educate problem users about such negative experiences.

*Physical well-being* – People who are characterised as high-frequent online users are identified as less physically active compared to those who are low-frequent users. Tsitsika et al. (2014) discovered that social media usage harms younger people between the ages of 14–16 years because it averts them from performing physical fitness activities. The use of TAGS could help individuals manage their problematic usage and *"get people out and about and doing outdoor activities"* (P15). TAGS can help people set physical activity goals and time duration for such activities, and it can then be used to send reminders about such activities. As participant (P16) commented, *"I would like to be reminded about other physical activities that I should be focusing on, so I do not spend all my time using social networks"*. Also, TAGS can be used to send suggestions for physical activities that others do if they want to detach from social networking usage.

*Social well-being* – Research has shown that social media users' personalities could adversely influence their online social well-being. This is evident in the study by (Qiu et al. 2012), which showed that after using Facebook, people with a low narcissism level perceive their friends to have better lives than them, which may negatively impact their social well-being. Social well-being is a major player in predicting adverse effects of internet usage (Caplan 2002).

TAGS can be used to improve users' social well-being by helping them get involved in *offline activities*, because *"if people spend less time using online applications, then they can probably spend more time outside socialising with friends"* (P6). Another participant commented: *"technology can help people focus on their real-time environment rather than on their virtual environment"* (P8). TAGS can help reduce online usage time because they can be utilised to form groups where friends and family can set usage goals and implement a feedback mechanism that would help motivate attainment of goals and regulate usage. TAGS can be used to set specific time related goals for being inactive on social networks, particularly during family events and other essential activities. Also, family meeting time can be integrated with TAGS so that when users are with their family and decide to use social networks, TAGS can send them a reminder and eventually block or lock them if the usage continues.

#### 6.5.1.2 USER PROFILING

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Technology provides an opportunity to profile users and deliver personalised feedback in real-time. The social aspect of TAGS provides an opportunity to characterise and group users according to their *age, profession, personality, and level of problematic usage*, among others. These personal characteristics were seen to be essential elements in the behavioural change process; *“technology should deal with people according to certain characteristics and psychology, i.e. whether they are sad, depressed or anxious, their personality and also their thoughts”* (P1). Research evidence has associated users’ personality characteristics as factors that could highly impact their social network usage. For example, neurotics and extraverts users of social media exhibit a more problematic usage style (Mehdizadeh 2010; Wang et al. 2015). TAGS can be used to group users based on specific characteristics, e.g. applications used, features accessed, and group relationships. Our study findings emphasised the need to reward performance using gamification tools by categorising users based on age. According to Shahri et al. (2019), age is a notable characteristic in gamification; for instance, older adults may not like online rewards such as points and badges.

#### 6.5.1.3 TRANSPARENCY

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Transparency is a mechanism to confront typical symptoms of problematic usage, including denial and a “flight into health”, the latter of which refers to people telling themselves that they are cured of their problematic usage, when in fact they have only made an incremental improvement (Frick 1997). TAGS provide an opportunity to be transparent with users about how they are monitored in a continuous and on-demand fashion. Technology can assure people about how their *personal information is managed* and be promptly informed if third-parties have access to such information. As participant (P6) commented, *“I need to know about how my information is kept and I should be able to access it whenever I need to.”* In a group setting, group members might worry about the sort of data stored on the technology, and the access and usage of this data. Also, some members might need to be updated whenever their stored data is going to be used and for what purpose *“when my data is collected, I should be informed about it. I need to be updated whenever this information is going to be used for any other purpose (P4)”*.

Additionally, users would like to know how their behaviour changes over time, as driven by informational influence in which individuals are motivated to establish how they are perceived and how they compare to others (Deutsch and Gerard 1955). Simply presenting individuals with accurate information about how they behave and how this relates to the behaviour of their peer group has been demonstrated to be an effective behaviour change strategy (Dempsey et al. 2018). Such strategies can be undermined if the target population is sceptical about the validity of the data with which they are presented, which may in part be influenced by the knowledge of the population if the data has been collected through self-report (Mcalaney et al. 2011). TAGS can address this by providing accurate and timely data through the automated collection of social network usage data, which the target population is likely to see as much more objective, reliable,

and transparent than self-reported data. As participant (P3) commented, “*The technology should have the ability to track my usage and keep me up to date at all times*”.

TAGS can be data-driven and demonstrate to the users how their *performance judgements* and recommendations are made. Transparency requirements should be carefully elicited and enforced to ensure that user expectations are accommodated, and any privacy and scepticism issues they may have are resolved.

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#### 6.5.1.4 TIME MANAGEMENT

TAGS provide an opportunity to help problematic users manage the time they spend using various applications; “*I think for me, it is mainly about helping people save time and reduce the time they spend online.*” Another participant (P4) commented: “*I think the biggest opportunity is the ability to control time, how I use my time among my daily activities, so that my online usage does not interfere with these activities*”. TAGS could be used to help users *set usage time* and can remind them of the set time. For example, a user can set a time to interact with social networks only after official working hours. Technology can help users *visualise their usage time*, which could act as a wakeup call for people to start to think or implement actions to regulate their usage. Also, technology has the ability to set a *time of use* for social networks. Users can set the time of usage so that they can only go online, e.g. during lunch breaks at work, school, or at night before bedtime. According to Ali et al. (2015), weekends and holidays are known for high usage of social networks. Based on the set time of usage, TAGS can lock users out of social networks.

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#### 6.5.1.5 ACCESSIBILITY

One predominant expectation is that the use of TAGS will significantly increase the accessibility of intervention materials and make users more engaged (Munson et al. 2010; Hall and Bierman 2015). The accessibility nature of TAGS could assure individuals that they can engage with different users and user groups in real-time. As a participant (P15) commented, “*technology would be beneficial to various people if it was easily accessible and helped them manage their usage problems.*” Such accessibility would enable users to set goals collaboratively irrespective of their geographical location and time. Also, it would enable users to have timely access to usage reminders, offline activities, suggestion information, feedback information, and usage warning messages during their behaviour.

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### 6.5.2 TAGS: CHALLENGES

Our study findings revealed three main categories of risk factors associated with TAGS, see **Figure 32**. These factors are related to social, personal, and technology. Below, a discussion of these factors and their associated elements is provided.

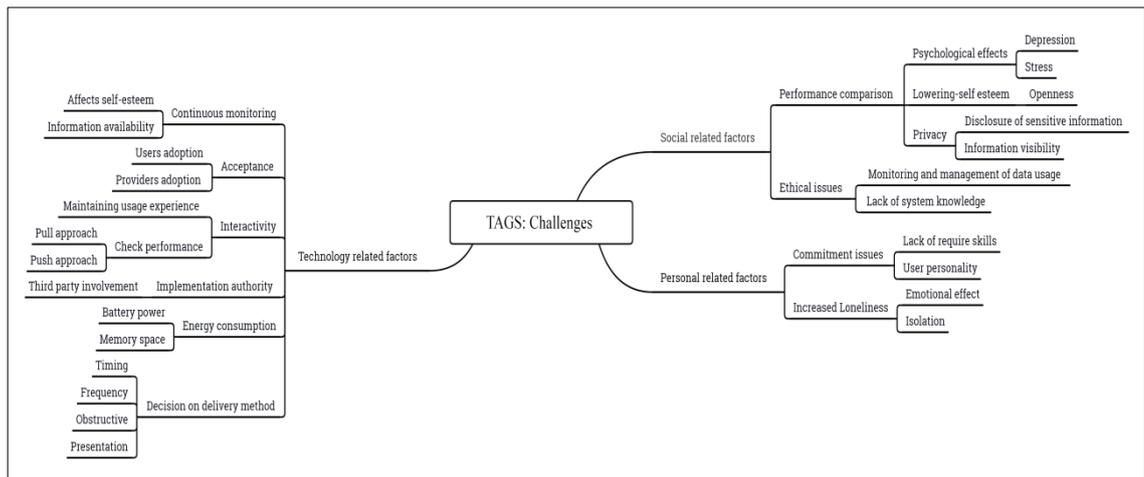


FIGURE 32: TECHNOLOGY-ASSISTED GOAL SETTING: CHALLENGES

### 6.5.2.1 SOCIAL RELATED FACTORS

The social factors refer to the risks TAGS may introduce when people work collaboratively to regulate their problematic digital usage.

*Performance comparison* – Persuasive technology commonly employs the goal setting technique to regulate problematic behaviour. Comparison is a critical element of the goal setting strategy, and it enables the comparison and sharing of goal performance information socially (Cham et al. 2019a). Comparison in real-time may have *psychological side-effects* when people with various usage styles are compared. A user (P3) commented, “users can become anxious, e.g. if I am using a lot of social networks, and this information is made available to others, this could further increase my anxiety”. The other risk associated with comparison is *lowering self-esteem*, which can result from openness, i.e. making users aware of the online engagement levels of other users. Given that self-esteem is in part determined by group comparison (Rubin and Hewstone 1998), these side-effects may result from lowering self-esteem when performance is compared within a group, and users from different stages of change are involved.

Another comparison related challenge is *privacy*, especially when the system automatically monitors usage information which may include sensitive data and makes this data available to third parties, e.g. people involved in the implementation of TAGS as outlined in (Dennison et al. 2013). A participant (P4) commented, “when others can access your online information, this can invade privacy”. Another (P9) commented, “so if there is another person in control and there is stuff you do not want them to see, then maybe there will be a risk of privacy”. When goals are set collaboratively, information visibility may raise some privacy concerns for some people because they may not have a say over what information is included in the comparison activity. A participant (P4) commented: “in terms of privacy, I should be able to be part of the process of information gathering, processing, and storing, and the information should be available to me whenever needed.”

*Ethical issues* – When TAGS is used to assist behavioural change, specific ethical issues might be presented. As participant (P17) commented, “*there is a legal risk of using data in an unethical manner.*” Care should be taken to ensure that all ethical requirements are considered to ensure that users are not negatively affected. Users of TAGS should be provided with complete information on how the technology works. Ethical concerns can relate to factors such as monitoring, comparison, the unconscious sharing of comparison information, and the provision of feedback information, and privacy. For example, technology might not inform users about how their personal information will be managed and used, i.e. how their performance information is measured and judged. Failing to consider these concerns could have an adverse effect on the psychological and social well-being of users.

#### 6.5.2.2 PERSONAL RELATED FACTORS

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The personal factors refer to the risks of TAGS concerning an individual user.

*Commitment issues* – The findings by (Dennison et al. 2013) show study participants lack the commitment to engage with long-term behavioural change Apps, which is a crucial factor in the success of these Apps. Concerning TAGS, if users lack the required skills and willpower to interact with the technology, this may negatively impact their acceptance and commitment. Participant (P15) commented, “*some people might want to use technology, but if they do not have the skills needed, then their commitment to interacting with technology might be reduced*” and participant (P12) commented, “*if the technology is hard to use, then I will not bother to use it because I might not know what to do.*” The users' personality may negatively impact on the adoption and success of TAGS, particularly when collaborative goals are set as Participant (P6) commented, “*some users might not feel comfortable sharing their usage time with their colleagues because it could cause shame for them, especially if their usage is way more than their colleagues'. This could affect their self-esteem*”. Also, the lack of awareness of the benefits of TAGS, along with time-taken to use and interact with them, can reduce acceptance and commitment.

*Increased loneliness* – For some users, social media is the primary means of communicating with others, i.e. friends and family. Using TAGS to reduce or control this usage may lead to increased users' feelings of isolation, which can adversely affect their emotions. A study participant commented: “*So the risk could be that everyone loses contact with everyone, like before we used letters and now, we are using social networks, so if technology reduces this, we might isolate ourselves differently*” (P15). For this reason, it might be challenging to convince such users, and they may negatively react to TAGS.

#### 6.5.2.3 TECHNOLOGY RELATED FACTORS

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*Continuous monitoring* – A key issue identified from our findings is the continuous nature of the TAGS to monitor behaviour. While monitoring provides an opportunity to reassure people,

continuous monitoring may have psychological side-effects on the users. *“Social networking applications provide an opportunity for people to reveal a lot of their personal information, so the uninterrupted monitoring of people’s online information could lead to accessing personal information or people’s online contact information”* (P12). Also, the availability of performance information every second may lead to daily usage judgement, and this can affect users’ self-esteem (Rubin and Hewstone 1998). A risk here is related to visibility. Some people might have concerns regarding what others can see. For example, showing usage time on each social network application could affect the self-esteem of some people, especially if their usage does not conform to the norm.

*Acceptance – Users’ adoption* of technology-assisted interventions such as TAGS can be affected by several factors, including users’ level of awareness, need for cognition, self-efficacy to set goals and monitor goal progress, and skills required to implement and use TAGS (Donkin et al. 2011; Short et al. 2015). A participant (P2) commented: *“People might say they are using social network applications at their own free will. Why should someone stop them from using them or help control their use?”* Social networking providers’ attitude (Huijg et al. 2013) towards TAGS and fear of reducing user access are identified as main factors that can affect *their adoption*, implementation, and commitment to TAGS.

*Interactivity* – TAGS aim to assist users to manage their online usage. However, too much interactivity introduces risks of maintaining or increasing problematic usage, i.e. a person who wants to reduce the amount of time spent on social networks might end up increasing it. A participant commented: *“I guess there are a small percentage of people that naturally have an obsessive personality that they can then become obsessed with technology and use it as sort of a crush”* (P14). Interactivity is important in social media but having a lot of interactivity can negatively impact problematic usage behaviour. The degree of interactivity of social media applications can be attributed to the design of the system features. Interactivity can cause issues, such as preoccupation with online behaviour even if the user is not actively engaged with the behaviour or can increase dedication and a desire to devote more time to a particular activity on social media, such as following email threads and replying to emails, responding to comments or likes on a post. Also, according to (Alrobai 2018), other interactivity can cause the fear of missing out on current social media events, such as newsfeeds.

An example can be seen when the pull approach is used for delivering performance information; messages delivered may cause problems for the users. The primary risk of this approach is the promotion of mental preoccupation by design, which may strengthen feelings of expectation (Alrobai et al. 2016). Mental preoccupation can be described as a state in which one cannot seem to get his/her mind off of certain thoughts. In terms of social media usage, preoccupation refers to when users are not actively using a software application but are continually thinking about it. The design facilitates cognitive preoccupation, possibly reinforcing the thoughts of anticipation

(Alrobai 2018). Whereas, with the push approach, a risk is that after accessing and reading the performance feedback, excessive usage may be caused, and users can be worried about the feedback messages.

*Decision on delivery method* – In terms of performance information, technology provides an opportunity to deliver personalised feedback in real-time. This feedback can be a powerful behaviour change tool (Bewick et al. 2008). However, the risk here may be delivering obstructive or too many messages. When the delivery of feedback affects expectations and tasks at hand, it can negatively affect its acceptance, “*feedback messages should not affect the way people work and should not be in their faces all the time*” (P11). Also, the timing and presentation of the feedback or reminder messages should not obstruct or distract people “*the problem is, sometimes you really need to be online to do something, but then a warning or reminder pops up and distracts you*” (P8).

*Implementation authority* – The mechanism through which the technology is implemented may introduce the risk of unwanted monitoring and access to data. *For example*, if a technology company delegates the implementation duties to third-party companies, users might be worried that others are privy to their data and contact information. A participant commented: “*Risk will depend on who is responsible for the implementation and upkeep of the software, like if someone else is controlling the software and they are monitoring you, then you might not be comfortable with that*” (P9).

*Energy consumption* – TAGS can be useful in assisting behavioural change. However, suppose the technology takes up huge battery power and huge memory when installed on a mobile device. In that case, this may negatively influence its adoption and lead to a loss of interest by various users. A participant commented, “*If the software takes so much battery, then this might be a risk as people would not want to install and use it*” (P1).

## 6.6 DISCUSSION

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In spite of the growing interest in the use of technology to assist the behavioural change process, there is still limited research that explores users’ viewpoints of such technology. Research findings and the interview participants’ comments emphasised the significance of exploring users’ views of behavioural change intervention systems (Keil and Beranek 1995; Venkatesh and Davis 1996; Bos et al. 2013). In the first part of this chapter, an investigation into users’ perceptions concerning TAGS was conducted. The focus was on the opportunities and challenges of the technology. The findings of the interviews suggested that the study participants were overly dependent on their digital devices, spent a considerable amount of time in the digital space, and acknowledged that having a technology that would help them regulate their behaviour was a promising idea.

In this section, we provide a preliminary discussion of some management techniques for some of the challenges identified in **Section 6.5.2**. TAGS should be designed to monitor and intelligently react to side-effects that may result from comparison activities. Involving users from the early stages of design may help capture their comparison preferences. Also, by providing an initial discussion on the ways that such risks can be managed, we aim to raise discussions on the role the tech industry could play in helping regulate problematic online usage. The psychological effects that may result from the real-time comparison can be reduced by anonymously showing or making averages of goal performance visible to the whole group, and actual individual performance visible only to the individual. Users can then be given a choice to share their performance with other group members. Technology should monitor and intelligently react to side-effects that may result from comparison activities. Involving users from the early stages of design may help capture their comparison preferences. Also, users can be clustered based on their self-esteem, self-efficacy, and technical skills level before delivering performance information. Related research by Pinder et al. (2018) and the study participants' comments clearly show that the privacy risk associated with the tracing and disclosure of the comparison information may be alleviated by disclosing what information is shared and the reason why, and the users should be given a chance to either consent or opt-out.

In order to help reduce users' negative reaction to the feedback messages, during TAGS design, users should be involved to help understand their preferences in relation to the delivery of such messages, e.g. the frequency, timing, and delivery mode. The challenges associated with the interactive nature of TAGS can be alleviated during system design. For example, TAGS should be designed to ensure that when the pull approach is adopted, the system will maximise user interaction and provide meaningful information. Factors such as users' technical skills required for effective interaction, and preferences on the number of messages that can be delivered in a day or week, should be elicited during system design.

The issue of acceptance and commitment can be reduced by raising awareness of the significance of TAGS and helping users develop the required skills for effective interaction. One aspect of DA that is often an issue is a lack of awareness that the behaviour is becoming, or has already become, problematic. Raising awareness is a fundamental factor in any intervention system (Livingstone and Bober 2006; Schilder et al. 2016). The majority of the participants mentioned that some people do not realise that they have an issue, which can be attributed to the lack of ability to self-recognise the problem. Using technology to help people recognise such problems can increase effectiveness. This concurs with the work on other behavioural interventions, e.g. (Bos et al. 2013). The authors' findings showed that problem awareness was one of the main factors related to user acceptance of low-calorie food. Making the technology simple and easy to use may improve users' commitment.

Provider acceptance can be increased by the introduction of laws and regulations by governments that would hold them accountable. The relevant authorities should consider creating strict laws and regulations for providers of social networking platforms which would hold them accountable for the addictive nature of their applications, and also ask them to put in more effort to help users control any problematic usage. Users should be guaranteed that all ethical concerns are taken into account and that companies can only use their data to help increase awareness and to reduce any negative impact that could be associated with problematic online usage (Cham et al. 2019b). Ethical challenges can be alleviated during the design of TAGS by putting into consideration certain General Data Protection Regulation (GDPR) requirements. These include requirements for the gathering and processing of users' data and the users' right to access such data or request copies of their data managed by a third party (Drosatos et al. 2018).

## 6.7 RESULTS: USERS' ACCEPTANCE FACTORS OF TECHNOLOGY-ASSISTED GOAL SETTING

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The Technology Acceptance Model (TAM) has been typically used to predict user acceptance and use of information technologies based on factors such as perceived usefulness and perceived ease of use (Venkatesh and Davis 1996; Turel and Yuan 2007). In this research, we used the TAM to guide the analysis of the interviews, with those users who had self-declared themselves as having DA (**Stage 2 Table 20**). The findings from the interviews, along with relevant literature in the area of behavioural change and software interventions, will guide the discussion in this section. We focus on those elements that would most likely influence users' acceptance of technology-assisted solutions. Based on the interview findings, two diagrams relating to perceived usefulness and perceived ease of use were developed. Due to space limitations, the main elements of each diagram and some of their sub-elements will be elaborated in the following sub-sections, along with selected illustrative interview comments.

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### 6.7.1 PERCEIVED USEFULNESS

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Perceived usefulness relates to the reasons that would make the technology useful for the users, and therefore assist with the behavioural change process. As presented in **Figure 33**, interviews with users who self-declared having DA outlined four main ways (elements), i.e. raising awareness, goal setting, behaviour regulation, and personalisation, as aspects that would make them perceive the technology to be useful. In the following sub-sections, we will discuss some of these elements and their associated sub-elements.

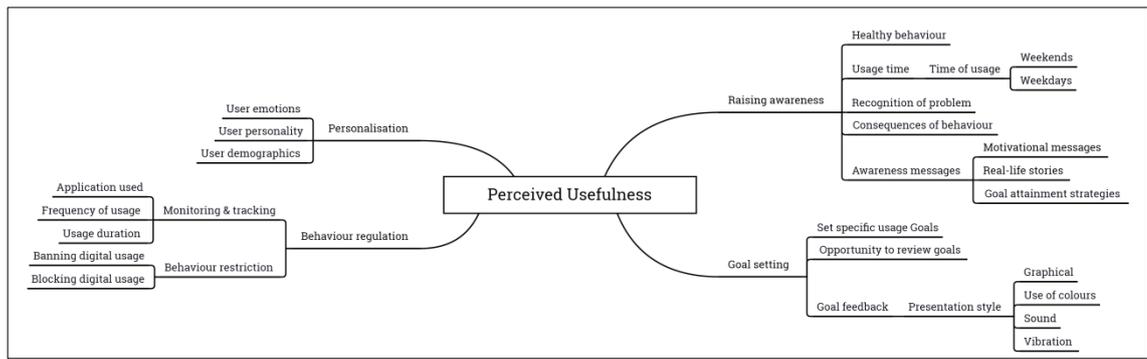


FIGURE 33: PERCEIVED USEFULNESS OF TECHNOLOGY-ASSISTED SOLUTIONS TO COMBAT DA

### 6.7.1.1 RAISING AWARENESS

Increasing awareness of a particular behaviour contributes to changing the behaviour as a result (Ajzen 1991; Prochaska et al. 1998). The direct impact of online risk awareness and children’s behaviour through software intervention was examined by (Schilder et al. 2016). Their findings showed that increased understanding of online risk was related to lower online risk behaviour. Another study by (Castellanos et al. 2009) revealed that adults who were aware of their eating conduct and what they should change about it concentrated more on their eating behaviour and were better able to recall and report disappointments to commit to their eating routine. In accordance with research conducted, raising awareness of the problem of usage emerged from the interview analysis as a key factor that would make TAGS considered to be useful.

*Awareness of healthy behaviour* – Participants reported that one of the reasons that would make TAGS useful was if it aided their awareness of healthy behaviour. Some users tend to have greater trust and be more loyal to the intervention software when they know that the software is careful about them and their behaviour, and would also be more likely to accept the subsequent interventions, e.g., heeding the messages (Ali et al. 2015). The participants felt that technology should provide information about what constitutes healthy behaviour when they are engaged with social networks in a potentially problematic manner. This would encourage reflection on behaviour before it becomes more problematic and would inform future behaviour; *“I think it is a good idea; the software can help people become aware that their behaviour is at a dangerous level whenever they are very much engaged in online activity or even before the behaviour commences”* (P3).

*Awareness of usage time* – To improve the usefulness of technology-assisted solutions, they should have the capability to track usage in terms of frequency and time (Alrobai et al. 2016). Technology-assisted behavioural change should enable users to be conscious of time and external reality when they are engaging with social networks, particularly those who are immersive or able to create an alternative reality. Some of the participants stated, *“technology should help us realise how much time we are spending on social networks because, as human beings, we do not realise how much time we have spent. For example, four to five hours out of a twelve-hour day. This*

*might help put people into perspective*” (P2). In addition, it is vital to recognise the *time of the behaviour* when calibrating and reporting usage time, i.e. whether the usage is during weekdays, e.g. students spending time on their digital devices when they are supposed to be attending seminars or working on course work, or at weekends, e.g. when people may see this as their leisure time to pursue their usage goals.

*Recognition of the problem* – The analysis of the interviews shows that for the technology to be seen as useful, it should have the capability to help users recognise their behavioural problems. People often do not recognise that they have a problem until it becomes severe, and even then they may be in denial of reality, which is linked with an advanced stage of addiction (Ali et al. 2015). As a participant commented, *“like with anything, it starts with yourself recognising you need help first, so if the software can help you realise this, then that would make it useful, because then you know that the software has your best interest at heart”* (P12). The technology should have the capability to understand what constitutes normal usage of digital media, e.g. based on a behaviour recognition matrix such as time of behaviour, activities performed (Ros et al. 2013), and user emotions and psychological states. For example, if a user spends most of their time during work hours using social networks, then technology should be in a position to help the user recognise that such usage does not constitute healthy behaviour.

*Consequences of behaviour* – Problematic behaviour could lead to various consequences that might affect the user and those people close to them, i.e., family and friends (Ellison et al. 2007; Nyland, Marvez, Beck 2007; Kirschner and Karpinski 2010). In **Chapter 5**, eight families of such consequences and their associated elements are presented. The results of the analysis show that for users to perceive TAGS as useful, they should help raise awareness of any consequences of their behaviour. The findings of the interviews show that some participants emphasised that awareness of such consequences would help them think about their behaviour and encourage them to take measures to manage it.

*Providing awareness messages* – Raising awareness of behaviour, e.g., in terms of usage time, healthy usage behaviours, and the impact of behaviour could be achieved by providing informative messages to users through technology. Some of the interview participants reported that they did not realise their behaviour was problematic until it seriously affected other aspects of their lives. Hence, they believe technology should present awareness information, e.g., *real-life stories, tips, motivational messages*, and factual information about DA *“I would like to see inspiring stories from other people”* (P10). Another participant (9) stressed the need to disseminate data based on evidence *“it is better to work on information that is based on facts than on data that can be biased. I want it to be a strong argument for me to believe it, so tell me this is what people who have problematic behaviour do and these are the signs”*.

#### 6.7.1.2 BEHAVIOUR REGULATION

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Behavioural regulation refers to the ability to resist performing problematic behaviour, for example, by controlling emotions or avoiding activity (Lowry 2016). Regarding the self-determination theory, there are various types of motivation that relate to the means by which user behaviour can be regulated (Ryan and Deci 2000). These types of regulation range along a spectrum from totally non-self-determined to total self-determined regulation.

The ability to develop self-determination to regulate problematic behaviour, i.e. turning unhealthy behaviour into a healthy one, can be challenging for some people, especially those whose stage of addiction is severe or advanced (Alrobai et al. 2019). This is because they often become so dependent on the behaviour that it becomes difficult for them to learn or develop ways of regulating such behaviour. Behavioural regulation can be a daunting task due to the issues of denial and bias that are associated with digital addiction. Based on (Mullan and Markland 1997) study findings, behavioural regulation in an exercise questionnaire discriminated between individuals at various stages of change for exercise, with those in the late stages, i.e. action and maintenance stages, being more self-determined in their behavioural regulation than those in the earlier stages.

Interview participants reported that technology would be seen as useful if it could help them to regulate their behaviour. The overall findings indicated two key areas that technology could adapt to. These include *monitoring and tracking behaviour* and *behaviour restriction*. Below we present a discussion on these elements.

*Monitoring and tracking behaviour* – People may have good intentions of changing their behaviour, but fail to sustain a planned behavioural change due to factors such as forgetting to implement important actions (Gollwitzer 1990). The use of TAGS provides an opportunity for users to actively engage in the behavioural change process, i.e. to check goal performance and make important decisions about their behaviour. The real-time tracking and monitoring of behaviour and performance may also provide the opportunity to prevent *deviations* from goals, as “*tracking triggers behavioural awareness and awareness of behavioural goals may help people continue to pursue their goals*” (P1). Participants mentioned that the technology would be seen as generally useful if it incorporated tracking *usage duration*, as this could help enhance their ability to manage their usage time.

*Behaviour restriction* – Restricting behaviour refers to using guidelines to reduce the chance of participating in the behaviour (Michie et al. 2011). Regulating behaviour could involve an element of control where users are temporarily restricted for a certain period of time, e.g. *banding* or *blocking* usage for a given time, e.g., two to three hours, or restricting the number of likes a user can make in one day. The interview participants stressed the need to be consulted and given the opportunity to be involved in setting the rules for such restrictions, both time and frequency “*in terms of restrictions, I want to be restricted at a specific time of the day, e.g. during work, during*

*family time, and after work up to a certain time in the evening, so the software can block me until the time I specify to use it” (P4).*

#### **6.7.1.3 GOAL SETTING**

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The majority of the interview participants stated that a feature that enabled the *setting of specific usage goals* would increase the usefulness and acceptance of TAGS “*setting my own goals would help me better analyse my progress” (P1).*

When setting goals, the extent to which the goal is well defined, showing the type and number of tasks required to attain the goal, should be considered. Based on the selected source of the goal, the experts facilitating the process of setting goals could help users to understand the nature of their problematic digital usage. This could help them set specific, measurable, and relevant goals, which are more likely to be met, leading to continual and effective behavioural change (Cham et al. 2019a). Users should also have the opportunity to *review the goal* when goal progress is below expectations. Examples of factors that could affect goal progress are when the set goals conflict with each other. Such conflicts, when detected, should be resolved to improve the chances of achieving those goals, e.g. through negotiation between those involved in the goal setting process (Lamsweerde et al. 1998; Morge and Mancarella 2014).

Some of the participants mentioned that after setting their goals, they would like technology to help them be aware of their *goal performance progress*. A significant aspect to consider is how goal performance messages are presented. The preference for the presentation style, whether textual or graphical, could depend on the user type, user group, the context of use and the situation of the user involved. Some users might be good at receiving and processing graphical information, whilst others might be good at receiving and processing textual and numerical information. Some of the interview participants mentioned that they would react well if the messages were presented graphically because “*graphs and charts are easier to read and understand, as many people do not like to read text, e.g. teenagers, especially if there is a lot of reading involved” (P13).* Presentation style also relates to how the technology itself is presented to the users. Some participants felt that TAGS would be most effective and acceptable if it was presented in a way that was attractive, fun to engage with, and had some gamified elements “*a fun and interactive system, make it like a gamified application, so if you achieve the goal, you receive a reward or a badge or something” (P8).*

#### **6.7.1.4 PERSONALISATION**

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Technology provides an opportunity to profile users and ensure that various functionalities are tailored to their personal needs. It is essential to ensure that the technology is designed to adapt and satisfy the personal requirements of the users targeted “*it could be based on the user, make it a little more context-aware and apply it differently, because if it is the same, then it would not work” (P9).* Another participant (P13) commented; “*I would like to see an application that is*

*personalised for every user and takes into consideration all the online activities of the user and tries to manage these activities”.*

Personalising technology can help tailor its various features and make them increasingly effective at managing users’ behaviour. This can be accomplished by focusing on what motivates the users, their personality, or preferences for functionalities, which will make them bound to be successful in evoking behaviour change (Noar et al. 2007; Hirsh et al. 2012). Users’ personalities could play a key role in predicting their attitude towards a behavioural change software intervention. For example, for an intervention implementing goal setting as a behavioural change strategy, care should be taken to ensure that extroverts who are highly receptive to collaborative goal setting do not group with neurotic people who are shy in nature when dealing with strangers, and, therefore, would not react well to collaborative goal setting. In addition to those elements, the interview analysis revealed other elements, including user demographics, i.e. user age, user profession, and user emotions, i.e. users may be stressed, sad or depressed. While some of these can be captured by self-reporting, advances in affective computing and multi-modal interaction can be employed to infer the user’s mental and psychological state, which could enhance knowledge of users’ requirements and better technology design and development.

## 6.7.2 PERCEIVED EASE OF USE

The use of TAGS should not be a complicated task and should not enhance the user’s addictive experience. The studies conducted revealed that users would like technology to be designed interactively and also to be fun to engage with. Understandable, configuration effort, the familiarity of features and software integration are identified as factors that can be employed to determine users’ acceptance and use of the technology (see **Figure 34**).

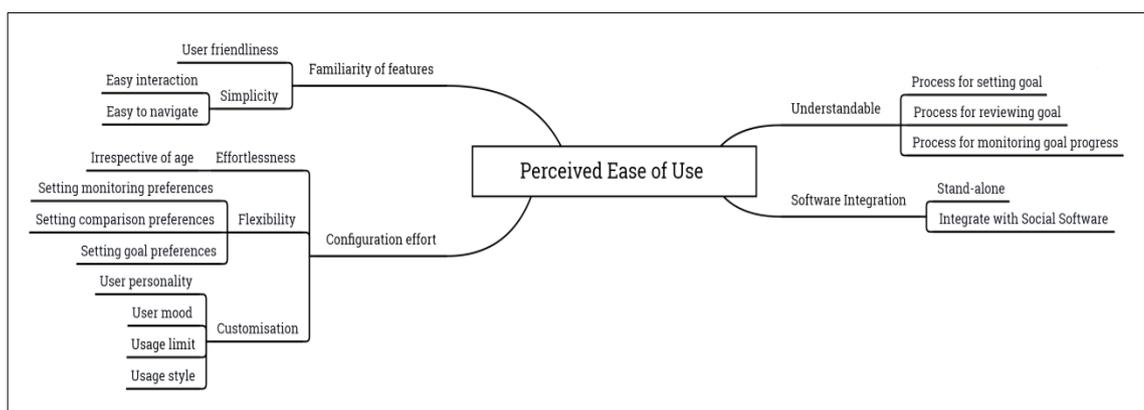


FIGURE 34: PERCEIVED EASE OF USE OF TECHNOLOGY-ASSISTED SOLUTIONS TO COMBAT DA

### 6.7.2.1 UNDERSTANDABLE

Users are likely to follow and use a new system if they can understand and interact with its various features, and this would depend on their level of skills and knowledge to develop such an understandable use (Venkatesh and Davis 1996; Dixon 1999). Interacting with technology should

be clear and understandable; it should be easy to use, and easy to achieve the task to ensure behavioural change irrespective of the users' skills and ability to use its various features. Therefore, using the technology should not depend on the users' self-efficacy, as this would play a significant role in its acceptance and adoption. The majority of the interviewees would like the technology to have easily understandable features relating to, e.g. the *process for setting goals*, *the process for monitoring the goal process*, and *the process for reviewing goals*, "*the software interface should be user-friendly for all user types to interact with and set up their usage goals*" (P13). Another commented, "*technology should be easy to learn and easy to understand by all users, irrespective of age, gender, or origin*" (P4).

#### 6.7.2.2 CONFIGURATION EFFORT

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Setting up the configuration of the technology should not require much *effort* from its potential users. Making the configuration a complex process that requires a lot of mental effort may affect the desire to adopt the technology "*it has to be easy, so even when I am setting it, it should not be some long process that I have to go through, it should be as easy as a button or two*" (P9). The results of the analysis showed interview participants stressing the fact that they were engaged in many other configurations, such as setting privacy requirements for various applications, so having another one requiring plenty of effort and time would not be appreciated. In the same light, some participants stressed that although the configuration should be simple and straight-forward, it should be *flexible* to ensure that their preferences can be accommodated.

#### 6.7.2.3 SOFTWARE INTEGRATION

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The way that technology is implemented and integrated into its eco-system can affect its adoption by various individuals (Munson et al. 2010). Considering the context in which the behaviour happens is essential to ensure successful design and implementation of the technology (Michie et al. 2011). Technology-assisted solutions should not be *standalone technologies*; instead, they should be *integrated into social software* in which the behaviour occurs to aid its use and enhance its effectiveness. It is believed that fitting the technology into the medium facilitating the problem would increase its adherence rate over time because such integration would reduce the steps and effort required to access the technology "*technology is broad, it is better to get the response right on the thing that is causing the problem than somewhere else, because if it is separate, then it means I might not switch it on or I might forget about it, e.g. if I am using YouTube, this software should be integrated into YouTube*" (P9).

Also, integrating the technology into the medium would facilitate the dissemination of goal-related information such as goal reminders and feedback about goal progress. Users would have the opportunity to share such feedback with their existing contacts on the software they are engaged with, "*so post the feedback from the software online, like on Facebook, so that people can comment on it and give me further advice*" (P11).

#### 6.7.2.4 THE FAMILIARITY OF FEATURES

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The findings of the interviews show that for the technology to be easy to use, it has to be properly designed, simple, user-friendly and straightforward. Users' perceptions in terms of the *simplicity* and *user-friendliness* of the technology can depend on their computer self-efficacy beliefs before and after system interaction (Venkatesh and Davis 1996). It is, therefore, important to consider the self-efficacy of the users when designing TAGS, which increases the acceptance of the technology. In terms of system navigation, having a simple, well-labelled and easy to find menu structure would help increase the ease of use perceptions "*the technology should be really simple. It may look nice and be high-tech, but people might not want to use it as much because they will say it looks nice, but it's too complicated to use*" (P15). Users' trust in the system would increase if they were able to effectively perform tasks, such as setting their goals and accessing and visualising their feedback information.

### 6.8 DISCUSSION

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In the second part of this chapter, the focus was on users' perceived acceptance factors, describing users' perceptions of such technology-assisted solutions, in terms of perceived usefulness and perceived ease of use. The Technology Acceptance Model (TAM) is a powerful tool for helping people predict users' acceptance of information technology. The study findings, i.e. interview participants' comments, emphasised the importance of exploring users' perceptions of acceptance of the technology. The interview findings showed that both perceived usefulness and perceived ease of use are factors that participants associated with the acceptance of TAGS. In relation to the perceived usefulness, participants raised elements such as *raising awareness about the problem*, *behaviour regulation*, *personalisation*, and *goal setting*. For perceived ease of use, *understandable*, *software integration*, *the familiarity of features* and *configuration effort* were among the critical factors that were raised. In addition to the acceptance factors outlined and discussed in **Sections 6.7.1 and 6.7.2**, other elements need to be elicited, for example, users' stage of change, stage of addiction, and self-efficacy levels. For example, variation in the stage of change might lead to a different perspective on acceptance factors for technology-assisted solutions. For a user who is in the contemplation stage, behaviour regulation might not be an immediate priority, and this can be linked to the fact that such individuals are still not fully immersed in the behavioural change process, and presenting them with various behaviour regulation strategies can scare them off the whole process.

Eliciting users' acceptance factors is one thing, whereas getting users involved in the actual design of the technology is another stage that needs to be considered. The question is how do we effectively involve users in the design and provide software that aids behavioural change? Involving users at the initial stages of the design would facilitate the process of profiling the users, assessing the users' stage of change and stage of addiction. Gathering such information would

enable designing and developing software features and functionalities that would work for a variety of users. Hence, the design of such software may consider approaches where its configuration and setting are carried out collaboratively between the user and the designers.

## 6.9 LIMITATIONS OF THE STUDY

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The studies conducted have some flaws/limitations. For example, some participants were recruited following the convenience sampling technique. This means that those who can be easily reached participated in the study, which could introduce bias in the findings. However, all the interview participants declared having problematic usage, which is comparable to other users in the same situation. The studies conducted suffered from a lack of diversity, in terms of age, gender, geographical location, and ethnicity of the participants. Gender-imbalance Dickinson et al. (2012), was evident in the focus group. Study participants were mainly male. However, we were not testing gender differences in the study findings; therefore, gender imbalance would have a limited effect. Also, another limitation could relate to sampling bias, for example, recruiting undergraduate students or experts with a computing background. Most of the recruited study participants have an academic background in computing or are pursuing a degree in computing related units, meaning that they could be more aware of technology interventions and have some knowledge of the area. However, as TAGS is intended for various users from different disciplines and backgrounds, this means that the study could have benefited from an increase in the study sample's representativeness and gained access to a larger segment of the population, i.e. including participants from different disciplines, academic backgrounds, or those with no research or academic background. The interviews conducted in stage two, mainly targeted users who self-declared having problematic usage. This may have biased the sample. Non-problematic users and those users who have symptoms of problematic digital behaviour but are in denial were not part of the sample. Including these user groups as study participants would have provided a different perspective about the perceptions of usefulness and ease of use of TAGS.

## 6.10 CHAPTER SUMMARY

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In this chapter, the researcher investigated users' perceptions of the opportunities and challenges associated with TAGS. This is discussed in relation to problematic social networking usage, intending to provide some theoretical foundations for their engineering. The analysis led to the identification of various categories of opportunities which could enhance the behavioural change process and factors that need to be addressed when designing the technology. In addition, the users' acceptance factor of the technology was investigated. An initial discussion on the management techniques for the identified challenges is provided. The next chapter proposes an elicitation method for goal setting design requirements for TAGS.

## 7. CHAPTER 7: TAGS: A METHOD FOR ELICITING GOAL SETTING DESIGN REQUIREMENTS

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The TAGS method was created based on research findings from the previous chapters. Six templates representing the elements that should matter to the design team of social network applications are created. The first three templates focus on eliciting the causes and negative effects of problematic usage, as well as any measures that users are implementing to help alleviate the problem. The remaining templates are based on the various elements of goal setting. In the first part of this chapter, an explanation of the various stages of the method is provided. In the second part, the activities involved in eliciting users' requirements and guidelines for the analyst and design team to help support users during the elicitation process are provided. Finally, to help guide the team when designing the new goal setting layer and justification for the elements included in the elicitation templates, good design practises are provided.

### 7.1 TAGS METHOD OVERVIEW

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Users depict social network usage, which they declare to be problematic. Such behaviour is traceable, tractable, and happens in real-time. The literature has revealed that such a usage style could result in various negative life experiences (Young and Case 2004; Grüsser et al. 2007). The developers of such applications have objective measures to help manage such problematic usage to ensure that the behaviour is under control, and this could be achieved by technology-assisted goal setting (TAGS). TAGS are capable of detecting deviation and correcting it as it occurs or immediately after it occurs. However, it is not easy to do this because people have different personalities and intentions. So, this thesis proposes a domain-specific method for eliciting goal setting design requirements. The method is meant for users who declare they have problematic social networking usage and are willing to seek help to manage the problem.

The TAGS method is proposed to provide a structured and systematic approach for eliciting goal setting design requirements. The method is for a design team who would like to augment their social networking platform with a new goal setting layer. This layer is expected to help users regulate their problematic social networking usage (PSNU). The TAGS method can be used as an interview template. The method will follow a particular outline that would help people, e.g. a self-declared problematic user, to express their goal setting design requirements. Representative users should be recruited and supported to specify their behavioural requirements. The outcome of the elicitation process will enable the design team to know the features that the users would prefer the new layer to have. For example, the software features, the context in which they would be implemented, and the constraints that might affect their success. Also, it would help them understand whether the current features of social media platforms are adequate to help users regulate their usage. The process is expected to be iterative where subsequent meetings will be

scheduled to re-evaluate users' problematic usage. In this chapter, the terms "system analyst" and "analyst" will be used interchangeably.

In order to create this method, various qualitative studies and literature reviews were conducted, such as practitioner, expert, and user interviews and focus group sessions. The literature reviews and studies conducted in this thesis show that when people set up or talk about goals that are behavioural requirements, they talk about the source of the goal, monitoring goal progress, provision of performance feedback, and deviation from goals and deviation countermeasures. The findings from these studies and the literature reviews discussed in the previous chapters of the thesis form the elements of the **TAGS** method depicted in **Figure 35**. In **Chapter 4**, five reference checklists for goal setting that illustrate the idea and show its shared and variable elements that will help achieve better software for behavioural goal support were developed and published (Cham et al. 2019a). **Chapter 5** was aimed at investigating the negative life experiences of DA, and the role technology-assisted solutions could play in raising awareness and helping combat digital addiction, which was published in (Cham et al. 2019b). Also, in **Chapter 5**, a discussion on social norms as factors that can influence problematic digital media usage and how technology-assisted solutions may be used to present accurate normative information to help with problematic digital usage was provided. The first part of **Chapter 6** aimed at exploring user perceptions of the opportunities and challenges of TAGS was conducted. The second part of **Chapter 6** focused on exploring the acceptance factors of TAGS. The findings from **Chapters 4, 5, and 6** fed into the design and creation of the TAGS templates, guidelines, and the supporting documents. The template elements would help the team to understand the representative users and help generate the common and useful features and functions that the new goal setting layer should have to help the behavioural change process. Presented in this chapter is the specialised version of the templates intended for the elicitation of goal setting design requirements that would facilitate the addition of a goal setting layer.

This chapter will commence by introducing the TAGS method. Among other things, introducing each of the stages (see **Figure 35**) and the method building blocks (see **Figure 36**), and then proceeding with a description of the method workflow and activities involved in each stage of the method. The system analyst is expected to use focus groups, semi-structured interviews, or diary study exploration to gather users' requirements.

## 7.2 RESEARCH GOAL OF CHAPTER

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This research aims to propose a domain-specific method to support users in specifying their goal setting design requirements in order to help regulate their problematic social networking usage. The method will follow a particular outline that would help people, e.g. representative users, peer mentors, parents/guardians, and experts from a multi-disciplinary background, such as system

analysts and psychologists, to specify or assist in the process of specifying requirements for the new goal setting layer. The four stages of the TAGS method outlined in **Figure 35** below, i.e. understanding stakeholders, understanding the problematic usage, understanding help needed, and understanding how to adhere to help, will be explained in sections 7.3, 7.4, 7.5, and 7.6.



FIGURE 35: STAGES OF THE TAGS METHOD

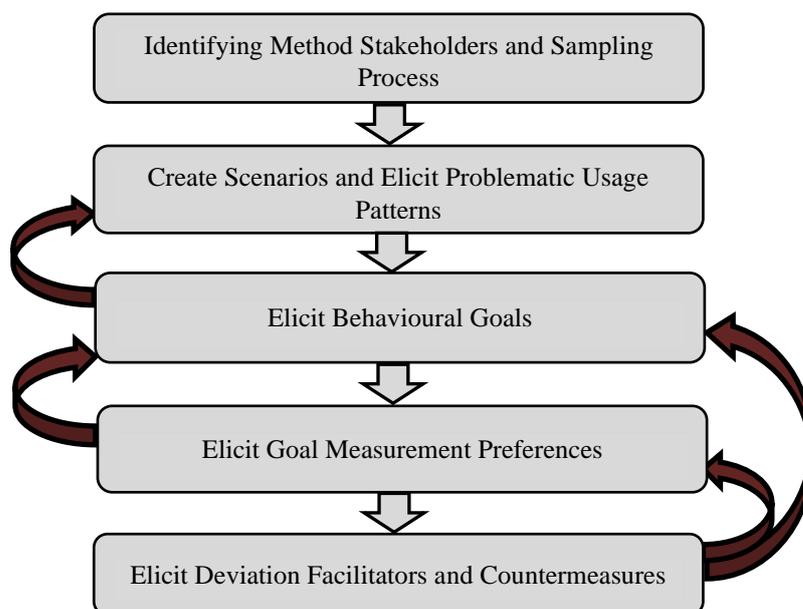


FIGURE 36: TAGS METHOD BUILDING BLOCKS

TABLE 21: DESCRIPTION FOR METHOD BUILDING BLOCKS

Process building blocks	Description
Identifying method stakeholders and sampling process	Refers to the various categories of help seekers and other stakeholders.
Create scenarios and elicit problematic usage patterns	Refers to the description of social network usage and factors that relate to the usage style.
Elicit behavioural goals	Refers to the goals defined to regulate usage.
Elicit goals measurement preferences	Refers to the process of observing people’s social network usage and comparing their goal performance progress.
Elicit deviation facilitators and deviation countermeasures	Refers to the various factors that can facilitate deviation from behavioural goals and the techniques that reduce or prevent deviation from behavioural goals.

### 7.3 STAGE 1: UNDERSTANDING STAKEHOLDERS

The first stage of the TAGS method involves identifying and understanding the various stakeholders who will partake in the goal setting design requirements elicitation process.

### 7.3.1 IDENTIFYING METHOD STAKEHOLDERS AND SAMPLING PROCESS

The stakeholders include those who ensure that the new goal setting layer meets the needs of its expected users. Before starting the elicitation process, the system analyst should identify the stakeholders who will participate in the process. A set of 8 stakeholders is suggested. In **Table 22**, the stakeholders involved in the system or impacted by the development and implementation of the TAGS are presented. Some of the stakeholders will be directly involved in interacting with the templates, while others will not (see **Table 22**).

TABLE 22: STAKEHOLDERS, DEFINITION AND LEVEL OF INVOLVEMENT

Stakeholder	Definition	Level of Involvement
Representative users	Refers to help-seekers who declare their problematic usage.	They are actively involved in all the phases of the elicitation process.
System analysts	Refers to the person who will gather and analyse users' goal setting requirements. The system analyst is expected to be an expert in software engineering and computing, and possess some expertise in psychology, human factors, user experience and usability.	Leads the elicitation process and is actively involved in all phases.
Support group member	People who surround a problematic user, such as immediate family members.	They are available to provide support when required.
Parents/guardian	Refers to a person who has parental responsibility or care for a minor.	They may be actively involved in the case of a minor.
Peer mentor	Refers to peers who share similar PSNU mentoring each other to express their goal setting requirements.	They are actively involved, e.g. peers consulting each other on their goal choices, monitoring preferences.
Designer	Refers to the people who are responsible for designing the goal setting layer.	They are not involved in the dialogue with users but apply the outcome of the elicitation.
Developer	Refers to the people responsible for developing the goal setting layer. They can evaluate any potential constraints, e.g. current technical limitations, and trade-offs, and then provide alternative options where applicable.	They are not involved in the interaction with users.
Psychologists	Refers to people who have psychological knowledge and relevant background in human behaviour, behavioural change processes, and understand psychology in the field of problematic behaviour. They are responsible for helping the design team understand users' psychological and emotional states concerning their social network behaviour.	They are fully involved in all the stages, from the elicitation of the goals to the subsequent re-evaluation meeting of the sample of people PSNU.

#### 7.3.1.1 HOW TO RECRUIT THE REPRESENTATIVE USERS

Representative users should be recruited and supported to provide their goal setting design requirements. When recruiting users, the system analyst is expected to seek diversity among the representative users based on the factors that may impact the elicitation of the behavioural goals.

The system analyst needs to be aware that various methods can be employed to recruit users. For example, an open call via social network platforms where problematic usage occurs. Also, other representative users can be recruited through convenience sampling via organisational and academic mailing lists, such as psychologists. The users will be recruited to partake in the elicitation study based on the criteria presented in **Table 23**.

TABLE 23: CRITERIA AND RATIONALE FOR STAKEHOLDERS' RECRUITMENT

Criterion	Rationale
Gender	Gender is an attribute which would enable the elicitation of different views or preferences around features and functionalities of the technology-assisted solution. For example, a male may prefer self-monitoring, a female may prefer peer-monitoring.
Age	Age is an attribute, which would enable gathering different preferences that may affect the acceptance of certain features such as gamification elements, e.g. older people may not like virtual rewards such as points and badges.
Stage of change	This aspect would show diversity concerning the goals, e.g. moderated goals for users who are on the mend and abstinence or avoidance goals for those who are heavily engaged. With this knowledge, the analyst could advise on the samples' level of involvement in setting the goals.
Degree of problematic usage	People in the advanced stage may be in denial, which may affect their credibility to provide required information and may, therefore, require additional support from the analyst to ensure that goals that would lead to effective behavioural change are elicited.
Emotional state	Knowing the emotions of the users would help the analyst understand whether their behaviour is compulsive, e.g. a user checking and posting all the time, or whether it is just habitual, e.g. a user repeatedly chatting with contacts and sharing posts on Facebook.
Causes of problematic usage	Knowing this would help to identify the reason for the problematic usage, e.g. peer pressure, habitual, user self-esteem, and hence avoid certain features that might aggravate such behaviours.
Social networks features	Knowing the social media features that are problematic for some users would enable the analyst to know the diversity of features causing the problematic behaviour.

After identifying the stakeholders, and recruiting the representative users, the analyst can consider inducting the users around the supporting documentation, i.e. (**Doc1, Doc3, Doc4, Doc5, Doc6 and Doc7, see Appendix 4, Part: H, I, J, K, L, M and N**), that is expected to be used during the elicitation process. During the induction, the analyst can clarify that some of the templates should be completed through a dialogue between the analyst and other stakeholders, while others should be completed solely by the users, who can be assisted by other stakeholders when required. Inducting the users would help to familiarise them with the relevant documents required and stimulate their thinking. In order to induct them, the analyst is expected to follow one of two options. First, the analyst can conduct a short focus group separate from the main elicitation session where all the supporting materials are presented to the users, or the induction can be conducted at the beginning of the elicitation, e.g. 20 minutes before the session.

## 7.4 STAGE 2: UNDERSTANDING THE PROBLEMATIC USAGE (PRE-ELICITATION SESSION)

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The method is not only for eliciting the goal setting design requirement, but it is also intended for assessing the causes of the problem, such as the features of social networks and other personal reasons. Therefore, the objective of the second stage is to help the design team to understand/diagnose the problematic usage (see **Figure 35**). This stage would help them know the degree of the problem, the part of the application where the problem exists, and what would likely work for the users. It involves two steps: (i) creating scenarios, and (ii) eliciting the usage patterns. Templates **ID 1, 2 and 3** are to be completed in this session before the actual elicitation session.

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### 7.4.1 CREATING SCENARIOS

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Various domains use the concept of scenarios, and it is defined as a

“consistent and coherent descriptions of alternative hypothetical futures that reflect different perspectives on past, present, and future developments, which can serve as a basis for action” (van Notten 2005.p.2).

Also, scenarios can be useful in the design process to support requirements elicitation and definition (Deissenboeck et al. 2009). The scenario generation guidelines outlined in **Table 24** were based on research work by (Gough et al. 1995; Sutcliffe 2003). One of the roles of scenarios is that they explain the behaviour of users and the current system/features that trigger the problem (Sutcliffe 2003). Creating scenarios to describe PSNU would enable the analyst and design team to better understand the users’ behaviour.

TABLE 24: GUIDELINES FOR GENERATING SCENARIOS

Scenario generation guidelines
<b>Provide a title for the scenario:</b> This aspect depicts what social media application the problematic usage is about and the primary users in the form of easy headings.
<b>User identification:</b> This aspect includes the identification of primary users who are experiencing problematic usage or those who are affected by the usage, the users’ profession and when the behaviour started.
<b>Description of the usage environment:</b> This aspect helps identify the environment or situation in which the problematic usage happens.
<b>Description of usage related data:</b> This aspect includes the story of the behaviour, including the application that the problematic usage is about, the usage time, activities performed, and time of usage, among others.
<b>Explain the reason/s for the behaviour:</b> This aspect includes a description of why the users started using their respective social network applications and how the usage became problematic.
<b>Describe the effect of the behaviour:</b> This aspect includes a description of the negative life experiences that the user is experiencing as a result of their problematic usage. The problematic usage can affect the users’ performance on work-related duties, it can affect their families, or it can change their personal lives.

<b>People affected by the problem:</b> This aspect includes a description of the people affected by the problematic usage and the extent of the negative life experiences on their lives.
<b>Feature/s that the usage is about:</b> This part includes a description of the features causing the problematic usage.
<b>Write concise scenario sentences:</b> Writing brief sentences will enable the users to understand the context, especially if they do not have the required expertise and experience in the area. Also, it will help prevent readers from being confused. It is recommended to avoid using ambiguous words.
<b>Tools and techniques to enhance better scenario development:</b> In some cases, it may be challenging to create scenarios which can be attributed to various reasons. For example, problematic users may be in denial of reality, hence they may not be in the position to express their problems. If this is the case, methods such as storyboarding and rehearsal can help imagine the situation and develop the scenario. Also, adopting the storyboarding technique can help, especially for those users who are good at visualising a situation rather than actually reading plain text.

#### 7.4.2 ELICIT PROBLEMATIC USAGE PATTERNS

The first part of this step focuses on eliciting the following. **Template ID 1** will be used here (see **Table 25**).

1. The social network features and the actual features from the identified family of features are responsible for the problematic usage.
2. The reasons for the problematic usage.
3. The context in which the usage is envisaged as risky.
4. Offline activities that might help users detach from social networking usage.

The second part utilised the elements of the taxonomy presented in **Chapter 5**, which illustrates the negative life experiences linked with DA. The aim is to help gather the negative effects linked with the representative users' problematic usage. Here, **Template ID2** will be used (see **Tables 26**). On **Template ID2**, various categories of negative life experiences and their associated elements are listed, including emotional problems, social problems, personal problems, and work performance problems (see **Table 26**). **Template ID 3** will support the elicitation of current actions that users are employing to try to reverse the PSNU (see **Table 27**). The researcher provided a Facebook version of the general elicitation templates by providing examples linking goal setting requirements with problematic Facebook usage (see **Appendix 4, part F**).

TABLE 25: ELICITING SOCIAL NETWORKS USAGE

					User
Template ID: 1		Social Networks Usage Statement			
Which family of <b>elements</b> is causing your problematic social networks usage?					
Conversations	<input type="checkbox"/>	Groups	<input type="checkbox"/>	Presence	<input type="checkbox"/>
Reputation	<input type="checkbox"/>	Identity	<input type="checkbox"/>	Relationships	<input type="checkbox"/>
<b>Other</b>		(please			specify)
.....					

In relation to the family <b>of elements</b> selected above, what are the actual <b>aspects</b> you struggle with on social networks?
Notifications <input type="checkbox"/> Location sharing <input type="checkbox"/> Posting <input type="checkbox"/> Profile <input type="checkbox"/> Length of Messages <input type="checkbox"/> Liking <input type="checkbox"/> Endless feeds <input type="checkbox"/> Private messaging <input type="checkbox"/> Impression <input type="checkbox"/> Delivery Report <input type="checkbox"/> Synchronous dialogue <input type="checkbox"/> Pull to refresh <input type="checkbox"/> Customised content <input type="checkbox"/> Group sharing <input type="checkbox"/> Status <input type="checkbox"/> Temporarily available content <input type="checkbox"/> Commenting <input type="checkbox"/> Asynchronous dialogue <input type="checkbox"/> Sharing <input type="checkbox"/> Relationship status <input type="checkbox"/> Tagging <input type="checkbox"/> The wall <input type="checkbox"/> Other (please specify) .....
Can you describe the cause of your problematic social networks usage?
<b>Emotions:</b> E.g. enhancing self-esteem, improving mood, opportunity to relate to others, emotional support from others. ..... ... <b>Peer pressure:</b> E.g. when others want me to respond on their social network posts, when others want me to be on social network at specific times ..... ... <b>Making influence:</b> E.g. influencing others to behave in a certain way on social networks, influencing others to change their belief about social networks. ..... Other (please specify) .....
How do you feel about the amount of time spent using social networks and the time of use?
.....
At what point do you think you cross the threshold of a moderate social networks usage to a risky usage? E.g. in terms of time, i.e. when you check social networks notifications continually for two hours, after you post a lot on your social network applications.
.....
When you feel you are on social networks for a long time, what offline activities do you think would help distract you from social networks?
.....
Is there any additional information that you would like to be considered or that you think is relevant?
.....

TABLE 26: ELICITING NEGATIVE LIFE EXPERIENCES

User

<b>Template ID: 2 Negative effects of Problematic Social Network Usage</b>	
As a result of your problematic social networks usage, what negative life experiences do you suffer from?	
<b>Emotional Problems</b>	
Lowering self-esteem <input type="checkbox"/> Aggressiveness <input type="checkbox"/> Restlessness <input type="checkbox"/> Preoccupation <input type="checkbox"/>	
Reduce self-confidence <input type="checkbox"/> Depression <input type="checkbox"/> Stress <input type="checkbox"/> Irritability <input type="checkbox"/> Anxiety <input type="checkbox"/>	
<b>Elaborate on when the negative experience you selected happen?</b>	
<b>Negative life experience</b>	<b>When does it happen</b>
<b>Disrupted Familial</b>	
Partnerships and relationship problems <input type="checkbox"/> Marital discord <input type="checkbox"/> Neglect of children <input type="checkbox"/>	
Spending less quality time with family <input type="checkbox"/> Affect parent-child relationship depth and strength <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>	
<b>Negative life experience</b>	<b>When does it happen</b>
<b>Personal Problems</b>	
Neglect of personal life <input type="checkbox"/> Increased loneliness <input type="checkbox"/> Distraction <input type="checkbox"/> Confused thinking <input type="checkbox"/>	
Poor time management <input type="checkbox"/> Lack of concentration <input type="checkbox"/> Sleep deprivation <input type="checkbox"/> Procrastination <input type="checkbox"/>	
Irregular sleeping pattern <input type="checkbox"/> Increased escapism <input type="checkbox"/> Reduced attention to daily life activities <input type="checkbox"/>	
Avoidance of facing real-life problems <input type="checkbox"/> Other wellbeing issues <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>	
<b>Negative life experience</b>	<b>When does it happen</b>
<b>Social Problems</b>	
Reduced amount of face-to-face social communication <input type="checkbox"/> Disrupted peer relationships <input type="checkbox"/>	
Reduced skills of face-to-face social communication <input type="checkbox"/> Letting down family and friends <input type="checkbox"/>	
Neglecting social contacts <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>	
<b>Negative life experience</b>	<b>When does it happen</b>
<b>Work Performance Problems</b>	
Poor academic performance <input type="checkbox"/> Academic failure <input type="checkbox"/> Early school truancy <input type="checkbox"/> Reduced performance <input type="checkbox"/>	
Lower-grade point average <input type="checkbox"/> Disrupting peer <input type="checkbox"/> Disrupting colleagues <input type="checkbox"/> Loss of creativity <input type="checkbox"/>	
Poor time management <input type="checkbox"/> Reduced teamwork <input type="checkbox"/> Loss of profitability <input type="checkbox"/> Reduced progression <input type="checkbox"/>	
Loss of productivity <input type="checkbox"/> Missing important work deadlines <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>	
<b>Negative life experience</b>	<b>When does it happen</b>

<b>Invasion of privacy by others</b>	
Damage on individuals' public profile <input type="checkbox"/>	Cyber-stalking <input type="checkbox"/> Public commenting <input type="checkbox"/>
<b>Elaborate on when the negative experience you select happen?</b>	
Negative life experience	When does it happen
<b>Dietary-related problems</b>	
Skipping meals <input type="checkbox"/> Irregular dietary behaviour <input type="checkbox"/> Poor diet quality <input type="checkbox"/> Preference for fast food <input type="checkbox"/>	
Forgetting meals <input type="checkbox"/> Poor quality eating time <input type="checkbox"/> Disrupting family or group eating <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>	
Negative life experience	When does it happen
<b>The Subject of Harm</b>	
Self-harm <input type="checkbox"/>	Harm to others <input type="checkbox"/> Harm from others <input type="checkbox"/>
<b>Elaborate on when the negative experience you select happen?</b>	
Negative life experience	When does it happen
Please state what you <b>struggle</b> to control as a result of your problematic Facebook behaviour: e.g. I struggle to control the frequency of checking, I struggle to switch off during lectures, and struggle to stop checking when with the family or when I am at work.	
.....	
.....	
Is there any additional information that you would like to be considered or that you think is relevant?	
.....	
.....	

TABLE 27: ELICITING CURRENT INTERVENTIONS

	<b>User</b>
<b>Template ID: 3</b>	<b>Current Behaviour Change Interventions</b>
Are there any actions you are presently taking to try to improve your problematic social networks usage? If yes, what are they?	
Actions taken: ..... ..... .....	
<b>Elaborate on the action/s taken:</b>	

7.5 STAGE 3: UNDERSTANDING HELP NEEDED

Stage 3 of the TAGS method involves gathering information about what type of help users would like to get to regulate their problematic usage (see Figure 35). This stage comprises of three main steps: eliciting behavioural goals, goal measurement preferences, and deviation facilitators and deviation countermeasures. The five goal setting reference checklists represented in **Chapter 4** will be used as supporting materials for these steps (see **Doc3, Doc4 and Doc6 in Appendix 4, Part J, K and M**).

7.5.1 STEP 1: ELICIT BEHAVIOURAL GOALS

This step provides information related to the source of the goals, types of goals and other elements to consider when setting behavioural goals. In this step, the reference checklist representing the sources of behavioural goals will be used to guide the process (see **Doc3**). This checklist outlined five sources of goals and provided a brief summary of each source. The source of goals represents the stakeholder who sets the goals. **Template ID 4** will be utilised to support the elicitation of goals (see **Table 28**). In this step, user preferences concerning the source of the behavioural goals, types of goals, and examples of the behavioural targets will be elicited. This step will be explained in detail in **Section 7.7, Activity 3**.

TABLE 28: ELICITING BEHAVIOURAL GOALS

Template ID: 4		Setting Behavioural Goals	
Dialogue			
<b>What behavioural targets would you like to set to help you manage your problematic Facebook usage? Refer to (Doc 3 for types and source of goals).</b>			
<b>Behavioural Goals (order by priority)</b> , e.g. for a student, goals that might help reduce my procrastination on Facebook may be on top of the list.			
G1. .....			
G2. .....			
G3. .....			
G4. .....			
<b>To list more goals, use the blank sheet at the end (Template ID4 blank)</b>			
<b>Estimate the time by which your behavioural targets are to be achieved</b>			
<b>Distal</b> goals (goal set on a long-term basis), and <b>Proximal</b> goals (goal set on a short-term basis)			
<b>See the examples in the table below:</b>			
<b>Goal</b>	<b>Type of Goal</b>	<b>Goal Proximity</b>	<b>Example</b>
G1			
G2			
G3			
G4			
<b>I would prefer to set goals &lt;source of your behavioural goals&gt;: Refer to (Doc 3 for the source of goal)</b>			
<b>See example below:</b>			
<b>Goal</b>	<b>Source of goal</b>	<b>Origin of problem</b>	<b>Reason for choice</b>
G1			
G2			
G3			
G4			
<b>Is there any additional information that you think should be considered here?</b>			
.....			
.....			

7.5.2 STEP 2: ELICIT GOAL MEASUREMENT PREFERENCES

This step is mainly concerned with monitoring goal progress (see **Tables 29 to 33**). The monitoring activity is primarily concerned with specifying what the system has to monitor, e.g. usage duration and usage frequency, and comparison to aid measurement of goal progress by collecting behavioural metrics and progress status and providing performance feedback. In this step, the analyst is expected to use **Doc4**, where elements related to the monitoring, comparison, and feedback elements are outlined.

7.5.2.1 ELICIT MONITORING PREFERENCE

This part of the method uses some of the findings presented and discussed in **Chapters 4 and 6**. Various monitoring options exist that the system analyst needs to be made aware of, e.g. self-monitoring, peer-monitoring, and automated monitoring.

### *7.5.2.2 ELICIT COMPARISON PREFERENCE*

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The comparison involves two principal approaches, i.e. self-comparison and social comparison. This step involves defining a comparison preference that would work for a particular user or group of users for each of the goals set. Some examples of how to relate the preferred comparison to the goals are provided in the Facebook version of **Template 5** (see **Appendix 4, part F**). More details about this step will be provided in Section **7.7**, activity **4**, in terms of factors to consider and how the users' preferences can apply to the new goal setting layer.

### *7.5.2.3 ELICIT FEEDBACK PREFERENCE*

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Performance feedback enables people to be aware of their goal progress. Detailed information about how to elicit the forms of feedback will be provided in section **7.7**, activity **4**. For each goal and feedback preference, examples of what factors to consider are provided in the Facebook version of Template **ID 5.1, 5.2, and 5.3** (see **Appendix 4, part F**).

TABLE 29: ELICITING MONITORING AND COMPARISON PREFERENCES

Dialogue

<b>Template ID: 5</b>		<b>Monitoring &amp; Comparing Behavioural Goals</b>	
So I would like the software to help me achieve my goals by <i>(state your preferences around monitoring and comparison)</i> Refer to <b>(Doc4 for monitoring &amp; comparison)</b>			
<b>Monitoring progress made towards the goals</b>			
Self-monitoring <input type="checkbox"/>	Peer-monitoring <input type="checkbox"/>	Automated-monitoring <input type="checkbox"/>	
Supervisory-monitoring <input type="checkbox"/>	Parental monitoring <input type="checkbox"/>	Blended approach <input type="checkbox"/>	
<b>Please provide details:</b>			
<b>Goal</b>	<b>Monitoring preference</b>	<b>Example when to apply</b>	
G1			
G2			
G3			
G4			
<b>Comparison of performance made towards the goals</b>			
Self-comparison <input type="checkbox"/>		Social-comparison <input type="checkbox"/>	
<b>Please provide details:</b>			
<b>Goal</b>	<b>Comparison Preference</b>	<b>Example when to apply</b>	
G1			
G2			
G3			
G4			
Is there any additional information that you would like to be considered or that you think is relevant?			
.....			
.....			

TABLE 30: ELICITING FEEDBACK CONTENT

Dialogue

<b>Template ID: 5.1</b>	<b>Behavioural Goal Feedback</b>						
In terms of feedback on your behaviour and performance made towards your goal, what feedback methods would you prefer? ( <b>Doc4 for feedback methods</b> )							
<b>Feedback Content, i.e. the type of information included in the feedback</b>							
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">A. Performance Feedback</td> <td style="width: 50%;">B. Suggestion Feedback</td> </tr> <tr> <td>C. Motivational Feedback</td> <td>D. Educational Feedback</td> </tr> <tr> <td>E. Supportive Feedback</td> <td>F. Comparative Feedback</td> </tr> </table>		A. Performance Feedback	B. Suggestion Feedback	C. Motivational Feedback	D. Educational Feedback	E. Supportive Feedback	F. Comparative Feedback
A. Performance Feedback	B. Suggestion Feedback						
C. Motivational Feedback	D. Educational Feedback						
E. Supportive Feedback	F. Comparative Feedback						
<b>Elaborate on</b>							
<b>When it should happen:</b>							
<b>How it should happen:</b>							
<b>Elaborate on</b>							
<b>When it should happen:</b>							
<b>How it should happen:</b>							
<b>Elaborate on</b>							
<b>When it should happen:</b>							
<b>How it should happen:</b>							
<b>Elaborate on</b>							
<b>When it should happen:</b>							
<b>How it should happen:</b>							
Is there any additional information that you think should be considered here?							
.....							
.....							

TABLE 31: ELICITING FEEDBACK FRAMING

Dialogue

<b>Template ID: 5.2</b>		<b>Behavioural Goal Feedback</b>	
<b>Feedback Framing, i.e. the language used in the message content of the feedback (Doc4)</b>			
Loss Frame	Gain Frame	Formal	Informal
<b>Elaborate on: When to implement, feedback messages, subject of feedback, source of feedback and features feedback is about</b>			
<b>Feedback Framing</b>		<b>When to apply</b>	
Loss frame			
Gain frame			
Formal			
Informal			
<b>Feedback Framing</b>		<b>Feedback message example</b>	
Loss frame			
Gain frame			
Formal			
Informal			
<b>Feedback Framing</b>		<b>The subject of the feedback</b>	
Loss frame			
Gain frame			
Formal			
Informal			
<b>Feedback Framing</b>		<b>Source of feedback</b>	
Loss frame			
Gain frame			
Formal			
Informal			
<b>Feedback Framing</b>		<b>Facebook features</b>	
Loss frame			
Gain frame			
Formal			
Informal			
<b>Is there any additional information that you think should be considered here?</b>			
.....			
.....			

TABLE 32: ELICITING FEEDBACK TIMING

Dialogue

<b>Template ID: 5.3</b>		<b>Behavioural Goal Feedback</b>	
<b>Feedback Timing, i.e. the right timing of the feedback messages (Doc4)</b>			
Feedback during the behaviour	Feedback before the behaviour	Feedback after the behaviour	
<b>Elaborate on: Context, feedback subject, features feedback is about, frequency of delivery, screen position (for each goal)</b>			
<b>Goal</b>	<b>Timing: Feedback during the behaviour</b>		
G1	Context Subject of feedback Features Frequency of delivery Screen position		
<b>Elaborate on: Context, feedback subject, frequency of delivery (for each goal)</b>			
<b>Goal</b>	<b>Timing: Feedback before the behaviour</b>		
G2	Context Subject of feedback Frequency of delivery		
<b>Elaborate on: Context, feedback subject, features, frequency of delivery, delivery method (for each goal)</b>			
<b>Goal</b>	<b>Timing: Feedback after the behaviour</b>		
G3	Context Subject of feedback Features Frequency of delivery Delivery method		
Is there any additional information that you think should be considered here?			
.....			
.....			

TABLE 33: ELICITING FEEDBACK PRESENTATION

		<b>Dialogue</b>
<b>Template ID: 5.4</b>		<b>Behavioural Goal Feedback</b>
<b>Feedback presentation, i.e. how the feedback is presented in terms of style (Doc4)</b>		
Graphical Feedback	Textual Feedback	Graphical and Text Feedback
<b>Elaborate on: Context, frequency of delivery, medium of presentation, feedback screen time</b>		
<b>Style</b>	<b>Graphical</b>	
Context		
Frequency of delivery		
Medium of presentation		
Feedback screen time		
<b>Style</b>	<b>Textual</b>	
Context		
Frequency of delivery		
Medium of presentation		
<b>Is there any additional information that you think should be considered here?</b>		
.....		
.....		

## 7.6 STAGE 4: UNDERSTANDING HOW TO ADHERE TO HELP

This stage uses deviation facilitators and countermeasures derived from the literature review and user study findings described in Chapter 4. Understanding these elements would enable identifying how users are likely to deviate from the goals, how deviation could be triggered, e.g. by the software, and the countermeasure techniques that can be implemented using the software. For each deviation facilitator identified, countermeasures that can be implemented to mitigate it should be elicited. **Templates ID 6 and 6.1** aim to support the elicitation of deviation facilitators as well as the countermeasures techniques that would help reduce or prevent potential deviations (see **Table 34 and 35**).

TABLE 34: ELICITING FEEDBACK FACILITATORS

		<b>User</b>
<b>Template ID: 6</b>		<b>Deviation Facilitators</b>
<b>Which of the elements could influence a deviation or potential deviation from your goals (Doc6)</b>		
<b>Facilitators relating to the setting of the goals</b>		
<b>No.</b>	<b>Deviation facilitators</b>	
F1	Social influence or peer pressure on the subject pursuing the goals Lack of understanding of barrier to gain attainment Lack of a structured method for goal setting Not understanding users' needs for the goals Goals that conflict with other goals Lack of commitment to the set goals Source of the behavioural goal Timing of the behavioural goals Frequency of executing the set goals	
<b>Facilitators relating to the execution of the goals</b>		
<b>No.</b>	<b>Deviation facilitators</b>	
F2	Lack of performance feedback Monitoring goal progress Comparing goal performance	
<b>Other Facilitators</b>		
Inaccessibility to resources to aid goal attainment		<input type="checkbox"/>
		Environmental influence <input type="checkbox"/>
<b>No.</b>	<b>Deviation facilitators</b>	
F3	Inaccessibility to resources to aid goal attainment Environmental influence	
<b>Is there any additional information that you think should be considered here?</b>		
.....		
.....		



## 7.7 TAGS METHOD: ACTIVITIES

The TAGS method adopts the participatory design approach to ensure that all relevant stakeholders are actively involved in the early or later stages of the goal setting layer design. The TAGS include seven activities (see Figure 37), which are supported by documentation such as (Doc 1, Doc 3, and Doc4). The method workflow is depicted following the Business Process Model and Notation (BPMN) style presented in **Figure 37**. The activities in **Figure 37** aim to explain the four stages of the TAGS method.

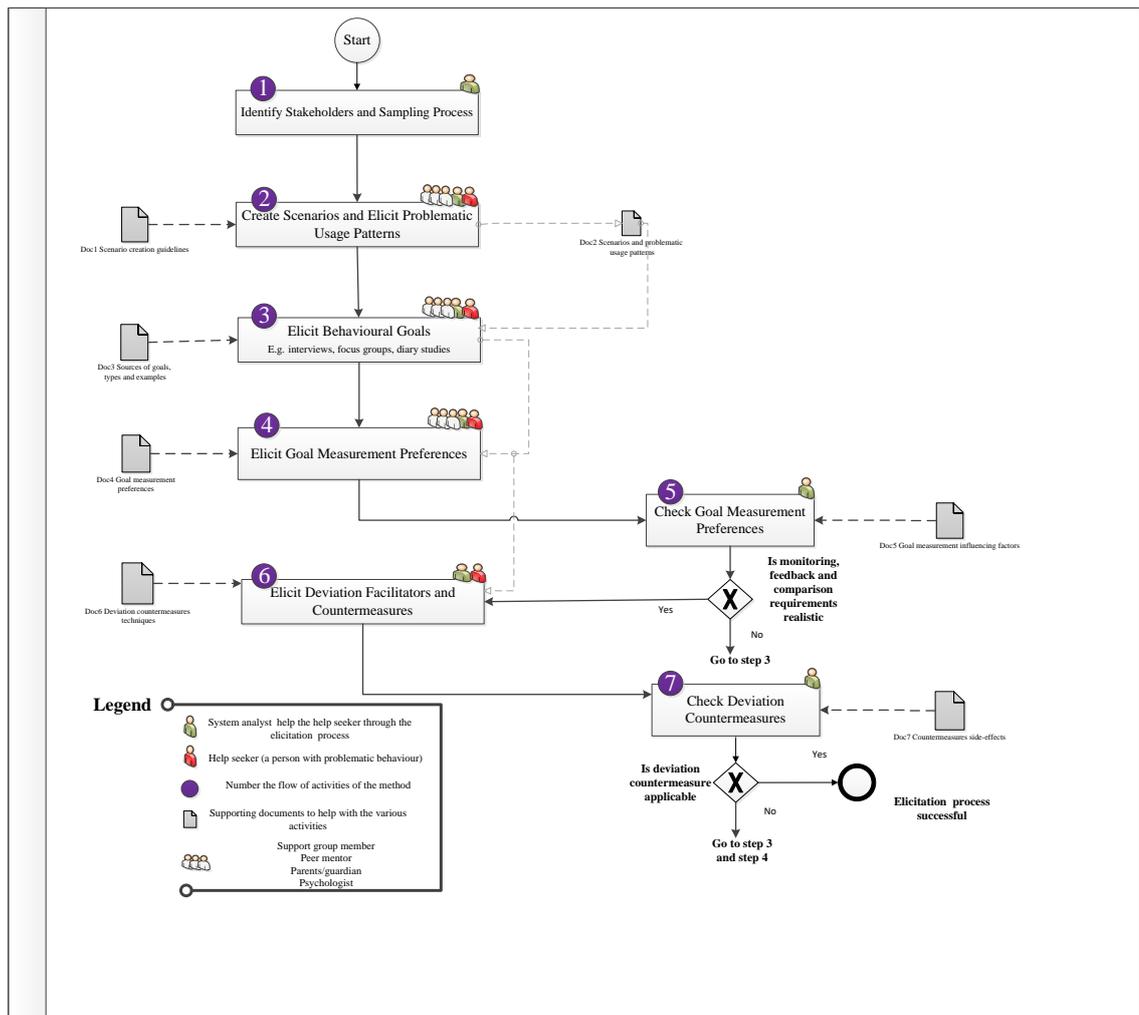


FIGURE 37: TAGS METHOD WORKFLOW

### Activity 1: Stakeholders identification

Here, it is expected to identify the stakeholders who will participate in the elicitation, design and development of TAGS. Also, the stakeholders' level of involvement in the process should be decided. In this activity, the system analyst can use **Table 22**, where the stakeholders, their definition and level of participation are provided. The system analyst is expected to be aware that not all stakeholders listed in **Table 22** would be needed for every social network application. For example, when the application does not have unlimited scrolling through the news feed, someone from psychology may not be needed. The elicitation process is expected to be iterative to re-

evaluate the problematic usage. Depending on the outcome of these sessions, the set of stakeholders, the behavioural goals and other preferences for the goal setting layer could change. The sampling process can be based on the nature of the social network application. For example, if the application has a grouping feature, peer mentors should be involved; this would enable peers to work collaboratively, which could lead to informed decisions. Also, the process should be based on the user’s age and the effect of the problem on other people.

**Activity 2: Creating scenarios and gathering problematic usage patterns**

Creating scenarios to describe PSNU would enable the system analyst to have a better understanding of the users’ behaviour. When creating the scenarios, the system analyst needs to ensure that they closely depict the situation in which the problematic usage exists. The system analyst should follow the scenario creation guidelines presented in **Doc1**. The scenarios can be created based on factors such as the platform that the problematic usage is about, the features of the platform, e.g. the features that users mostly interact with, frequency of use, usage time, causes of the problematic usage, negative life experiences, and the context of use. The system analyst can ensure that useful scenarios are created by collecting and analysing data from various sources. For example, interviews, diary studies, and online forums where users discuss and reveal their PSNU. The system analyst can use the template presented in **Table 36**, which outlines the elements that should be considered. The scenarios created will be stored in (**Doc2**) and used in activities **3, 4 and 6**.

After creating the scenarios, the next step is to understand users’ problematic usage patterns. To help attain this, the system analyst would discuss the scenarios with the users, and also the information gathered using **Template ID 1 and 2**. The data gathered can be analysed by focusing on categories of factors such as why users developed a PSNU, including self-esteem related, compulsive usage related, peer pressure, social influence, privacy and social expectation. Also, the negative experiences of the usage and triggering features should be considered. As guidance, a sample template to consider is provided in **Table 37**. This information would inform the system analyst’s decision during the elicitation of the behavioural goals and re-evaluation process. During the re-evaluation process, the system analyst is expected to use the information recorded in **Table 37**, and focus on any changes in the usage. The patterns will be stored in **Doc2** and used in activities **3, 4 and 6**.

TABLE 36: SCENARIO CREATION SAMPLE TEMPATE

User ID	Applicati on used	Device used	Triggering features	Most access features	Type of content	Usage duration	Usage frequency	Reason for usage	Negative experiences
1	Facebook	Mobile	Share Comments	like	Messages Photos	3 hours daily	20 times a day	Improve mood	Reduce productivity
2									

TABLE 37: TEMPLATE FOR ELICITING PROBLEMATIC USAGE PATTERNS

Problematic social networks usage patterns		
Reasons for problematic usage	Negative experiences	Triggering features

### Activity 3: Eliciting behavioural goals (Template ID 4)

In this activity, the analyst and stakeholders are actively involved in the elicitation process to participate in defining users' behavioural goals. The analyst is expected to be aware of the different sources of goals, and the system design needs to provide tools for all modalities, i.e. self-administered or mediator-led in the case of guided goals. When defining the goals, the system analyst could use **(Doc3)** where the types of goals, examples of goals, and sources of goals are provided.

If the selected source of goal is assigned or guided, the analyst is expected to be aware of the effect of authority as it could be a barrier to goal acceptance and attainment. In the induction stage, the analyst should discuss the various sources of goals and communicate the examples presented in **Table 38** to the users to stimulate thinking. If the source of the goal does not lead to effective behavioural change, the analyst may consider supporting the users to understand the nature and reality of their problem. After preferences for the goals are specified, there may be a reaction where the users do not want to achieve the goals. Therefore, it is necessary to assess whether the goal is still needed. If the goals are no longer needed, the analyst is expected to go back to the problematic usage patterns block and assist the users in specifying different preferences.

TABLE 38: GOAL TYPES AND EXAMPLES OF GOALS

	Goal types	Examples of goals
1	Time-based goals	Specifying the time for using social networks, e.g. using Facebook for an hour daily.
2	Frequency-based goals	Reduce the number of times Facebook is accessed daily.
3	Moderation-based goals	Regulate access to Facebook features monthly. Regulate Facebook usage and keep track of daily tasks.
4	Reduction-based goals	To reduce the time spent on Facebook every month.
5	Reminder-based goals	Set a reminder alarm for the above goal types.
6	Abstinence-based goals	Quit using the update status feature on Facebook.
7	Avoidance-based goals	To leave devices behind when attending social events. To lock digital devices to prevent Facebook use.

8	Restriction-based goals	To restrict interactions during certain times, e.g. mealtimes.
---	-------------------------	--

#### Activity 4: Eliciting goal measurement preferences (Templates ID 5, 5.1, 5.2, 5.3 and 5.4)

Various monitoring options exist that the system analyst needs to be made aware of, e.g. self-monitoring, peer-monitoring, and automated monitoring. Users' preferences would specify whether the system has to provide automated means, self-monitoring or peer monitoring, and any of these choices will impact other requirements and design decisions. In this activity, the system analyst should use **Doc4**, where elements linked to the monitoring activity, comparison, and feedback are outlined. Since the PSNU can occur in various situations, understanding such context is essential when implementing users' preferred monitoring technique.

- **Self-monitoring** refers to the user taking responsibility for observing and reflecting on their progress towards their usage and behavioural goals. The analyst is expected to consider users' preferences for the source of the goals in **Activity 3**, as this might affect the suitability of self-monitoring. For example, self-monitoring might not be useful for group-set goals. When the problem does not involve other users, or the nature of social networks does not allow a group feature, then self-monitoring might be useful. The system could be designed so that the results of the monitoring activity do not require specialised knowledge to visualise and comprehend.
- **Peer monitoring** refers to when other people observe and report on user behaviour. The analyst needs to be aware that peer monitoring does not work with users who have a high degree of privacy concerns. The analyst can consider providing users with the opportunity to specify what to include in the monitoring, e.g. usage time, time of use, activities performed, features accessed, and the context of behaviour. Peer monitoring may be feasible when social networks have grouping functionality, and when the behavioural goals are collaboratively set. The feedback system should be designed to avoid a negative effect on the group relationship.
- **Supervisory monitoring** refers to managers performing the monitoring. The system analyst can consider this approach if the application enables, e.g. posting pictures regularly, viewing other contacts' life stories, commenting or tagging contacts on posts, liking and sharing posts. When some users opt for this option, the design should consider delivering warning messages about the implications of specific usage before they are executed.
- **Automated monitoring** refers to the use of sensors and communication technology to observe and monitor goal progress. If the majority of users prefer this option, the analyst is expected to consider the consequences associated with it, e.g. the lack of privacy and anxiety. Also, automated monitoring may fail to account for the intention and context of the behaviour, which creates additional requirements for the analyst to gather. Automated monitoring might be effective in the early stages of change and when users are always on social media updating and making profile postings.

### Activity 4.1: Performance comparison

The comparison comprises two types, i.e. self-comparison and social comparison. The analyst needs to be aware of these approaches and decide on the comparison requirements, e.g. self-progress, setting a benchmark (showing the average usage performed by other users), and emotions or sentiments about usage during or after the behaviour is regulated. If the majority of users preferred self-comparison, the analyst is expected to consider their monitoring preference because self-comparison may work better when self-monitoring is selected.

If some users select social comparison, the analyst is expected to consider the source of goals, as this option would be useful when goals are set collaboratively. If the social network allows people to see the number of likes on a profile photo and the number of shares on a post, then social comparison could be implemented and allow people to set up a protocol for the comparison activity. The analyst needs to be aware that social comparison may lead to competition due to the open availability of comparison information. The system can be designed to monitor and intelligently react to side-effects that may result from the comparison.

### Activity 4.2: Feedback content

Performance feedback enables people to be aware of their goal progress. The analyst is expected to discuss the various forms of feedback with the users, see **Table 39**. In terms of the feedback content, e.g. motivational feedback, the system could implement motivational techniques, and for evaluative feedback, consider what the performance should be compared with, such as group norms. The analyst is expected to guide users to elaborate on 'when' and 'how' the feedback content should be implemented.

TABLE 39: FEEDBACK CONTENT AND FACTORS TO ELABORATE ON

Feedback Content	×/✓	When it should happen	How it should happen
Performance feedback			
Educational feedback			
Motivational feedback			
Suggestion feedback			
Supportive feedback			
Comparative feedback			

### Activity 4.3: Feedback timing

Feedback timing is about the proper timing of the messages such that the users see it as a motivational tool, which could increase its acceptance. Feedback can be provided during the behaviour, after or before the behaviour takes place. The system could be designed to provide tools for each modality, and the analyst is expected to consider requirements for the factors presented in **Table 40**.

TABLE 40: FEEDBACK TIMING AND FACTORS TO ELABORATE ON

Feedback Timing	×/✓	Feedback context	Subject of feedback	Features feedback is about	Frequency of delivery	Delivery method
Feedback during						
Feedback before						
Feedback after						

**Activity 4.4: Feedback framing**

Regarding feedback framing, the analyst is expected to be aware of the tone of feedback messages and consider requirements in terms of when to implement user preference, message examples, subject of feedback, source of feedback, and feedback features (see **Table 41**). Also, the system could be designed to ensure that negative messages are not presented, as this could affect user self-esteem. The system design could take into consideration the level of detail in the feedback, which can be based on users' treatment levels.

TABLE 41: FEEDBACK FRAMING AND FACTORS TO ELABORATE ON

Feedback Framing	×/✓	When to implement	Feedback messages	Subject of feedback	Source of feedback	Feature feedback is about
Gain frame						
Loss frame						
Formal						
Informal						

**Activity 4.5: Feedback presentation**

For feedback presentation, the analyst can consider requirements for the context in which the preferred style should be delivered, frequency of delivery, the medium of presentation, and feedback screen time (see **Table 42**). Examples of these aspects are provided in the Facebook versions of the templates (see **Appendix 4, part F**). If users do not agree on a modality for the monitoring, then the analyst may consider self-monitoring or go back and modify the behaviour goals.

TABLE 42: FEEDBACK PRESENTATION AND FACTORS TO ELABORATE ON

Feedback presentation	×/✓	Feedback context	Frequency of delivery	Medium of presentation	Feedback screen time
Graphical					
Textual					
Graphical & textual					
Telephone					

### **Activity 5: Checking goal measurement preferences**

This activity aims to assess the realistic nature of the elicited monitoring, comparison, and feedback requirements. This activity should be performed in parallel with activity 4. After gathering goal measurement preferences, the system analyst is expected to check whether they are satisfactory by using **Doc5** to guide the process. If the users' monitoring preference may not be suitable, the analyst can consider going back to the elicit behavioural goals block (see **Figure 36**) and eliciting other typical goals.

### **Activity 6: Eliciting deviation facilitators and countermeasures (Templates ID 6 and 6.1)**

The analyst is expected to be aware of the various aspects that could lead to deviation from the goals. The analyst needs to raise users' awareness of various facilitators by presenting the elements, then asking users to indicate whether they may have these conflicts and what help they may need. This will enable them to detect and know the typical conflicts users may face. Some facilitators need to be discussed based on previous elicitation templates. For example, the lack of a structured method for goal setting would be discussed based on **Template ID 4**.

When eliciting the deviation countermeasures, the analyst is expected to consider the requirements of the context in which the countermeasures should be applied, how they would be implemented, and the constraints that might hinder their success. The analyst is expected to be aware that the countermeasures are classified into different categories, and user preference would determine if software implementation is required. For example, the category relating to the setting of goals may not require technical implementation. The deviation countermeasures aim to help people avoid deviation in the later stages, when the users start pursuing their behavioural goals. If the social network has a chatting feature and users select time-based goals, the analyst should consider a timer and usage reminder functionality. If the social network has like and comment features and some users choose reduction-based goals, the system could be designed to group users and compare their access to these features. Privacy requirements for different users should be considered. The analyst could use **Doc6** for further information on the facilitators and countermeasures.

### **Activity 7: Checking deviation countermeasures**

This activity should be conducted in parallel with activity 6. In this activity, the system analyst is expected to use the elements presented in **Table 43** and **Doc7** to analyse the selected countermeasures in terms of any impact or potential side effects. This will aid their decision on whether they should be implemented. If some deviation countermeasure strategies are not applicable, consider modifying the behavioural goals elicited in **Activity 3** and the goal progress

measurements defined in Activity 4. If the eliciting deviation countermeasures are suitable, then the elicitation process ends.

TABLE 43: POTENTIAL COUNTERMEASURE SIDE EFFECT

Side effect that may exist due to countermeasure implementation			
Creating alternate problematic usage		Acceptance of countermeasure techniques	
Lowering self-esteem		Level of control	
Peer pressure		Distraction from present tasks	
Loss of interest		Visibility of comparison information	
Social influence		Frequency of delivering performance information	
Reduce engagement		Length of performance information	
Lack of motivation		Importance level	
Lack of group commitment		Fear of missing out on social network interaction	
Storage of the comparison information		Accessibility of member information	
Obstruction		Lack of transparency	

## 7.8 GOOD DESIGN PRACTICE FOR TAGS

After eliciting the goal setting design requirements, the system analyst needs to consider how to implement these requirements to help inform better design decisions. To help answer this question, this section aims to provide some good design practises for the analyst and design team to be used as a reference point when designing the goal setting layer. The design practises presented here are derived from relevant literature reviews, previous studies in the thesis, as well as the researcher's own experience gained from the studies conducted in this thesis.

- ***Constraints around usage vs harm***

When social networks' usage becomes risky during the time users are supposed to be focusing on their daily tasks, such as work-related or academic-related tasks, they cannot self-regulate their usage. The goal setting layer should be designed to understand and integrate users' work calendars and their target behaviour. Based on this information, the analyst should consider implementing tools that would block usage or lock users out of the applications they usually interact with (Alrobai et al. 2016). For those in the advanced stages of change (Prochaska et al. 2013), the system could be designed to occasionally remind the users about their present tasks and set targets.

- ***Encourage self-intervention initiative***

Some users may start implementing behavioural change techniques to help regulate their problematic usage, e.g. switching the Wi-Fi connection off at specified times. When this is the case, the system could be designed to encourage those users to continue with such techniques. This can be achieved by implementing tools for persuasive strategies such as gamification, e.g. points and badges, to help encourage users to be proactive and take actions towards their chosen

intervention techniques. It is essential to elicit strategies that work for particular users or user groups.

- ***Awareness of the negative life experiences of problematic social networks usage***

When some users report limited knowledge about the negative experiences of their usage and spend most of their day on social networks, the system could be designed to implement functionality that would help enhance their awareness of such negative experiences. This can be accomplished by presenting educational information, e.g. real-life accounts or experiences of others who have recuperated from problematic usage, as well as occasionally displaying warnings about the negative effects of problematic social networking usage (Cham et al. 2019b). Such information could be presented in the form of short videos, images, emails or text messages. Also, awareness could be raised by employing memory intervention techniques such as the spaced retrieval technique (Schacter et al. 1984; Brush 1998). For example, the system could be designed to present specific consequences at a time, and users could be asked to recall them after some time. This can be a continuous process to enhance user awareness of negative experiences. However, their timing and presentation should be considered.

- ***Encourage engagement in offline activities***

Providing tools that support the suggestion of offline activities during the use of social networks could help users make an informed decision, which may lead to a reduction in problematic usage. Also, the system design should consider a reminder functionality that would remind users of these offline activities. These messages should be presented in a way that would encourage a positive user reaction.

- ***Increasing effectiveness of the source of behavioural goals***

Once users select their preferred source of a goal, techniques that would lead to its successful implementation should be included in the system design. For example, when self-set is selected as a source of goals, the system design should consider implementing persuasive techniques such as reminders to help motivate and encourage users to set up usage targets. Also, a provision for expert support may be needed based on the user's stage of change, e.g. contemplation. When participatory or guided goals are selected, the system design should consider implementing features for interactive discussion between the users and the experts involved in the process. Finally, when assigned goals are the preferred choice, the system design needs to consider functionality for presenting instruction for the goal and goal-related tasks and for checking the clarity and precision of the language used for easy comprehension by various types of users.

- ***Encourage effective monitoring***

Various monitoring options are identified from the literature and studies conducted. The system should be designed to implement each monitoring modality. For example, when some users select

self-monitoring, the system design needs to consider implementing functionality that would help raise users' understanding of the consequences of the failure to report goal progress correctly. Also, appropriate gamification strategies that aid effective monitoring might be applied. For instance, points and badges may be provided to maintain goal progress. When peer monitoring is selected, the system design should consider the feedback system to help prevent a negative impact on the group relationship (Alrobai et al. 2016). Making users aware of the metrics used to monitor behaviour on social networks could motivate and increase awareness of the behaviour.

- ***Enhancing provision of the goal performance information***

All relevant aspects associated with the provision of the feedback should be considered, e.g. feedback timing, i.e. during or after the usage, framing, i.e. tone of the messages, and presentation style, i.e. colour coding, use of graphs or tables, text only or blending graphs and text. The feedback could be delivered following a push or pull approach. Technology should be designed to understand users' preferences in relation to these approaches (Alrobai et al. 2016). For example, when the push approach is selected, the technology should ensure that the messages are not a burden to the users, as this may lead to unwanted usage or a total loss of interest. Whereas, when the pull approach is selected, the system design should ensure that the messages do not lead to an increase in problematic experiences.

- ***Reducing negative experience resulting from group comparison***

When some users like to compare their usage with their peers, the system could be designed to reduce the side-effects that may result from such comparisons, e.g. lowering self-esteem and competition (Cham et al. 2019b). This process could motivate those who are below the average usage of the group to focus more on reducing their usage. Another option that could be useful is to consider the structure of the group and the group set up (Alrobai et al. 2016). The group can be structured by identifying and grouping users according to age, personality, and reasons for the usage. Having this group structure in place may help to reduce the lowering of self-esteem for some users and maintain behaviour change.

## 7.9 JUSTIFICATION FOR TEMPLATES ELEMENTS

In Table 44, justification for the various elements included in the TAGS elicitation templates is presented.

TABLE 44: TEMPLATE ELEMENTS VS JUSTIFICATION

Template Elements	Justification
Social network features	This knowledge would help the analyst to identify the features causing the problematic usage. Also, it would enable the analyst to decide on the functionalities that are more likely to work for the users.
Cause of the problematic usage	This information would help the analyst to establish which goal setting elements would work for the users. For example, if the cause of the problem relates to peer pressure, self-set

	goals and self-monitoring may not work. Therefore, other goal setting elements need to be considered.
Usage duration and time of use	This information would enable the analyst to (i) contextualise the usage and (ii) identify the severity of the problematic usage.
Risky usage of social networks	When the analyst is aware of these risks, it can help them implement functions to manage them. One approach would be collaborative support where the system enables users to identify and report risky usage. Also, this knowledge could help the analyst to raise awareness of the consequences of risky usage by disseminating information.
Offline activities	Knowledge about the users' offline activities would help the analyst to establish the stage of addiction. For example, having no offline activities may be an indication of social network dependency. Hence, the analyst may utilise such information with other behavioural variables to assign the degree of severity.
Negative life experiences	This information would enable the analyst to project these to a broader sample of users. Also, elaborating on the negative effects would help to identify features that trigger such effects and try to avoid them in the design of the goal setting layer.
Current intervention measures	This knowledge would help the analyst decide whether the current features of the social network are enough or whether a technical intervention is needed. If such intervention is not required, then the analyst could encourage and support the users to continue with their current strategies. For example, if some users are using a function to stop others from adding them to a group, all the analyst needs to do is to make this feature prominent in the application.
Target behaviour	Knowing the target's behaviour would help the analyst to decide on system features and functionalities. For example, suppose some users want the software to help them manage the fear of being socially excluded for being temporarily unresponsive in group conversations. In that case, the system could consider a function for a messaging protocol, i.e. auto-reply to inform that the user is busy.
Time to achieve the goals	This information would help the analyst provide tools that would avoid having many goals at the same time and having more distal goals than proximal goals. If users set goals that are to be achieved at the same time, breaking down the goals into a series of sub-goals may help resolve such timing issues, if any. Also, the analyst should consider functionality for prioritising goals based on their importance.
Source of the goal	Knowledge of the various sources of goals would help establish whether it is going to be self-administered or whether a mediator would be required, e.g. when the goals are to be set collaboratively.
Monitoring preferences	This information would help the analyst understand the modalities for observing users' behaviour. Also, it would enable the analyst to set up a protocol for the monitoring activity, whether the design of the monitoring feature should be time-based or frequency-based or a combination of both.
Comparison preferences	Knowledge of the comparison approaches would enable the analyst to provide functionality for measuring goal progress. Also, it would help the analyst support users to avoid

	selecting a method that would lead to competition or a reduction of interest in the goal.
Behavioural goal feedback	This information would enable the analyst to consider the various forms of feedback. Also, it will help them decide on the feedback requirements, such as features feedback is about, the goal/s that users would like feedback on, and also transparency on how the feedback information was derived.
Deviation facilitators and countermeasures	This knowledge would enable the analyst to assess the extent to which users are likely to deviate from the set goals and what deviation the software can trigger. It would also enable them to establish the countermeasures that would be technically implemented and provide tools for them to help mitigate goal deviation.

## 7.10 CHAPTER SUMMARY

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This chapter presented the TAGS method and its supporting materials. It explained the four stages of the method and recommended the elicitation templates to be used in each stage. Also, explained are the seven activities of the method. The activities include eliciting the behavioural goals and eliciting monitoring, comparison, and feedback requirements. Guidelines for the system analyst to guide users to express their goal setting design requirements are provided. The next chapter presents how to evaluate the TAGS method, and this would help assess whether the method could help users specify their requirements and whether it is something the users would like to use.

## 8. CHAPTER 8: TAGS METHOD: EVALUATION

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TAGS is a method that provides a systematic approach to guide the elicitation of goal setting design requirements. A method can be described as

“an approach to perform a systems development project, based on a specific way of thinking, consisting of directions and rules, structured in a systematic way in development activities with corresponding development products” (Brinkkemper 1996, p.275-275).

The ultimate aim of the TAGS method is to increase the chances of successfully implementing a goal setting tool that helps meet users' behavioural change needs. Due to the limited knowledge of approaches for eliciting behavioural requirements which would enhance the design of TAGS, and because people have different personalities and intentions, it would be challenging to develop an effective method. Also, this would require having a clear understanding of the goal setting technique and the goal setting elements that people talk about when they set up goals, as well as user personality and intention of use. In **Chapter 7**, the method for gathering goal setting design requirements consisting of several templates is proposed. The method's scope involves guiding and helping the process of specifying goal setting design requirements and supporting the activities outlined in the various templates using documentation, including guidelines and some good design practices as reference materials for the system analyst and design team. A qualitative case study will be adopted to evaluate the TAGS method. The process will focus on assessing the usefulness of the method, whether it covers all the required goal setting elements, and the extent to which the guidelines support the elicitation process. This chapter aims to achieve the second part of **Objective 5** outlined in **Chapter 1**.

(Kitchenham et al. 1997) state that it is surprising how little effort is devoted towards reviewing software engineering methods and procedures. An attempt to address this issue was made in the 1980s when various projects were launched to explore the subject of evaluating software engineering methods. The findings from the DESMET projects proposed nine approaches for the evaluation process and a set of measures that would aid the selection of a suitable approach (Kitchenham et al. 1997).

The process of evaluating an engineering method may vary depending on the context in which the evaluation is applied, i.e. having people with varying knowledge and understanding taking part in the evaluation study. Kitchenham et al. (1997) described and categorised the evaluation activity into three primary categories, i.e. objective, subjective and hybrid evaluation. The first is the objective evaluation, which focuses on identifying the benefits of a proposed method by quantitatively assessing its effects, such as a reduction in time and cost. The second is the subjective evaluation, which involves qualitatively assessing whether the proposed method meets

the needs/requirements of its intended organisation. Third, hybrid evaluation combines elements from the objective and subjective approaches.

Also, Kitchenham et al. (1997), introduced another aspect to the evaluation, which focuses on the approaches that will be employed in the evaluation process. These include:

**Formal experiment:** Participants perform tasks by engaging with the various elements of the method. The data gathered from the process can be analysed following a statistical approach.

**Case study:** The method or tool to be evaluated is tested in a real-world project context following the guidelines and procedures of the project it is intended to evaluate.

**Survey:** Participants who have experience in specific domains using methods and tools are recruited to provide statistical data around the method under investigation.

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### 8.1.1 AIM OF THE EVALUATION STUDY

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This chapter aims to evaluate the effectiveness of the TAGS method in (i) aiding users to express their goal setting design requirements, (ii) the extent to which users would like to express their behavioural goals following the method, (iii) whether the proposed method covers all the goal setting elements, and (iv) how communication between the analyst and other stakeholders should work. Also, this chapter aims to evaluate the method and some of its supporting documentation by considering the following elements:

**Understandability:** The goal here is to determine the degree to which the method can be easily understood and whether the documents provided are useful and easy to understand.

**Efficiency:** Here, the evaluation would help to assess to what extent the users find the templates easy and efficient to use, are satisfied with the components of the templates and can easily follow them.

**Usefulness:** Here, the goal is to evaluate how the method templates and the supporting documents simplify and improve the dialogue between the system analyst and the representative users during the elicitation process. Also, to be evaluated is whether the representative users would like to use the templates.

**Completeness:** Here, the goal is to evaluate whether the method has the entire goal setting elements needed to help people change their problematic usage and whether the guidelines provided to aid the elicitation process are enough.

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## 8.2 REASONS FOR ADOPTING THE CASE STUDY APPROACH

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The thesis will conduct a case study to evaluate the effectiveness of the method in the elicitation of goal setting design requirements that could help regulate problematic social networking usage. A case study is an approach that facilitates the exploration of a phenomenon using a variety of data sources within its context (Baxter and Jack 2008). The case study method would enable the evaluation of the method in a natural setting with respect to the application that is hosting the problematic usage. The primary aim of adopting the case study method was to investigate whether the proposed method could help various users successfully specify their behavioural goals with the help of the system analyst. The case study as a method will enable the observation of users' interaction with the various aspects of the TAGS method. This will provide details and a better understanding of users' reactions as the elicitation is happening. The case study approach will help us identify any flaws in the method, and using the outcome of the process, the method and its accompanying documents will be optimised. This thesis, informed by the stated advantages of case study design, available resources, time, and type of research, has adopted the case study as a model for evaluating the TAGS method in helping users express their goal setting design requirements.

Also, it will enable the system analyst, who is the main stakeholder in the process, to use the proposed templates and the supporting materials to evaluate the elicitation process in a real environment. The case study approach helps the researcher:

- To investigate the ability of the TAGS method to support help seekers express their various goal setting design requirements and those supporting them through the process.
- To gather participants' feedback that would help establish the strength and weaknesses of the TAGS method.
- To investigate whether the proposed method would help the system analyst and design team establish which of the template elements would be needed by users, e.g. help seekers to help support the behavioural change process.

### 8.3 LIMITATIONS OF THE CASE STUDY METHOD

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The case study method also has some flaws. For example, collecting case study data takes time, and analysing it takes much longer. As a result, conducting big or many case studies might be quite costly. The authors, Hodkinson and Hodkinson (2001), suggest that taking short cuts on either of these aspects, on the other hand, is likely to significantly reduce the value and trustworthiness of any conclusions reached. However, some types of case study conducted on a small-scale can be quite inexpensive. Additionally, for experts wanting to undertake small-scale action research projects, a case study of one group is also attainable and can provide significant data. Aside from the flaws that are common in case study research, there is also a difficulty if they present topics or findings that are unpopular, such as among policymakers or managers. Those

who disagree with the conclusions of case study researchers can easily find reasons to ignore them, stating, for example, small sample size and researchers' bias. It has been claimed that much more difficult to resist is research based on large representative samples and seemingly obvious, unequivocal results (Hodkinson and Hodkinson 2001). The case study approach has long been chastised for its lack of rigour and the researcher's inclination to interpret data in a biased manner. As case studies rely on the examination of qualitative data, a lot largely depends on the researcher's interpretation of the material he/she gathered. For example, this thesis researcher is solely responsible for interpreting the data collected from the TAGS evaluation. When a small sample is used, the grounds for establishing trustworthiness and generalisation are also questioned. According to Zainal (2007), this means that the findings reached in one case may not be applicable in other situations.

#### 8.4 PHASES OF THE EVALUATION STUDY

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The evaluation process, as defined in **Figure 38**, includes three primary phases. An initial discussion of these phases is presented below, and a detailed explanation can be found in sections **(8.4.1, 8.4.2, and 8.4.3)**. Supporting material used in each phase is presented in **Appendix 4**.

**Phase 1:** Induction and familiarisation with the proposed method and its supporting materials. During the induction, the researcher walks the relevant stakeholders through the documents, ensures that all questions are answered, and misunderstandings are clarified. Also, the researcher needs to explain that the elicitation is expected to be an iterative process and the need for scheduling follow up meetings to re-evaluate the users' problematic usage. For example, every couple of months, the system analyst meets with the help seekers and other relevant stakeholders to re-evaluate the problematic usage.

**Phase 2:** Evaluation of the TAGS method and its accompanying materials. The goal of this phase was to find out whether the documents were ready to be tested and to address any issues before the case study began.

**Phase 3:** This was the key phase in the evaluation of the TAGS. This phase was divided into two steps, as explained below:

- **Exercise 1:** Involves elicitation of goal setting design requirements without using the TAGS method.
- **Exercise 2:** Involves elicitation of the requirements with the aid of the TAGS method.

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##### 8.4.1 EXPERT EVALUATION

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This phase was centred on evaluating the TAGS method and its associated documents. The researcher provided all the templates and documents to experts who have experience in various domains. The researcher then explained all the materials before the evaluation began. The experts

were required to use their expertise and critically review and validate all documents provided to them. They were expected to refine the elements of the templates by adding and removing elements, which then helped in our final classification and creation of the final templates. The findings from this phase helped the researcher to produce specialised versions of the templates and their supporting documents.

Also, concerning the elicitation templates, the experts evaluated the relevance of the various elements and the extent to which they cover all goal setting elements. The objective of this phase was to find out if the documents were ready to be evaluated and to correct any issues before commencing the evaluation case study. The selection of the experts was based on (i) no less than five years of experience in their respective fields, including psychology, computing, and informatics, and (ii) familiarity with behavioural change theories. This is to ensure the credibility of the results. Six experts participated in the method evaluation. Expert perception of the documents will be gathered, and a specialised version will be provided based on their recommendations. After the optimisation of the templates, Phase 3, exercise 2 was conducted using the updated templates. After this session, the templates were further refined per the system analysts' and other stakeholders' recommendations.

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#### 8.4.1.1 EVALUATION DOCUMENTS

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The participants were provided documents detailing information related to the elicitation process. The following documents were provided (see **Appendix 4**).

- **Document A:** The elicitation templates depict various aspects of the process.
- **Document B:** Guidelines for the system analyst and design team to help the representative users complete the elicitation templates.
- **Document C:** Five reference checklists of goal setting elements.
- **Document D:** Goal types and examples of goals.
- **Document E:** Deviation facilitators and countermeasure strategies.
- **Document F:** Resolving conflict.
- **Document G:** Defining specific behavioural goals.

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#### 8.4.2 REQUIREMENTS ELICITATION WITHOUT THE METHOD

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The first part of Phase 3 was focused on eliciting the users' goal setting design requirements without the help of the TAGS method and its supporting documents. At this stage, the participants were provided with five reference checklists representing various goals setting elements. The participants involved in this phase were not engaged in any study that led to the development of the method and therefore had no prior knowledge about it, i.e. what it is made of, how it works

and the supporting documents. Participants who consented to partake in this exercise were invited to a session in which they were asked to work with a system analyst to express their requirements.

The researcher began by describing the aim of the session. The system analyst is familiar with the standard requirements gathering process and guides the representative users through the process. The users were divided into two groups to maximise their participation, which could increase the chances of gathering various viewpoints. This also helped to reduce the chances of users having an impact on each other's points or some dominating the entire discussion. The findings of this session are represented in **Table (47)**.

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#### 8.4.3 REQUIREMENT ELICITATION WITH THE METHOD

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This phase of the study was aimed at eliciting goal setting design requirements with the help of the TAGS method and its supporting materials. This phase involved two main activities:

The first part involved an assessment of the method as a diagnostic tool in terms of helping the system analyst and design team understand the users' problematic social networking usage and also whether it could aid the dialogue and help the elicitation process.

The other part of this phase focused on eliciting the representative users' goal setting design requirements. This activity involves mainly the system analyst, representative users and psychologists. Also, where needed, peer mentors, support group members, and parents/guardians (see **Table 22**). Participants who agreed to participate in this phase were provided with the various templates and other supporting materials. This activity was conducted to help users specify their requirements by following the elements on the templates. During the evaluation session, participants were given some screenshots of Facebook. The screenshots depict features of the application and various interfaces. After the templates were completed, the information was analysed to help establish the functionalities the new layer needed to provide.

Also, for the users, the researcher aims to evaluate the usefulness of the templates, i.e. how easy they are to use, understand and follow the various components, and whether this is something they would like to use. Also, how they found the process of filling out the templates, e.g. did not struggle with the method, whether they would like to see other elements, and the overall length of the templates will be gathered.

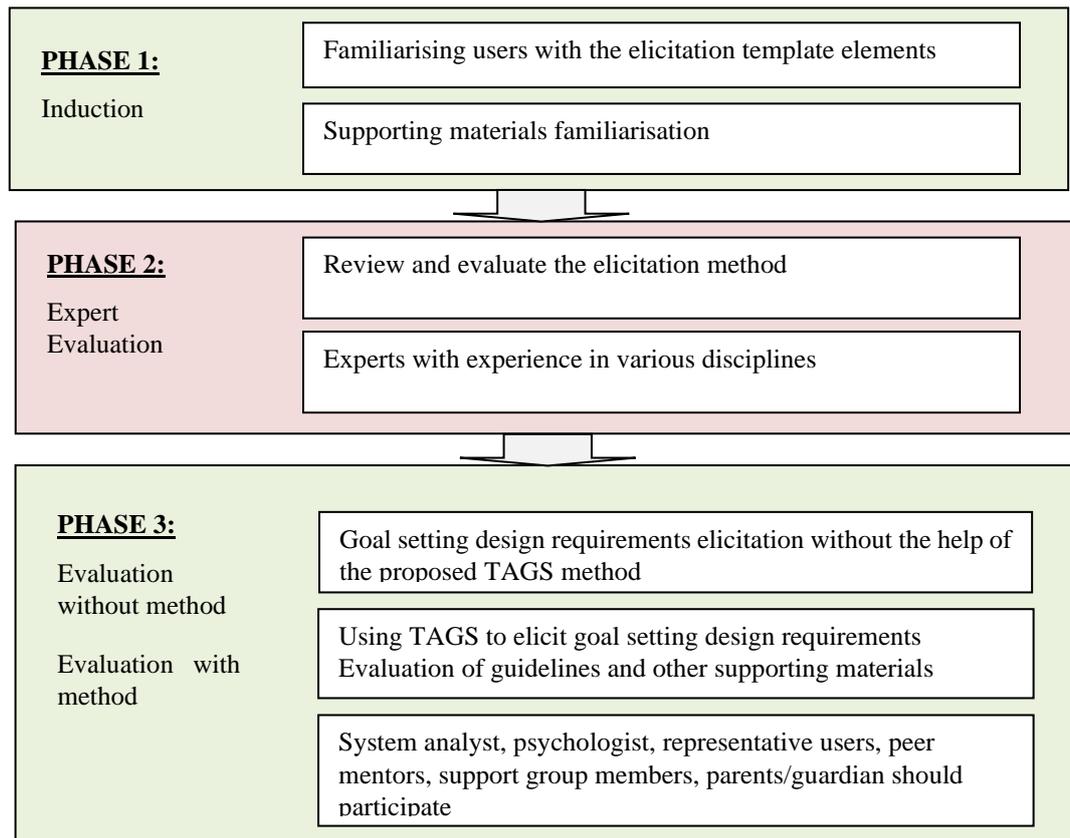


FIGURE 38: LAYOUT OF THE EVALUATION PHASES

#### 8.4.4 EVALUATION STUDY QUESTIONS

The goal of the evaluation study is to establish whether the TAGS method can help to satisfy the questions below.

##### **Experts Questions**

- What do you think about the relevance of the various template elements?
- To what extent do you think the template covered all goal setting elements?
- What challenges do you think users will come across using the method?
- What are your recommendations for enhancing the method and its supporting materials?
- To what extent do you think the template, guidelines, and other supporting documents will aid users in expressing their goal setting design requirements?

##### **Users' Questions**

- What do you think about the idea of expressing goal setting design requirements following the proposed method? Why?
- How do you think the proposed method helps you specify your goal setting design requirements?

- To what extent do TAGS supporting documents aid in the expression of the goal setting design requirements?
- What challenges did you come across when using the method? Why?
- How should communication work between the analyst and other stakeholders?
- What are your recommendations for enhancing the method and its supporting materials?

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#### 8.4.5 TAGS METHOD EVALUATION STUDY PROCESS

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The method's evaluation was conducted based on the following guidelines.

- A participant consent form was sent to the study participants before the date of the TAGS methods evaluation, as well as a study information sheet outlining the purpose of the study and what is expected from the participants during the study.
- The participants met in a seminar room, and all documents relating to the evaluation of the method were provided.
- For diversity purposes, participants from different backgrounds and disciplines were recruited.
- The study participants were inducted about the nature of the evaluation session, supporting documents, what was expected from them when completing the elicitation templates, and examples of how to complete the templates.
- The researcher acted as a 'participant as observer', in order to be able to participate in the discussion and, at the same time, provide the required guidance to study participants.
- The participants were divided into two groups, where each group had one system analyst, one psychologist, and the representative users in order to maximise time.
- Supporting materials were provided to the participants at the beginning of the session to familiarise and educate them about the study. The goal was not to influence the participants' thinking, but to educate and help them understand the topic under investigation and stimulate their thinking.
- The study consisted of three phases, as outlined in **Figure 38**.
- Phase two was conducted a week before phase three to reduce the workload associated with analysing study results and refining the TAGS method documents.
- At the start of the session, participants were instructed to read and familiarise themselves with the proposed case study and discuss it in their respective groups. The participants were given the opportunity to ask questions regarding the evaluation case study.
- The researcher observes participants during the evaluation session and notes down key points. This helped to evaluate the strengths and weaknesses of the TAGS method.
- In the end, participants were asked to partake in a group discussion to help gather their opinions on the method documents, including their completeness, usefulness, and efficiency.

#### 8.4.6 EVALUATION STUDY PARTICIPANTS' SELECTION

The TAGS method recommends the participation of a specific set of stakeholders who could play various roles in the elicitation process. Generally, the analysts and design team of a social network platform are expected to use the TAGS method. The primary stakeholder is the system analyst, who is expected to have good knowledge of collecting and analysing requirements, coming up with the functionalities for the new layer and providing good design practises for the designers to consider. Two other stakeholders actively involved are psychologists who have psychological background and knowledge in related areas, and the users who are expected to benefit from the new goal setting layer. The primary role of the system analyst is to assist the representative users during the elicitation process. Tables 45 and 46 present the details of the participants and experts who participated in the evaluation of the TAGS method. The study information sheet can be found in Appendix 4, part A.

The selection criteria for evaluation participants include (i) representative users who have experience and expertise in interacting with social network applications, and (ii) representative users who self-declare having problematic social network usage, are seeking help or are willing to control their problematic usage. The remaining participants were invited solely based on their expertise in the area and other areas related to the topic under investigation. As such, the evaluation study employed a convenient sampling approach.

TABLE 45: PHASE 2 EXPERT PARTICIPANTS

Participants	Research background & Expertise	Gender	Years of experience
P1	Social Informatics/behaviour change/human computer interaction	Male	10
P2	Social Informatics/gamification	Male	6
P3	Behaviour change/psychology	Male	5
P4	Software engineering/social informatics/behaviour change	Female	5
P5	Psychology	Male	17
P6	Software engineering	Male	8

TABLE 46: PHASE 3 PARTICIPANTS

Table 46: Participants	Academic background	Age	Gender	Role
Participants for exercise 1, i.e. without the method				
P1	Computing	30	Male	Representative user
P2	Computing	34	Male	Representative user
P3	Psychology	29	Female	Representative user & psychologist
P4	Computing	27	Male	System analyst
P5	Psychology	30	Male	Representative user
P6	Computing	26	Female	System analyst
P7	Psychology	30	Female	Representative user & psychologist

P8	Media and Communication	35	Male	Representative user
Participants for exercise 2, i.e. with the method				
P9	Computing	37	Male	Representative user
P10	Cyber Security and Human Computing Interaction	32	Female	Representative user
P11	Computing and Social Informatics	36	Female	System analyst
P12	Psychology	35	Female	Representative user & psychologist
P13	Computing	26	Male	Representative user
P14	Psychology	30	Male	Representative user & psychologist
P15	Computing	39	Male	System analyst

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#### 8.4.7 DATA GATHERING TECHNIQUES

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Qualitative data collection methods comprising interviews and focus groups will be adopted to help attain the evaluation study aim. These are discussed below.

**Focus Group:** After recruiting the representative users, they need to be invited to focus group sessions. Two focus group sessions will be conducted, with 15 multi-disciplinary participants taking part in the sessions. Eight participants will participate in the first session and seven participants in the second session. Before the sessions commence, the participants will be informed about the context of the evaluation and its supporting documents. The analyst and design team are expected to use the questions on the elicitation templates to guide and focus the attention of the participants on the goal setting elements. After the participants specify their goal setting design requirements, a group discussion will be conducted focusing on how they find the elicitation process, i.e. the templates and the supporting materials.

**Interviews:** These will be conducted after the experts review the method to gather their opinions on the templates and the supporting documents. The researcher is expected to follow a semi-structured interview style and seek to clarify statements made by the experts with follow-up questions. Before the interviews commence, the researcher describes the objectives of the interviews and takes care of all ethical processes. Permission will be taken from them before recording any conversation.

**Interview and Focus Group Analysis:** After the focus groups and interviews are conducted, the data collected will be analysed qualitatively by following some of the steps of the thematic analysis (Braun and Clarke 2006). The studies audio recordings will be transcribed verbatim or by other means that the analyst deems equally effective. The transcription process would help the thesis researcher become immersed in the interview and focus group data, which would be useful during the analysis. The researcher will then familiarise themselves with the transcribed data by reading or listening to snippets of the recordings and making notes where necessary. The

researcher will then code sentences that are relevant to the template elements and other documents of the TAGS method. The codes could reference things like the situation that triggers a particular usage, emotions and psychological states during the usage, and other elements not expected but may be vital to the behavioural change process. In the results section, the findings from the analysis will be presented.

## 8.5 METHOD EVALUATION: CASE STUDY

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The evaluation study used Facebook as a case study. Facebook is an online application that provides social media and social networking services to various people around the world. Facebook was developed to help people communicate and connect, as well as for relax. Facebook enables members to share information, i.e. messages, pictures, and videos, and create and share status updates with other friends who are also using the application. The application also provides features that enable people to comment on and like other people's posts. Some people's usage of Facebook can be regarded as problematic because this usage is traceable, tractable, and happens in real-time. The developers of Facebook or third-party developers would like to augment their digital media platform with an additional layer for goal setting. The goal of adding a new layer to the platform is to help those people who exhibit a problematic usage style manage their usage and to ensure that it is under control. The goal setting procedure could be done using the same Facebook application. Also, such a digital space can empower goal settings, for example, through monitoring usage, interactivity in real-time, encouraging transparency to users about what information was used to come up with the intervention and its content, and enforcement of deviation countermeasures.

The application development team would like to know whether they can design the goal-setting layer and what the design would look like in terms of the functionalities it should provide. In order to help understand this, they need to elicit typical requirements from users or representatives of the users. This research focuses on assisting the analyst and design team gather a range of goal setting design requirements that would help the regulation of problematic usage and enable the design of the new layer to provide facilities for setting and enforcing the goals. The TAGS method will help the analyst conduct user studies and establish the range of people and their requirements, as well as the functionalities of the new layer. During the evaluation session, participants will be given screenshots of various Facebook interfaces. The screenshots depict different features/interfaces of the application (see **Figure 39**).



FIGURE 39: SCREENSHOTS DEPICTING VARIOUS FACEBOOK FEATURES

## 8.6 EVALUATION STUDY: RESULTS

This section will discuss the findings of the evaluation study. The results will be discussed in line with the proposed objectives of the evaluation, i.e. first, the effectiveness of the method in assisting the elicitation process and second, the effectiveness of the method’s guidelines in aiding the process.

### 8.6.1 EXPERT EVALUATION RESULTS

In general, the experts found the proposed TAGS method and the guidelines to be comprehensive, relevant and useful for the elicitation of goal setting design requirements. The experts concluded that the elicitation templates provide detailed information on goal setting and its related elements, which would aid the elicitation of goal setting design requirements for regulating problematic social network usage. The experts also agreed that the examples provided in the Facebook version of the templates would be beneficial as they would enable a better understanding of user expectations and facilitate dialogue between the system analyst and representative users during the elicitation process.

Regarding content and template layout, some of the experts suggested adding more content to the template to ease the selection of various goal setting preferences. For example, it was recommended to add a **blended approach** to monitoring and then to ask the users to specify which monitoring options they would like to have at the same time, “so that users would not think

*that they are restricted to only selecting one of the options provided.*” The researcher argued that this was explained in the guidelines, but the experts made the case that providing this option on the template would ensure that users could directly select it if needed. Also, **parental monitoring** was suggested to be added to the template.

Some elements have been suggested to be added to the categories of negative life experiences, such as **fear of missing out, the guilt of not finishing work on time,** and **public commenting,** while others, such as **inadequacy** and **poor diet quality,** are recommended to be removed. The experts found the list of stakeholders, their definition and level of involvement in the elicitation, design and development of the new layer to be useful and informative.

Regarding the language used in the templates and the guidelines, the experts agreed that the language would be generally understandable by users. However, some experts recommend simplifying the language to enhance user understanding. For example, using less technical words, e.g. replacing features with ‘elements’.

The experts reacted positively regarding the good design practises and agreed that the recommendations provided useful information which could lay the foundation for different ways in which the new layer design could be enhanced, *"I like such implementation; this is what designers need."* The reminding documents were mostly agreed upon by the experts. Regarding the guidelines, amendments suggested were reflected in the wording and the length. Some of the experts agreed on the length. At the same time, others recommended shortening it for easy elicitation and to retain user interest *"the text needs to be shortened because there is too much information."* Also, they recommended merging some parts of the guidelines *"I think you need to simplify the process by perhaps merging some phases, for example, creating scenarios and eliciting problematic online usage patterns"*. Finally, some of the experts pointed out that some of information provided might not be necessarily needed at this stage of the elicitation process, e.g. checking the specificity of the goals and prioritising the goals. This was acknowledged, and subsequently, the guidelines were amended to reflect their feedback.

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## 8.6.2 RESULTS WITHOUT USING TAGS METHOD

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This phase was conducted without the support of the TAGS method and its associated documents. The task of the study participants included providing their goal setting design requirements for the new goal setting layer. The findings are shown in **Table 47**.

TABLE 47: SAMPLE REPOSSES OF THE FIRST FOCUS GROUP SESSION

Goal setting elements	Participants’ preferences	Researcher’s observation
Source of goals	Self-set, guided and group-set goals.	Participants managed to identify three out of the five sources of goals, but they lacked

		understanding of the proximity of the goals.
Types of goals and examples of goals	Time-based goals: <ul style="list-style-type: none"> <li>• I want to reduce the number of hours I spend on Facebook.</li> <li>• I want to reduce the amount of time I spend commenting on my friends' posts.</li> </ul>	Specified are generic long-term goals and time-related goals (participants did not think or mention other types of goals). This was discussed in the group discussion and participants pointed out that they were not familiar with the other types of goals.
Monitoring	Self-monitoring Peer-monitoring	Participants provided little elaboration on their selected monitoring options.
Comparison	None of the participants mentioned the performance comparison option.	None.
Feedback	I want feedback on my usage, e.g. how long I spend on Facebook.  I want feedback that would motivate me to reduce my usage.	Most of the participants only mentioned that they would like feedback on their goals, but failed to elaborate on a specific aspect of the feedback, e.g. feedback during or after the usage.
Deviation facilitators	Peer pressure, lack of motivation Lack of structure for setting goals. Inaccessibility to resources needed to achieve goals, ambiguous goals, and social influence.	Participants were able to identify some factors that might facilitate deviation from their behavioural goals.
Deviation countermeasures	Automated pop-up messages. Re-assess the subjects' commitments and motivation. Monitor and hold users responsible when a deviation occurs. Proper explanation of goal-related tasks.	Some participants failed to specify any deviation countermeasures and those who did, failed to elaborate on their preferred countermeasures.

The interactions between the participants and the session facilitator during the evaluation session were documented by taking notes, pictures, and collecting the materials produced. Participants also answered questions that helped to generate feedback and comments on various aspects of the method. The results of the analysis showed some concerns with regard to the goals expressed in this phase. These are identified below:

- Most participants did not reflect on all the goal setting elements, and this seems to be attributed to a lack of sufficient knowledge about the concept. Some elements were partly considered while others were not, such as performance comparisons, i.e. self-comparisons, and social comparisons. As a result, limited information was provided regarding the various goal setting elements. Also, participants seemed to struggle to specify behavioural goals and those who did specified generic time-related goals. In terms of monitoring, most participants preferred self-monitoring. Peer monitoring was the

second preferred option, and this was attributed to their familiarity with these elements compared to the other monitoring options. Also, the sources of goals specified by some participants did not match their preferred monitoring options, e.g. 'self-set goals' and 'peer monitoring'.

- During the session, the researcher noticed that participants were struggling to understand the various aspects of goal setting and how they could relate to the given scenarios, and the participants asked several questions to help clarify some elements. For example, some participants specified self-set as a source of goals without considering the source of the problematic behaviour. In the scenario where, self-set goals were selected, the problematic usage happened within a social context. In such circumstances, the goals are expected to be group set or participatory set, agreed and committed to by all, with help from an expert. Without thinking about the origin of problematic usage, self-set goals might not lead to effective behavioural change.
- During the session, the researcher noted that participants took a considerable amount of time to express their preferences. Participants were unable to decide on the goal setting elements quickly, e.g. they spent a long time specifying the facilitators that might lead to a deviation from the behavioural goals. As a result, they were still working on specifying some of the elements when it was time to move to the next task.
- All the participants failed to elaborate on the identified goal setting elements. For example, concerning feedback content, participants specified various preferences but did not elaborate on how these should be implemented. Also, concerning peer monitoring, additional requirements were not specified by most participants, and those who did only mentioned that they would like to have peers who have the same kinds of problematic behaviour in the group.
- It was observed that most of the participants were mainly familiar with monitoring goal progress and feedback performance. They have little understanding of the deviation countermeasure techniques, and this was mentioned during the group discussion.
- The study participants did not identify the negative consequences of problematic usage before specifying their goals. Recognising the negative effects first could help when deciding the suitability of the various sources of the goals, monitoring and comparison techniques.
- All the participants mentioned that they found the process without following a particular method to be challenging "*it was like taking an exam.*" As a result, they were writing general behavioural requirements because there was no structure and examples to follow. When asked whether the process would be more straightforward if they were provided with materials to guide and support them, they all replied in the affirmative.

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### 8.6.3 RESULTS USING TAGS METHOD

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This phase was conducted to evaluate the use of the TAGS method in eliciting goal setting design requirements. Seven participants and the researcher, who played the role of ‘participant as observer’ participated in the study. The participants were divided into two groups to maximise the participation of all users, which could increase the chances of gathering various viewpoints in relation to the goal setting elements. Other reasons included preventing timing issues, and loss of interest and focus from participants. In this phase, participants were asked primarily to specify their requirements with the aid of the method. It was observed that the participants successfully stated their preferred requirements concerning the source of the goal, goal types, monitoring and comparison, feedback, and deviation countermeasures.

- **Participants**

In this stage, the last seven participants listed in **Table 46** partake in the evaluation, with various levels of involvement in the method activities as outlined in the method workflow diagram, see **Figure 36**. For activity one, the system analyst is the sole participant. In the second activity, the system analyst and representative users were the main participants. For the following activities, in addition to the mentioned stakeholders, representatives of psychologists, peer mentors, support group members, and parents/guardians were involved at some point in the process. The open-call technique was employed for participant recruitment. The study was announced by sending email invitations to the mailing lists of student and staff research groups with a brief explanation of the study. For the representative users, inclusion will be mainly based on self-declaration and willingness to seek help, ensuring that those who acknowledge their problem and want to be helped are included in the study. For diversity purposes, participants from different backgrounds and disciplines were recruited.

- **Preparation**

The study ethics documentation, including study information sheets and participant agreement forms, were sent to the participants before the session commenced. Also, sent were the supporting documents, including the five goal setting reference checklists, the eight families of negative life experiences of problematic digital media usage, and the TAGS elicitation template. The aim was to familiarise and educate participants about the study and its associated materials, and not to influence their thinking. Participants were encouraged to contact the researcher for further clarification where necessary. During the session, all the required documentation was given to the participants, and each one was fully explained. The method workflow diagram was provided to the system analyst, where the stakeholders and required documents are defined for each activity. The TAGS templates were pilot tested in two different sessions, with six participants before the

evaluation session. The purpose was to assess whether people would be able to express their goal setting design requirements following the templates.

This session lasted five hours and thirty minutes in total, with one and a quarter hour allotted for scenario creation, three hours and forty-five minutes for goal elicitation, and thirty minutes for group discussion. In the next subsections, the findings of the evaluation are discussed based on the steps of the TAGS method.

### 8.6.3.1 SCENARIOS CREATION STEP

Before the session core activity, the system analyst and the representative users were tasked with creating scenarios depicting various problematic social network usages using the guidelines in **Doc1**. The scenarios were explicitly intended to assist the system analyst and the users to focus on specific problematic usages, which would help the elicitation of the goals. The scenario creation task satisfied step two of the proposed method. The system analyst works with the users to help ensure that the scenarios created depict their problematic user style closely. The purpose of the scenario creation phase was to aid the elicitation because they are written in clear and concise language to describe how the usage is problematic and the resulting negative life experiences. The participants were allowed a 10 minute break before the next activity commenced. The created scenarios can be found in **Appendix 4, part I**. Tables **48, 49, 50,** and **51** present users' sample responses to Templates ID1, ID2 and ID3.

TABLE 48: SAMPLE RESPONSES FOR SOCIAL NETWORKS USAGE STATEMENT

Table 48: <b>Template ID 1</b>	
Features of the social networks	<b>Family of elements causing the problematic behaviour</b>
	Relationships, sharing, conversations, Groups, presence, identity
	<b>Actual elements people struggled with</b>
	Status, temporarily available content, group sharing, posting, notifications, endless feeds, relationship status, smileys, followers, commenting, private messaging, synchronous dialogue, the wall, length of messages
Usage time and time of use	My usage is alarming sometimes, especially on weekends. I think my usage is affecting my work. I am wasting my time, and I should do something productive. I feel like I spend a lot of time on social networks. I feel like I spend a huge amount of time on Facebook in the evening. I feel I spend a long time using social networks daily, e.g. 12 hours a day.
Threshold of a risky usage	When I stop concentrating and keep delaying essential tasks. I think when I check every hour; the usage becomes risky and unhealthy. After that, I posted profile pictures five times in two days. After I spent two hours or more daily. Time spend, for example, each time I make a public post or send a private message, I continually check my contacts' feedback and their replies.
Offline activities	Going out with friends, playing sports, reading books. I go shopping, during which I avoid opening my phone. I play games with my friends, such as cards. Go out for a walk or do indoor exercise.

TABLE 49: SAMPLE RESPONSES FOR CAUSES OF PROBLEMATIC USAGE

<b>Template ID 1</b>	
<b>Causes of the problem usage</b>	<b>Representative user elaboration</b>
Emotions	Improving my mood to help me forget tasks that I am struggling with. Enhancing mood and for emotional support. I can relate to others, which will help me understand what they are doing. Improve my mood by keeping me entertained when I am bored. When I am stressed about something, I chat with my friends, and this makes me feel better.
Peer pressure	Sometimes, my chat groups want me to go online at specific times. When others in my social network chat groups expect an answer from me as soon as possible. When others see you online, they immediately expect or want a reply. My friends want me to be online most of the time.
Making influence	Some of my social network friends want me to post photos and make a status update about the events I attend. My friends want me to like their posts on Facebook. People in my close contacts expect me to share any posts they make. My contacts want me to be online all the time and reply to messages immediately.
Others	How many likes have I got on my profile picture? What is trending on social networks? Escapism. To know what others are doing online.

TABLE 50: IDENTIFIED NEGATIVE LIFE EXPERIENCES OF USERS PROBLEMATIC USAGE

<b>Template ID 2</b>	
<b>Negative life experiences</b>	<b>When does it happen</b>
Restlessness	When I feel, I want to open my Facebook again and again to see any new notifications on my post.
Neglect of personal life	I usually skip my meals when I am on Facebook.
Sleep deprivation	When I use Facebook until after 11 pm, then I feel I cannot sleep. Social network usage is restricting me from going to bed early because I stay up late, and when I get up early for work, my brain is barely functioning. I will mean to go to bed, but I will be on social networks, and before I look up, it is like 1 in the morning already.
Depression	When I used Facebook a lot on one day.
Irritability	I got irritated when I lost my time using Facebook.
Reduce self-confidence	When I fail to complete my work, the next day I feel a lot less confident about the work. When I post something, other people bully me because of my post. When I made a profile post, very few people commented on it.
Marital discord	When married, couples do not spend time together because of social networking usage.
Spending less quality time with family	Using social networks when the family is having lunch or other family gatherings.

	When I am home, I spend most of my time posting and chatting with my friends on social networks, and I do not spend much time with my family.
Reduced amount of face-to-face social communication	I did not get much time to talk to my family; instead, I stayed in my room using my phone. Hesitate to talk to people and always try to talk through messages.
Poor time management	Using social networks when I am supposed to be working on my research. My social networking usage affects the time I spend on my work, and sometimes I cannot even do my work on time. I cannot finish my work on time because of social media usage. Distraction from my present task. Social networks take a lot of my time when I should be doing other things, like studying or going to bed on time. I could never set a usage time and stick to it; it never happened.
Poor diet quality	I always eat a lot while using social networks. Because of the time I spend on social networks, I started eating fast food, and I cannot follow any diet since I have no time to prepare healthy food. I am so immersed in online behaviour that I forget about my dietary needs.
Partnership and relationship problems	I ignore my partner most of the time due to my social networks.
Cyber-stalking	When my relatives or friends know my social networking accounts login, they start watching what I am posting, such as pictures or private messages, and then they use this information to judge me in real-life.
Stress & anxiety	When the internet disconnects and I cannot connect and use my social network applications, I feel stressed and anxious. I also struggle with anxiety and temporary stress when I hear a negative comment on social networks.
Affect parent-child relationship	My kids and I spend a long time using social networks. I feel I do not have a strong relationship with my children.
Increased escapism	When I have an assignment that I am struggling with, I use social networks to escape from the work in real-life. When I am struggling with my research, and I cannot think of how to deal with the problem, I immediately go to the social networks to escape from my work.
Reduce skills of face-to-face communication	I realised that I could express my feelings better on social networks than in real-life.
Reduced progression	My study progress is too slow because most of my time is spent using social networks, and I keep checking my social media applications every ten minutes.
Self-harm	I harm myself, and I cannot eat well, which affects my level of focus on my work. I feel like scratching my head, or I scratch my head when I post something and wait for comments or likes.
Harm from others	When others bully or judge me in real-life because of what I post on social networks.

TABLE 51: USERS SAMPLE CURRENT INTERVENTION MEASURES

<b>Template ID 3</b>	
Current interventions	<p>I am putting screen time on the phone, e.g. for two hours.</p> <p>I tried to put my phone away when I am working on a specific task, but sometimes this does not work.</p> <p>I switched off my phone and tried very hard to concentrate on my work.</p> <p>I put my phone away from me when I am about to go to sleep at night.</p> <p>I switch my data connection off, but after thirty minutes, I turn it back on and check whether I have an important message from my family or close friends.</p> <p>I have tried to put my phone in a flight mood. I also downloaded software to block social networks if I spend more than three hours using my applications (the flight mode does not work for me, and I also end up uninstalling the software I downloaded).</p>

### 8.6.3.2 RESULTS OF ELICITING BEHAVIOURAL GOALS STEP

In this activity, behavioural goals are elicited using template ID 4 and its supporting documents. In this activity, stakeholders include the system analyst, representative users, psychologist, and, when required, (support group members, parents/guardians, and peer mentor). Behavioural goal elicitation is a crucial step in the method. The process commenced by reading the scenarios created in the previous step. In order to support the process, the participants were provided with document **Doc3** which includes, (i) the source of the behavioural goals, (ii) types of goals, and (iii) examples of goals, (see **Appendix 4, part J**).

In this activity, the researcher who played the role of ‘participant as an observer’ advised the groups to assign one participant in each group to the role of system analyst. The system analyst was responsible for leading the session discussion, directing and supporting users to specify their behavioural goals. As stated already, the goal of the evaluation study includes evaluating the **TAGS** method to elicit goal setting design requirements. Therefore, the researcher was mainly responsible for checking how the participants expressed their goals, instead of which goals they specified. Below, the findings of this activity are presented. The types of goals, identified goal proximity and the behavioural goals expressed by the participants in each group are presented in **Table 52**.

- The study participants who played the role of the representative users agreed that the template and the examples enable them to think of their own goals and specified goals that could help regulate their problematic social network usage.
- The researcher observed that the participatory design technique utilised by the TAGS method aids the usefulness of the elicitation method. Having the representative users involved directly enhanced the communication between the system analyst and the users, which helped ensure that they adequately specified their requirements.

- The system analyst mentioned that, since the elicitation is concerned with finding the commonalities and templates for the behavioural goals, measuring user commitment towards the set goals should not be considered at this stage. Instead, it should be considered in the customisation of the goal setting layer to the personal needs of users or user groups. This is because user behavioural needs can change over time as well as their interest level in the goal and cannot be handled by traditional commitments.
- The participants agreed with all the elements relating to the setting of the behavioural goals. They emphasised the order of the elements that guide them through the process, for example, specifying the types of goals, defining the proximity and providing examples of their behavioural goals.
- The system analyst participant was very proactive during the session and ensured that the guidelines were followed during the elicitation process. The user participants found this useful in helping them understand the situation in which each source of goal could lead to effective behavioural change. For example, participants who specified group-set as a source of goals and stated that they did not prefer social comparison were advised to reconsider their choice for the source of goals. The system analyst emphasised how the guidelines clearly state the aspects of the design that need to be considered.

TABLE 52: SAMPLE RESPONSES FOR ELICITING BEHAVIOURAL GOALS ACTIVITY

Template ID 4				
Goal setting element	Types of goals	Source of goals	Goal proximity	Examples of goals
<b>Behavioural goals</b>	Reduction-based goals	Self-set goals	Distal	I want to reduce the time I spend chatting with my friends on Facebook. I want to reduce the use of social networks this month.
	Time-based goals	Self-set	Proximal goals	I want to set the time I use Instagram to two hours daily. To reduce the time, I spend on Facebook by 12 hours a week.
	Frequency-based goals	Guided goals	Distal goals Proximal goals	I want to limit the frequency of checking for WhatsApp notifications. Reduce the frequency of using Facebook during the time I am supposed to be working on my research.
	Avoidance-based goals	Group-set goals	Distal goals Proximal goals	I want to avoid using the phone at a specific time when eating, studying or socialising. I want to be reminded to stop using Facebook during meal times and family gatherings. I want to avoid using social networks so that when on a family outing, all the applications I use will be blocked. As a group with my friends, we want to use Facebook for 1 hour in the evening during workdays. My friends and I want to go to the gym together every day for one hour, during which we have no access to social networks. I want to hang out with my friends daily without using social networks.
	Reminder-based goals	Assigned goals	Proximal goals	As a group, we want to be assigned reminder goals so that after one hour on Facebook, we will be sent a reminder of our usage.

### 8.6.3.3 RESULTS OF ELICITING GOAL PROGRESS MEASUREMENTS STEP

This is the fourth activity in the elicitation process. The participants in this activity mainly include the system analyst, psychologist, and representative users. Also, support group members and peer mentor when required. The primary goal of this activity was to elicit requirements for the behavioural goal progress measurements. The first stage of the elicitation concerned the various modalities for monitoring goal progress and comparison preferences, and in the second stage, the preferences in relation to performance feedback were elicited. In addition to Template **ID 5**, the system analyst was advised to use the output of the last activity, i.e. elicit behavioural goals which were expressed in Template **ID 4**. It is essential to consider users' preferred sources of goals when deciding the appropriateness of the selected monitoring modality. The reason is, if a group-set is selected as a source of goals, then self-monitoring in relation to the goal progress might not be useful. When this is the case, peer monitoring should be considered. Study participants were asked to use the supporting material provided in **Doc4**. In this document, goal setting reference checklists for monitoring, comparison, and performance feedback are provided. The aim was to help inform participants about the various aspects to consider, which would help stimulate thinking.

The first part of the activity involves eliciting monitoring modalities and comparison of performance towards the goals. Participants were asked to 'state their preferences around monitoring and comparison'. Also, participants were asked to provide examples of how their preferences should be implemented. The second stage of this activity involves eliciting requirements in relation to feedback content, feedback framing, feedback timing, and feedback presentation. Concerning feedback content, participants were asked to state 'when' and 'how' the feedback should be implemented. Regarding feedback framing, the following factors need to be considered: when to implement, feedback message example, subject of the feedback, source of the feedback, and features feedback should be associated. Finally, for feedback timing and feedback presentation, requirements in relation to context, subject of feedback, features the feedback is about, frequency of delivery, screen position, the medium of presentation, feedback screen time and delivery method should be considered.

The findings of this activity provided a template representing participants' monitoring, comparison, and feedback requirements (see **Tables 53 and 54**). The bullet points below present an overview of the findings:

- The participants agreed that classifying the feedback content, feedback framing, feedback timing and feedback presentation on different templates was very useful as it provided a direction for them to follow. This enabled them to specify their requirements for all aspects of the feedback and prevented them from overlooking or ignoring some elements.

Also, some of the participants stated that the format helped them avoid expressing general feedback requirements.

- The elicitation of feedback requirements, such as feedback content, was straight forward for the participants. They specified their preferences about the various aspects of the feedback and provided some additional information for each of the selected feedback content. The system analyst and the participants' stakeholders appreciated some of the examples provided on the 'when' and 'how' to implement feedback content and agreed that these would be vital in the successful implementation of their preferred feedback content. During the study, the researcher ensured that appropriate explanations were provided where needed, and this helped some participants to complete this activity.
- Some of the participants stressed that much writing is involved in completing the templates associated with performance feedback; this can be a challenging task for them and could lead to loss of interest. Therefore, it was recommended that the system analyst should record the participants' feedback requirements; the recordings can then be transcribed and analysed. The system analyst completes the feedback elicitation templates using this information. Alternatively, the participants mentioned that others from the design team should participate in the session and assist the system analyst in writing down the requirements as they provide them.
- At the beginning of the activity, the researcher asked the participants to start with Template **ID 5**, i.e. the feedback content. In the end, some of the participants point out that it would be helpful for them to be given the option to start with their preferred feedback template and not be restricted to following a particular order. The researcher clarified that while this would lead to the same outcome, the reason was to ensure that the requirements were elicited in an orderly fashion to help prevent confusion and missing out on some templates.
- The researcher observed that participants discussed and noted that some of them were worried that the specified feedback requirements might not be relevant to them after some time, e.g. when they are in control of their social network usage. When this is the case, the requirements specified may not be applicable. The researcher made it clear that the system analyst is expected to re-evaluate the requirements periodically during the behavioural change process and make the necessary adjustments.

TABLE 53: REPRESENTATIVE USERS SAMPLE MONITORING AND COMPARISON PREFERNECES

Table 53: Template ID 5		
Goal setting elements	Specified preferences	Examples/Situation in which to implement
<b>Monitoring</b>	Automated monitoring	I want the new technology to monitor my progress towards my goal and lock the social network application after pass my usage goal by one hour. I want the software to monitor and send me a warning when I am supposed to be working on other tasks. I want automated monitoring because sometimes I may not be able to perform the monitoring.
	Self-monitoring	I want self-monitoring of my usage because I do not want other people to see my usage at the beginning. I want to self-monitor my behaviour in relation to time and how much I use social network applications.
	Peer-monitoring	I like to be compared with my friends in relation to the number of likes and comments made on Facebook. I prefer to be monitored by my close group of friends concerning the number of profile updates and videos and images shared on social networks.
<b>Comparison</b>	Self-comparison	I want my goal performance to be compared with my past goal performance. I prefer self-comparison in relation to the time I spend using Facebook Messenger. I want self-comparison when I set my own goals. When I set my own goals, I compare my performance to the previous day.
	Social comparison	I prefer social comparison when it comes to my usage of the live video feature on social networks, but would only want to see the average usage of everyone compared to my usage. I want to be compared with people who want to reduce their use of the status update feature. I want my usage of the comment and like features to be compared with people I am not familiar with.

TABLE 54: REPRESENTATIVE USERS SAMPLE FEEDBACK PREFERENCES

Templates ID 5.1, 5.2, 5.3 & 5.4
<b>Feedback content: When it should happen and how it should happen:</b>
When I am not doing well towards my goals, provide me with my performance information every day. I want to receive reminders about my goal progress. When I am less motivated to continue pursuing my goals. I want performance receive and motivational feedback. So they tell me what I did, and then they motivate me to continue with my goal. I would like educational feedback to help me learn about the consequences of my actions and not achieving my goals. When I am losing interest in my goal, I want to be supported through feedback on how I can meet or work towards achieving my goal.
<b>Feedback framing: When to apply, messages, subject of feedback, source of feedback and features:</b>
I want to get positive messages about my goal performance.

<p>I do not like harsh messages, but the feedback should express disappointment. That would be more effective for me. For example, if I was doing really well the past couple of weeks and then had a terrible week, then the feedback should say "it is a shame you did not achieve your goals. How can you improve next week?"</p> <p>I would like the feedback to be friendly.</p> <p>If the feedback message is framed aggressively, then I will feel bad and guilty about my behaviour.</p> <p>I would like to get critical messages, but also something that encourages me to achieve my goal.</p> <p>I want neutral messages. I do not like them to be fake, and I want them to be real and bold. I do not want it to be negative and shout at me.</p> <p>I want the feedback to be a bit negative when the system provides it.</p> <p>I want the feedback to be about my time interacting with social networks.</p> <p>I want the feedback to be about my usage time.</p>
<p><b>Feedback timing: Context, feedback subject, feedback features, frequency of delivery, screen position:</b></p>
<p>I want feedback after the behaviour so that I can reflect on my activities and usage time.</p> <p>The feedback message should not appear over and over again, as this can be distracting.</p> <p>I think the behaviour would be useful for me because it would give me an incentive to perform better.</p> <p>A daily report and at the end of the week you get the results of the whole week.</p>
<p><b>Feedback presentation: Context, frequency of delivery, the medium of presentation, feedback screen time</b></p>
<p>I want to see textual feedback like saying you achieved a specific goal or progressing well towards your goal.</p> <p>Graphical feedback because graphs and charts are easier to read and understand.</p> <p>I think textual feedback would be good in terms of praising my progress.</p> <p>Visual feedback for me I would like things like pie-charts and graphs.</p> <p>Probably get a text or for example, like the percentage thing, that could be a visual and then an explanation underneath, so it can be like a little bit of both text and graphic, so you can see it and be able to read it if you want to know more about it.</p> <p>Graphical, so then I know where my usage peaks and falls again, and I know that sometimes I can have busy days and sometimes I do not. Then I can figure out why it peaks.</p>

#### 8.6.3.4 RESULTS OF ELICITING DEVIATION FACILITATORS AND COUNTERMEASURES STEP

This activity was the last in the evaluation session. In the first part, the method recommended representative users as the main stakeholders. There will be an opportunity for the system analyst to support them when required. The first objective of the activity was to elicit the factors that could cause users to deviate from their set goal. The deviation facilitators are grouped into three groups: the first group relates to the setting of the goals, the second relates to the execution of the goals, and the third group represents other facilitators. The researcher ensures that the three groups are clearly explained to the participant stakeholders. The representative users were asked to select from each group of facilitators elements that could lead to a deviation or potential goal deviation. The system analyst supervised the process and helped clarify any misunderstandings that the users might have. Also, during the activity, it was observed that some participants were discussing, but the final decision was made individually.

- In the second part, a dialogue between the representative users and the system analyst is recommended. The primary aim of this part was to elicit countermeasures that would help prevent deviations or potential deviations from the set goals. The countermeasures are grouped into three groups: the first group concerns non-technical countermeasures, which relate to the setting of goals. The second group pertains to the countermeasures that can be technically implemented, i.e. the ones about monitoring goal performance and those about feedback-based on goal performance. The third group refers to other countermeasure strategies. For each selected countermeasure, the users were required to provide details about the context, how to implement it and constraints that might affect its successful implementation. The participants were provided with a supporting document, **Doc6**, where a list of countermeasures and a short description of each were provided. The participants were asked to select the countermeasures that may have worked for them. A discussion was held between the system analyst and the users before template **ID 6.1** was completed. Findings from this activity are presented in **Table 55**. The bullet points below summarise the findings.
- Both the system analyst and the user participants agreed that the countermeasure techniques and the description were clear and very useful. It helped them to understand each countermeasure and assess what applied to them quickly. Some of the participants stated that the countermeasures presented in **Doc6** help raise their awareness of the various potential techniques, which can help them focus on specific techniques rather than general methods that would not help prevent any deviation.
- The participants agreed that providing details in terms of context, how to implement selected countermeasures and their constraints gave them a direction and focused on what is required. Also, the examples provided on the templates concerning the context, implementation, and constraints *“were quite helpful and helped me think about my responses”*. It was observed that the users spent time thinking about their responses regarding the context, implementation, and constraints. When asked why this was the case, *“it is easy to understand what is required in the different sessions but elaborating on the various parts can be time-consuming”*. Also, they emphasised that the re-evaluation of the problematic usage and re-expressing the requirements will take less time as they become familiar with the various aspects of the countermeasures template.
- The system analyst emphasised the usefulness of the guidelines relating to countermeasure techniques. This is because it gives them direction on the various aspects to consider when the users express their preferences.

TABLE 55: SAMPLE DEVIATION FACILITATOR AND COUNTERMEASURE REQUIREMENTS

<b>Table 55: Templates ID 6 &amp; 6.1</b>	
<b>Goal setting elements</b>	<b>Representative users' responses</b>
<b>Deviation facilitators</b>	Lack of commitment to the goals, social influence or peer pressure on the subject pursuing the goals, lack of performance feedback, lack of understanding of barriers to goal attainment, monitoring goal progress, comparing goal performance, environmental influence, frequency of executing the set goals, lack of a structured method for goal setting, inaccessibility to resources to aid goals.
<b>Deviation countermeasures</b>	Assess commitment, review goals, set a specific goal, self-monitoring, reminders of the set goals, self-comparison, automated monitoring, feedback on real-time goal performance, providing summary feedback in relation to goal performance, negative reinforcement, having a verbal commitment to the goals, discussing barriers to the goal and goal-related tasks, peer-monitoring.
	<b>Context the countermeasures should be applied</b>
	After setting the goals, an option should be provided asking people to state their commitment level to the goals. To improve goal progress, when I set my goals with my close contacts, everyone involved needs to state their commitment to the goals. The system analysts can help me set specific goals at the start because my problematic usage is high. When I set my own goals and at the start of the change process. When I am attending lectures at university. Self-monitoring because I will be able to analyse where I am now with my usage and how much I have improved.
	<b>Application of the countermeasures</b>
	Restriction of access to the social network application I am using. I want the system to group and compare me with people from my same age group. The system should be able to detect my location, and if I decide to log on to my social network application, I should be reminded of my goal. The system should provide a list of goal performances and boxes to tick what applies to me. I should be prompted twice daily.
	<b>Constraints of applying the countermeasures</b>
	Lack of motivation, exclusion from the group, loss of group identity. If I use social networks for work purposes, then important work can be delayed. Lowering self-esteem when other goal performances are better than mine. Loss of interest and forgetting to perform the monitoring.
<b>Countermeasures Side effects</b>	<b>The side effects due to countermeasures implementation</b>
	Creating problematic alternate usage, peer pressure, visibility of comparison information, frequency of delivering performance information, lack of group commitment, lack of motivation, lower self-esteem, acceptance of countermeasure techniques, and distraction from present tasks.

8.7 RECOMMENDATIONS AND AMENDMENTS MADE

When the design team of a social network application, e.g. if Facebook, decides to add a goal setting layer to their platform, they need to know what functionalities the new layer should have to aid effective behavioural change. In order to come up with a sample of such functionalities, the findings from the users' evaluation of the TAGS method were utilised. In the method evaluation, the users specified their goal setting design requirements using the templates provided in **Chapter 7**. In **Table 56**, a summary of the functionalities for some of the requirements is presented.

TABLE 56: SAMPLE FUNCTIONALITY FOR NEW GOAL SETTING LAYER

<b>Additional functionality for new goal setting layer after the evaluation</b>
<b>Motivational related functionalities</b>
If some users select group set or directed as a source of goals, the design of the new layer should consider functionality for a peer support group.
If some users want to set goals collaboratively, the design of the new layer should consider the functionality that would enable communication, negotiation, and argumentation.
If users select social comparison, the design should consider functionality where peers can report a friend for being online for continuous hours or all the time.
If feedback content is motivational, consider functionality for gamification techniques such as rewarding progress with points and badges to help maintain or enhance goal performance.
If evaluation feedback is selected, the design should consider functionality for calculating the usage norm of a group for appropriate performance evaluation.
If the majority of users select positive feedback framing, the design should consider functionality to ensure that the feedback does not lead to negative emotions. Also, functions for detecting, filtering and flagging any negative comments should be considered when goals are set collaboratively.
<b>Profiling related functionalities</b>
Suppose the majority of users select social comparison. In that case, the design should consider tools that would assess and cluster users based on factors such as self-esteem, skill levels, and the degree of problematic usage and stage of change.
If some users select suggestion feedback, the design should consider functionality to categorise users and deliver appropriate information based on, e.g. their treatment level.
<b>Privacy/visibility related functionalities</b>
For social comparison, the design should consider functionality for anonymising user identity in the comparison information, e.g. comparing the averages of all usages against an individual user for those with privacy concerns, and this may help reduce competition that may result from the availability of the comparison information.
If users select peer monitoring, the design should consider functionality for setting membership in the group and access control rights.
<b>Actions related functionalities</b>
When some users select self-monitoring, it implies that the system should provide the functionality for this monitoring option. The design should consider functionality for an online diary for people to record their behaviour and monitor any behavioural change progress.
Also, for self-monitoring, the design should consider a reminder functionality to help remind and prompt people to perform the monitoring activity and consider timely reminders by taking into consideration users' present tasks to avoid obstruction or distraction from their tasks.
<b>Usage management related functionalities</b>
If the majority of users select time-based goals to help reduce their usage time, consider functionality for time management, such as restricting access to social networking features that facilitate excessive usage.
Also, when some users select a time-based goal, the design should consider functions that allow users to set usage limits for the feature causing the problem usage.

If the majority of users select frequency goals to help regulate the rate of checking social networks, the design should consider functionality for locking access to such applications.
If users select an abstinence goal, the design should consider functionality for banding usage of the features causing the problem behaviour after a specific usage time or between specific times, e.g. during work times.
When the posting feature causes problematic usage, and some users select abstinence-based goals, the system design could provide tools which regulate interaction with this feature.
When the comment feature is the source of the problematic usage, and some users prefer avoidance-based goals, the system design could consider implementing functionality that blocks usage of the commenting feature for specific times.
<b>Location and context awareness functionalities</b>
If some users want to prevent deviations while at a particular location, the design should consider the context of use and include GPS monitoring and sensors to help detect the location and send reminders about the usage when a deviation or potential deviation is detected.
When some users select automated monitoring, the design should consider functionality for capturing users' intentions and the context of the usage.

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### 8.7.1 COMMUNICATION RELATED RECOMMENDATION

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While the discussion at the end of the session and responses to the evaluation questions showed that, overall, the participants agreed that the method was understandable, useful, efficient, and complete, based on the participants' recommendation and the researcher's observation, the communication should be reconsidered to enhance the outcome of the elicitation process.

Regarding the number of sessions, it was suggested that the elicitation should be conducted in two sessions. In the first session, Template ID 1 to ID 3 should be completed, and user entries collected and analysed by the system analyst. This would enable the analyst to establish an understanding of the participants' problematic social networking usage before their goal setting design requirements are elicited. With this knowledge, the analyst can better support the participants to specify requirements that would lead to effective behavioural change. It was suggested that the actual elicitation of requirements should be conducted in the second session; a participant commented that *"setting a plan to help manage the problem can begin after the problem is diagnosed"*. Working through the template and the supporting materials requires time to ensure the requirements are adequately specified. As a participant commented, *"the elicitation needs more time so we can provide detailed information and for the system analyst to provide a detailed explanation to the group"*. Conducting the elicitation in two sessions would also ease the effort required from the participants compared to just having one session.

Concerning the number of participants, having fewer people per session or two system analysts would be better to support the participants during the elicitation process. This would enhance communication during the session. The participants recommended having more breaks in addition to the one allocated after the scenario creation activity, for example, another break halfway through the session.

This section presents the refinements made to the TAGS method following the evaluation study. The participants' feedback and their preferences were analysed, and the proposed method documents were modified accordingly. The specialised version of the elicitation templates, the method flow diagram, and the guidelines presented in **Chapter 7** of the thesis and the documents before the evaluation are outlined in **Appendix 4**.

- After the evaluation, the following amendments were made to **Figure 36**, representing the method's building blocks, and the method flow diagram, presented in **Figure 37**.
  - The *create scenario* and *elicit problematic usage patterns blocks* were merged and performed in parallel.
  - The steps *elicit deviation facilitators* and *elicit deviation countermeasures* were separated before the session and experts reviewed them. After the expert reviewed, the building blocks were updated, and these two blocks merged because the same supporting document was used in both steps. Also, it helps enhance goal adherence as the users are more likely to identify applicable countermeasures for each identified deviation facilitator.
  - The stakeholders representing the psychologist, support group member, peer mentor and parents/guardians are added to activities 3 and 4.
  - The following activities: scrutinise the goals, which involve checking goal specificity and detecting and resolving goal conflicts, are removed from the flow diagram. The reason being, these activities should not be part of the elicitation process, but in the customisation of the technology for the various users and user groups.
  - Step 4, which represents eliciting monitoring, comparison, and feedback requirements, was replaced with 'elicit goal measurement preferences', which covers all three elements.
- In the **guidelines**, the following changes were made.
  - Some elements were removed from **Table 23** that lists the criteria for recruiting stakeholders, i.e. competency, personality, self-control capability, and ex-problematic users. These elements will be needed in the next stage of the elicitation process.
  - The guidelines for step 2 and step 3 are merged, i.e. creating scenarios and eliciting problematic usage patterns because the second step used elements from the first step, for example, reasons for the problematic usage and negative life experiences of the usage, and triggering features.

- The guidelines relating to setting specific, relevant, and realistic goals and goal prioritisation are removed from the main elicitation guidelines. This activity and its guidelines are needed during the customisation stage to ensure that the goal setting design requirements elicited are tailored to the personal needs of the representative users.
- **Table 22** depicting stakeholders' definition and level of involvement was amended, and some stakeholder representatives, e.g. policymakers, market representatives, and management representatives, were removed.
- The following changes were made to the TAGS elicitation templates.
  - The question relating to user goal commitment assessment, i.e. on a scale of 1 to 10, how committed are you towards the set goals on template ID 4 (see **Appendix 4, part D**), was recommended to be removed at this stage as this will be required during the customisation of the goal.
  - Participants recommended adding the following question (is there any additional information that you think should be considered here?) to each template instead of asking this question at the end of the elicitation because the users may forget what they wanted to add to earlier templates.
  - Also, some terminologies were simplified, including replacing the word 'techniques' with 'methods', features with 'elements', and implement with 'apply'.
  - On **Template ID 2**, which depicts categories of consequences of problematic social networking usage, 'public commenting' was added to the category 'invasion of privacy by others', while 'inadequacy' was removed from the group 'emotional problems'. Also, on **Template ID 5**, 'parental monitoring' and 'blended approach' were added.
  - 'Telephone feedback' was removed from the feedback presentation **Template ID 5.4** as the participants agreed that none of them would opt out of having their feedback delivered over the phone.

## 8.8 TAGS: PARTICIPANTS' REACTIONS AND RESEARCHER'S OBSERVATION

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Based on the results of the evaluation, this section discusses the aim of the evaluation proposed at the beginning of this chapter. In terms of understandability, based on the observation and the discussion at the end, in general, the participants found the TAGS method and the associated documents to be understandable. The participants found the method to be useful in helping them express their goal setting design requirements. They emphasised that expressing the goals using the method was straight forward, and it was observed that they were fully engaged in all the activities. This shows the usefulness of the proposed method in supporting the elicitation process.

Regarding efficiency, generally, participants found it easy to follow the proposed method. Finally, all of the participants stated that they intended to use the method to specify their requirements (see **Table 57**).

TABLE 57: SUMMARY OF PARTICIPANTS OPINION ON THE METHOD

Understandability	
The templates provide a clear structure for the elicitation process, which makes it easy to follow.	+
The order of the templates is logical. For example, starting with setting the behavioural targets, then monitoring, comparison, and feedback, and finally deviation facilitators and countermeasures techniques.	+
The participants agreed that the method is understandable because it does not only ask questions but also provide examples.	+
In relation to method guidelines and supporting materials, both the participants and the system analysts agreed that these documents make the elicitation process easier " <i>it is helpful that I can ask questions and refer to the other documents</i> ".	-
Some participants indicated that some of the terms on the templates might be a bit technical to understand and needed to be simplified.	±
Elaborating on 'when' and 'how' to implement users' preferred deviation countermeasures was regarded as requiring some degree of thinking and, therefore, taking some time.	
Elaborating on 'when' and 'how' to implement users' preferred deviation countermeasures was regarded as requiring some degree of thinking and, therefore, taking some time.	
Completeness	
Templates cover all the required goal setting elements " <i>I think the template is complete, it covers the goal setting elements, and I think a wide range of users can use it</i> ".	+
Both the user participants and the system analysts agreed that the guidelines and other supporting documents made the method more complete.	+
Both the system analyst and the users suggested some elements that should be added or removed from the TAGS method documents. These suggestions are described in <b>Section 8.7.2</b> .	-
Usefulness	
Both the system analyst and user participants mentioned that the elicitation templates were handy because they allowed them to consider all the goal setting elements in specific detail.	+
The participants stressed that having each goal setting element on a separate template and asking questions relevant only to that element helped prevent confusion while completing the templates and thinking of elements that they were not aware of before the evaluation.	+
The examples provided were well received by the user participants and system analysts; they mentioned that they helped them think of how to specify requirements for each of the template elements.	+
Involving representatives of support group members and peer mentor stakeholders was regarded as useful by the participants because it helped them interact and discuss with their peers when they were unsure of what goals would work for them.	+
The participants mentioned that the system analyst and psychologist were useful in terms of helping them understand some aspects of the templates, but that their knowledge and experience were limited.	
Efficiency	
The system analyst indicated that they found it easy to guide the elicitation process by following the guidelines provided.	+
	+

The participants emphasised that the participatory nature of the elicitation process enables them to discuss with each other, which helps the user participants adequately express their goals. Also, the examples provided in the Facebook version of the templates were effective in helping the system analyst support the users to express their goals.	+
<b>Intention to use method</b>	
The method provided a format that laid out a clear structure to easily follow and also, the direction and guidance provided with the method.	+
The participants emphasised that the supporting documents would enhance their intention to use the method.	+
Allowing the users to provide additional requirements at the end of each template shows that they are not restricted.	+
The amount of writing involved and the effort required to read the documents did not deter participants from wanting to use the method.	+

## 8.9 THREATS TO VALIDITY

In this section, the threats to the validity of this research will be discussed.

- The examples provided on the elicitation templates and supporting documentation may have affected the level of details the participants provided on the template. They can, for instance, specify their requirements by closely following or using the ideas provided, as an example. The researcher's main aim in providing the examples was to help stimulate the participants' thinking during the session. However, the researcher frequently reminded the participants to use the information provided to help specify their requirements and not to copy them directly.
- The incentive given to participants as a token of appreciation for taking part in the validation study could have influenced them to provide a favourable response in relation to the proposed method. However, to help mitigate this, the participants were rewarded at the end of the session and not prior to the study date.
- The sessions were divided among the various activities involved in the elicitation process based on the researcher's estimations. During the elicitation, the time allocated for each template may have affected the quality of the information provided. However, the system analysts were comfortable during the process and adequately guided the participants. As a result, most of the participants managed to write their behavioural goals adequately.
- Another limitation is that the participants might misinterpret that the supporting documents and the elicitation templates contain all the goal setting elements. However, the researcher clarifies that the participants and system analysts were not restricted to the template's elements; therefore, they were given options to add additional elements to the templates that they deemed relevant to goal setting.
- While a more significant number of participants may have benefited from the evaluation study to help ensure the elicitation of diverse viewpoints, the time limit meant that only 15

participants could be recruited. However, the participants declared having problematic social networking usage, which meant that a range of goal types, examples of goals and goal progress measurement preferences were still elicited. As the intention here is a proof of concept, the number of participants would not have any effect on the results of the elicitation. Also, the evaluation study involved participants from one organisation, i.e. university students. Although this is not a problem in itself, as students and other users experience similar problematic social networking usage, it may be argued that student users are well informed and somehow more technically oriented. Such limitations make the generalisation of the gathered goal setting requirements to less informed or tech-savvy users challenging and give rise to the need for further elicitation. Such elicitation must be carried out in different communities with a larger sample population in order to provide adequate requirements for the new layer and for generalisation purposes.

## 8.10 CHAPTER SUMMARY

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This chapter evaluated the proposed TAGS method for eliciting goal setting design requirements. The chapter discusses the process employed to assess the method. Also, evaluated was whether the guideline materials could adequately support the elicitation process. The outcome of the chapter showed that the TAGS method could help the analyst and design team elicit users' behavioural goal requirements. A case study approach was employed to assess the potential of the TAGS method to aid the elicitation process. In the final chapter, the thesis conclusion and future work will be discussed.

## 9. CHAPTER 9: CONCLUSION AND FUTURE WORK

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Problematic social networking usage is linked to various personal, social, professional and psychological effects. Several studies have shown that people who spend a considerable amount of time on social networks develop negative life experiences such as lack of sleep, depression, preoccupation, lowered self-esteem, academic problems, and relationship problems. Salience, mood modification, tolerance, withdrawal symptoms, conflict, and relapse are described as six characteristics of behavioural addiction. Technology is a medium that facilitates problematic usage. At the same time, it can also be part of the solution by accommodating better designs that are not distractive and obstructive to the users and also delivering behaviour change methods in a timely and contextualised manner.

There is a growing interest in researching and analysing the characteristics and prevalence of problematic social networking usage (BaAnyai et al. 2017). The use of technology to assist behavioural change is increasing in various disciplines, including healthcare and the management of addictive behaviours such as problematic social networking usage. Despite the argument that technology can be designed to sense and react to problematic usage styles (Ali et al. 2015), there is still limited research on how this can be achieved. Although such use of technology is on the rise, there is little understanding of the process by which technology-assisted behavioural requirements are elicited. Methods in health psychology centred on motivational interviewing and cognitive behavioural therapy can also be beneficial for holistic requirements elicitation and personalization approaches (Westra 2004). While requirements are typically seen as desired states of the world, wanted by the users, in the case of behavioural change software, they may conflict with the current behaviours, attitudes, and intentions of the users. This is mainly because the software is meant to help users change them. For example, in an app that helps people regulate their compulsive smartphone usage, the app could monitor the frequency and time of usage and confront the person with their statistics, including using the phone at odd times of the day.

This research proposes the need for a systematic approach to support the elicitation of goal setting design requirements. In this thesis, the research was conducted through several exploratory studies and literature reviews to understand the users' perspective of TAGS. The findings of the studies were used to develop a method for eliciting behavioural goals. Therefore, this thesis proposed the TAGS method, which aids the elicitation of requirements for the new goal setting layer. The thesis used the findings presented in Chapters 4, 5, and 6 to develop the method. The technique is accompanied by a document that outlines a set of guidelines to support the system analyst during the elicitation process.

To conclude this thesis, **Section 9.2** describes the thesis's contributions to knowledge, followed by the thesis limitations in **Section 9.3**, as well as potential future work in **Section 9.5**.

## 9.1 RESEARCH QUESTIONS AND OBJECTIVES REVISITED

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As outlined in the introductory chapter of this thesis, the purpose of this research was to explore:

**Objective 1: Conduct a background study on problematic social networks usage and related areas.**

In order to achieve this objective, the thesis reviewed research on problematic social networking usage from domains, including psychology, health care, and computing. Also, reviewed was the literature on behavioural change and behavioural change theories, technology-assisted persuasive techniques, software design approaches, and technology-assisted behavioural change. The aim of the review was to help understand core theories and how they can be used to inform the development of technology-assisted solutions. The review also helped develop an understanding of the significance of several diagnostic criteria to assess problematic digital usage and several treatment approaches.

**Objective 2: Provide a taxonomy of goal setting elements**

literature review on goal setting and its associated elements was conducted in order to address this objective. The aim was to explore goal setting and how it is used in various studies for behavioural change purposes. The literature review findings showed that when people talk about goals and goal setting, elements such as the source of the goals, elements that facilitate deviation from goals, and goal performance feedback information are mentioned. The findings of the review revealed five elements of goal setting, which were presented in five reference checklists. Each checklist was developed to represent one goal setting element. Additionally, studies were conducted to investigate how the goal setting elements can be instantiated in the case of problematic digital media usage. The study results showed that most of the goal setting elements depicted in the checklists could be applied in the case of problematic digital media usage. Although additional elements were not highlighted, study participants raised some concerns when technology is used to assist in the goal setting process.

**Objective 3: To provide a taxonomy of the negative life experiences associated with problematic social networking usage.**

In order to address this objective, the knowledge gained from objective one was used to inform the review of more literature on problematic digital media usage. The focus was on negative life

experiences of problematic digital media usage. Two focus group sessions were conducted to help refine the results of the literature review. The final results were categorised and presented in a taxonomy. The taxonomy classified negative life experiences into eight families and listed elements associated with each family: i) work performance problems, (ii) disrupted familial relationships, (iii) invasion of privacy of others, (iv) dietary-related factors, (v) social problems, (vi) personal problems, (vii) emotional problems, and (viii) source of harm. In addition to the interviews with experts and practitioners, an extended online survey to gather users' comments on digital addiction warning labels was conducted.

The analysis of the interview data and survey comments led to three mechanisms through which the software can be used to prevent and raise awareness of digital media usage. Finally, a discussion on the role the tech industry could play in helping regulate problematic social networking usage was provided.

**Objective 4: To explore technology-assisted goal setting to combat problematic social networking usage.**

The outcome of objectives two and three prompted the need to explore TAGS, which was achieved by conducting further studies. A focus group session and semi-structured interviews were conducted. The first aim of conducting the studies was to explore the opportunities and challenges of TAGS from the perspective of the users. The findings from the analysis of the collected data were used to develop two thematic maps. One map presented the five main opportunities and their associated elements, and the second presented the three main challenges associated with TAGS. In addition, a preliminary discussion on how the identified challenges can be controlled was provided. The second aim was to explore users' acceptance of TAGS. The focus of the data analysis was on those elements that would be most likely to impact users' acceptance of TAGS. Based on the interview results, two diagrams relating to perceived usefulness and perceived ease of use were created. The factors relating to perceived usefulness were classified into four categories and associated elements were listed under each category. While elements related to perceived ease of use were classified into four categories.

**Objective 5: To create, evaluate, and refine a method for eliciting the requirements of TAGS as an additional layer to social networking sites**

The outcomes of objectives 2, 3 and 4 were used to support the development of the TAGS method. Six main elicitation templates representing various goal setting elements were developed. Also, guidelines for completing these templates were provided with the method. A two-stage evaluation study was conducted to evaluate the TAGS method. First, participants were invited to partake in a session aimed at eliciting goal setting requirements without the aid of the TAGS method and its supporting documents. This part of the evaluation aimed to assess whether participants could

express their goal setting requirements without using the proposed method. In the second stage, participants participated in a session intending to specify their goal setting requirements. At this stage, the proposed method and its supporting materials were provided to support the elicitation process. The goal of this stage of the evaluation was to establish whether the **TAGS** method could help participants express their goal setting requirements, focusing specifically on the understandability, completeness, usefulness, and efficiency of the method. The findings of the evaluation study showed that the TAGS method is understandable and useful for the elicitation of participants' goal setting design requirements. Participants mentioned that specifying the goals without the aid of a method was a challenging task. Therefore, they fail to consider all goal setting elements during the process, and the information they provide is limited.

## 9.2 CONTRIBUTION TO KNOWLEDGE

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This thesis has contributed to the knowledge of technology-assisted solutions, particularly in the area of eliciting goal setting design requirements to help regulate problematic social network usage. In the next sub-sections, the main contributions of this thesis will be presented.

### **Five reference checklists depicting various elements of goal settings**

The first contribution of this thesis is the development of reference checklists representing the main pillars of goal setting as a strategy for behaviour change. The reference checklists were developed based on a literature review of 65 papers on interventions that utilised goal setting as a behavioural change strategy. The checklists are presented in **Chapter 4**. The checklists showed the various characteristics and common practise of the goal setting process. The reference checklists were then refined to reflect the case of problematic digital media usage, taking digital addiction as an exemplary case. This will help facilitate easy access to the various goal setting elements and provide a common ground for the managed application of goal setting in software-based behaviour change and digital motivation systems.

### **Eight categories of negative life experiences of problematic digital media usage and the role of technology in assisting the behavioural change process**

The second contribution of this thesis is eight families of negative life experiences of problematic digital media usage and the elements associated with each family (see **Chapter 5**). The primary and common negative life experiences linked to problematic digital media usage were elicited based on a review of internet addiction, online addiction, problematic internet usage, and online gaming addiction, which are sub-areas of digital addiction. Two focus group sessions informed the classification of the literature review findings. The aim was to have participants who declared having experience with digital addiction to elaborate on various negative experiences and support their grouping into categories to reduce duplication and to gather additional insight where

possible. The taxonomy will be used as a reference point for researchers from various domains, e.g. software engineers and psychologists, and will help them in their efforts to combat the negative life experiences of DA.

### **Opportunities, challenges and acceptance factors of technology-assisted goal setting**

The third contribution of the thesis is the thematic maps depicting the opportunities, challenges, and factors that might influence the acceptance of TAGS. The success of technology-assisted interventions requires understanding users' expectations of such technology and implementing them in the design and development of the technology. The exploration of users' perspectives on TAGS led to five categories of opportunities, three groups of challenges, four categories of perceived usefulness, and four categories of perceived ease of use and their associated elements. These thematic maps are presented in **Chapter 6**. These results and their related discussions provide vital information that would inform better design and implementation of TAGS.

### **A systematic approach for eliciting goal setting requirements - TAGS method**

The fourth contribution of the thesis is a method for eliciting TAGS requirements. The proposed method includes various templates for users to express their goal setting design requirements and guidelines to help guide the elicitation process (see **Chapter 7**). The proposed method will enable various individuals, such as help seekers, system analysts, psychologists, support group members, and peer mentors, to participate in the setting of the goal setting design requirements. The elicitation templates were developed primarily based on the various goal setting elements presented in the five reference checklists in **Chapter 4** and the negative life experiences of DA in **Chapter 5**.

### **Recommended functionalities for new goal setting layer**

The fifth contribution of the thesis is the recommendation of features for the new goal setting layer. Twenty functionalities were recommended based on the requirements gathered using the templates. This will enable the design team of a social network application facilitating problematic usage to have an idea of the features they need to consider when augmenting their platform with a new goal setting layer to help regulate such problematic usage.

## 9.3 THESIS LIMITATIONS

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The research has some limitations which could potentially affect the findings. The following bullet points present the limitations of the research:

- The first limitation of the research was the literature reviews conducted in Chapters 4 and 5, focusing mainly on goal setting elements and strategies without the support of

technology and the consequences of problematic digital media usage. To reduce this limitation in Chapter 4, additional studies exploring goal setting and its associated elements when supported by technology were conducted. Also, in Chapter 5, focus group sessions were conducted which focused on elaborating and explaining the findings from the literature review based on some participants' experience with DA.

- The second limitation is one of the main concerns when developing questions, and is concerned with ensuring that all users understand the questions as planned and are willing to respond to them. This limitation was addressed by conducting a pilot study with typical participants, after which some questions on the templates were updated and changed to ensure clarification.
- This research specifically targeted those users who self-declared having problematic social networking usage and were seeking help. Although targeting this type of participant helped reduce a wide variety of denial of problem usage, the results could be limited to those individuals. Non-addicts and non-help seekers can have different views and opinions about the features of the new goal setting layer.
- The research focuses on the goal setting strategy as a method to assist in the elicitation of behavioural goals. Other strategies that could be useful for requirement elicitation but have not been considered are motivational interviewing and cognitive behavioural therapy. This is because requirements for behavioural change technology may conflict with the users' present behaviours, attitudes, and targets.
- In relation to study participants' recruitment, this research thesis used convenience sampling, which means study participants can be reached easily and they all volunteered to take part in the studies, which may have biased the study sample. However, this technique may be satisfactory for exploratory purposes, for example, the studies conducted in this thesis. Furthermore, the collection is supported by past research, indicating that it was created using both empirical and literature-based methods, e.g. the discussion sections are provided in addition to the findings from the studies and the literature reviews conducted to help achieve some of the research objectives.
- Secondly, based on how data collection is conducted in all the chapters, i.e. focus groups and interviews, there are ethical concerns concerning the process of forming and managing relationships, the use of power, and the effects of the relationships on the participants. However, this was addressed by ensuring the researcher's and participants' relationship was strictly professional and by ensuring that the participants were not under pressure during the sessions or interviews.
- The CAGE questionnaire was employed in chapter 4 to evaluate the participants' addiction levels. The CAGE questionnaire is basic and inexpensive but does not address the whole range of addiction instances and the degree of addiction. Other extensive

psychometric tests, on the other hand, still have flaws with the addiction criteria itself. For example, Griffiths (2000) argued that such tests failed to consider the context of use as well as features of the temporal dimension, such as compensating relationship disintegration and the preoccupation element (Griffiths 2000). This illustrates why there is currently no "gold standard" for diagnosing and evaluating digital addiction, as stated by (Kuss et al. 2014).

#### 9.4 REFLECTIVITY

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This thesis suggested the need for an approach for eliciting goal-setting design requirements, and the researcher provided guidance for supporting the process. To help achieve this goal, literature reviews and various user studies were conducted. The aim is to manage problematic digital media usage. In this thesis, investigating technology-assisted solutions, i.e. TAGS, from the representative users' perspectives provided new insight into users' requirements and design considerations for TAGS, which could help influence new understanding of the research topic. This could also help empower the analysts and design team and help save them considerable amounts of time by avoiding implementing features or functionalities that the users do not want to see in the TAGS. The researchers' interest and background in requirements engineering, behavioural change, and digital addiction, and also in software design, were vital in the studies and analysis conducted. The researcher's previous experience and knowledge of conducting user studies has helped in the data collection and data analysis stages, i.e. ensuring that all ethical documents were created and approved, the right participants were recruited for the studies, and that all participants contributed to the data collection stage. For example, during the focus group sessions, the researcher was able to engage all the study participants and ensure all their views were collected by gently asking those who were reluctant to contribute to the discussion if they had anything to add, and also created smaller groups where the participants may have felt more confident in talking. Also, the researcher understands the importance of creating study guidance and supporting materials and inducting study participants before the interviews or focus group sessions commence to help stimulate their thinking. In terms of language used, the researcher understands the significance of using simple and easy-to-understand words and avoiding technical terms when creating the study questions and the TAGS methods elicitation templates because not all studies have a strong technical background.

Some of the study participants' demographics are similar to that of the researcher, i.e. in terms of age, research and educational background. The similarity in age has helped enhance the cooperation and interaction between the participants and the researcher during the interviews and focus group sessions. The researcher observed that this helped in structuring and controlling the study participants during the sessions. However, it is worth mentioning that the researcher was able to adequately interact with those participants from a different age group. The researcher also

uses various digital devices, and this, in a way, helps in understanding the participants' responses or explanations of their digital media activities. They were able to explain the various functionalities of behaviour change applications.

In relation to the study methods, the researcher's background helps in adopting the right research methods to help achieve the research objective outlined in Chapter 1. For example, in objective two, the researcher was aware that it was vital to conduct a literature review on goal setting and its elements to help understand how the technique is used in various domains before conducting a focus group on technology-assisted behavioural goals. One of the reasons is that the literature review findings would better inform the user study.

## 9.5 FUTURE WORK

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The TAGS method provides an approach for eliciting and specifying goal setting design requirements. The elements of the method are gathered from previous studies and literature reviews conducted in this thesis (see Chapters 4, 5 and 6). The process for specifying the requirements may require further investigation due to the time users need to invest. Future work for the thesis could be to build on this knowledge and provide an online system to help enhance the elicitation process. For example, list the feedback framing options and the goals that may be linked to them, then provide tick boxes for users to tick their preferred options.

In addition, this research will expand on the user acceptance factors of TAGS and discuss the major software design considerations that would enhance the successful design and implementation of the technology. Also, a further elaboration on users' perceived challenges of TAGS and propose ways of countering them to ensure better implementation, e.g. ethical issues around TAGS design. The features and functionalities that users would like TAGS to have will require further elaboration and provide a prototype of the system based on the defined features.

Most of the participants in the TAGS method evaluation study stated that they would like to use TAGS elicitation templates and supporting documents to express their goal-setting design requirements. However, further research is needed in order to provide a mapping between the negative life experiences presented in the thesis to behavioural goals, potential deviation patterns and countermeasures for deviation. This would help further guide the analysts and design team and the representative users during the elicitation process. Also, the relationship between the representative users' personalities and the deviation countermeasures could be determined in order to ensure that the countermeasures are personalised for the users or group of users, especially when the goals are set collaboratively or within a group. Additionally, the personality of the users could be used to help identify those at risk of losing interest in accomplishing the goal, especially when goal setting is done collaboratively. Therefore, it is essential to consider the user's personality when deciding the source of the goal. For example, extraverts tend to be active in

groups compared to their opposites, introverts, who tend to be withdrawn and do not perform well in a group.

This research thesis presented the set of stakeholders who are expected to be involved in the TAGS method, e.g. the problematic users and their level of involvement in the goal setting design requirements elicitation process. However, further research that looks into the stakeholders and their decision-making rights in the elicitation process is needed. Because for those users who are in denial of reality, it could be challenging for them to set behavioural change goals or select sources of goals that could help manage their problematic digital media usage. Another future work would be to provide heuristics for the analysts and design team to help detect deviations from the set goals before they actually happen. They are not going to solve it, but part of the solution could be to make the users aware of a deviation or potential deviation from their goals. The author suggests conducting similar studies, such as interviews and focus groups, using a card sorting method to aid in the mapping of behavioural goals, deviation patterns, and countermeasures. Finally, the thesis will provide an elaboration on social norms and normative beliefs and how TAGS could be used to address these factors.

The TAGS method comprises of various goal setting design requirements elicitation templates, guidelines to help guide the system analysts and design time during the elicitation process, and other supporting documentation as stated in the previous chapters. Using these templates and their supporting materials with recruited representative users who self-declared having problematic social networking use could enable the analysts and design team to establish assumptions about other end-user requirements, e.g. features and functionalities for the new goal setting layer. However, to enable the analysts and design team to generalise the gathered goal setting design requirements to different groups of users or the entire users, the elicitation should be conducted with a larger sample of representative users with different characteristics.

## 9.6 SUMMARY

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This research thesis was motivated by the need for a method for the elicitation of goal setting design requirements. The method will help in the design of technology-assisted solutions to support the goal setting process. Having a method tailored to the elicitation of behavioural goals could lead to a better design of technology-assisted goal setting, which could in-turn support users to manage their problematic social media usage. To help the successful implementation of behavioural change interventions, it is essential to properly elicit the system requirements. As stated by Rehman et al. (2013), researchers show that the majority of software errors are directly related to the mistakes committed during the requirements gathering and elicitation stages. To achieve the aim of the research thesis, i.e. to propose an elicitation and design method that aids the design of a software-assisted solution to host or support the goal setting process. The thesis

began with a literature review of goal setting and its associated elements, followed by focus group sessions on the instantiation of goal setting for the case of digital addiction (see Chapter 4). Five reference checklists for goal setting were created, and the factors or elements that should be taken into consideration when applying the goal setting elements for managing problematic digital usage were also created.

Additional literature reviews and user studies were conducted to further work toward achieving the aim of the research thesis. A literature review and focus group sessions on the negative life experiences of problematic digital media usage, experts and practitioners' interviews to explore their views on online labelling and warning messages, in order to decrease or warn against problematic digital media usage (see Chapter 5). Also, build on a survey in terms of the number of participants and the comments they provided. The findings revealed eight families of negative life experiences linked with digital addiction and a discussion of these families. Also, the findings suggested three preliminary ways that software might be used to help manage problematic usage, i.e. using software to disseminate educational information, goal setting assisted by software, and transparency. The results indicated a need for exploring and understanding users' perceptions of the use of technology to assist in the goal setting process. Hence, in Chapter 6, focus group sessions and interviews were conducted. The goal of the sessions was to investigate persuasive techniques, e.g. self-monitoring, regarding technology-based monitoring of printing behaviour, and enforcement of printing reduction goals. The interviews were conducted to explore users' views on the use of technology to assist the management of problematic digital media usage and the elements that need to be put into consideration to assist the behavioural change process. The findings of the studies suggest that for such technology to be successful, it is important to establish an understanding of users' acceptance factors, perceived usefulness, and perceived ease of use of technology-assisted goal setting.

This thesis uses the findings from the chapters mentioned above and proposes an elicitation method for goal setting design requirements. The method consists of six elicitation templates, guidelines, and other supporting materials (see Chapter 7). This method can greatly benefit the analysts and design team of a social media platform who would like to augment their platform with a new goal setting layer to help users manage their problematic usage. The evaluation of the TAGS method found that it provides a systematic approach to goal setting design requirements elicitation in a useful and understandable way. The method was favourably assessed by users. following the evaluation metrics, i.e. usefulness, understandability, completeness, and efficiency.

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### 11.1 APPENDIX 1

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The supporting materials used for the user study in Chapter 4.

#### **Part A: Information sheet**

##### **Participants study information Sheet**

###### **Study title**

Conceptualising Goal-setting as a Persuasive Technique and its Usage in Combating Problematic Online Usage

###### **Invitation**

You are being invited to take part in this research project conducted by Sainabou Cham, a research student at the Faculty of Science & Technology at Bournemouth University. This study is a part of her PhD thesis which is under the supervision of Dr Raian Ali. Before you decide, it is important for you to understand why the research is being conducted and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. You will be asked to sign a participant agreement form and at the end of the session you will be given a copy of this information sheet and a copy of the signed participant agreement form.

###### **What is the purpose of the study?**

Goal setting refers to planning what you want to achieve and how you intend to attain them. This research aims to study how goal setting as a strategy help people regulate their usage of cyber interaction systems. By conducting this study, we hope to provide guidelines which could be used in goal setting application design in relation to problematic usage.

###### **Why have I been chosen?**

This is an open call that aims to reach those who feel they can contribute to the research by sharing their experience with technology, utilising our mechanisms and giving us feedback on them.

###### **Do I have to take part?**

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep (and be asked to sign a participant agreement form). You can withdraw from the study at any time, up to the point where the recording of the focus group is being transcribed, analysed and anonymized. You do not have to give a reason.

###### **What would taking part involve?**

If you decide to take part in this study you will be given a commercial goal setting application which you will be expected to review and familiarise yourself with its features and functionalities. You will be given the application couple of days prior to the study date. You will be given scenarios of typical usage of social networking systems and you will be asked to discuss how goal setting could be used to help encourage a behaviour change in each of the scenarios.

###### **What are the advantages and possible disadvantages or risks of taking part?**

Whilst there are no immediate benefits for those people participating in the study, it is hoped that this work will improve the understanding of the development of goal setting software in relation to healthy usage which could help encourage behaviour change. There are no specifying risks for participating in this study.

### **Will my taking part in this project be kept confidential?**

All the information that I collect about you during the course of the research will be kept strictly confidential. You will not be able to be identified in any reports or publications.

### **What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?**

As outlined above you will be asked for your opinion on the topic of goal setting in relation to problematic usage, in a focus group setting. This information will help me meet the research objective of developing a better understanding of these issues.

### **Will I be recorded, and how will the recorded media be used?**

Yes, the recording will help me to capture the information that will be sought from you during the study. However, you will be given the right to accept or reject recording the session. The audio recordings made during this research will be used only for the analysis. No other use will be made of them without your written permission, and no one outside the project team will be allowed access to the original recordings. The transcription of the session will not include your name or any identifiable information. Instead, each person will be identified by a participant number (i.e. participant 1, participant 2, etc.).

### **Contact for further information**

If you have any queries about this research, please contact Dr. Raian Ali by email on [rali@bournemouth.ac.uk](mailto:rali@bournemouth.ac.uk) or by phone on 01202 966682 or by post to:

Dr. Raian Ali

Department of Computing & Informatics  
Faculty of Science and Technology  
Bournemouth University  
BH12 5BB

### **Complaints**

If you have any complaints about this research please contact Professor Christine Maggs, Executive Dean of Faculty of Science and Technology by email on [cmaggs@bournemouth.ac.uk](mailto:cmaggs@bournemouth.ac.uk) or by phone on 01202 965847.

**Thank you for taking the time to read this information sheet, and please do not hesitate to contact the researcher if you have any queries.**

## **Part B: Focus group: Participants Selection**

### **Pre-selection questions**

- I sometimes feel I should cut down my social networks usage
- I sometimes get annoyed by people when they are criticising my social networks use

- I sometimes feel bad or guilty about my social networks use
- I have tried to control my use of social networking systems without success
- I would become restless or trouble if I stop using my social networks
- I sometimes use social networking systems in a hasty manner or unthoughtful style

**Or**

- None of the above statements applies to me

**Part C: Participants Consent Form**



**Participant Agreement Form: (Focus group study)**

**Title of study:** Goal setting in digital addiction for self-regulatory behaviour

**Name, position and contact details of researcher:**

Sainabou Cham

PhD Student, Bournemouth University

Email: scham@bournemouth.ac.uk

**Please  
Initial  
or  
Tick**

**Here**

I have read and understood the participant information sheet for the above research project	
I confirm that I have had the opportunity to ask questions.	
I understand that my participation is voluntary.	
I understand that I am free to withdraw up to the point where the data are processed and become anonymous, so my identity cannot be determined	
During the study/focus group I am free to withdraw without giving reason and without there being any negative consequences.	
Should I not wish to answer any particular question(s) I am free to decline	



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**Part F: Focus groups**

Focus Group Data				
Scenario 1				
Source of Goal	Types of Goal	Monitoring, comparison & Feedback	Elicitation	Deviation countermeasures
Self-set	Proximal	Location-based (during usage) Surveillance Self-monitoring -performance Motivational	Baseline study data	Communication related? Monitor goal related activity Send goal reminders
Group-set	Time-based Specific	Usage duration Social comparions Graphical representation Self-evaluation Motivation Outcome feedback		Time related, Lack of goal commitment Social influence, Goal source, Set goals that show clear deadline, Combine goals Social influence
Self-set Group-set	Proximal – commitment and effort	During usage After usage Text, Self-monitoring Motivational	In-person interview Survey Algorithm	Time-related, Communication related, Lack of goal commitment, Conflicting, Assess complexity of goal, Provide information on behaviour that hinder goal attainment
Self-set Group-set	Proximal	Before the usage based on last usage During usage Graphical presentation Text , Self-evaluation feedback Performance feedback	Baseline study data Algorithm	Lack of goal commitment, Lack of self-efficacy
Self-set	Proximal - commitment and feedback Specific Moderation	During usage Graphical representation Self-monitoring Motivational Performance , Outcome		Conflicting goals, Social influence Lack of self-efficacy, Provide information on behaviour that hinder goal attainment, Assess complexity of goal/sub-goals/tasks towards goal attainment, Send goal reminders
Participatory	Proximal Added: location based	During and after usage Graphical representation Self-monitoring , Learning feedback, Motivational feedback Performance feedback	In-personal interview Online survey	Time related Social influence Send reminders

Scenario 2				
Self and group set goals	Specific and abstinence	Before the usage Graphical representation Self-monitoring Performance		Lack of goal commitment Highly challenging goals Provide information on behaviour that hinder goal attainment, send reminders
Self-set	Proximal Distal	During usage Graphical representation Self-monitoring, motivational	In-person interview Algorithm	Social influence Provide information on behaviour that hinder goal attainment Send reminders, monitor goal related activity
Group set goals	Proximal -commitment	After usage Text Performance	Baseline study data Online survey	Social influence, lack of self-efficacy Not understanding participants' needs Provide information on behaviour that hinder goal attainment, send reminders
Self and group set goals	Abstinence	Group feedback Text Performance	In-person interview Experimental brainstorming exercise Baseline study data Survey	Time related Conflicting goals Social influence Assess/evaluate/measure individual commitment level and self-efficacy towards goal achievement, Send goal reminders
Self and group set goals	Proximal Specific Frequency-based	Before the usage During usage Surveillance Graphical representation Self-monitoring Performance feedback	Algorithm	Conflicting goals Not understanding participants' needs Over-estimating participants' self-efficacy level Provide information on behaviour that hinder goal attainment
Self-set and group-set-friends	Abstinence (location based)	Graphical representation During usage –time-based Social comparison Group feedback Motivational feedback	Online survey Algorithm	Time-based Communication Lack of goal commitment/motivation Set goals that shows clear deadline Send reminders
Scenario 3				
Participatory	Distal	After usage Graphical representation	Baseline study data Online survey	Time based Lack of goal commitment

		Self-evaluation	Algorithm	Social influence
Self-set and guided	Proximal Frequency-based Specific Moderation	Before the usage Surveillance Graphical representation Self-evaluation Motivational feedback Outcome feedback	In-person interview Pilot study	Frequency related Communication related Lack of goal commitment/motivation Combined goals Lack of self-efficacy Provide information on behaviour that hinder goal attainment Assess/evaluate/measure individual commitment level and self-efficacy towards goal achievement Conduct manipulation checks Monitor goal related activity Review goals, re-strategies and made require modification based on progress on goal achievement Send goal reminders
Guided	Proximal Moderation -time Location? AM	During usage Social comparison Graphical representation Self-evaluation Motivational feedback	Survey Online survey	Time-related Environmental influence Conduct manipulation checks
Participatory Guided Group-set	Moderation	During usage Social comparison Graphical representation Self-evaluation Learning feedback (educational) Outcome feedback	Pilot study Survey Algorithm counselling intervention and self- management	Time-related, lack of measurable properties such as time Environmental influences Goal source, set goals that shows clear deadline Assess complexity of goal, monitor goal related activity Review goals, re-strategies and made require modification based on progress on goal achievement Send goal reminders
Participatory Group-set	Moderation	Text Self-monitoring Learning feedback Motivational Performance	Pilot study Pre-assessment screening interviews Survey Algorithm	Combine goals Social influence Lack of measurable properties such as time Monitor goal related activity Provide information on behaviour that hinder goal achievement

Guided Group-set	Location based	During usage Self-monitoring Motivational feedback Performance feedback	Behaviours experiments Diary study	Location related Time related, Communication related Lack of goal commitment Lack of measurable properties such as time Not understanding participants need Monitor Review goals, re-strategies and made require modification based on progress on goal achievement Send goal reminders
Scenario 4				
Participatory Guided Group-set	Specific goals	During usage Social comparison Group feedback Graphical representation Self-evaluation Learning feedback (educational) Motivational Outcome feedback	In-person interviews Survey Algorithm	Time-related Combine goals Social influence Environmental influences Goal source Over-estimating participants' self-efficacy level Set goals that shows clear deadline Assess complexity of goal Monitor goal related activity Send goal reminders
Group-set	Distal – commitment	After usage Text Performance feedback	Baseline study data Online survey Counselling intervention and self- management guides	Lack of goal commitment/motivation Conflicting goals Social influence – from friends, family and other members of the group, Environmental influence Send goal reminders
Participatory Group-set	Proximal – commitment and effort	Group feedback Text Self-monitoring	Pilot study Pre-assessment screening interviews Online survey	Time-related, communication related Highly challenging goals Review goals, re-strategies and made require modification based on progress on goal achievement

				Assess/evaluate/measure individual commitment level and self-efficacy towards goal achievement
Participatory Guided	Specific Frequency-related	Before the usage Text Learning feedback Outcome	In-person interviews Experimental brainstorming exercise Pilot study Online survey	Frequency related, Lack of goal commitment/motivation Social influences, Goal source Provide information on behaviour that hinder goal attainment, conduct manipulation checks, monitor goal related activity, Review goals, re-strategies and made require modification based on progress on goal achievement, Send goal reminders
Assigned Group-set	Proximal Specific	Before the usage Group feedback Electronic -email Self-monitoring	Experimental and brainstorming exercise Survey Online survey	Communication related Conflicting goals Assess/evaluate/measure individual commitment level and self-efficacy towards goal achievement
Self-set Guided	Time-based Frequency-based	After usage, Group feedback Self-evaluation Motivational Performance	Diary study Monitoring usage? Time-related Frequency-related	Send goal reminders
<b>Scenario 5</b>				
Self-set	Distal	Surveillance Graphical representation Self-monitoring Outcome	In-person interviews	Frequency related, Social influence Monitor goal related activity Review goals, re-strategies and made require modification based on progress on goal achievement
Self-set Group-set	Distal – feedback and effort Specific Moderation	Before the usage Text Self-monitoring Self-evaluation Performance feedback	In-person interviews Pre-assessment screening interviews Online survey Algorithm	Time related, Communication related Conflicting, Social influence Ambiguous/less structured goals, Goal source Provide information on behaviour that hinder goal achievement, Monitor goal related activity
Guided	Frequency related	Before the usage Surveillance	In-person interviews Online survey	Communication related Lack of goal commitment

		Text Performance	Algorithm	Conflicting, Social influence, Monitor goal related activity
Participatory Guided	Proximal -commitment and feedback	Before the usage During usage Surveillance Graphical representation Text Learning Motivational Outcome	In-person interviews Online survey	Communication related, Frequency related, Lack of goal commitment/motivation, Conflicting goals, Social influence, Lack of self-efficacy or confidence to achieve goals, Environmental influence -lack of a structure method for goal setting Over-estimating participants' self-efficacy level Assess complexity of goal/sub-goals/tasks towards goal attainment Provide information on behaviour that hinder goal attainment, Assess/evaluate/measure individual commitment level and self-efficacy towards goal achievement, Conduct manipulation checks, Monitor goal related activity, Send goal reminders, Review goals, re-strategies and made require modification based on progress on goal achievement
Self-set Group-set	Proximal -commitment and feedback specific	During usage Social comparison Group feedback Graphical presentation Learning Motivational Outcome	Counselling intervention and self- management guides	Time-related, Frequency related, Combine goals, Social influence, Lack of self-efficacy or confidence to achieve goals, Conflicting goals, Goal source Over-estimating participants' self-efficacy level Set goals that shows clear deadline Assess complexity of goal/sub-goals/tasks towards goal attainment, Provide information on behaviour that hinder goal attainment, Assess/evaluate/measure individual commitment level and self-efficacy towards goal achievement, Monitor goal related activity, Send goal reminders
Group-set	Proximal goals Frequency-based- feedback	After usage Group feedback Graphical presentation Performance feedback	Group discussion Online survey Algorithm	Frequency-related, Lack of self-efficacy or confidence to achieve goals, Not understanding participants needs Set goals that shows clear deadline Send goal reminders

The supporting materials used for the user study in Chapter 5 and the literature findings.

**Part A: Sample of focus group data**

What are the negative consequences and symptoms of digital addiction?

Addictions, whether to a substance or behaviour, are typically associated with consequences which could cause physical or mental damage to the individuals or their surroundings, e.g. family members and friends. In comparison to substance addiction where consequences of use are visible and quantifiable, consequences related to behavioural addiction, in particular digital addiction, are not of the same nature and could be different for each user and each software and usage patterns. In this session, we will focus on the negative consequences of digital addiction seen as an obsessive, excessive and hasty usage of software. As a starting point and to help guide the discussion, some examples of the consequences are provided as shown in the table below. As a participant, you are free to refine or add other elements as the list is by no means exhaustive. For each of the items, please (discuss, annotate, comment, give example) why this is regarded as a negative consequence of digital addiction or addictive usage of software.

You are free to give evidence where require, for example, references to reports (newspaper stories), references to the media and other relevant evidence. To add your contribution, please write your name or the code provided to you before you start writing. Examples of consequences of digital addiction

<input type="checkbox"/> Harm to others	<input type="checkbox"/> Early school truancy
<input type="checkbox"/> Self-harm	<input type="checkbox"/> Disrupted familial
<input type="checkbox"/> Poor academic performance/academic failure	<input type="checkbox"/> Disrupted peer relationships
<input type="checkbox"/> Social and economic cost	<input type="checkbox"/> Relationship problems
<input type="checkbox"/> Disconnect from real life	<input type="checkbox"/> Marital discord
<input type="checkbox"/> Lower self-esteem	<input type="checkbox"/> Negligence of children
<input type="checkbox"/> Depression	<input type="checkbox"/> Loss of creativity
<input type="checkbox"/> Disconnect from real life issues	<input type="checkbox"/> Loss of productivity and profitability
<input type="checkbox"/> Forgetting meals	<input type="checkbox"/> poor time management
<input type="checkbox"/> Reduction in social communication	<input type="checkbox"/> Procrastination
<input type="checkbox"/> Negligence of social connections – friends, colleagues, etc.	<input type="checkbox"/> Sleep deprivation/lack of sleep/loss of sleep
<input type="checkbox"/> Slow withdrawal from normal daily routing	<input type="checkbox"/> Lack of focus
<input type="checkbox"/> Preoccupation	<input type="checkbox"/> Lack of concentration
<input type="checkbox"/> Conflict	<input type="checkbox"/> Not thinking clearly
<input type="checkbox"/> Mental preoccupation	<input type="checkbox"/> Invasion of privacy of other contacts
<input type="checkbox"/> Neglect of personal life	<input type="checkbox"/> Effects on one's public profile
<input type="checkbox"/> Lower self-esteem resulting from negative feedback	<input type="checkbox"/> Lower grade point average
<input type="checkbox"/> Reduce/poor in wellbeing	<input type="checkbox"/> Reduce performance
<input type="checkbox"/> Mental health effects	<input type="checkbox"/> Occupational problems
<input type="checkbox"/> Relapse	<input type="checkbox"/> Missing important work deadlines
<input type="checkbox"/> Conflict	<input type="checkbox"/> Spending less time with family
<input type="checkbox"/> Feeling loss without a connection	<input type="checkbox"/> Damage on individuals' public profile
<input type="checkbox"/> Cyber-stalking	<input type="checkbox"/> Anxiety
<input type="checkbox"/> Reduce self-confidence	<input type="checkbox"/> Distraction
<input type="checkbox"/> Professional problems	<input type="checkbox"/> Tolerance
<input type="checkbox"/> Affect parent-child relationship	<input type="checkbox"/> Skipping meal
<input type="checkbox"/> Increased loneliness	<input type="checkbox"/> Irregular dietary behaviour
<input type="checkbox"/> Aggression	<input type="checkbox"/> Irregular sleeping pattern
<input type="checkbox"/> Restlessness	<input type="checkbox"/> Poor diet quality
<input type="checkbox"/> Deceiving family and friends about time spent online	<input type="checkbox"/> Irritability
<input type="checkbox"/> Using software longer than intended	<input type="checkbox"/> Increased duration of time spend online
	<input type="checkbox"/> Use software as an escape strategy from real life problems
	<input type="checkbox"/> Concealing addictive behaviour

## **Part B: Experts and practitioners interview questions**

### **Introductory questions**

- Can you give me some information about yourself?
- Can you tell me all about your use of social networking sites?
- What do you think the social networking sites could do to help people who may have or potentially have excessive usage behaviour?
- What do you think are the benefits of using social network sites?
- What are the disadvantages?
- Can you think of any times or situations when using the sites could become a problem?
- What are your views on the idea that people could develop excessive usage to social networking sites? How far would you say this could be similar, or different, to other addictions like gambling, alcohol or tobacco?

We are exploring the concept of using labels on social networking sites (similar to what you may have seen on tobacco products or alcohol) to help those who may feel their use is becoming potentially excessive.

- What are your initial thoughts about this idea?
- Do you have any suggestions for how they could work to best help people who use social networking sites and other internet application?
- Do you think labelling should be a requirement for social networking sites?

We are also considering ways that could mean that the labels are shown at a time when a social networking sites user would find it most useful

- What are your general views on this idea
- When do you think would be the most appropriate times to show these labels?
- How do you think labels should be presented and deliver (in terms of layout and placement) in order to prevent putting users off, improve their experience and promote their acceptance of the software and the labels?
- What stage during the software development do you think warning labels should be considered
- How do you think warning labels can improve the experience of the user?
- Software features: Which type of software features/functionality/services would promote excessive usage and would require labelling at certain point?
- Do you think warning labels can help improve users' software usage behaviour?
- Do you think personal factors such as age, cultural background and gender can affect the effectiveness of the warning labels?
- How do you think labels should be made to attract the users attention among other things on the screen?

### **Autonomy vs. Control:**

- How much control or what sorts of control should the user be given on these labels and what are the implications, for example, controlling different settings of the label (would the user be able to do this based on their experience or will they be provided with tutorials
- How intelligent/autonomous the labelling should be? For example, in creating and delivery the labels, should the software control the setting and delivery of the labels and what are the implications to this
- Awareness: When showing a label, like any recommendation, what sort of explanation the user would expect to see? E.g. why me and why now, what or how user data is use to create label?

### **Closing questions:**

- Do you have any other comments or questions?
- If there is any follow up questions would you mind if I emailed them you?

## Part C: Papers reviewed

Papers reviewed		
No. Paper	Notes	Reference
Mobility Reconsidered: Topological Aspects of Interaction	Spatial, Temporal and contextual	Masao Kakihara and Carsten Sørensen, Department of Information Systems London School of Economics and Political Science, United Kingdom Mobility Reconsidered: Topological Aspects of Interaction , 2002
Regular and problematic leisure-time Internet use in the community: Results from a German population-based survey	Participants who reported at least one negative life experiences in the following areas: Problems and neglect of family, partners and friends Work, education, health, financial problems (the least reported), avoidance of negative emotions	Beutel ME, Braehler E, Glaesmer H, Kuss DJ, Woelfling K, Mueller KW. Regular and problematic leisure-time Internet use in the community: Results from a German population-based survey. <i>Cyberpsychol Behav Soc Netw</i> 2011; 14: 291-6.
Online social networks: Why do students use Facebook?	Social presence: The presence of others in a virtual environment is important because it implies direct or indirect human contact Social enhancement- to impress others and to feel good about oneself, refers to the value that a participant derives from gaining acceptance and approval of other members, and the enhancement of one's social status within the community on account of one's contribution to it Social identity - Social identity can create a sense of belonging to an online social networking site when users view themselves as the members of the community. The psychological state of being part of the community in an online social network can be derived from either one of the following situations: <ul style="list-style-type: none"> <li>• Affective social identity: a sense of emotional involvement with the community</li> <li>• Evaluative social identity: an evaluation of self-worth on the basis of belonging to a particular group or</li> <li>• Cognitive social identity: a sense of self-awareness of being part of the community.</li> </ul> Entertainment – play, relax and pass time	Online social networks: Why do students use facebook? Christy M.K. Cheung a, Pui-Yee Chiu a, Matthew K.O. Lee b, 2011.

Older Adolescents' Motivations for Social Network Site Use: The Influence of Gender, Group Identity, and Collective...	Motive for use: Peer group communication Entertainment Passing time Social compensation Positive collective self-esteem Negative collective self-esteem	Older Adolescents' Motivations for Social Network Site Use: The Influence of Gender, Group Identity, and Collective Self-Esteem Valerie Barker, Ph.D  CYBERPSYCHOLOGY & BEHAVIOR Volume 12, Number 2, 2009
Internet Over-Users' Psychological Profiles: A Behaviour Sampling Analysis on Internet Addiction	Negative consequences: Loneliness Depression Compulsiveness	Internet Over-Users' Psychological Profiles: A Behaviour Sampling Analysis on Internet Addiction Leo Sang-Min Whang, Ph.D., Sujin Lee, Ph.D., <sup>2</sup> and Geunyoung Chang, M.A. CYBERPSYCHOLOGY & BEHAVIOR Volume 6, Number 2, 2003
Cultural difference in motivations for using social network sites: A comparative study of American and Korean...	Motivation for usage: Seeking friends Seeking information Seeking social support Seeking entertainment Seeking convenience	Cultural difference in motivations for using social network sites: A comparative study of American and Korean college students Yoojung Kim a, Dongyoung Sohn b, <sup>1</sup> , Sejung Marina Choi a, <sup>2</sup> , Computers in Human Behavior 27 (2011) 365–372
Facebook (R) and academic performance	Negative impact of Facebook usage: Procrastination, distraction and poor time management skills, Lower grade point averages	Facebook (R) and academic performance Article in Computers in Human Behaviour · November 2010 Author: Paul Kirschner 2010
Social Media and the Fear of Missing Out: Scale Development and Assessment Confirmatory factor analysis	Fear of missing out – inadequacy, irritability, anxiety, and self-esteem	Social Media and the Fear of Missing Out: Scale Development and Assessment Jessica P. Abel, Beech-Nut, USA Cheryl L. Buff, Siena College, USA Sarah A. Burr, Ipsos, USA Journal of Business & Economics Research – First Quarter 2016 Volume 14, Number 1
Social network sites, marriage well-being and divorce: Survey and state-level evidence from the United States	Consequence: Divorce or a high likelihood of divorce  Troubled/problematic relationship	Social network sites, marriage well-being and divorce: Survey and state-level evidence from the United States Sebastián Valenzuela a, Daniel Halpern a, James E. Katz b Computers in Human Behaviour 36 (2014) 94–101

Negative and positive impact of internet addiction on young adults: Empirical study in Malaysia	Negative impacts of excessive internet use: interpersonal problem, behavioural problem, physical problem, psychological problem, and work problem	Syed Shah Alam et al. 2014 Negative and positive impact of internet addiction on young adults: Empirical study in Malaysia
The “Facebook-self”: characteristics and psychological predictors of false self-presentation on Facebook	Social compensation, low self-esteem, social presence, social pressure, real-life deficiencies False identity	Oren Gil-Or, Yossi Levi-Belz and Ofir Turel, Frontiers in psychology, 2015 <a href="https://doi.org/10.3389/fpsyg.2015.00099">https://doi.org/10.3389/fpsyg.2015.00099</a>
The Facebook divorces: Social network site is cited in 'a THIRD of splits	Divorce and relationship troubles “An Indian woman has filed for divorce because she can’t trust her husband, after the husband neglected to update his relationship status on Facebook” “The most common reasons for Facebook causing problems in relationships were a spouse finding flirty messages, photos of their partner at a party they did not know about or with someone they should not have been with”.	<a href="http://www.dailymail.co.uk/femail/article-2080398/Facebook-cited-THIRD-divorces.html">http://www.dailymail.co.uk/femail/article-2080398/Facebook-cited-THIRD-divorces.html</a> <a href="http://www.huffingtonpost.com/penney-berryman/divorce-social-media_b_4263498.html">http://www.huffingtonpost.com/penney-berryman/divorce-social-media_b_4263498.html</a> I found out I was having a divorce through Facebook
Effect of Social Media Pertication in the Workplace on Employee Productivity	Reasons for social media participation: Interpersonal communication Seeking and viewing information Entertainment and passing time Escaped from demanding job Escaped from un-satisfying job Negative consequences:	Assa Gakui Munene, Ycliffe Misuko Nyaribo Mar.-April. 2013   Vol.2   Issue 2 141-150
The effects of Internet addiction on the lifestyle and dietary behaviour of Korean adolescents	Dietary behaviour and diet quality: Small meal sizes, a poor appetite, and irregular eating speeds, snacking, skipping meals, diet quality, eating fast food Sleep problems and lifestyle issues	The effects of Internet addiction on the lifestyle and dietary behavior of Korean adolescents. Yeonsoo Kim, Jin Young Park, Sung Byuk Kim, In-Kyung Jung, Yun Sook Lim, and Jung-Hyun Kim, 2010
Internet Use and Collegiate Academic Performance Decrements: Early Findings	Negative consequences: Missing school or class, academic impairment	Internet Use and Collegiate Academic Performance Decrements: Early Findings. By Robert W. Kubey, Michael J. Lavin, and John R. Barrows 2001
Determinant factors of time spent on Facebook: brand communication engagement and usage types	Reason for usage: Entertainment, to get away from the daily routine	Determinant factors of time spent on Facebook: brand community engagement and usage types Yrd. Doç. Dr. Yeşim ULUSU, 2010
Why do I Keep Checking my Facebook?	Withdrawal: feeling bad, angry or stressed	Why do I Keep Checking my Facebook?

The Role of Urge in the Excessive Use of Social Networking Sites	Negative outcome: difficulty in managing personal life, conflict (creating problems in personal life) and missing social engagements and activities REASONS FOR USAGE: Instant gratification: enjoyment, excitement and pleased due to social media usage	The Role of Urge in the Excessive Use of Social Networking Sites. Chan et al. 2015
The Role of Context in Online Gaming Excess and Addiction: Some Case Study Evidence	Negative consequences: moodiness, anxiety, depression, and irritability Conflict - losing family and job Relapse Relationship breaking, spending too little time with children and family Escape from real life issues/problems	Griffiths, M.D., "The Role of Context in Online Gaming Excess and Addiction: Some Case Study Evidence", International Journal of Mental Health and Addiction, 8(1), 2010, pp. 119-125.
Excessive computer game playing: evidence for addiction and aggression?	Aggression - (rewarding violence, hostile thinking refer to reference 3)	Excessive Computer Game Playing: Evidence for Addiction and Aggression? CYBERPSYCHOLOGY & BEHAVIOR Volume 10, Number 2, 2007 © Mary Ann Liebert, Inc. DOI: 10.1089/cpb.2006.9956. S.M. GRÜSSER, R. THALEMANN, and M.D. GRIFFITHS
Game Addiction from Psychosocial Health Perspective	Reasons: Loneliness, Depression	Eui Jun Jeong, Dan J. Kim, Dong Min Lee ICEC '15, August 03 - 05, 2015, Seoul, Republic of Korea
Impact of Facebook addiction on narcissistic behaviour and self-esteem among students	Narcissism, low self-esteem	Impact of Facebook addiction on narcissistic behavior and self-esteem among students Sadia Malik, Maheen Khan, 2015
The Relationship Between Facebook and the Well-Being of Undergraduate College Students	Well-being measured by self-esteem, social adjustment, emotional and social connections	The Relationship Between Facebook and the Well-Being of Undergraduate College Students Maria Kalpidou, Ph.D., Dan Costin, M.A., and Jessica Morris, B.A, Cyber psychology, behaviour, and social networking Volume 14, Number 4, 2011
A Study on the Negative Effects of Social Networking Sites Such as Facebook among Asia Pacific University Scholars in Malaysia -	Negative consequences:  Impacts academic performance of students, damage on health, privacy	A Study on the Negative Effects of Social Networking Sites Such as Facebook among Asia Pacific University Scholars in Malaysia.

		International Journal of Business and Social Science Vol. 5, No. 10; September 2014 133
The Role of Status Seeking in Online Communities: Giving the Gift of Experience	Status seeking, raising self-image	Journal of Computer-Mediated Communication 12 (2007) 434–455 <sup>a</sup> 2007 International Communication Association
The benefits of Facebook “friends”: Social capital and college students’ use of online social network sites	REASON FOR DA: “Facebook usage was found to interact with measures of psychological well-being, suggesting that it might provide greater benefits for users experiencing low self-esteem and low life satisfaction”	The Benefits of Facebook “Friends:” Social Capital and College Students’ Use of Online Social Network Sites Nicole B. Ellison Charles Steinfield Cliff Lampe, 2007, Journal of Computer-Mediated Communication
The Associations between Aggressive Behaviours and Internet Addiction and Online Activities in Adolescents	Aggressive behaviour	The Associations Between Aggressive Behaviors and Internet Addiction and Online Activities in Adolescents Chih-Hung Ko, M.D, Ju-Yu Yen, M.D, Shu-Chun Liua, Chi-Fen Huang , and Cheng-Fang Yen, M.D., 2009
Internet Addiction and Interpersonal Problems in Korean Adolescents	Interpersonal problems (conflicts) Reasons: To avoid boredom 430 (69.4) To relieve stress 122 (19.7) Just to spend time 44 (7.1) To make friends 16 (2.6) To study	Internet Addiction and Interpersonal Problems in Korean Adolescents. MIA SEO, HEE SUN KANG, YOUNG-HEE YOM, CIN: Computers, Informatics, Nursing & Vol. 27, No. 4, 226–233 & Copyright B 2009 Wolters Kluwer Health   Lippincott Williams & Wilkins
Exploring Associations between Problematic Internet Use, Depressive Symptoms and Sleep Disturbance among Southern Chinese Adolescents	Depression and sleep disturbance	Yafei Tan, Ying Chen, Yaogui Lu and Liping Li, 2014 International Journal of Environmental Research and Public Health. Int. J. Environ. Res. Public Health 2016, 13, 313; doi:10.3390/ijerph13030313
The relationship between excessive Internet use and depression: A questionnaire-based study of 1,319 young people and adults	Depression	Morrison CM, Gore H. The relationship between excessive Internet use and depression: A questionnaire-based study of 1,319 young people and adults. Psychopathol 2010; 43: 121-6.
Online flow experiences, problematic Internet use and Internet procrastination	Procrastination	Thatcher A, Wretschko G, Fridjhon P. Online flow experiences, problematic Internet use and Internet procrastination. Comp Human Behav 2008; 24: 2236-54.

Internet sociology: Impact of Facebook addiction on the lifestyle and other recreational activities of the Indian youth	Consequences: Neglect of personal life, Reduced attention to daily life activities and Lower grade point , Social interaction, health and self-care Affects academic performance – studying Anger, frustration, boredom and sadness Reasons: leisure activities for entertainment purposes	Internet sociology: Impact of Facebook addiction on the lifestyle and other recreational activities of the Indian youth Modi and Gandhi 2014 Y.A. Modi & I.S. Gandhi
Assessing Internet addiction using the parsimonious Internet addiction components model. A preliminary study	Saliency, mood modification, tolerance, withdrawal, conflict, and relapse	Kuss, D. J., Shorter, G. W., van Rooij, A. J., Griffiths, M. D., & Schoenmakers, T. (2013). Assessing Internet addiction using the parsimonious Internet addiction components model. A preliminary study. International Journal of Mental Health and Addiction, 11(5), online first.
Characteristics of Internet Addiction/Pathological Internet Use in U.S. University Students: A Qualitative-Method Investigation SNOWBALLING	Consequences: Sleep deprivation, academic under-achievement, failure to exercise and to engage in face-to-face social activities, negative affective states, and decreased ability to concentrate, affect academic productivity, neglected school work and other daily obligations Factors triggering internet use: Sadness and depression, boredom, and stress, escape from problems or relieve a negative mood, browsing entertainment	Wen Li, Jennifer E. O'Brien, Susan M. Snyder, Matthew O. Howard. <a href="http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0117372">http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0117372</a>
An Investigation into the Problematic Use of Facebook	Negative outcomes: Missing school or work, missing social engagement, getting into trouble with employer or school because of Facebook Mood modification: Used when feeling isolated, make self-feel better when down or when anxious	Lee Wai Yu, 2011
Habitual Facebook Use and its Impact on Getting Deceived on Social Media	Current study focuses on Facebook habits and its determinants and the extent to which they ultimately influence individual susceptibility to social media phishing attacks. Number of social network contacts	Journal of Computer-Mediated Communication Vishwanath, 2014
A “Components” Model of Addiction within a Biopsychosocial Framework	Components of addiction: Saliency, mood modification, tolerance, withdrawal, conflict and relapse	Mark Griffiths Journal of Substance Use · July 2009, August 2005; 10(4): 191–197 DOI: 10.1080/14659890500114359

An Investigation into the Problematic Use of Facebook,	Negative outcomes: Missing school or work, missing social engagement, getting into trouble with employer or school because of Facebook Mood modification: Used when feeling isolated, make self-feel better when down or when anxious	Zach W.Y. Lee ; Christy M.K. Cheung ; Dimple R. Thadani,2012 45th Hawaii International Conference on System Sciences, IEEE computer society
Sleep problems and internet addiction among children and adolescents: a longitudinal study	Sleep problems	
Sleep quality, internet addiction and depressive symptoms among undergraduate students in Nepal	Poor sleep quality, changing in sleep patterns	<a href="http://pubmedcentralcanada.ca/pmcc/articles/PMC5361804/">http://pubmedcentralcanada.ca/pmcc/articles/PMC5361804/</a> Parash Mani Bhandari, <sup>1</sup> Dipika Neupane, <sup>1</sup> Shristi Rijal, <sup>1</sup> Kiran Thapa, <sup>1</sup> Shiva Raj Mishra, <sup>2,3</sup> and Amod Kumar Poudyal <sup>1</sup>
Prevalence of internet addiction in the general population: Results from a German population-based survey	Problems with family Neglect of other leisure activities Neglect of friends/partner Health problems Problems with school or work, financial problems	Behaviour and Information Technology 33(7) · July 2014 DOI: 10.1080/0144929X.2013.810778 Kai W. Muller, Heide Glaesmer, Elmar Brähler, Klaus Woelfling & Manfred E. Beutel
The role of social networking sites on romantic relationships: effects on jealousy and relationships happiness	Need for popularity for low self-esteem users	Journal of Computer-Mediated Communication, 16 (2011) 511–527 2011 Sonja Utz Camiel J. Beukeboom
Too Much Internet Use “Can Damage Teenagers’ Brains	Affects concentration level	Too Much Internet Use “Can Damage Teenagers’ Brains <a href="http://www.dailymail.co.uk/sciencetech/article-2015196/Too-internet-use-damage-teenagers-brains.html">http://www.dailymail.co.uk/sciencetech/article-2015196/Too-internet-use-damage-teenagers-brains.html</a>
Proposed diagnostic criteria for Internet Addiction	Preoccupation, withdrawal, tolerance, loss of control or difficulty to control usage, alleviation of negative emotions, hiding from friends and family about time spent or cost involve	Proposed diagnostic criteria for internet addictionadd_2828 556. 564 Ran Tao <sup>1</sup> , Xiuqin Huang <sup>1</sup> , Jinan Wang <sup>1</sup> , Huimin Zhang <sup>1</sup> , Ying Zhang <sup>1</sup> & Mengchen Li 2010 Society for the Study of Addiction
Internet addiction among Norwegian adults: A stratified probability sample study	Obsession and compulsions, Anxiety, Feeling of depression/feeling down, sleep disorder Motivation for use:	Internet addiction among Norwegian adults: A stratified Probability Sample Study

	Communication/interaction/participation in discussion groups, entertainment	
Internet addiction in Korean adolescents and its relation to depression and suicidal ideation: A questionnaire survey	Negative consequence:  Depression	International Journal of Nursing Studies 43 (2006) 185–192 Kyunghee Kima , Eunjung Ryub,, Mi-Young Chonb , Eun-Ja Yeunb , So-Young Choic , Jeong-Seok Seod , Bum-Woo Namd
Internet Addiction among Students: the Relation of Self-esteem and Depression	Depression and Self-Esteem are two main courses of internet addiction	Bulletin of Environment, Pharmacology and Life Sciences Bull. Env. Pharmacol. Life Sci., Vol 3 (3) February 2014: 01-06. Abdolmajid Bahrainian 1, A. Khazaee 2
The Impact of Internet Addiction on Life Satisfaction and Life Engagement in Young Adults	During of use, frequency of use, time spent daily	Universal Journal of Psychology 2(9): 273-284, 2014 Ishrat Shahnaz, A.K.M. Rezaul Karim
Internet addiction in children and adolescents	Interpersonal conflict, abundance of information/content, family conflict	Beard, K.W., Yarnall, C.: Internet addiction in children and adolescents. Computer science research trends (2008) 59–70
Habitual Facebook Use and its Impact on Getting Deceived on Social Media	Number of social network could drive continued usage of the application.	Journal of Computer-Mediated Communication 20 (2015) 83–98. Arun Vishwanath
Five clues that you are addicted to Facebook	You lose sleep over Facebook You spend more than an hour a day on Facebook You become obsessed with old loves You ignore work in favour of Facebook The thought of getting off Facebook leaves you in a cold sweat	Five clues that you are addicted to Facebook. Retrieved April 23, from <a href="http://www.cnn.com/2009/HEALTH/04/23/ep.facebook.addict/">http://www.cnn.com/2009/HEALTH/04/23/ep.facebook.addict/</a> Elizabeth Cohen, 2007
Understanding the underlying factors of Internet addiction across cultures: A comparison study	Escapism, poor time management, mood enhancement, Emotional/psychological conflict and moodiness, Social and work dysfunction, loss of control, Excitement	L. Chen, R. Nath. Electronic Commerce Research and Applications 17 (2016) 38–48
Online social networking and addiction - a review of the psychological literature.	Negative impact: affects romantic relationships and could lead to divorce as a result of disclosure of private information, cyber-stalking and electronic surveillance.	Kuss, D. J., Griffiths, M. D Environmental research and public health 8.9 (2011): 3528-3552.
The benefits of Facebook “friends”: Social capital and college students’ use of online social network sites.	Negative consequences: Lower self-confidence and self-esteem	Ellison, N.B., Steinfield, C., Lampe, C, Comput-Mediat. Comm. 2007, 12.

Loneliness and social uses of the Internet	Motivation: loneliness – relaxation, passing time, emotional support Regulate negative moods Use affecting daily life functioning	Janet Morahan-Martina and Phyllis Schumacherb, Computers in Human Behavior 19 (2003) 659–671
Prevalence and Correlates of Excessive Internet Use among Youth in Singapore	Preoccupation, academic performance, social activities,	Subramaniam Mythily, Shijia Qiu, and Munidasa Winslow
A social technology that reduces social involvement and psychological well-being	Reduces communication with family, reduces social contacts Depression Loneliness	Kraut et al. 1998
Prevalence of pathological Internet use among university students and correlations with self-esteem, the General Health Questionnaire (GHQ), and disinhibition	Academic, social and interpersonal problems Lower self-esteem	Niemz K, Griffiths M, Banyard P Cyberpsychol Behav 2005;8 (6):562-70.
Motivational, emotional, and behavioral correlates of fear of missing out	Fear of missing out relates to increase Facebook engagement	Andrew K. Przybylski a,† , Kou Murayama b , Cody R. DeHaan c , Valerie Gladwell
The Relationship Between Unwillingness-to-Communicate and Students' Facebook Use	Motivation for use: maintain off-line relationships, passing time, entertainment, companionship	Journal of Media Psychology 2008; Vol. 20(2):67–75 Pavica Sheldon
The Compulsive Internet Use Scale (CIUS): Some Psychometric Properties	loss of control, preoccupation, conflict, withdrawal symptoms, and coping	Cyber psychology & behavior. Volume 12, Number 1, 2009, Meerkerk G. J. van den Eijnden R. J. Vermulst A. A. Garretsen H. F
A social skill account of problematic Internet use	Loss of control, impact work and school – missed classes or work Missed social engagement	Journal of Communication, December 2005, Caplan
A New Addiction for Teacher Candidates: Social Networks	Defensive or secretive about online activities Annoyed when interrupted while online Preoccupied with online activities Feel depressed, moody or nervous when not online	Cam, Emre; Isbulan, Onur. Turkish Online Journal of Educational Technology - TOJET, v11 n3 p14-19 Jul 2012
The relationship between optimal parenting, Internet addiction and motives for social networking in adolescence	Motivations: seek friendship, relationship maintenance, and escapism, along with the the impulsive use of the Internet, predicted more frequent SNS participation. Impulsive Lonely, depressed	Floros G and Siomos K. Psychiatry Research. 2013; 209:529–534.

Social Capital, Self-Esteem, and Use of Online Social Network Sites: A Longitudinal Analysis	Lower self-esteem	Journal of Applied Developmental Psychology 29 (2008) 434–445. Charles Steinfield, Nicole B. Ellison, Cliff Lampe
Prevalence of Internet addiction and correlations with family factors among South Korean adolescents. Adolescence	Risks factors of family violence - marital violence and parent-to-child violence – disrupted family relationship (needs to be considered by policymakers)	Park, S.K., Kim, J.Y., Cho, C.B., 2008. (San Diego) 43, 895- 909. <a href="https://www.thefreelibrary.com/Prevalence+of+internet+addiction+and+correlations+with+family+factors...-a0191213842">https://www.thefreelibrary.com/Prevalence+of+internet+addiction+and+correlations+with+family+factors...-a0191213842</a> PDF not found but this link has the paper material.
The influence of the Internet game addiction on social problem-solving ability and communication style	Psychological withdrawal – irritable, anxious, depressed, Using games to escape from life problems Academic issues, defensiveness and anger, lying or hiding behaviour, preoccupation	Understanding online gaming addiction and treatment issues for adolescents Kimberly Young, the American journal of family therapy, 37-355-372, 2009
Net-Generation Attributes and Seductive Properties of the Internet as Predictors of Online Activities and Internet Addiction	Different persona/identities Motivation: media use – reading news, video viewing, social interaction	Cyberpsychology & behavior Volume 7, Number 3, 2004
Unregulated Internet Usage: Addiction, Habit, or Deficient Self-Regulation?	Depression	MEDIA PSYCHOLOGY, 5, 225–253
Internet search behaviour and mood alteration: Replication and expansion of selective exposure theory.	Motivation for use: boredom and stress	Mastro, D., Eastin, M. S., & Tamborini, R. (2002). Media Psychology, 4, 157–172.
Predicting online service adoption likelihood among potential subscribers: A motivational approach	Motives for use: entertainment, escape, surveillance,	CAROLYN A. LIN, 1999, Journal of advertising research
Internet addiction: Current status and implications for employees.	Reduce productivity	Beard, K.W. (2002). Journal of Employment Counseling 39:2–11

The supporting materials used for the user studies in Chapter 6

**Part A: Study 1 Information sheet**



## Information Sheet

**The title of the research project:**

Researching intervention methods to help change student and staff habits in relation to printing at BU

**Invitation**

You are being invited to take part in this research project conducted by *Sainabou Cham*, a postgraduate researcher, in the Department of Computing and Informatics, Faculty of Science & Technology, Bournemouth University, UK. Before you decide, it is important for you to understand why this research is being conducted and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

**What is the purpose of the study?**

This research aims at investigating Digital Motivation methods to help change or improve staff and students habits in relation to printing at Bournemouth University. By conducting this research, we hope to provide methods which could be used to help change printing usage at Bournemouth University. Using the study findings, we will provide recommendations to Bournemouth University of how to apply these techniques. In addition, the study will help achieved a conceptual design of a web-based printing intervention platform which will monitor/track printing habits in real time and deliver feedback in relation to printing activities with the intention of making positive behaviour changes.

**Why have I been invited to take part?**

You have been chosen because of your probable interest in helping the research assistant in better understanding staff and students habits towards printing at Bournemouth University and help provide techniques for changing these habits.

**Do I have to take part?**

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a participant agreement form. You can withdraw at any time, up to the point where the data are processed and become anonymous, so your identity cannot be determined, without it affecting any benefits that you are entitled to in any way. You do not have to give a reason. Deciding to take part or not will not adversely affect you.

**What would taking part involve?**

If you decide to take part in this study, you will be asked to participate in two focus groups. In the first focus group, firstly, a brainstorming exercise will be conducted to help understand staff and student printing habits and the under-laying factors that could influence these habits. Next, you will be given some examples of printing awareness pictures and you will be asked to provide comments, and discuss in relation to your printing habits. Then, you will be provided with two tables showing behavioural determinants and behaviour change techniques. You will be asked to discuss which techniques you will use as part of an intervention to help change/reduce each behavioural determinant in the context of printing. We will also have a short discussion on your

printing requirements and preferred intervention delivery mode. Finally, you will be given a list showing examples of deviation facilitators and countermeasures for deviation from goals, you will then be asked to discuss how these goals setting related elements could be considered in relation to printing behaviour change. In the second focus group, you will be provided with examples of printing intervention prototypes and the discussion will focus on gathering your opinion/comments on the designs of the interfaces.

**What are the benefits (if any) of taking part?**

You will be contributing to the knowledge that could help improve or change printing habits of staff and students thereby reducing cost at Bournemouth University.

**What are the risks (if any) of taking part?**

There are no speculated risks for participating in this study.

**Will my taking part in this study be kept confidential?**

All the information that we collect about you during the course of the research will be kept strictly confidential. Your identity will not be identified in any reports or publications. All data relating to this study will be kept for 5 years on a BU password protected secure network.

**Will I be recorded, and how will the recorded media be used?**

Yes, if you take part in the focus groups. The recording will help me to capture the information that will be sought from you during the study. However, you will be given the right to accept or reject recording the session. No other use will be made of the recording without your written permission, and no one outside the research team will be allowed access to the original recordings. The audio recordings made during this research will be deleted once transcribed and anonymised. No other use will be made of them without your written permission, and no one outside the project team will be allowed access to the original recordings. The transcription of the session will not include your name or any identifiable information. Instead, each person will be identified by a participant number (i.e. participant 1, participant 2, participant 3, etc.).

**Who should I contact for further information?**

If you have any questions or require more information about this study, please contact me using the following contact details:

Sainabou Cham

Faculty of Science and Technology  
Bournemouth University  
BH12 5BB  
Scham@bournemouth.ac.uk  
Tel: 01202 961217

**What if something goes wrong?**

If this study has harmed you in any way or if you wish to make a complaint about the conduct of the study you can contact Professor Tinatian, Deputy Dean of the Faculty of Science and Technology at Bournemouth University using the details below for further advice and information:

Professor Tinatian Zhang  
Faculty of Science and Technology  
Bournemouth University  
BH12 5BB  
[researchgovernance@bournemouth.ac.uk](mailto:researchgovernance@bournemouth.ac.uk)  
Tel: 01202 965721

**Thank you for reading this information sheet and for considering taking part in this research.**

## **Part B: Study 2 information sheet**

# **Information Sheet**



### **The title of the research project:**

Engineering technology-assisted behavioural requirements aiding by user stories

### **Invitation**

You are being invited to take part in this research study. This project is being undertaken by Sainabou Cham, a PhD student in the Department of Computing and Informatics at Bournemouth University.

Before you decide whether or not to take part, it is important for you to understand why this research is being done and what it will involve. Please take time to read the following information carefully and discuss it with friends and relatives if you wish. Ask us if there is anything that is unclear or if you would like more information.

### **What is the purpose of the study?**

This research aims to explore whether people can write their behavioural requirements in a user story format. As a first step, the study seeks to investigate users thoughts on the use of technology to help the management of problematic online behaviour and the aspects that need to be considered when technology is used to assist the behavioural change process in domains like problematic social media usage, problem gambling, and problematic online gaming. Also, the study will investigate users thought on the idea of employing the user story format to express behavioural requirements.

### **Why have I been invited to take part?**

You have been invited because of your background and experience in relation to problematic online behaviour. This research will involve experts in areas related to the problem space and also individuals who have or had problematic experience with online usage. Also, you will help the research assistant explore whether people can write their behavioural requirements in a user story format.

### **Do I have to take part?**

You are free to decide whether you wish to take part or not. If you do decide to take part you will be asked to sign a consent form. You are free to withdraw from this study at any time and without giving reasons and without there being any negative consequences, up to the point where the data are processed and become anonymous, so your identity cannot be determined.

### **What would taking part involve?**

Depending on your role, you will be asked to participate in one or more of these activities:

- Interview sessions: in these sessions, the researcher will discuss with you individually about your perceptions on the use of software to manage the problematic online behaviour including the various aspects that need to be put into consideration, and the opportunities and risks that the use of software might introduce.

### **What are the benefits of taking part?**

You will be contributing to the knowledge about engineering technology-assisted behavioural requirements which will help the behavioural change process and improve people online behaviour.

### **What are the risks of taking part?**

There are no speculated risks for participating in this study.

### **How my information will be used?**

The data collected will be stored securely, and will be used only for the purpose of this study. The data will be completely anonymised before it appears in any type of publication. No other use will be made of them without your written permission, and no one outside the project will be allowed to access the original files.

### **Who will have access to my information?**

Your confidentiality will be safeguarded during and after the study. Only the researcher and her research collaborators on the same project will be able to have access to your data. The data will be stored securely and destroyed immediately after use.

### **Will I be recorded, and how will the recorded media be used?**

Yes, if you take part in the interviews and focus groups sessions. The recording will help the research team to capture the information that will be sought from you during the interview or the focus group. However, you will be given the right to accept or reject recording the interview. No other use will be made of the recording without your written permission, and no one outside the research team will be allowed access to the original recordings. The audio recordings made during this research will be deleted once transcribed and anonymised. The transcription of the interviews will not include your name or any identifiable information

### **Contact for further information**

If you have any queries about this research, please contact my PhD supervisor Dr Raian Ali by email on [rali@bournemouth.ac.uk](mailto:rali@bournemouth.ac.uk) or by phone on 01202 966682 or by post to:

Dr Raian Ali  
Department of Computing and Informatics  
Faculty of Science and Technology  
Bournemouth University  
BH12 5BB

### **Complaints**

If you have any complaints about this project please contact Professor Tiantian Zhang, Deputy Dean for Research and Professional Practice of the Faculty of Science and Technology at Bournemouth University at the following address:

Professor Tiantian Zhang  
Talbot Campus, Fern Barrow, Poole, BH12 5BB  
E-mail: [researchgovernance@bournemouth.ac.uk](mailto:researchgovernance@bournemouth.ac.uk)

Tel: 01202 965721

**Thank you for taking the time to read this information sheet, and please do not hesitate to contact me if you have any queries.**

## **Part C: Study materials focus group session**

### **Discussion area 1**

To understand staff and students printing habits

#### **Questions:**

1. How would you assess your overall printing behaviour?
2. What factors do you think could influence your printing habits, i.e. your printing behavioural determinants? E.g., goals, motivation, influence from others, and skills.
3. Finally, do you think you need to change your behaviour towards printing in order to help achieve greener printing habits at BU?

### **Discussion area 2:**

In this section, figures 1, 2, 3, and 4 show some examples of basic print awareness methods, please take a minute to have a look the images.



Figure: Feedback on printing statistics, (Xerox 2016)



Figure: Monthly printing points, (Xerox 2016)



Figure: Print history, (Xerox 2016)



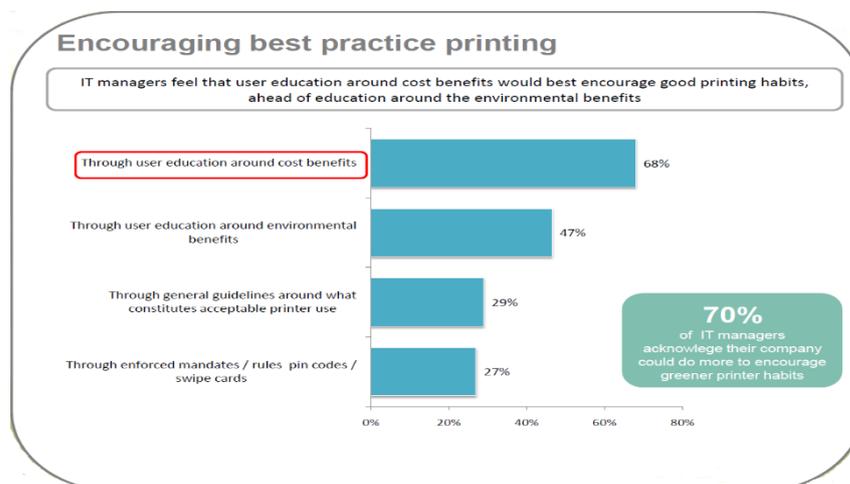
Using gamification to compare users printing points, (Xerox 2016)

Questions:

4. When you see these printing awareness images what come to you mind?
5. What do you like or not like about these printing awareness methods?
6. Which of these printing awareness methods could influence your printing habits and why?
7. What other methods do you think would help influence your printing habits?

**Discussion area 3**

Figure 5 below shows some examples of best practice printing



Examples of best printing practice, (Anon. 2010)

**Questions:**

- 8. Do you think that the points listed above could help encourage best printing habits? Why or why not?
- 9. Apart from the ones listed in figure 5 above, in your opinion how do you think we could encourage better printing practice?

**Discussion area 4**

The figure below shows some examples causes print wastage.

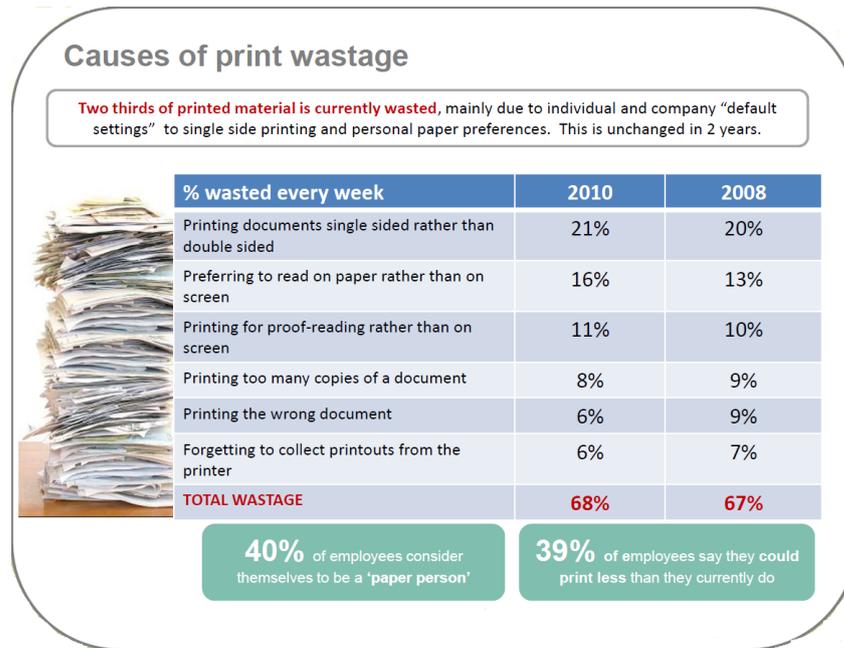


Figure: (Anon. 2010)

**Questions:**

- 10. Which of these causes of print wastage do you think applies to you?
- 11. Apart from the ones listed in the above figure, can you think of any other causes of print wastage?
- 12. In your daily use of printing, how much of the material you print is wasted
- 13. How do you think print wastage could be tackle

**Discussion area 5**

The figure below shows some examples of unnecessary printing or wastage of printing papers.

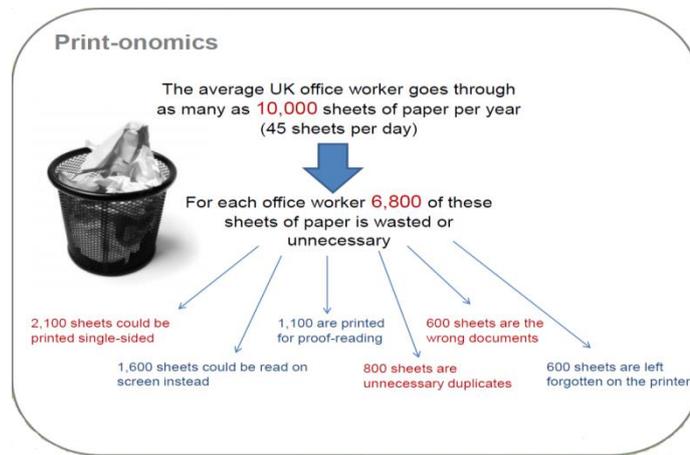


Figure: (Anon. 2010)

Question: How you would compare yourself to the numbers in the figures above.

### **Discussion area 6**

In this section, the discussion will focus on discovering staff and students printing requirements.

Some examples are provided below:

- Send me reminders when I reach a certain number of papers (e.g. 200papers)
- Allow me to print at certain times
- Allow me print based on the task on hand
- Set printing limit based on my role

### **Discussion area 7**

Table 1 below, shows examples of factors that could lead people to deviate from their set goals

Question: Using table 1 as an example, could you think of factors that could facilitate deviation from your printing goals.

Table: Deviation facilitators

Situations in which people could deviate
The lack or poor communication
Lack of understanding the obstacles for goal attainment
Lack of commitment and motivation
Over-estimating participants' self-efficacy level
Social influence/peer pressure
Conflicting goals
Environmental influence – the lack of a structured approach for goal setting
Setting ambiguous goals
Not understanding participants needs

Lack of a structured way of setting the goal
Triggers and timing of goal-related activity
Negative affect in monitoring goal progress
Setting complex or highly challenging goals
The source of goal – who set the goal

### **Discussion area 8**

Table 1 above shows some examples of behaviour change techniques/deviation countermeasure and brief definition

Question: In the context of printing, which techniques or countermeasures will be effective as part of an intervention to help change printing habits?

### **Discuss area 9**

Table 2 below shows three categories of intervention delivery modes, and under each category, a list of delivery modes is provided.

Question: In terms of printing, what delivering modes will be more effective?

Mode of delivery (Webb, Joseph, et al. 2010)

<b>Automated Functions</b>	<b>Communicative functions</b>	<b>supplementary modes</b>
Testimonials	Ask the expert for advice	Emails
Videos	Expert-led discussion board	Telephones
Games	Chat sessions	Short messaging service
Feedback comparing progress to goals	Scheduled contact with advisor	Video Conferencing
Reinforcing messages	Peer-to-peer discussions boards	
Coping messages	Forums	
Reminders	Live systems	

### **Part D: User Interview questions**

1. What are your initial thoughts about the use of technology to assist the management of problematic online behaviour?
2. What are the aspects that need to be put into consideration when technology is used to assist the management of behavioural goals?
3. What do you want to see from such a system?
4. What are the opportunities and challenges that the use of technology may introduce?
5. How do you think the challenges mentioned above can be managed?
6. What do you think will inspire users to consider the use of technology to help address their problematic online behaviours?

7. When software is used to aid users achieve their behavioural requirements, what features/elements do you prefer the software to have: E.g. progress bar, timers, reminders, avatar.
8. What do you think about the idea of expressing behavioural requirements using the user story format? Initial behavioural requirements user story templates to be presented to the interviewees and they will be familiarised with the template.
9. Do you have any suggestions on the different aspects to have on a behavioural requirements user story template? We are interested in identifying the different elements that should be included on the user story template such as gamification elements, software features.
10. What do you think will frustrate various users about the idea of expression behavioural goals following user story format? We are interested in identifying the different categories of users from the perspective of their perception of these user stories?
11. Do you have any other suggestions on what you would like to be specified on your behavioural goal user story?

### **Part E: Results of interview data**

<b>Theme: Acceptance</b>		
<b>Sub Themes</b>	<b>Quotes</b>	<b>Description</b>
1.1 Ease of use		
1.1.1 Simplicity		
	<p>“The technology should be Like easily usable so is really simple so instead of like if you are trying to find out the log out button on Facebook you have to trail quite deep into it when you could just have the button there like you know just really easy and clearly label because it may look cooler having it high tech but people might not want to use it as much because they are like it looks cool but I cannot use it because it’s too complicated”.</p> <p>“The technology should not be overly technical in a way”.</p>	Participants describe that the simplicity of the technology would help enhance user navigation.
1.1.2 Effortlessness		
	“I would like the technology to be user-friendly and one that I can easily interact with.”	Participants expect the interaction with the technology to require minimal effort.
1.1.3 Understandable		
	The technology should be easy to learn and easy to understand by all users irrespective of age, gender or origin.	Participants describe how all users should be able to understand the technology.
1.2 Usefulness		
1.2.1 Feedback		
	“In addition to monitoring the behaviour, the software should provide information telling you what should be right, what should be wrong for you which	Participants describe how the technology should not just stop at monitoring them but also should provide information relating to their actions.

	could help you make the right decision”.	
<b>1.2.2 Monitoring</b>		
	“The software should be intelligent, working at the back end monitoring all the activities of the user and then provide recommendation according to the information recorded about their usage”.	Participants describe what should be included in the monitoring activity.
<b>1.2.3 Usage regulation</b>		
	“People are already using technology, so if this technology comes and helps them to see how they can use social technology better and control their usage that would be a good thing”. “So, if nobody is going to come and physically tell you, then I think having technology within technology to help you manage your online behaviour would be beneficial”.	Participants describe the significance of integrating the new technology within the application they interact with.
<b>1.2.4 personalisation</b>		
	“I think it would be a very helpful idea, first of all I would like to see an application that becomes personalise for every user and I would like to see an application that takes into consideration all the online activity of the user and try to manage these activities”.	Participants expect the technology to be personalised for the users.
<b>1.2.5 Goal setting</b>		
	“You have to get the right amount of usage on both different levels like for example may be on this new software you can have like little breaks whereas the software tells you to go and do something, it gives you like goals for the day and make sure you have to complete every single one”.	Participants expect the technology to be able to help them set usage goal.

This section presents the supporting documents utilised for the method evaluation study discussed in Chapter 8.

**Part A: Information sheet**

**Information Sheet**



**The title of the research project:**

*Eliciting requirements for TAGS*

**Invitation**

You are being invited to take part in this research project conducted by Sainabou Cham, a PhD research student in the Department of Computing and Informatics, Faculty of Science & Technology at Bournemouth University. Before you decide whether or not to take part, it is important for you to understand why this research is being done and what it will involve. Please take time to read the following information carefully and discuss it with friends and relatives if you wish. Ask us if there is anything that is unclear or if you would like more information. You will be asked to sign a participant agreement form and at the end of the session, you will be given a copy of this information sheet and a copy of the signed participant agreement form.

**What is the purpose of the study?**

The aim of this research is to validate TAGS elicitation method which is meant to help the gathering of goal setting requirements. This study is being conducted to explore the usability and validity of the proposed method for assisting users to express their goal setting requirements to help them regulate their problematic social networks behaviour.

**Why have I been invited to take part?**

You have been invited because of your background and experience in relation to problematic social networks behaviour. You will help the researcher explore whether people can express their goal setting requirements following the proposed method.

**Do I have to take part?**

You are free to decide whether you wish to take part or not. If you do decide to take part you will be given this information sheet to keep and be asked to sign a participant agreement form. You are free to withdraw from this study at any time and without giving reasons and without there being any negative consequences, up to the point where the data are processed and become anonymous, so your identity cannot be determined, without it affecting any benefits that you are entitled to in any way. You do not have to give a reason. Deciding to take part or not will adversely affect you.

**What would taking part involve?**

Depending on your role, you will be asked to participate in one or more of these activities:

- Focus group sessions: In these sessions, the researcher will invite you and others to specify to express your goal setting requirements using the proposed method.
  - Step 1: The system analyst will be asked to create scenarios depicted various problematic usage of a social network application following specified scenario

generation criteria. The purpose of the scenarios is to assist the study participants (analyst and representative users) focus the elicitation process on specific problematic behaviour.

- Step 2: Study participants (representative users with assistance from the system analyst) will be asked to express their goal setting requirements using the scenarios created in **Step 1**.
  - Step 3: Study participants will be asked to evaluate the usefulness of elicitation template and its supporting documentation then identify the advantages and weakness of the template and documents.
- Interview sessions: in these sessions, the researcher will discuss with experts individually in order to gather some feedback and their opinion on the proposed elicitation method.

### **What are the benefits or risks of taking part?**

Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will improve our knowledge about eliciting goal setting requirements for technology-assisted solutions which will help the behavioural change process and improve people social networks behaviour. There are no speculated risks for participating in this study.

### **How will my information be kept?**

All the information that I collect during the course of the research will be kept strictly confidential. You will not be able to be identified in any reports or publications. All data relating to this study will be kept for five years on a BU password protected secure network.

### **Will I be recorded, and how will the recorded media be used?**

Yes, you will be recorded if you take part in the interviews and focus groups sessions. The recording will help the research team to capture the information that will be sought from you during the interviews and focus group. However, you will be given the right to accept or reject being recorded. No other use will be made of the recording without your written permission, and no one outside the research team will be allowed access to the original recordings. The audio recordings made during this research will be deleted once transcribed and anonymised. The transcription of the interviews and focus groups will not include your name or any identifiable information. Instead, each person will be identified by their code (i.e. #id232223, #id150821, etc.).

### **Contact for further information**

If you have any queries about this research please contact Sainabou Cham by email on [scham@bournmouth.ac.uk](mailto:scham@bournmouth.ac.uk) or by phone on 01202 966682 or by post to:

Sainabou  
Department of Computing and Informatics Faculty of Science and Technology  
Bournemouth  
BH12 5BB  
Cham  
University

### **Complaints**

If you have any complaints about this project please contact Professor Tiantian Zhang, Deputy Dean for Research and Professional Practice of the Faculty of Science and Technology at Bournemouth University at the following address:

Professor Tiantian Zhang  
Talbot Campus, Fern Barrow, Poole, BH12 5BB  
E-mail: [researchgovernance@bournemouth.ac.uk](mailto:researchgovernance@bournemouth.ac.uk) Tel: 01202 965721

**Thank you for taking the time to read this information sheet, and please do not hesitate to contact me if you have any queries.**

**Part B: Participants incentive receipt**

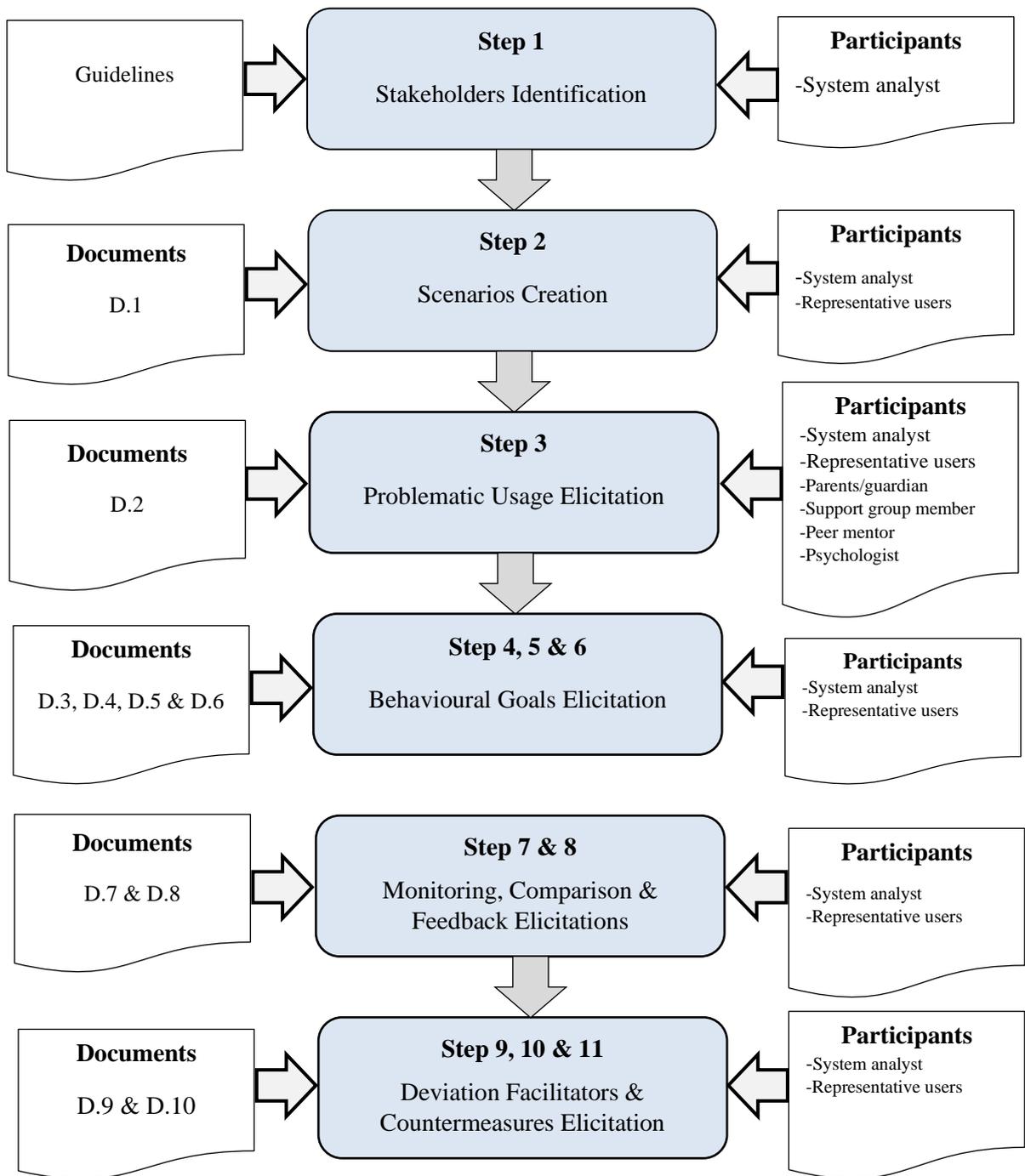


**Receipt for participant compensation**

This information will be used for financial audit and verification only. It will be kept confidential.

Participant name:	
Participant's signature:	
Phone number:	
1 <sup>st</sup> line of address and post code:	
Date of payment:	
Amount of payment:	
Researcher's name:	

**Part C: TAGS evaluation study road map**



**Part D: General elicitation templates**

			User		
<b>Template ID: 1</b>			<b>Social Media Usage Statement</b>		
Which family of features is causing your problematic social networks usage?					
Conversations	<input type="checkbox"/>	Groups	<input type="checkbox"/>	Presence	<input type="checkbox"/>
Reputation	<input type="checkbox"/>	Identity	<input type="checkbox"/>	Relationships	<input type="checkbox"/>
<b>Other</b>		(please		specify)	
.....					

In relation to the family of features selected above, what are the actual features you struggle with on social networks?
Notifications <input type="checkbox"/> Location sharing <input type="checkbox"/> Posting <input type="checkbox"/> Profile <input type="checkbox"/> Length of Messages <input type="checkbox"/> Liking <input type="checkbox"/> Endless feeds <input type="checkbox"/> Private messaging <input type="checkbox"/> Impression <input type="checkbox"/> Delivery Report <input type="checkbox"/> Commenting <input type="checkbox"/> Synchronous dialogue <input type="checkbox"/> Pull to refresh <input type="checkbox"/> Customised content <input type="checkbox"/> Group sharing <input type="checkbox"/> Status <input type="checkbox"/> Temporarily available content <input type="checkbox"/> Asynchronous dialogue <input type="checkbox"/> Sharing <input type="checkbox"/> Relationship status <input type="checkbox"/> Tagging <input type="checkbox"/> The wall <input type="checkbox"/> Other (please specify) .....
Can you describe the cause of your problematic social networks usage?
<b>Emotions:</b> E.g. enhancing self-esteem, improving mood, opportunity to relate to others, emotional support from others ..... ... <b>Peer pressure:</b> E.g. when others want me to be on social media at specific times ..... ... <b>Making influence:</b> E.g. influencing others to behave in a certain way on social media ..... ... <b>Other</b> (please specify) .....
How do you feel about the amount of time spent using social networks and the time of use?
..... ..... .....
At what point do you think you cross the threshold of a moderate social networks usage to a risky usage? E.g. in terms of time, i.e. when you check Facebook notifications continually for two hours, after you post a lot on your Facebook wall in a short time
..... ..... .....
When you feel you are on social networks for a long time, what offline activities do you think would help distract you from social networks?
..... ..... .....

**User**

<b>Template ID: 2</b>	<b>Consequences of Problematic Social Network Usage</b>
As a result of your problematic social networks usage, what negative life experiences do you suffer from?	
<b>Emotional Problems</b>	
Lowering self-esteem <input type="checkbox"/> Aggressiveness <input type="checkbox"/> Restlessness <input type="checkbox"/> Preoccupation <input type="checkbox"/> Anxiety <input type="checkbox"/> Reduce self-confidence <input type="checkbox"/> Inadequacy <input type="checkbox"/> Depression <input type="checkbox"/> Stress <input type="checkbox"/> Irritability <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>	
<b>Negative life experience</b>	<b>When doe it happen</b>

<b>Disrupted Familial</b>	
Partnerships and relationship problems <input type="checkbox"/>	Marital discord <input type="checkbox"/>
Spending less quality time with family <input type="checkbox"/>	Negligence of children <input type="checkbox"/>
Affect parent-child relationship depth and strength <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>	
Negative life experience	When does it happen
<b>Personal Problems</b>	
Neglect of personal life <input type="checkbox"/>	Increased loneliness <input type="checkbox"/>
Poor time management <input type="checkbox"/>	Distraction <input type="checkbox"/>
Irregular sleeping pattern <input type="checkbox"/>	Confused thinking <input type="checkbox"/>
Avoidance of facing real-life problems <input type="checkbox"/>	Lack of concentration <input type="checkbox"/>
	Sleep deprivation <input type="checkbox"/>
	Procrastination <input type="checkbox"/>
	Reduced attention to daily life activities <input type="checkbox"/>
	Other wellbeing issues <input type="checkbox"/>
<b>Elaborate on when the negative experience you select happen?</b>	
Negative life experience	When does it happen
<b>Social Problems</b>	
Reduced amount of face-to-face social communication <input type="checkbox"/>	Disrupted peer relationships <input type="checkbox"/>
Reduced skills of face-to-face social communication <input type="checkbox"/>	Letting down family and friends <input type="checkbox"/>
Neglecting social contacts <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>	
Negative life experience	When does it happen
<b>Work Performance Problems</b>	
Poor academic performance <input type="checkbox"/>	Academic failure <input type="checkbox"/>
Lower-grade point average <input type="checkbox"/>	Early school truancy <input type="checkbox"/>
Loss of creativity <input type="checkbox"/>	Reduced performance <input type="checkbox"/>
Poor time management <input type="checkbox"/>	Disrupting peers <input type="checkbox"/>
Reduced progression <input type="checkbox"/>	Disrupting colleagues <input type="checkbox"/>
Loss of productivity <input type="checkbox"/>	Reduced teamwork <input type="checkbox"/>
Missing important work deadlines <input type="checkbox"/>	Loss of profitability <input type="checkbox"/>
<b>Elaborate on when the negative experience you select happen?</b>	
Negative life experience	When does it happen
<b>Invasion of privacy by others</b>	
Damage on individuals' public profile <input type="checkbox"/>	Cyber-stalking <input type="checkbox"/>
<b>Elaborate on when the negative experience you select happen?</b>	
Negative life experience	When does it happen
<b>Dietary-related problems</b>	
Skipping meals <input type="checkbox"/>	Irregular dietary behaviour <input type="checkbox"/>
Forgetting meals <input type="checkbox"/>	Poor diet quality <input type="checkbox"/>
	Preference for fast food <input type="checkbox"/>
	Disrupting family or group eating <input type="checkbox"/>
<b>Elaborate on when the negative experience you select happen?</b>	
Negative life experience	When does it happen
<b>The Subject of Harm</b>	
Self-harm <input type="checkbox"/>	Harm to others <input type="checkbox"/>
	Harm from others <input type="checkbox"/>
<b>Elaborate on when the negative experience you select happen?</b>	
Negative life experience	When does it happen
Please state what you <b>struggle</b> to control as a result of your problematic Facebook behaviour: e.g. I struggle to control the frequency of checking, I struggle to switch off during lectures, and struggle to stop checking when with the family or when I am at work.	

.....  
 .....  
 .....

User

<b>Template ID: 3</b>	<b>Current Behaviour Change Interventions</b>
Are there any actions you are presently taking to try to improve your problematic social networks usage? If yes, what are they?	
Actions taken: ..... ..... .....	
<b>Elaborate on the action/s taken:</b>	

Dialogue

<b>Template ID: 4</b>	<b>Setting Behavioural Change Goals</b>
What behavioural targets would you like to set to help you manage your problematic social networks usage? Refer to (Doc 3 and Doc 4 for types and source of goals).	
<b>Behavioural Goals (order by priority)</b> , e.g. for a student, goals that might help reduce my procrastination on Facebook may be on top of the list. 1. .... 2. .... 3. .... 4. ....	
To list more goals, use the blank sheet at the end (Template ID4 blank)	
Estimate the time by which your behavioural goals are to be achieved	
Proximal goals (goal set on a short-term basis) <input type="checkbox"/> Distal goals (goal set on a long-term basis) <input type="checkbox"/>	
<b>Goal</b>	<b>Type of Goal</b>
	<b>Goal Proximity</b>
	<b>Example</b>
G1	
G2	
G3	
G4	
I would prefer to set goals <source of your behavioural goals>: Refer to (Doc 3 for the source of goal)	
<b>Goal</b>	<b>Source of goal</b>
	<b>Reason for choice</b>
G1	
G2	
G3	
G4	
On a scale of 1 to 10, how committed are you towards the set goals? ..... ..... .....	

Dialogue

<b>Template ID: 5</b>	<b>Monitoring &amp; Comparing Behavioural Goals</b>
So I would like the software to help me achieve my goals by (state your preferences around monitoring and comparison) Refer to (Doc 7 and Doc 8 for monitoring & comparison)	
<b>Monitoring progress made towards the goals</b>	
Self-monitoring <input type="checkbox"/> Peer-monitoring <input type="checkbox"/> Automated monitoring <input type="checkbox"/> Supervisory monitoring <input type="checkbox"/>	
<b>Please provide details:</b>	

Goal	Monitoring Preference	Example
G1		
G2		
G3		
G4		
<b>Comparison of performance made towards the goals</b>		
Self-comparison <input type="checkbox"/>		Social-comparison <input type="checkbox"/>
<b>Please provide details:</b>		
Goal	Comparison Preference	Example
G1		
G2		
G3		
G4		

**Dialogue**

Template ID: 5.1	Behavioural Goal Feedback
In terms of feedback on your behaviour and performance made towards your goal, what feedback techniques would you prefer? ( <b>Doc 7 and Doc 8 for feedback techniques</b> )	
<b>Feedback Content, i.e. the type of information included in the feedback</b>	
G. Performance Feedback	H. Suggestion Feedback
I. Motivational Feedback	J. Educational Feedback
K. Supportive Feedback	L. Comparative Feedback
<b>Elaborate on</b>	
<b>When it should happen:</b>	
<b>How it should happen:</b>	
<b>Elaborate on</b>	
<b>When it should happen:</b>	
<b>How it should happen:</b>	
<b>Elaborate on</b>	
<b>When it should happen:</b>	
<b>How it should happen:</b>	
<b>Elaborate on</b>	
<b>When it should happen:</b>	
<b>How it should happen:</b>	

**Dialogue**

Template ID: 5.2	Behavioural Goal Feedback		
<b>Feedback Framing, i.e. the language used in the message content of the feedback</b>			
Loss Frame	Gain Frame	Formal	Informal
<b>Elaborate on: When to implement, feedback messages, subject of feedback, source of feedback and features feedback is about</b>			
<b>Feedback Framing</b>		<b>When to implement</b>	
Loss frame			
Gain frame			
Formal			
Informal			

<b>Feedback Framing</b>	<b>Feedback message example</b>
Loss frame Gain frame Formal Informal	
<b>Feedback Framing</b>	<b>The subject of the feedback</b>
Loss frame Gain frame Formal Informal	
<b>Feedback Framing</b>	<b>Source of feedback</b>
Loss frame Gain frame Formal Informal	
<b>Feedback Framing</b>	<b>Facebook features</b>
Loss frame Gain frame Formal Informal	

**Dialogue**

<b>Template ID: 5.3</b>		<b>Behavioural Goal Feedback</b>	
<b>Feedback Timing, i.e. the right timing of the feedback messages</b>			
Feedback during the behaviour	Feedback before the behaviour	Feedback after the behaviour	
<b>Elaborate on: Context, feedback subject, features feedback is about, frequency of delivery, screen position (for each goal)</b>			
<b>Goal</b>	<b>Timing: Feedback during the behaviour</b>		
G1	Context	Subject of feedback	Features
	Frequency of delivery	Screen position	
<b>Elaborate on: Context, feedback subject, frequency of delivery (for each goal)</b>			
<b>Goal</b>	<b>Timing: Feedback before the behaviour</b>		
G2	Context	Subject of feedback	Frequency of delivery
<b>Elaborate on: Context, feedback subject, features, frequency of delivery, delivery method (for each goal)</b>			
<b>Goal</b>	<b>Timing: Feedback after the behaviour</b>		
G3	Context	Subject of feedback	Features

Frequency of delivery
Delivery method

**Dialogue**

<b>Template ID: 5.4</b>	<b>Behavioural Goal Feedback</b>
<b>Feedback presentation, i.e. how the feedback is presented in terms of style</b>	
Graphical Feedback	Textual Feedback
Graphical and Text Feedback	Telephone Feedback
<b>Elaborate on: Context, frequency of delivery, medium of presentation, feedback screen time</b>	
<b>Style</b>	<b>Graphical</b>
Context	
Frequency of delivery	
Medium of presentation	
Feedback screen time	
<b>Style</b>	<b>Textual</b>
Context	
Frequency of delivery	
Medium of presentation	
<b>Style</b>	<b>Telephone</b>
Context	
Frequency of delivery	
Medium of presentation	

**User**

<b>Template ID: 6</b>	<b>Deviation Facilitators</b>
<b>Which of the elements could influence a deviation or potential deviation from your goals (Doc9)</b>	
<b>Facilitators relating to the setting of the goals</b>	
<b>No.</b>	<b>Deviation facilitators</b>
F1	<ul style="list-style-type: none"> <li>Social influence or peer pressure on the subject pursuing the goals</li> <li>Lack of understanding of barrier to gain attainment</li> <li>Lack of a structured method for goal setting</li> <li>Not understanding users' needs for the goals</li> <li>Goals that conflict with other goals</li> <li>Lack of commitment to the set goals</li> <li>Source of the behavioural goal</li> <li>Timing of the behavioural goals</li> <li>Frequency of executing the set goals</li> </ul>
<b>Facilitators relating to the execution of the goals</b>	
<b>No.</b>	<b>Deviation facilitators</b>

F2	Lack of performance feedback Monitoring goal progress Comparing goal performance
<b>Other Facilitators</b>	
Inaccessibility to resources to aid goal attainment <input type="checkbox"/>	Environmental influence <input type="checkbox"/>
<b>No.</b>	<b>Deviation facilitators</b>
F3	Inaccessibility to resources to aid goal attainment Environmental influence

**Dialogue**

**Template ID: 6.1 Behavioural Goal Deviation Countermeasures**

To help me follow my goals, and avoid deviating from them, I would like preventative and corrective plans such as (*state your requirements for deviation countermeasure techniques*): Refer to (Doc 9 and Doc 10) for short descriptions and additional techniques.

**Non-Technical Countermeasures: Relating to the setting of the goal**

Deviation Facilitator	Deviation Countermeasures (Templates ID 1 to ID 4, and Doc. 7)	
F1	Assess commitment State a clear goal outcome Review goal Set a specific goal Have a verbal commitment to the goal	A clear understanding of the goal and goal-related task Discuss barriers to goal attainment Instruction (for assigned and guided goals)
<b>Provide details on:</b>		
Context		
Implementation		
Constraints		

**Technical Countermeasures 1: Monitoring goal performance**

Self-monitoring       Peer-monitoring       Automated-monitoring

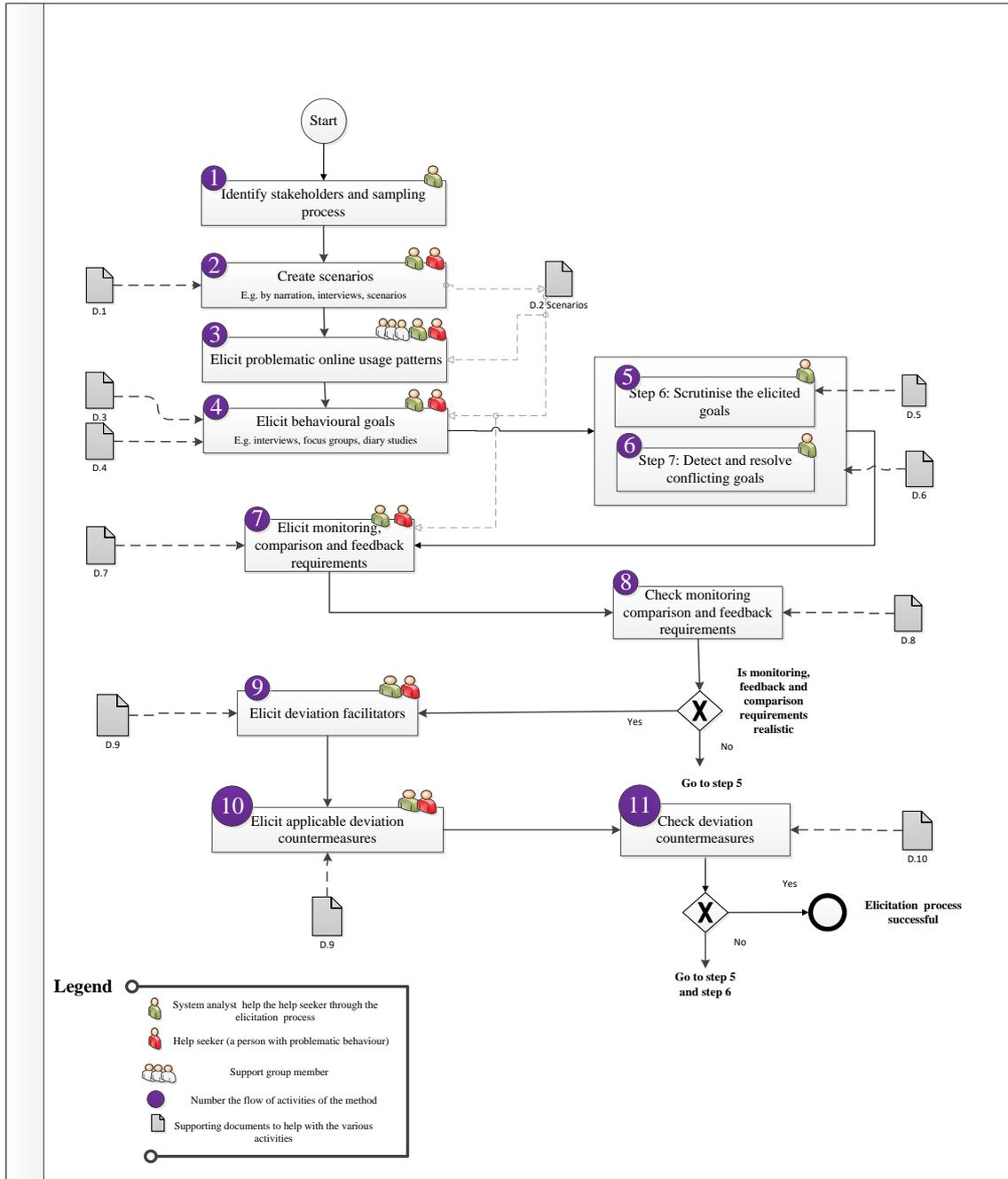
Deviation Facilitator	Deviation Countermeasures (Template ID 1 to ID 4, and Doc. 8)	
F2	Self-monitoring Peer-monitoring	Automated-monitoring Supervisor-monitoring
<b>Provide details:</b>		
Context		
Implementation		
Constraints		

**Technical Countermeasures 2: Feedback-based on goal performance**

Deviation Facilitator	Deviation Countermeasures (Template ID 1 to ID 4, and Doc. 8)
-----------------------	---

<b>F2</b>	Feedback on real-time goal performance Acknowledge user goal performance Reminders of the set goals Self-comparison Transparency	Provide summary feedback in relation to goal performance Positive reinforcement Negative reinforcement Personalised messages Social-comparison Notification
<b>Provide details on:</b>		
<b>Context</b>		
<b>Implementation</b>		
<b>Constraints</b>		
<b>Other Techniques</b>		
<b>Deviation Facilitator</b>	<b>Deviation Countermeasures (Template ID 1 to ID 4, and Doc. 8)</b>	
<b>F3</b>	Set usage benchmark Make require resource available	Hold users accountable when a deviation occurs Relapse prevention
<b>Provide details:</b>		
<b>Context</b>		
<b>Implementation</b>		
<b>Constraints</b>		

**Part E: Method workflow diagram prior evaluation**



**Part F: TAGS elicitation templates with examples (Facebook Version)**

Template ID: 1		Facebook Usage Statement		User
Which family of features is causing your problematic Facebook usage?				
Conversations	✓		Sharing	✓
In relation to the family of features selected above, what are the actual activities you struggle with on Facebook?				
For example, you selected the conversations feature. You may struggle with:				
Private messaging	<input type="checkbox"/>	Commenting	<input type="checkbox"/>	Live chats
Length of Messages	<input type="checkbox"/>	Audio messages	<input type="checkbox"/>	Sharing
Other (please specify) .....				
Can you describe the cause of your problematic Facebook usage?				

**Emotions:** E.g. enhancing self-esteem, improving mood, opportunity to relate to others, emotional support from others.  
 .....  
 ....

**Peer pressure:** E.g. when others want me to respond on their Facebook posts, when others want me to be on Facebook at a specific time.  
 .....  
 ...

**Making influence:** E.g. influencing others to behave in a certain way on Facebook, Influencing others to change their belief about Facebook.  
 .....

**How do you feel about the amount of time spent using Facebook and the time of use?**  
 .....  
 .....

**At what point do you think you cross the threshold of a moderate Facebook usage to a risky usage? E.g. in terms of time, i.e. when you check Facebook notifications continually for two hours, after you post a lot on your Facebook wall in a short time, after missing calendar events. In terms of feelings, i.e. when people start criticising you for making a frequent status update.**  
 .....  
 .....

**When you feel you are on Facebook for a long time, what offline activities do you think would help distract you from Facebook?**  
 .....  
 .....

**User**

<b>Template ID: 2</b>	<b>Consequences of Problematic Facebook Usage</b>
As a result of your problematic Facebook usage, what negative life experiences do you suffer from?	
<b>Emotional Problems</b>	
Lowering self-esteem <input type="checkbox"/> Aggressiveness <input type="checkbox"/> Restlessness <input type="checkbox"/> Preoccupation <input type="checkbox"/> Anxiety <input type="checkbox"/>	
Reduce self-confidence <input type="checkbox"/> Inadequacy <input type="checkbox"/> Depression <input type="checkbox"/> Stress <input type="checkbox"/> Irritability <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>	
<b>Negative life experience</b> Depression	<b>When does it happen</b> Seeing friends posting on their Facebook wall pictures or videos having a good time at a social event makes me depressed.
<b>Disrupted Familial</b>	
Partnerships and relationship problems <input type="checkbox"/> Marital discord <input type="checkbox"/> Negligence of children <input type="checkbox"/>	
Spending less quality time with family <input type="checkbox"/> Affect parent-child relationship depth and strength <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>	
<b>Negative life experience</b> Marital discord	<b>When does it happen</b> When people post sensitive information about their partners on Facebook or when people stalk their partners by constantly checking or monitoring activities on their timeline, this could lead to relationship issues.
<b>Personal Problems</b>	

Neglect of personal life <input type="checkbox"/>	Increased loneliness <input type="checkbox"/>	Distraction <input type="checkbox"/>	Confused thinking <input type="checkbox"/>
Poor time management <input type="checkbox"/>	Lack of concentration <input type="checkbox"/>	Sleep deprivation <input type="checkbox"/>	Procrastination <input type="checkbox"/>
Irregular sleeping pattern <input type="checkbox"/>	Increased escapism <input type="checkbox"/>	Reduced attention to daily life activities <input type="checkbox"/>	
Avoidance of facing real-life problems <input type="checkbox"/>		Other wellbeing issues <input type="checkbox"/>	
<b>Elaborate on when the negative experience you select happen?</b>			
<b>Negative life experience</b>	<b>When does it happen</b>		
Increased loneliness	When I am using Facebook and seeing some contacts making status updates planning a social event, and I am not invited to it.		
<b>Social Problems</b>			
Reduced amount of face-to-face social communication <input type="checkbox"/>	Disrupted peer relationships <input type="checkbox"/>		
Reduced skills of face-to-face social communication <input type="checkbox"/>	Letting down family and friends <input type="checkbox"/>		
Neglecting social contacts <input type="checkbox"/>			
<b>Elaborate on when the negative experience you select happen?</b>			
<b>Negative life experience</b>	<b>When does it happen</b>		
Letting down family and friends	When I am on Facebook making posts, tagging friends, liking and commenting on posts made by friends, I tend to forget about other essential things like birthday parties and other special occasions.		
<b>Work Performance Problems</b>			
Poor academic performance <input type="checkbox"/>	Academic failure <input type="checkbox"/>	Early school truancy <input type="checkbox"/>	Reduced performance <input type="checkbox"/>
Lower-grade point average <input type="checkbox"/>	Disrupting peers <input type="checkbox"/>	Disrupting colleagues <input type="checkbox"/>	Loss of creativity <input type="checkbox"/>
Poor time management <input type="checkbox"/>	Reduced teamwork <input type="checkbox"/>	Loss of profitability <input type="checkbox"/>	Reduced progression <input type="checkbox"/>
Loss of productivity <input type="checkbox"/>	Missing important work deadlines <input type="checkbox"/>		
<b>Elaborate on when the negative experience you select happen?</b>			
<b>Negative life experience</b>	<b>When does it happen</b>		
Disruption peers	When I see a funny video on my Facebook newsfeed, I would call on my friends to have a look, during which they might be distracted from other tasks.		
<b>Invasion of privacy by others</b>			
Damage on individuals' public profile <input type="checkbox"/>	Cyber-stalking <input type="checkbox"/>		
<b>Elaborate on when the negative experience you select happen?</b>			
<b>Negative life experience</b>	<b>When does it happen</b>		
Damage on individuals' public profile	When people shared photos or videos of them or others and tagged their friends in the post, and this can be seen and used by employers or potential employers.		
<b>Dietary-related problems</b>			
Skipping meals <input type="checkbox"/>	Irregular dietary behaviour <input type="checkbox"/>	Poor diet quality <input type="checkbox"/>	Preference for fast food <input type="checkbox"/>
Forgetting meals <input type="checkbox"/>	Poor quality eating time <input type="checkbox"/>	Disrupting family or group eating <input type="checkbox"/>	
<b>Elaborate in terms of when the negative experience you select happen?</b>			
<b>Negative life experience</b>	<b>When</b>		
Poor diet quality	When people are posting, sharing, re-sharing and scrolling through their Timeline continuously for hours and forgetting to eat or drink or have very little to eat or drink.		
<b>The Subject of Harm</b>			
Self-harm <input type="checkbox"/>	Harm to others <input type="checkbox"/>	Harm from others <input type="checkbox"/>	
<b>Elaborate in terms of when the negative experience you select happen?</b>			
<b>Negative life experience</b>	<b>When does it happen</b>		

Self-harm	When I use the commenting and newsfeed features continuously for hours, I have pain on my wrist, and text-neck due to the scrolling and position of the head.
Harm to others	When you share a picture of someone who might be in a compromise position and send the photo privately to the person, then you are causing harm to them.
Please state what you <b>struggle</b> to control as a result of your problematic Facebook behaviour: e.g. I struggle to control the frequency of checking, I struggle to switch off during lectures, and struggle to stop checking when with the family or when I am at work.	
.....	
.....	
.....	

**User**

<b>Template ID: 3</b>	<b>Current Behaviour Change Interventions</b>
Are there any actions you are presently taking to try to improve your problematic Facebook usage? If yes, what are they?	
Actions taken:	
.....	
.....	
.....	
<b>Elaborate on the action/s taken:</b>	
For example, you are switching Wi-Fi connection at specific times during the day to avoid sharing on Facebook or leaving devices behind when going out with friends to avoid the temptation of posting on Facebook about the outing.	

**Dialogue**

<b>Template ID: 4</b>	<b>Setting Behavioural Goals</b>		
What behavioural targets would you like to set to help you manage your problematic Facebook usage? Refer to (Doc 3 and Doc 4 for types and source of goals).			
<b>Behavioural Goals (order by priority)</b> , e.g. for a student, goals that might help reduce my procrastination on Facebook may be on top of the list.			
<b>G1.</b> I want to reduce the time spent browsing my News Feed and sharing posts on Facebook.			
<b>G2.</b> I want to set the time spent procrastinating on through my Facebook wall.			
<b>G3.</b> I want to restrict the frequency of checking my Facebook notification feature during working hours.			
<b>G4.</b> As a group, we want to avoid using the ‘commenting’ and ‘liking’ features on Facebook at specific times.			
<b>To list more goals, use the blank sheet at the end (Template ID4 blank)</b>			
<b>Estimate the time by which your behavioural targets are to be achieved</b>			
Distal goals (goal set on a long-term basis), and Proximal goals (goal set on a short-term basis)			
See the examples in the table below:			
<b>Goal</b>	<b>Type of Goal</b>	<b>Goal</b>	<b>Example</b>
		<b>Proximity</b>	
<b>G1</b>	Reduction goal	Proximal goal	To reduce the time spent on scrolling through Facebook by 15 minutes weekly.
<b>G2</b>	Time-based goal	Distal goal	To reduce the time spent browsing my News Feed and sharing posts on Facebook.
<b>G3</b>	Frequency-based	Proximal goal	To restrict the number of times I checked the Facebook notification daily by 20.
<b>G4</b>	Avoidance goal	Distal goal	We want to avoid using the Facebook ‘commenting’ feature at specific times intervals.
<b>I would prefer to set goals</b> <source of your behavioural goals>: Refer to (Doc 3 for the source of goal)			

See example below:

Goal	Source of goal	Reason for choice
G1	Participatory	I want help from an expert but still, like to have a say in the process.
G2	Self-set	Due to privacy issues, e.g. if my commenting and sharing of posts on Facebook is affecting other aspects of my life, then I would not like others to know.
G3	Guided	Lack of adequate knowledge, so the expert would better understand my usage and advice on goals that would lead to effective behavioural change.
G4	Group-set	I want to work with my close friends who are in a similar situation to set the behavioural targets.

Dialogue

**Template ID: 5 Monitoring & Comparing Behavioural Goals**

So I would like the software to help me achieve my goals by (state your preferences around monitoring and comparison) (Doc 7 and Doc 8 for monitoring & comparison)

**Monitoring progress made towards the goals**

Self-Monitoring  Peer monitoring  Automated monitoring  Supervisory monitoring

Please provide details; For example

Goal	Monitoring Preference	Example
G1	Self-monitoring	I prefer self-monitoring concerning my Facebook usage time and time of use.
G2	Automated monitoring	I prefer automated monitoring when it comes to the locations I logged in and update my Facebook status.
G3	Supervisory monitoring	I want supervisory monitoring when it comes to the content shared on Facebook to help prevent damage to my reputation and the reputation of my organisation.
G4	Peer monitoring	I prefer peer monitoring when it comes to my Facebook actions, e.g. sharing images, videos and other content, profile posting, and updating profile photos.

**Comparison of performance made towards the goals**

Self-Comparison  Social-Comparison

Please provide details: For example,

Goal	Comparison Preference	Example
G3	Self-comparison	I prefer <b>self-comparison</b> in terms of the number of times I access the Facebook Notification daily, i.e. frequency of use.
G2	Social comparison	I prefer <b>social-comparison</b> when it comes to comparing my usage of Facebook live video and posting features.

Dialogue

**Template ID: 5.1 Behavioural Goal Feedback**

In terms of feedback on your behaviour and performance made towards your goal, what feedback techniques would you prefer? ((Doc 7 and Doc 8 for feedback techniques)

**Feedback Content, i.e. the type of information included in the feedback.**

Performance Feedback	Suggestion Feedback
Motivational Feedback	Educational Feedback
Supportive Feedback	Comparative Feedback

**Elaborate on when it should happen and how it should happen: For example, you prefer motivational feedback.**

**When** When I set my own goals.  
**How** Provide rewards, i.e. points or badges when significant progress is made, or avatars showing how much I improve my usage of the Facebook commenting feature on a daily or weekly basis.

**Elaborate on when it should happen and how it should happen: For example, you prefer Supportive feedback.**

<b>When</b>	I need supportive feedback when I am failing to attain my goal or after a potential failure is detected.
<b>How</b>	Provide awareness messages on goal attainment and warnings on factors that could distract from goal attainment.
<b>Elaborate on when it should happen and how it should happen: For example, Educational feedback.</b>	
<b>When</b>	When I am unable to understand the consequences of certain use.
<b>How</b>	Provide a short description of the consequences of the usage during the interaction and detail information immediately after I finish the usage to inform a better usage, i.e. reminders.

**Dialogue**

Template ID: 5.2		Behavioural Goal Feedback
Feedback Framing, i.e. the language used in the message content of the feedback.		
Loss Frame	Gain Frame	Formal
Informal		
<b>Elaborate on: When to implement, feedback messages, subject of feedback, source of feedback and features feedback is about</b>		
Feedback Framing		When to implement
Loss frame	As a subject, in general, I want loss framing when the monitor is computerised because of the impartiality of the system.	
Gain frame	As a subject, I want positive and friendly framing of the messages when peers perform the monitoring to avoid negative comments which could affect my self-esteem.	
Formal	As a subject, I want the feedback to be formal and straight to the point when colleagues perform the monitoring.	
Informal	As a subject, for a goal 'G1' I want informal feedback when my performance progress suddenly declined.	
Feedback Framing		Feedback message example
Loss frame	Spending five hours on Facebook a week causes missing work deadlines.	
Gain frame	Reducing usage by 30 minutes a week means more quality time with the children.	
Formal feedback	The number of times you check Facebook notification went down today, and more effort is needed this week to ensure the target behaviour is attained.	
Informal feedback	Is a shame, your usage of the Facebook commenting feature increased yesterday by 15 minutes	
Feedback Framing		The subject of the feedback
Loss frame	The usage time	
Gain frame	Usage reduction time	
Formal	Interaction type	
Informal	Time of the usage	
Feedback Framing		Source of feedback
Loss frame	System	
Gain frame	Peers	
Formal	Colleagues	
Informal	System/close contacts	
Feedback Framing		Facebook features
Loss frame	Conversations	
Gain frame	Grouping	
Formal	Reputation	
Informal	Sharing	

**Template ID: 5.3** **Behavioural Goal Feedback****Feedback Timing, i.e. the right timing of the feedback messages**

Feedback during the behaviour    Feedback before the behaviour    Feedback after the behaviour

**Elaborate on: Context, feedback subject, features feedback is about, frequency of delivery, screen position (for each goal)**

Goal	Timing: Feedback during the behaviour	
G1	Context	When I am heavily engaged with the Facebook newsfeed.
	Subject of feedback	Time spent using Facebook features such as the status update, groups and messages.
	Features	While I am using the conversation features, for example, chatting with friends and commenting on others post.
	Frequency of delivery	I want the feedback to be delivered when I comment and shared posts for continuous one hour and then every 30 minutes until the usage reduces.
	Screen position	Information to appear at one corner of the screen to avoid disrupting screen view.

**Elaborate on: Context, feedback subject, frequency of delivery (for each goal)**

Goal	Timing: Feedback before the behaviour	
G2	Context	When I open my mobile device and before assessing Facebook notification to make me conscious about the usage
	Subject of feedback	Usage time for the day before
	Frequency of delivery	Once-daily and overall weekly report

**Elaborate on: Context, feedback subject, features, frequency of delivery, delivery method (for each goal)**

Goal	Timing: Feedback after the behaviour	
G3	Context	After I logged out from Facebook
	Subject of feedback	Frequency of checking the Facebook notification
	Features	Notification
	Frequency of delivery	After the second time, I logged out from the application and then every time I logged out, and at the end of the week provide a weekly report
	Delivery method	Text message and email for weekly report

**Template ID: 5.4** **Behavioural Goal Feedback****Feedback Presentation, i.e. how the feedback is presented in terms of style**

Graphical Feedback    Textual Feedback    Graphical and Text Feedback    Telephone Feedback

<b>Elaborate on: Context, frequency of delivery, medium of presentation, feedback screen time</b>	
<b>Style</b>	<b>Graphical</b>
Context	When quick visualisation is needed
Frequency of delivery	Once every 30 minutes
Medium of presentation	Flashes at the corner of device engaged with
Feedback screen time	Remove after 30 seconds of displayed
<b>Style</b>	<b>Textual</b>
Context	When subjects want praises for, e.g. G1 progress, additional information or detail report of progress
Frequency of delivery	Once at the end of each day, and average feedback at the end of the week
Medium of presentation	Email
<b>Style</b>	<b>Telephone</b>
Context	When the user is not comfortable with processing text-based feedback
Frequency of delivery	Weekly
Medium of presentation	Mobile device

User

**Template ID: 6** **Deviation Facilitators**

**Which of the elements could influence a deviation or potential deviation from your goals (Doc9)**

**Facilitators relating to the setting of the goals**

No.	Deviation facilitators
F1	<ul style="list-style-type: none"> <li>Social influence or peer pressure on the subject pursuing the goals</li> <li>Lack of understanding of barrier to gain attainment</li> <li>Lack of a structured method for goal setting</li> <li>Not understanding users' needs for the goals</li> <li>Goals that conflict with other goals</li> <li>Lack of commitment to the set goals</li> <li>Source of the behavioural goal</li> <li>Timing of the behavioural goals</li> <li>Frequency of executing the set goals</li> </ul>

**Facilitators relating to monitoring and feedback**

No.	Deviation facilitators
F2	<ul style="list-style-type: none"> <li>Lack of performance feedback</li> <li>Monitoring goal progress</li> <li>Comparing goal performance</li> </ul>

**Other Facilitators**

No.	Deviation facilitators
F3	<ul style="list-style-type: none"> <li>Inaccessibility to resources to aid goal attainment</li> <li>Environmental influence</li> </ul>

Dialogue

**Template ID: 6.1** **Behavioural Goal Deviation Countermeasures**

**To help me follow my goals, and avoid deviating from them, I would like preventative and corrective plans such as (*state your requirements for deviation countermeasure techniques*): Refer to (Doc 9 and Doc 10) for short descriptions and additional techniques.**

**Non-Technical Countermeasures: Relating to the setting of the goal**

Deviation Facilitator	Deviation Countermeasures (Templates ID 1 to ID 4, and Doc. 8)	
F1	<ul style="list-style-type: none"> <li>Assess commitment</li> <li>State a clear goal outcome</li> <li>Review goal</li> </ul>	<ul style="list-style-type: none"> <li>A clear understanding of the goal and goal-related task</li> <li>Discuss barriers to goal attainment</li> </ul>

	Set a specific goal Have a verbal commitment to the goal	Instruction (for assigned and guided goals)
<b>Provide details on: For example, assess commitment</b>		
<b>Context</b>	Early stages of the behavioural change process, when goals are to be set collaboratively.	
<b>Implementation</b>	People could be asked to complete assessment questionnaires, or persuasion mechanisms could be adopted to persuade subjects to commit to the goals verbally or improve commitment	
<b>Constraints</b>	Factors such as peer pressures, social influence, low self-esteem could influence some people to commit to the goals of the group	
<b>Technical Countermeasures 1: Monitoring goal performance</b>		
<b>Deviation Facilitator</b>	<b>Deviation Countermeasures (Template ID 1 to ID 4, and Doc. 8)</b>	
<b>F2</b>	Self-monitoring Peer-monitoring Parent-monitoring	Automated-monitoring Supervisor-monitoring
<b>Provide details: For example, self-monitoring</b>		
<b>Context</b>	When a subject believes that he/she has the required ability and understanding when there is a problem between their actual and targeted behaviour.	
<b>Implementation</b>	An online diary that subjects can document their actions in pursuance of the goals.	
<b>Constraints</b>	The subjects' level of knowledge, subjects forgetfulness, losing track of time, lack of interest, loss of interest, and inclination to lie.	
<b>Technical Countermeasures 2: Feedback-based on goal performance</b>		
<b>Deviation Facilitator</b>	<b>Deviation Countermeasures (Template ID 1 to ID 4, and Doc6)</b>	
<b>F2</b>	Feedback on real-time goal performance Acknowledge user goal performance Reminders of the set goals Self-comparison Transparency	Provide summary feedback in relation to goal performance Positive reinforcement Negative reinforcement Personalised messages Social-comparison Notification
<b>Provide details on: For example, social comparison</b>		
<b>Context</b>	When goals are set collaboratively	
<b>Implementation</b>	Compare subjects from the same or similar demographics, e.g. age, profession, academic level and similar online usage, e.g. applications used, time spent. Also, anonymous comparison, i.e. without revealing subject identity in the comparison data but just providing the averages of usage.	
<b>Constraints</b>	Competition, lower self-esteem	
<b>Other Techniques</b>		
<b>Deviation Facilitator</b>	<b>Deviation Countermeasures (Template ID 1 to ID 4, and Doc6)</b>	
<b>F3</b>	Set usage benchmark Make require resource available	Hold users accountable when a deviation occurs Relapse prevention
<b>Provide details: For example, set a benchmark</b>		
<b>Context</b>	When subjects think that close contacts usage is higher than their usage	
<b>Implementation</b>	Involved target subjects in the decision-making process when setting usage benchmark, also, such data can be compiled by the technology-assisted solution, and consider the subject's stage of change, treatment level and self-efficacy	
<b>Constraints</b>	Not involving people in the process and randomly assigning usage benchmark	

## **Part G: Guidelines for eliciting goal setting requirements**

### Phase 1: Identify stakeholders and sampling process

The stakeholders include those who ensure that the new goal setting layer meets the needs of its expected users. Before starting the elicitation process, the system analyst should identify the stakeholders to be involved in the process. A set of 12 stakeholders are identified. Some of the stakeholders will be directly involved in interacting with the template while others are not, see **Table 2**. The system analyst should be aware that not all stakeholders listed in **Table 2** would be needed for every social network application. For example, when the application does not have unlimited scrolling through the news feed, someone from psychology may not be needed. The system analyst is expected to schedule subsequent meetings to re-evaluate users PSNU. In such meetings, the set of stakeholders could change based on users progress in the behavioural change process. The sampling process can be based on the nature of the social network application. For example, if the application has a grouping feature, peer mentors should be involved; this would enable peers to work collaboratively, which could lead to inform decision.

STAKEHOLDERS DEFINITION AND LEVEL OF INVOLVEMENT

Stakeholder	Definition	Level of Involvement
Representative users	Refers to help-seekers who declared their problematic usage.	They are actively involved in all the phases of the elicitation process.
System analyst	Refers to the person who will gather and analyse users goal setting requirements. The system analyst is expected to be an expert in software engineering and computing, and possess some expertise in psychology, human factors, user experience and usability.	Leads the elicitation process and actively involved in all phases.
Support group member	People surrounding a problematic user such as immediate family members.	They are available to provide support when required.
Parents/guardian	Refers to a person who has parental responsibility or care for a minor.	They may be actively involved in the case of a minor.
Peer mentor	Refers to peers who share similar PSNU mentoring each other to express their goal setting requirements.	They are actively involved, e.g. peers consulting each other on their goal choices, monitoring preferences.
Designer	Refers to the people who are responsible for designing the goal setting layer.	They are not involved in the dialogue with users but apply the outcome of the elicitation.
Developer	Refers to the people responsible for developing the goal setting layer. They can evaluate any potential constraints, e.g. current technical limitations, and trade-offs, and then provide alternative options where applicable.	They are not involved in the interaction with users.
Psychologist	Refers to the people who have psychological knowledge and relevant background in human behaviour, behavioural change processes and understand the psychology in the field of problematic behaviour. They are responsible for helping the design team understand users psychological and emotional states concerning their social network behaviour.	They are fully involved in all the stages from the elicitation of the goals setting requirements to the subsequent meeting for the re-evaluation of the sample of people PSNU.
Management Representative	Refers to managers and supervisors responsible for ensuring that the design team has the resources needed to keep the project on track. Also, they are	They are not involved in the interaction with the users but

	responsible for analysing the performance of the design team.	directly interact with the analyst and design team.
Policymakers	Refers to the people who create guidance on how the goal setting layer should be designed, considering all the required ethics, e.g. how users should be recruited, the adaptation and integration of the technology, to name a few.	They are not directly involved in the interaction with users but they guide how such interaction should be conducted.
Marketing representative	Refers to the people responsible for raising awareness of the goal setting layer to various users and user groups.	Active involvement in creating the marketing information and the dissemination of such information.

### How to recruit the representative users

The system analyst needs to be aware that various methods can be employed to recruit users, for example, an open call via the social network platforms where problematic usage occurs. Also, other representative stakeholders can be recruited through open call via organisational and academic mailing lists such as psychologist and other experts.

### Criteria for selecting the representative users

When recruiting users, the analyst and design team are expected to seek diversity in the users based on the factors impacting the elicitation of the goal setting requirements.

CRITERIA AND RATIONALE FOR STAKEHOLDERS' RECRUITMENT

Criterion	Rationale
Gender	Gender is an attribute, which would enable the elicitation of different views or preferences around features and functionalities for the technology-assisted solution, e.g. male may prefer self-monitoring, female may prefer peer-monitoring.
Age	Age is an attribute, which would enable gathering different preferences that may affect the acceptance of certain features such as gamification elements, e.g. older people may not like virtual rewards such as points and badges.
Stage of change	This aspect would show diversity in relation to the goals, e.g. moderated goals for users who are on the mend and abstinence or avoidance goals for those who are heavily engaged. With this knowledge, the analyst could advise on the samples' level of involvement in setting the goals.
Degree of problematic usage	People in advance stage may be in denial which may affect their credibility to provide required information and may, therefore, require additional support from the analyst to ensure that goals that would lead to effective behavioural change are elicited.
Emotional state	Knowing the emotions of the users would help the analyst understand whether their behaviour is compulsive, e.g. a user checking and posting all the time or whether it is just habitual, e.g. a user repeatedly chatting with contacts and sharing posts on Facebook.
Causes of problematic usage	This would help to identify the reason for the problematic usage, e.g. peer pressure, habitual, user self-esteem and hence avoid certain features that might aggravate such behaviours.
Social networks features	The social media features that are problematic for some users would enable the analyst to know the diversity of features causing problematic behaviour.
Ex problematic users	Providing real-life stories about the negative experiences of problematic social networks usage and how recovery was managed would improve the technology-assisted solution.

Self-control capability	Knowledge of users' self-control levels would enable the analyst to establish users, ability to self-administer and the level of support to provide.
Competency	The competency could affect whether users can configure technology-assisted solutions or would require support.

After identifying the stakeholders, and recruiting users, the analyst can consider inducting the users around the supporting documentation, i.e. (**Doc. 1 to Doc. 10**), that are expected to be used during the elicitation process. During the induction, the analyst can clarify that some of the templates should be completed by the users, while other templates need a dialogue between the analyst and the users. This will be indicated on each template. Inducting the users would help to familiarise them with the relevant documents required in the elicitation of the goal setting requirements and stimulate their thinking during the elicitation.

### Phase 2: Create scenarios

Creating scenarios to describe PSNU would enable the analyst and design team to have a better understanding of the users' behaviour. When creating the scenarios, the system analyst needs to ensure that they closely depict the situation in which the problematic usage exists. The scenarios can be created based on factors such as the social media platform that the problematic usage is about, the features of the platform, e.g. the features that users mostly interact with, frequency of use, usage time, causes of the problematic usage, negative life experiences, and the context of use. The system analyst can ensure useful scenarios are created by collecting and analysing data from various sources. For example, users may use online forums to create an online thread where they discuss and reveal their PSNU, then gather and analyse comments to create useful scenarios. Other sources can be through interviews, diary studies, and narration by users about their usage style. The system analyst can use such template presented in (**see Table 4**) which outlined the elements should be covered.

Scenario Creation Sample Template

User ID	Application used	Device used	Features access	Most access features	Type of content	Usage duration	Usage frequency	Reason for usage	Negative life experiences
1	Facebook	Mobile	Share Comment	Like	Messages Photos	Three hours daily	20 times a day	Improve mood	Reduce productivity
2									
3									

### Phase 3: Elicit problematic social networks usage (Template 1 and 3)

The goal of this phase is to help the system analyst to understand users' problematic usage patterns. In order to aid this process, the analyst should discuss the scenarios created in **phase 2** with the users. When eliciting these patterns, the focus should be on the reasons why users developed a PSNU e.g. self-esteem related, compulsive usage related, reputation related, peer pressure, social influence, privacy and social expectation. Also, negative patterns and triggering

features should be considered. The data gathered can be analysed by focusing on categories of factors such as the negative experiences of the usage, and assess whether specific features trigger them. As guidance, a sample template to consider when eliciting problematic usage patterns is provided in **Table 5**. This information would inform the system analyst’s decision during the elicitation of the behavioural goals and re-evaluation process. During the re-evaluation process, the system analyst is expected to use the information in **Table 5**, and focus on any changes in the usage.

TEMPLATE FOR ELICITING PROBLEMATIC USAGE PATTERNS

Problematic social networks usage patterns		
Reasons for problematic usage	Negative experiences	Triggering features

#### Phase 4: Elicit SMART behavioural goals

<b>Specific</b>	Describe the extent to which goals are well defined, showing the type and number of tasks required.
<b>Measurable</b>	Identify how goal performance progress will be measured.
<b>Achievable</b>	Determine the amount of effort required to perform a task in relation to a user’s ability.
<b>Realistic</b>	Determine whether the goals are still within the users skills level
<b>Timely</b>	Determine when the behavioural goals need to be attained.

This phase provides information related to the source of the goals and other elements to consider when setting SMART behavioural goals. The system analyst is expected to use semi-structured interviews, qualitative diary study, or scenario-based exploration to gather users requirements.

#### Activity 1: Elicit behavioural targets and source of goals (Template ID4)

The source of goals represents the stakeholder who sets the goals. The analyst is expected to be aware of the different source of goals, and the system design needs to provide tools for all modalities, i.e. self-administered or mediator-led in the case of guided goals. When defining the goals, the system analyst could use **(Doc3)** where goals types, examples and sources are provided. If the selected source of goals is assigned or guided, the analyst is expected to be aware of the effect of authority as it could be a barrier for goal acceptance and attainment. In the induction stage, the team should discuss the various sources of goals and communicate these examples to the users to stimulate thinking. If the source of goal did not lead to effective behavioural change; the analyst may consider supporting the users to understand the nature and reality of their problem. **Table** below is a potential template to guide the setting of such goals.

GOAL TYPES AND EXAMPLES OF GOALS

Goal types	Examples of goals

1	Time-based goals	Specifying the time for using Facebook, e.g. to use social networks an hour daily.
2	Frequency-based goals	Reduce the number of times Facebook is accessed daily.
3	Moderation-based goals	<ul style="list-style-type: none"> <li>• Regulate access to Facebook features on a monthly basis.</li> <li>• Regulate Facebook usage and keep track of daily tasks.</li> </ul>
4	Reduction-based goals	To reduce the time spent on Facebook on a monthly basis
5	Reminder-based goals	Set a reminder alarm for above goal types.
6	Abstinence-based goals	Quit using the update status feature on Facebook.
7	Avoidance-based goals	<ul style="list-style-type: none"> <li>• To leave devices behind when attending social events.</li> <li>• To lock digital devices to prevent Facebook use.</li> </ul>
8	Restriction-based goals	To restrict interactions during certain times, e.g. mealtimes.

### Activity 2: Setting specific, attainable and relevant behavioural goals

The analyst needs to consider helping the users to set proximal goals to help achieve distal goals as they provide a relatively quick sense of achievement in the short-term. For example, if some of the users set generic Facebook usage goal, e.g. to spend less time commenting on others posts this month, this goal could be attained by setting proximal goals such as to reduce the time spent commenting on posts by 10 minutes a week. The analyst can recommend implementing gamification elements to motivate people to set proximal goals by awarding points and badges when goals are self-administered or collectively when the behavioural goals are set collaboratively.

Also, the analyst is expected to consider and understand barriers to goal attainment, e.g. skills required to attain goals, commitment and goal complexity. When users preferred group-set goals, the analyst can elicit collective group commitment to goal attainment. Regarding the required skills, questionnaires could be considered to assess users' skills. Skills could be improved by persuasion and providing information about the required strategies for goal achievement. The goal complexity could be established by using a 1 to 5 Likert scale with 1 representing "goals not complex" and 5 representing "goals very complex". Also, the analyst is expected to be aware of conflicting behavioural goals, **Doc.4** provides guidance for detecting and resolving goal conflict.

### Activity 3: Goal prioritisation

When people set more than one goal that is to be achieved in relatively the same time, the analyst is expected to provide tools for prioritising or ranking the goals. Prioritising goals enable users to focus attention on achieving the most urgent goal rather than dividing attention to various goals at the same time. The goals and goal-related tasks can be prioritised based on, e.g. **the importance of the goals** and **the execution time of the tasks**, i.e. timeframe required to attain the tasks, **behavioural goals outcome** and **the cost of failure to achieve the goals**. The system analyst

could also consider prioritising goals by assigning **achievement levels** using a 1 to 5 Likert scale. Based on the importance level of the goals, the analyst could consider reminder functionality and providing suggestion information about goal-related tasks to motivate users to continue pursuing their goals.

### **Phase 5: Elicit Goal Measurement Preferences (Template ID 5)**

The monitoring activity is mainly concerned about specifying what the system has to monitor, e.g. usage duration and usage frequency, comparison to aid measurement of goal progress by collecting behavioural metrics and progress status. Various monitoring options exist that the system analyst needs to be made aware of, i.e. self-monitoring, peer-monitoring, supervisory monitoring and automated monitoring. Users' preferences would specify whether the system has to provide automated means, self-monitoring or peer monitoring and any of these choices will impact other system requirements and design decisions. Since the PSNU can occur in various situations, understanding such context is essential when implementing users preferred monitoring technique. In this phase, the system analyst to use **Doc.5**, where elements related to the monitoring activity, comparison and feedback are outlined. If the users monitoring preference may not be suitable, the analyst can consider going back to (elicit behavioural goals block) and elicit other typical goals.

#### **Activity 1: Various monitoring options**

**Self-monitoring** refers to *the user taking the responsibility to observe and reflect on their usage and behavioural goals progress*. When some users select **self-monitoring**, this implies that the system should provide the tools for this monitoring option. The analyst is expected to consider users' preferences for the source of the goals in **Phase 4, Activity 1**, as this might affect the suitability of self-monitoring. When the problem does not involve other users or the nature of social networks does not have a group feature, then self-monitoring might be useful. The system could be designed so that the results of the monitoring activity will not require considerable skills to visualise and understand.

**Peer monitoring** refers to when other people observe and report on user behaviour. The analyst needs to be aware that peer monitoring would not work with users who have a high degree of privacy concerns. The analyst can consider providing users with the opportunity to specify what to include in the monitoring, e.g. usage time, time of use, activities performed, features accessed, and the context of behaviour. Peer monitoring may be feasible when social networks have grouping functionality, and when the behavioural goals are set collaboratively. The feedback system should be designed to avoid a negative effect on the group relationship.

**Supervisory monitoring** refers to managers performing the monitoring. The analyst can consider this approach if the social network enables users to post pictures all the time, view life story posted

by other contacts, tag contacts on posts or comments, liking and sharing others posts. When some users opted for supervisory monitoring, the design to consider delivering warning messages about the implications of specific usage before they are executed.

**Automated monitoring** refers to the use of sensors and communication technology to observe and monitor goal progress. If the majority of users select prefer this option, the analyst is expected to consider the consequences associated with it, e.g. the lack of privacy and anxiety. Also, automated monitoring may fail to capture the intention and context of the behaviour, which creates additional requirements for the analyst to gather. Automated monitoring might be useful in the early stages of change, and when users are always on social media updating and making profile posts

### **Activity 2: Performance comparison**

The comparison involves two principal approaches, i.e. self-comparison and social comparison. The analyst needs to be aware of these approaches and decide on the comparison requirements, e.g. self-progress, setting a benchmark (showing the average usage performed by other users), and emotions or sentiments about usage during or after the behaviour is regulated. If the majority of users preferred self-comparison, the analyst is expected to consider their monitoring preference and access self-esteem because self-comparison may work better when self-monitoring is selected and may fit well those people with lower self-esteem.

If some users select social comparison, the analyst is expected to consider the source of goals as this option would be useful when goals are set collaboratively. If the social network allows people to see the numbers of likes on a profile photo, the number of shares on a post then the system could be designed to implement social comparison, and allow people to set up protocol for the comparison activity, e.g. the timing and frequency of delivery the comparison information, as well as the content of the messages. The analyst needs to be aware that social comparison may lead to competition resulting from the open availability of the comparison information. The system can be designed to monitor and intelligently react to side-effects that may result from comparison activities.

### **Activity 3: Performance feedback**

Performance feedback enables people to be aware of their goal progress. The analyst is expected to discuss the various forms of feedback with the users see **Table 6**. In terms of the feedback content, the system could be designed to reflect strategies for the users' preference, e.g. motivational feedback could implement some motivational techniques, and evaluative feedback could consider what the performance should be compared with such as usage norms of a group. Also, the analyst is expected to consider requirements on 'when' and 'how' the feedback content should be implemented.

Feedback timing is concerned with the right timing of the messages so that the users see it as a motivational tool which could increase its acceptance. Feedback can be provided during the behaviour, after or before the behaviour takes place. The system could be designed to provide tools for each modality, and the analyst is expected to consider requirements for factors such as **feedback context, subject of feedback, features the feedback is about, and frequency of delivery.**

Regarding feedback framing, the analyst is expected to be aware of the tone of feedback messages and consider requirements in terms of when to implement user preference, **message examples, subject of feedback, source of feedback and feedback features.** Also, the system could be designed to filter negative messages as this could affect user self-esteem. The system design could consider the level of detail in the feedback, which can be based on users' treatment levels.

For feedback presentation, the analyst can consider requirements on the context in which the preferred style should be delivered, frequency of delivery, medium of presentation, feedback screen time. Examples on these aspects are provided on the Facebook version of the TAGS templates. After gathering goal measurement preferences, the analyst is expected to check whether are satisfactory using **(Doc5)** to guide the process. If users do not agree on a modality for the monitoring, then the analyst may consider self-monitoring or go back and modify the behaviour goals.

FEEDBACK CONTENT

Feedback Content	×/✓	When it should happen	How it should happen
Performance feedback			
Educational feedback			
Motivational feedback			
Suggestion feedback			
Supportive feedback			
Comparative feedback			

FEEDBACK CONTENT

Feedback Framing	×/✓	When to implement	Feedback messages	Subject of feedback	Source of feedback	Feature feedback is about
Gain frame						
Loss frame						
Formal						
Informal						

FEEDBACK CONTENT

Feedback Timing	×/✓	Feedback context	Subject of feedback	Features feedback is about	Frequency of delivery	Delivery method

Feedback during						
Feedback before						
Feedback after						

FEEDBACK CONTENT

Feedback presentation	×/✓	Feedback context	Frequency of delivery	Medium of presentation	Feedback screen time
Graphical					
Textual					
Graphical & textual					
Telephone					

**Phase 6: Identification of deviation facilitators and elicitation of countermeasure strategies**

Understanding these factors would enable the analyst to identify how users are likely to deviate from the goals, how deviation could be triggered, e.g. by the software and the countermeasures techniques that can be implemented using the software. The analyst is expected to be aware of the various aspects that could lead to deviation from the goals. The analyst needs to raise users' awareness of various facilitators by presenting the elements, then ask them to indicate whether they may have these conflicts and what help they may need. This will enable them to detect and know the typical conflicts users may face. Some facilitators need to be discussed based on previous elicitation templates, for example, lack of structure method for goal setting, would be discussed based on **Template ID 4**. The countermeasures can be elicited through a dialogue. During which, the analyst is expected to consider requirements on the context the countermeasures should be applied, how they would be implemented, and the constraints that might hinder their success. The analyst could use **Doc6**, for further information on these factors. The analyst to be aware that the countermeasures are classified into different categories and user preference would determine if software implementation is required. For example, the category relating to the setting of the goals may not require technical implementation. The goal setting countermeasures aim to help people avoid deviation in the later stages when the users start pursuing their behavioural goals. Privacy requirements for the different users should be considered.

After eliciting the countermeasures, the analyst is expected to check whether they are realistic (see **Doc7**) and whether the social network platform can implement them. If some of the countermeasures are not realistic, the analyst can consider checking whether other aspects need to be included in the monitoring activity, also review and modify the goals and make the required adjustment.

**Part H: Document 1**

## Doc1: Scenarios generation guidelines – Utilised In: Activity 2

Scenario generation guidelines
<b>Provide title for scenario:</b> This aspect depicts what social media application the problematic usage is about and the main users in the form of easy headings.
<b>User identification:</b> This aspect includes the identification of main users who are experiencing the problematic usage or those who are affected by the problematic usage, users' profession and when the behaviour started.
<b>Description of the usage environment:</b> This aspect helps identify the environment or situation in which the problematic usage happens.
<b>Description of usage related data:</b> This aspect includes the description of the behaviour including, the application that the problematic usage is about, the time spent usage the application, activities performed, time of usage, among others.
<b>Explain reason/s for the behaviour:</b> This aspect includes a description of why the users started using their respective social network applications and how the usage becomes problematic.
<b>Describe effect of the behaviour:</b> This aspect includes a description of the negative life experiences that the user is experiencing as a result of their problematic usage. The problematic usage can affect the user performance on work related duties, it can affect their family or it can affect their personal life.
<b>People affected by the problem:</b> This aspect includes a description about the people affected by the problematic usage and the extent of the negative life experiences on their lives.
<b>Feature/s that the usage is about:</b> This part includes a description of the features that the problematic usage is about.
<b>Write concise scenario sentences:</b> Writing brief sentences will enable the users understand the context especially if they do not have the require expertise and experience in the area. Also, it will help prevent the readers from being confused. It is recommended to avoid using ambiguous words.
<b>Tools and techniques to enhance better scenarios development:</b> In certain situation, it may be challenging to create scenarios which can be attributed to various reasons. For problematic users may be in denial of reality hence may not be in the position to express their problem. If this is the case, methods such as storyboarding and rehearsal can help imagine the situation and develop the scenario. Also, adopting the storyboarding technique can help especially those users who are good at visualising a situation than actually reading plain text.

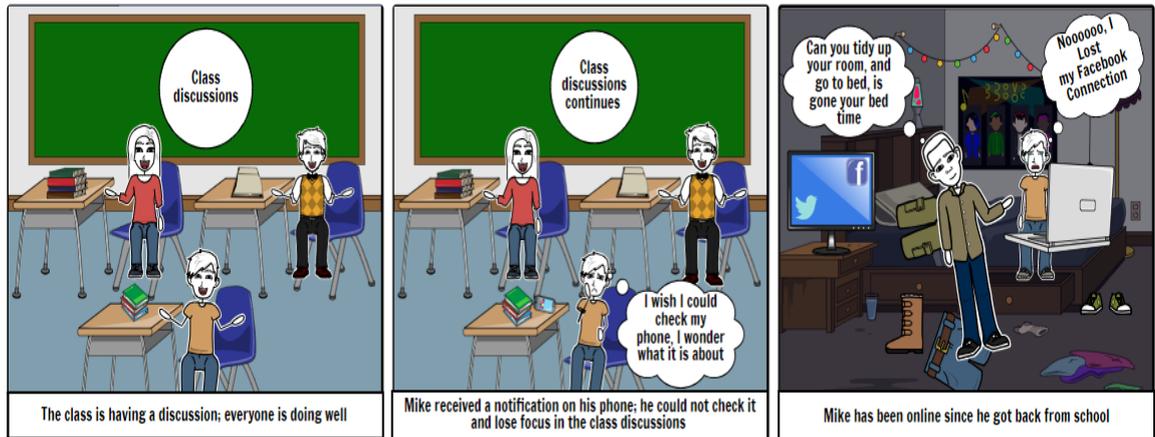
### **Part I: Document 2**

#### **Doc2: Evaluation Scenarios - Utilised In: Activity 3, 4 and 6**

##### Scenario 1 - Mike the Facebook User

Mike is in year ten of his secondary education. He first started using Facebook at the age of 11 and spends considerable amounts of time on these applications. Mike's digital usage continues to increase, and he developed excessive usage behaviour at the age of 14. He spends a lot of time sharing, commenting and liking posts. Mike hardly spends any time with his family, and he is

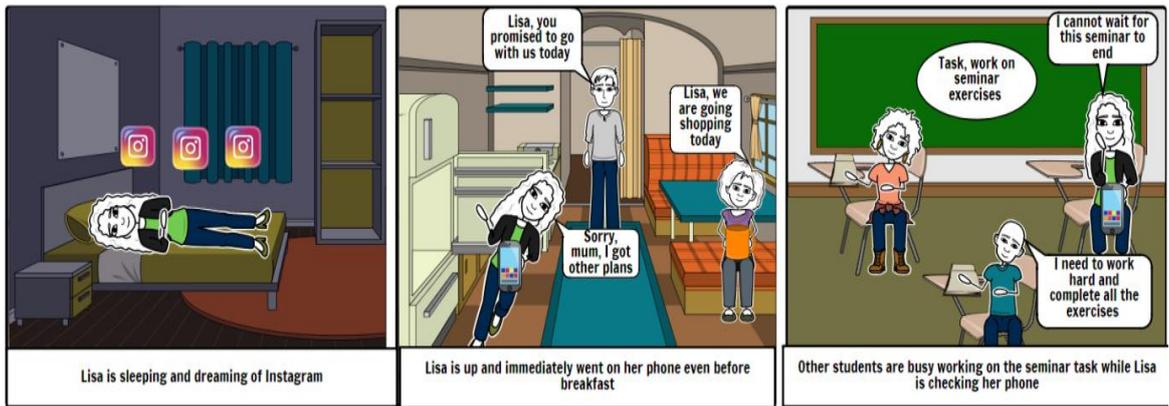
continually arguing with his parents about his online behaviour. His parents have tried on numerous occasions to help him control his behaviour without success, i.e. by taking his devices from him after school and specifying hours in which he can go online during the weekend. His parents' approach has affected Mike's relationship with them, and he became restless and aggressive towards his parents, he is also withdrawn and feels stress when his access is restricted. His teachers are worried about; his behaviour in the class, his concentration and participation in classroom activities are below satisfactory.



PROBLEMATIC FACEBOOK USAGE STORYBOARD

### Scenario 2: Lisa the Instagram User

Lisa is an undergraduate student and an Instagram user. She uses Instagram to show and realise her identity by posting videos and photos. She spends too much time on Instagram and finds it difficult to switch off from the application. Lisa feels that switching off could lead to missing important events such as the chance to see and comment on photos and videos which everyone is liking and commenting. She thinks that not reacting might leave her friends unhappy, negatively affects their relationship, and her online popularity might be reduced. She is always checking Instagram during seminars, lectures and even had to delay working on her assignments. Lisa realised that her Instagram usage is getting in the way of her education. She is at risk of re-submitting some assignments or resitting the entire year. Also, her behaviour is affecting other aspects of her life, i.e. skipping or missing meals, and grabs and eat anything available on the go. Lisa spends most of her time in the virtual world to the extent that she neglects essential things in the physical world, such as her in-person social interaction. Lisa tries without success to control her presence on Instagram.



PROBLEMATIC INSTAGRAM USAGE STORYBOARD

### Scenario 3: Martha the WhatsApp User

Martha is a 25-year-old. She has a Master degree and now works as a software developer. Martha started to use WhatsApp heavily five years ago. She joined WhatsApp groups with her close friends and family members who were already users of the application. Martha started to develop an excessive WhatsApp usage habit after she moved abroad for her new job. In order to help maintain close contact with her friends, Martha spends considerable amounts of time sending messages, reading and replying to messages, creating status updates, checking and responding to contacts status updates. Martha feels relief from work-related stress and loneliness when she is online with her friends. She has now lost control over his WhatsApp usage habit. Martha stayed up until the small hours of the morning using WhatsApp. As a result, she finds it very difficult to wake up early and get to work on time. Martha goes to work most of the week late or call in sick due to lack of sleep. Her performance at work is negatively affected, and she is in the habit of missing important deadlines. Martha has received verbal warnings from her employer for coming to work late and calling in sick on various occasions over the past few months. Her employer's warning is the specific trigger that led Martha to think of doing something about WhatsApp usage habits.



PROBLEMATIC WHATSAPP USAGE STORYBOARD

### Part J: Document 3

**Doc3: Source of goals, goal elicitation methods, Goals Identifiers, goal types and examples of goals.**

Sources of Behavioural Goals

Source	Description
<i>Self-set</i>	Goals are designed and chosen solely by subjects
<i>Assigned</i>	Goals are designed by experts with no subjects input
<i>Participatory</i>	Goals are designed jointly by subjects and experts
<i>Guided</i>	Subjects are given directions by experts on how to choose a goal, but the choice is left for them to make
<i>Group-set</i>	Goals are designed and chosen within a group, typically facilitated by an expert

Behavioural Goal Elicitation Methods

Elicitation Method	Description
Interview	Used when in-depth understanding is required
Diary Study	Used for capturing events as they happen
Group discussion	Used for discussing barriers and strategies for alleviating them
Counselling	Used for helping subjects understand their behavioural change needs
Brainstorming	Used for discovering bespoke strategies for reaching the goal
Observation	Used for assessing behaviours in a natural setting
Consultation	Used for ideation and getting subject views and preferences
Algorithms	Used for understanding a subject's behaviour from their historical data

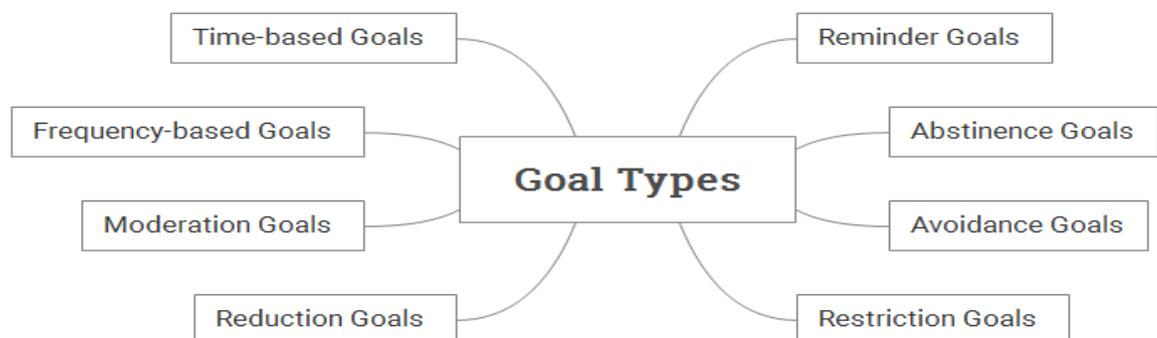
Behavioural Goals Identifiers

Goal Properties	Description
<i>Proximity</i>	The time by which the goals is to be achieved; Distal (goals set on a long-term basis) or Proximal (goals based on short-term goals)
<i>Goal specificity</i>	The precision and granularity of what is to be achieved

<i>Goal difficulty</i>	The effort required from a subject for goal attainment
<b>Goal Moderators</b>	<b>Description</b>
<i>Commitment</i>	The importance of goal attainment and an individual's determination to achieve the goal defined by subjects': <ul style="list-style-type: none"> <li>• Self-efficacy or believing in one's ability to achieve the goal</li> <li>• Perception of usefulness, and the significance of achieving the goal</li> </ul>
<i>Feedback</i>	The knowledge of performance progress in relation to attaining goals
<i>Task complexity</i>	The complex nature of a task defines the level of effort, skills, and also the strategy required to attend the goal

### Examples of goals

Goal types		Examples of goals
1	Time-based goals	Specifying the time for using Facebook, e.g. to use social networks an hour daily.
2	Frequency-based goals	Reduce the number of times Facebook is accessed daily.
3	Moderation-based goals	<ul style="list-style-type: none"> <li>• Regulate access to Facebook features on a monthly basis.</li> <li>• Regulate Facebook usage and keep track of daily tasks.</li> </ul>
4	Reduction-based goals	To reduce the time spent on Facebook on a monthly basis
5	Reminder-based goals	Set a reminder alarm for above goal types.
6	Abstinence-based goals	Quit using the update status feature on Facebook.
7	Avoidance-based goals	<ul style="list-style-type: none"> <li>• To leave devices behind when attending social events.</li> <li>• To lock digital devices to prevent Facebook use.</li> </ul>
8	Restriction-based goals	To restrict interactions during certain times, e.g. mealtimes.



Goal types

**Part K: Document 4**

**Doc4: Measurement preferences**

Monitoring & Feedback

Monitor and Feedback	
Monitor	Self-monitoring; Peer monitoring; Automated
Feedback Content	Motivational feedback; Learning feedback; Outcome feedback; Performance feedback; Comparative feedback (Self-comparisons; Social comparisons)
Feedback Timing	Reflection during the behaviour; Reflection after the behaviour
Feedback Framing	Gain frame; Loss frame; Formal; Informal

Types of Feedback		
<input type="checkbox"/> Generic	<input type="checkbox"/> Targeted	<input type="checkbox"/> Personalised
Feedback Mechanisms		
<input type="checkbox"/> Performance feedback	<input type="checkbox"/> Educational feedback	<input type="checkbox"/> Motivational feedback
<input type="checkbox"/> Suggestion feedback	<input type="checkbox"/> Supportive feedback	<input type="checkbox"/> Comparative feedback
Feedback Framing		
<input type="checkbox"/> Loss frame	<input type="checkbox"/> Gain frame	<input type="checkbox"/> Formal
<input type="checkbox"/> Informal		
Feedback Timing		
<input type="checkbox"/> Feedback before the behaviour	<input type="checkbox"/> Feedback during behaviour - Real-time feedback	<input type="checkbox"/> Feedback after the behaviour
Feedback Presentation		
<input type="checkbox"/> Graphical feedback	<input type="checkbox"/> Textual feedback	<input type="checkbox"/> Telephone feedback
Monitoring (assessment mechanism)		
<input type="checkbox"/> Self-monitoring	<input type="checkbox"/> Peer-Monitoring	<input type="checkbox"/> Automated
Comparison Mechanism		
<input type="checkbox"/> Self-comparison	<input type="checkbox"/> Social-comparison	

**Feedback Mechanisms**

**Performance feedback** - shows a subject's performance toward their goal and could be used to help determine the chances of attaining behavioural goals.

**Motivational feedback** - informs subjects how well they perform towards their goals and encourages them to continue in the same way or perform better

**Suggestion feedback** – indirectly tell the subjects what they can do you improve their goal performance, i.e. these types of feedback help subject improve their performance

**Supportive feedback** – feedback provided to subjects in a clear and precise way, without upsetting them, it can be used to encourage better behaviour in the online space. Provide support to subjects around how they can attain their goals

**Comparative feedback** - compares subjects to their past goal performance (self-comparison) or to the performance of their peers when the collaborative goal setting is adopted (social comparison).

### **Feedback framing**

**Gain frame** - relates to feedback which indicates a positive impact of healthy behaviour, e.g. quitting smoking makes sleep quality better.

**Loss frame** - refers to feedback which shows a negative impact, e.g. smoking can cause cancer, whereas gain frame.

**System-based feedback** (Formal) – feedback delivered without human interaction, e.g., automated

**Interpersonal feedback** (Informal) – feedback delivered as a result of human interaction, a therapist/counsellor delivering feedback personally to their clients.

### **Part L: Document 5**

#### **Doc5: Checking goal measurement preferences**

#### **Factors to consider when checking monitoring, comparison and feedback preference**

- Source of goal: The source of goals could affect the successful implementation of monitoring option, for example, peer monitoring could be useful/effective when the goal is group-set.
- Self-efficacy level to perform the monitoring activity especially when goals are self-set, therefore it is essential to assess user self-efficacy.
- Feedback presentation: Avoid impacting user experience (when feedback is to be presented while the user is performing an action, care should be taken to ensure that it does not distract or obstruct the user). It is, therefore, significant to know the users whom the feedback is intended for, to adopt the best presentation and language style.
- Feedback messages: The feedback information should not contain strict or threatening information.
- Avoid ineffective comparison:
  - For example, when the *source of goals* is participatory or group-set, a social comparison technique could be more appropriate. Also, the visualization of comparison information whether textual, numerical or quantified form, should be considered to avoid rejection by the user.
  - *Self-comparison* may work better when self-monitoring is employed and may fit well those subjects with lower self-esteem.
  - For *social comparison*, consider group membership, e.g. users should be assigned to a matched group – assigning users who are in the same behavioural change stage/treatment as members of the same group.
- Users should have the skills required to evaluate whether the feedback information represents a good or bad goal performance.

### **Part M: Document 6**

## Doc6: Deviation facilitators and countermeasures strategies

### Deviation from Behavioural Goals: Types, Facilitators and Countermeasures

<b>Type</b>	Time-related; Frequency-related; Communication-related
<i>Facilitators</i>	Goals that combined, conflict or compete with other goals; Source of the behavioural goal; Social influence or peer pressure on the subject pursuing the goals; Setting ambiguous goals with limited skills or time to attain the goals; Lack of commitment to the set goals; Lack of proper timing of the goals; Setting complex goals that do not match subjects' ability to attain them; Lack of self-efficacy to achieve the goal; Environmental influence; Lack of a structured method for goal setting; Inaccessibility to resources to aid goal attainment; Not understanding users' needs for the goals; Over-estimating participants' self-efficacy level to achieve goals; Lack of understanding of barrier to gain attainment; Timing of the behavioural goals; Frequency of executing the set goals.
<i>Countermeasures</i>	Detect and resolve goal conflict; Discuss barriers to goal attainment and ensure subjects could adequately handle them; State clear goal outcome; Assess subjects commitment and self-efficacy levels; Assess complexity of goal and analyse complex goals into series of sub-goals; Review goals, re-strategise and make necessary modification; Monitor goal-related activities; Provide summary feedback in relation to goal performance; Hold users accountable when a deviation occurs; Perform manipulation checks to assess whether subjects understand the goal or task; A proper explanation of the goal-related task; Task familiarisation by asking subjects to try out a task similar to the goal; Have subjects make a verbal commitment to the goal.

Deviation Countermeasure Techniques		
No.	Countermeasures Techniques	Brief Description
DC1	Monitoring – peer or automated	Recording specified behaviour (person has access to recorded data of behavioural performance e.g. from diary).
DC2	Self-monitoring	Refers to the responsibility of a subject to observe and reflect on their behaviour and goals.
DC3	Feedback on real-time goal performance	Shows performance towards the goal.
DC4	Reminders of the set goals	Increase the awareness of goal-related behaviour.
DC5	Notification	Countermeasures messages delivered in real-time or after the behaviour.
DC6	Positive reinforcement	Presenting or offering a reward when behaviour is performed, and increasing the likelihood of the behaviour occurring in the future
DC7	Negative reinforcement	Contingent removal of aversive consequence, i.e. if and only if the behaviour is performed.
DC8	Progress bars	The reflection of progress to show users how much of their goal is attained and how much is left to be attained, helping them to keep track of their progress.
DC9	Personalised messages	Tailor techniques or messages from others to individual's resources and context (includes stages of change-based information; doesn't include personal plans and feedback).
DC10	Avatar	A graphical representation of users behaviour towards the goal.

DC11	Comparison (provide comparative data - self; social comparison)	Provide opportunities for social comparison e.g. contests and group learning, with the behavioural performance of peers.
DC12	Social comparison	Provide comparative data (cf. standard, person's own past behaviour, others' behaviour).
DC13	Leaderboards for participatory goals	Rank users according to their attainment of the goal.
DC14	Transparency	Allowing users to see each other's goal performance, i.e. within a social setting. Also, it involves making users aware of what information their performances are based on.
DC15	Rewards	Contingent valued consequence, i.e. if and only if the behaviour is performed (including. social approval, etc. general non-contingent encouragement or approval).
DC16	Badges	Achieve based on users goal performance.
DC17	Review goal	Assess the extent to which the goal/target behaviour is achieved, identify the factors influencing this and amend goal if appropriate.
DC18	Detect and resolve goal conflict	The work environment could influence conflicting goals, i.e. the social setting of the users, detecting and resolving conflicts could help users progress towards achieving their goals. Goals could be prioritised to help resolve the conflicts among goals.
DC19	Discuss barriers to goal attainment	Any obstacle to goal attainment should be discussed especially when goals a, countermeasures to such obstacles devise set collaboratively.
DC20	Environmental Change	Change the environment in order to facilitate the target behaviour (other than prompts, rewards, and punishments).
DC20	Goal-related task familiarisation	Asking users to try out a task similar to the goal.
DC21	Assess self-efficacy	This is referred to evaluating an individual's capability and devotion towards achieving the set goal.
DC22	Instruction (for assigned and guided goals)	Teach new behaviour required for the performance of target behaviour (not as part of a graded hierarchy or as part of modelling) e.g. give clear instructions.
DC23	Set specific goal	A goal has a clear-cut definition showing the type and amount of effort required to achieve the goal.
DC24	Points	Awarded based on the goal or goal-related tasks users successfully attained
DC25	Keep a diary of actions	This is when users make diary entries of their actions anytime they perform a behaviour that they were not supposed to. They can then use the diary entries to find out where the deviation occurs and why.
DC26	Acknowledge user goal performance	This allows users to where they are at and encourages them to continue pursuing the goal.
DC27	A clear understanding of the goal and goal-related task	When goal setting is participatory, ensuring that all those involved in the process understand what is expected from them is essential for the attainment of the goal.
DC28	State a clear goal outcome	<i>Setting a</i> clear goal outcome could motivate individuals to continue pursuing their goals by focusing their efforts, time, and attention on the goal attainment.
DC29	Relapse prevention	Identify situations that increase the likelihood of the behaviour not being performed and apply coping strategies to those situations.

DC30	Assess subjects commitment	Users may also be asked to fill out questionnaires describing their degree of goal commitment.
DC31	Assess the complexity of goal and analyse complex goals into a series of sub-goals	Setting a complex goal could be prevented by strategically reducing the complex goal into sub-goals that are attainable in the short term; this could help users achieve a complex goal.
DC32	Provide summary feedback in relation to goal performance	Getting the feedback timing right, presentation and using an appropriate language and message style that users can easily relate to.
DC33	Hold users accountable when a deviation occurs	Establish a proper means of communication and ensure that users are answerable when a deviation is detected.
DC34	Monitor goal-related activities	This technique involves monitoring and tracking the difference between the desired and actual behaviour.
DC35	Perform manipulation checks to assess whether subjects understand the goal or task;	These checks are conducted to detect whether the subjects are paying attention to the set goals and goal-related task.
DC36	Have subjects make a verbal commitment to the goal	When subjects commit verbally to the setting of goals, this could help prevent deviation, especially when goal setting is performed collaboratively.
DC37	Set a benchmark/averages	Show the average behaviour performed by other users.

## **Part N: Document 7**

### **Doc7: Checking deviation countermeasures**

#### **Potential side effects of deviation countermeasures**

<b>Side effects that may exist due to countermeasure implementation</b>			
Creating alternate problematic usage		Acceptance of countermeasure techniques	
Lower self-esteem		Level of control	
Peer pressure		Distraction from present tasks	
Loss of interest		Visibility of comparison information	
Social influence		Frequency of delivering performance information	
Reduce engagement		Length of performance information	
Lack of motivation		Importance level	
Lack of group commitment		Fear of missing out on social network interaction	
Storage of the comparison information		Accessibility of member information	

## **Part O: Identifying conflicting goals**

- If there is a goal to reduce social networks usage time and another goal to go for an adventure or an outing, then consider that these two goals might conflict, because people might need social networks sometimes when on outing for social support, e.g. asking friends about exciting places to visit, or to make posting about the outing, and may check others reactions on the posts, e.g. likes and comments.
- If there is a goal to reduce usage time and another goal to plan social event with friends, if the planning of the event requires use of social networks, e.g. Facebook then consider that these goals might conflict because a lot of time may be invested in the planning, e.g. messaging contacts, posting about the event and replying to messages from those who require further information and clarification about the event.

- If there is a goal ‘to reduce daily comments on Facebook’ and a goal to update Facebook posts regularly, then consider that these goals may conflict because when people make a post, they expect others to comment and might feel obligated to return the favour.
- If there is a group goal, e.g. to post on the social network when out and about and an assigned goal to restrict the use of certain features, then consider the possibility of a conflict because posting online may require the use of the restricted features.
- If there is a goal to reduce usage time and a goal to prevent loss of social identity, then consider the possibility of a conflict. For example, reducing usage time during the evening might lead to missing group chats which may lead to loss of ties with the group.
- If there is a goal to leave behind digital devices when attending social events and a goal to post all social engagement then consider the possibility of a conflict because posting online require the use of the smartphone or other digital devices.
- If there is an assigned goal to avoid social networks between 9 am to 5 pm and another goal to respond to messages from close contacts any time, e.g. family members, then there is a possibility of a conflict because replying to messages would require using social networks.
- If there is an interdependence of plans for goal attainment between two or more goals, and there is a chance of executed these plans at the same time then there is a possibility of a conflict between the strategies as well as the goals themselves.

<b>Techniques for Resolving Conflicting Goals</b>
Ensure that the plans to attain two separate goal-related tasks do not conflict with each other.
If there is more than one goal, prioritised the goals and explain why some are prioritised high, e.g. because of the impact of the negative experiences, because the goal addresses immediate user need, e.g. improve academic performance for students, meet work deadlines for employees.
Ensure that the timing of goals does not coincide with other personal activities, this can be achieved by establishing clear understanding of the user's personal and work life, e.g. daily work time, work duties and family commitments.
If the goals are group-set, encourage group members to negotiate and try to resolve any conflict by making compromises and trade-offs. The analyst to guide the negotiation process.
If there is a conflict between two or more goals, consider weakening some of the goals to resolve the conflict between them, for example, extending the timing of one goal if the conflict results from the execution times of the goals.
Ensure that all those who are to attain the goals collectively participate in the goal setting process, e.g. make decisions on the goals, sub-goals or plans to achieve them.
If there is a conflict between the sub-goals of two separate goals, find alternative ways of further breaking down the goals into sub-goals at a level higher than the one at which the conflict was detected, this way, sub-goals that are conflict-free may be obtained.
If the conflict between the goals is attributed to specific barriers, consider discussing and analysing these barriers, and detect and resolve situations that are likely to prevent goal attainment.

## **Part P: Specifying specific behavioural goals**

### **Checklist for specifying specific behavioural goals: Goal specificity**

	<b>Response Place ✓/×</b>
Are the goals explicitly define as much as possible, e.g. ‘reduce social networks usage by one hour daily for a week before assignment due date’ rather than ‘focus more on my course work?’	
Are the required supporting instructions for attaining the goal provided?	
Are the numbers of required tasks for goal attainment well-defined?	

Is the goal attainment process as effortless as possible?

Is the goal specific to the targeted problematic social network, e.g. 'to reduce the frequency of Facebook access' rather than 'to reduce social networks usage'?

Are stakeholders for goal attainment well defined, e.g. group members and their requirements when goals are to be set collaborative?

Is the time required to attain goals well-defined, e.g. a goal 'to reduce the time spent reading and commenting on posts', can be time-specific, e.g. 'to reduce the time spent reading and commenting on posts by 15 minutes daily'?

**Part Q:** The screenshots below show examples of templates completed by the user participants during the evaluation.

**Behavioural Requirements Elicitation Template**

Figure 1: Behavioural Goals Elicitation Element Flow

Stage 1: Information about social networks usage  
Stage 2: Information about what users suffer from due to social networks usage  
Stage 3: Information about what type of help users would like  
Stage 4: Information about what the solution to the issue is

**Template ID: 1**

Which family of features is causing your problematic social networks usage?

Conversations		Groups		Presence		Sharing	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Reputation  Identity  Relationships

**Other (please specify)**

In relation to the family of features selected above, what are the actual features you struggle with on social networks?

Notifications		Location sharing		Posting		Profile		Length of Messages		Liking	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Endless feeds  Private messaging  Impression  Delivery Report  Synchronous dialogue

Pull to refresh  Customised content  Group sharing  Status  Temporarily available content

Commenting  Asynchronous dialogue  Sharing  Relationship status  Tagging  The wall

**Other (please specify)**

Can you describe the cause of your problematic social networks usage?

Emotions: E.g. enhancing self-esteem, improving mood, opportunity to relate to others, emotional support from others  
*Improving mood & support emotional*

Peer pressure: E.g. when others want me to be on social media at specific times  
*want me online most of my time*

Making influence: E.g. influencing others to behave in a certain way on social media  
*to be online all the time & reply to the message*

**Other (please specify)**

How do you feel about the amount of time spent using social networks and the time of use?  
*I spent a long time using social network & then then some*

At what point do you think you cross the threshold of a moderate social networks usage to a risky usage? E.g. in terms of time, i.e. when you check Facebook notifications continually for two hours, after you post a lot on your Facebook wall in a short time  
*time spent for example sent after sent post or sent private message I keep continue check the feedback as the message I r*

When you feel you are on social networks for a long time, what offline activities do you think would help distract you from social networks?  
*watching a.o.ing exercises*

Is there any additional information that you would like to be considered or you think is relevant?  
*NA*

Please state what you struggle to control as a result of your problematic Facebook behaviour: e.g. I struggle to control the frequency of checking. I struggle to switch off during lectures, and struggle to stop checking when with the family or when I am at work.

I struggle to... *to... during... stick... social media work*  
*to... stop checking when I go home & stop*

Is there any additional information that you would like to be considered or you think is relevant?

---

**Template ID: 3** User

Are there any actions you are presently taking to try to improve your problematic social networks usage? If yes, what are they?

Actions taken: *I tried to... out my phone in... high mood, download... to... social media if I... more than 3 weeks*

Elaborate on the action/s taken:  
*The flight mood doesn't work with me & I am not the star what I download was not help because I uninstal it*

---

**Template ID: 4** Dialogue

**Setting Behavioural Change Goals**  
 What behavioural targets would you like to set to help you manage your problematic social networks usage? Refer to (Doc 3 for types of goals).

Behavioural Goals (order by priority), e.g. for a student, goals that might help reduce my procrastination on Facebook may be on top of the list.

- I want to... reduce... time... using... social media*
- I want to... reduce... frequency... of... checking... social media during work*
- 
- 

To list more goals, use the blank sheet at the end (Template ID4 blank)

Estimate the time by which your behavioural goals are to be achieved

Proximal goals (goal set on a short-term basis)  Distal goals (goal set on a long-term basis)

Goal	Type of Goal	Goal Proximity	Example
G1	<i>Reduction goal</i>	<i>Proximal goal</i>	<i>To reduce time spending social media by 12 hrs a week</i>
G2	<i>Frequency based</i>	<i>Proximal goal</i>	<i>reduce frequency of using social media during work hours</i>
G3			
G4			

I would prefer to set goals <source of your behavioural goals>: Refer to (Doc 3 for the source of goal)

Goal	Source of	Reason for choice
<i>Guided Goal</i>		<i>- I would like to have an expert could help &amp; guide me in setting the goal USA</i>

**Template ID: 2** Consequences of Problematic Social Network Usage

As a result of your problematic social networks usage, what negative life experiences do you suffer from?

**Emotional Problems**

Lowering self-esteem  Aggressiveness  Restlessness  Preoccupation  Anxiety   
 Reduce self-confidence  Inadequacy  Depression  Stress  Irritability

Elaborate on when the negative experience you select happen? When does it happen

Negative life experience

*Depression* *when I use facebook alot.*  
*Irritability* *got irritated when lost my time*  
*Reduce self-confidence* *I didn't complete my work and next day feel reduced confidence.*

**Disrupted Familial**

Partnerships and relationship problems  Marital discord  Negligence of children   
 Spending less quality time with family  Affect parent-child relationship depth and strength

Elaborate on when the negative experience you select happen? When does it happen

Negative life experience

*Marital discord* *when we both not giving enough time to each other using facebook*  
*Spending less quality time with family* *using social media and not having lunch with family.*

**Personal Problems**

Neglect of personal life  Increased loneliness  Distraction  Confused thinking   
 Poor time management  Lack of concentration  Sleep deprivation  Procrastination   
 Irregular sleeping pattern  Increased escapism  Reduced attention to daily life activities   
 Avoidance of facing real-life problems  Other wellbeing issues

Elaborate on when the negative experience you select happen? When does it happen

Negative life experience

*Distraction* *Distracted from my job.*  
*Poor time management* *morning first checking notif*  
*Irregular sleeping pattern* *sleep late at night and to go early for work*

**Social Problems**

Reduced amount of face-to-face social communication  Disrupted peer relationships   
 Reduced skills of face-to-face social communication  Letting down family and friends   
 Neglecting social contacts

Elaborate on when the negative experience you select happen? When does it happen

Negative life experience

**Behavioural Requirements Elicitation Template**

Figure 1: Behavioural Goals Elicitation Element Flow

Template ID: 1	Dialogue
Which family of features is causing your problematic social networks usage?	<b>Social Media Usage Statement</b>
Conversations <input type="checkbox"/>	Groups <input type="checkbox"/>
Reputation <input type="checkbox"/>	Identity <input type="checkbox"/>
	Presence <input type="checkbox"/>
	Relationships <input checked="" type="checkbox"/>
	Sharing <input checked="" type="checkbox"/>
<b>Other (please specify)</b>	
In relation to the family of features selected above, what are the actual features you struggle with on social networks?	
Notifications <input checked="" type="checkbox"/>	Location sharing <input type="checkbox"/>
Endless feeds <input checked="" type="checkbox"/>	Private messaging <input type="checkbox"/>
Pull to refresh <input type="checkbox"/>	Customised content <input type="checkbox"/>
Commenting <input checked="" type="checkbox"/>	Asynchronous dialogue <input type="checkbox"/>
	Posting <input checked="" type="checkbox"/>
	Profile <input type="checkbox"/>
	Length of Messages <input type="checkbox"/>
	Liking <input type="checkbox"/>
	Delivery Report <input type="checkbox"/>
	Synchronous dialogue <input type="checkbox"/>
	Status <input type="checkbox"/>
	Temporarily available content <input type="checkbox"/>
	Relationship status <input checked="" type="checkbox"/>
	Tagging <input type="checkbox"/>
	The wall <input type="checkbox"/>
<b>Other (please specify)</b>	
Can you describe the cause of your problematic social networks usage?	
Emotions: E.g. enhancing self-esteem, improving mood, opportunity to relate to others, emotional support from others	
Peer pressure: E.g. when others want me to be on social media at specific times	
Making influence: E.g. influencing others to behave in a certain way on social media	
<b>Other (please specify)</b>	
How do you feel about the amount of time spent using social networks and the time of use?	
At what point do you think you cross the threshold of a moderate social networks usage to a risky usage? E.g. in terms of time, i.e. when you check Facebook notifications continually for two hours, after you post a lot on your Facebook wall in a short time	
When you feel you are on social networks for a long time, what offline activities do you think would help distract you from social networks?	
Is there any additional information that you would like to be considered or you think is relevant?	

**Behavioural Requirements Elicitation Template**

Figure 1: Behavioural Goals Elicitation Element Flow

Template ID: 1	Dialogue
Which family of features is causing your problematic social networks usage?	<b>Social Media Usage Statement</b>
Conversations <input checked="" type="checkbox"/>	Groups <input type="checkbox"/>
Reputation <input type="checkbox"/>	Identity <input type="checkbox"/>
	Relationships <input checked="" type="checkbox"/>
	Sharing <input checked="" type="checkbox"/>
<b>Other (please specify)</b>	
In relation to the family of features selected above, what are the actual features you struggle with on social networks?	
Notifications <input checked="" type="checkbox"/>	Location sharing <input type="checkbox"/>
Endless feeds <input type="checkbox"/>	Private messaging <input type="checkbox"/>
Pull to refresh <input checked="" type="checkbox"/>	Customised content <input type="checkbox"/>
Commenting <input checked="" type="checkbox"/>	Asynchronous dialogue <input type="checkbox"/>
	Posting <input checked="" type="checkbox"/>
	Profile <input type="checkbox"/>
	Length of Messages <input type="checkbox"/>
	Liking <input type="checkbox"/>
	Delivery Report <input type="checkbox"/>
	Synchronous dialogue <input type="checkbox"/>
	Status <input type="checkbox"/>
	Temporarily available content <input checked="" type="checkbox"/>
	Relationship status <input type="checkbox"/>
	Tagging <input checked="" type="checkbox"/>
	The wall <input type="checkbox"/>
<b>Other (please specify)</b>	
Can you describe the cause of your problematic social networks usage?	
Emotions: E.g. enhancing self-esteem, improving mood, opportunity to relate to others, emotional support from others	
Peer pressure: E.g. when others want me to be on social media at specific times	
Making influence: E.g. influencing others to behave in a certain way on social media	
<b>Other (please specify)</b>	
How do you feel about the amount of time spent using social networks and the time of use?	
At what point do you think you cross the threshold of a moderate social networks usage to a risky usage? E.g. in terms of time, i.e. when you check Facebook notifications continually for two hours, after you post a lot on your Facebook wall in a short time	
When you feel you are on social networks for a long time, what offline activities do you think would help distract you from social networks?	
Is there any additional information that you would like to be considered or you think is relevant?	

**Consequences of Problematic Social Network Usage**

As a result of your problematic social networks usage, what negative life experiences do you suffer from?

**Emotional Problems**  
 Lowering self-esteem  Aggressiveness  Restlessness  Preoccupation  Anxiety   
 Reduce self-confidence  Inadequacy  Depression  Stress  Irritability

**Elaborate on when the negative experience you select happen?**  
 Negative life experience: Aggressiveness, Restlessness, Irritability  
 When does it happen: When I see close friends and family get involved in heated arguments on social media, it makes me feel irritable and aggressive.

**Disrupted Familial**  
 Partnerships and relationship problems  Marital discord  Negligence of children   
 Spending less quality time with family  Affect parent-child relationship depth and strength

**Elaborate on when the negative experience you select happen?**  
 Negative life experience: Spending less quality time with family  
 When does it happen: When I spend too much time on social media, it ends up in giving less time to parents who require my support and attention.

**Personal Problems**  
 Neglect of personal life  Increased loneliness  Distraction  Confused thinking   
 Poor time management  Lack of concentration  Sleep deprivation  Procrastination   
 Irregular sleeping pattern  Increased escapism  Reduced attention to daily life activities   
 Avoidance of facing real-life problems  Other wellbeing issues

**Elaborate on when the negative experience you select happen?**  
 Negative life experience: Spending excessive time on whatsapp and reacting to every notification on whatsapp results in the above ticked issues.

**Social Problems**  
 Reduced amount of face-to-face social communication  Disrupted peer relationships   
 Reduced skills of face-to-face social communication  Letting down family and friends   
 Neglecting social contacts

**Elaborate on when the negative experience you select happen?**  
 Negative life experience: Spending too much time on social media is reducing my skills and talk properly face to face.

**Behavioural Requirements Elicitation Template**

Stage 1: Information about social networks usage → Stage 2: Information about what users suffer from due to social networks usage → Stage 3: Information about what type of help users would like

Figure 1: Behavioural Goals Elicitation Element Flow

Dialogue

**Template ID: 1** **Social Media Usage Statement**

Which family of features is causing your problematic social networks usage?  
 Conversations  Groups  Presence  Sharing   
 Reputation  Identity  Relationships

**Other (please specify)** .....

In relation to the family of features selected above, what are the actual features you struggle with on social networks?  
 Notifications  Location sharing  Posting  Profile  Length of Messages  Liking   
 Endless feeds  Private messaging  Impression  Delivery Report  Synchronous dialogue   
 Pull to refresh  Customised content  Group sharing  Status  Temporarily available content   
 Commenting  Asynchronous dialogue  Sharing  Relationship status  Tagging  The wall

**Other (please specify)** .....

Can you describe the cause of your problematic social networks usage?  
 Emotions: E.g. enhancing self-esteem, improving mood, opportunity to relate to others, emotional support from others  
 Peer pressure: E.g. when others want me to be on social media at specific times  
 Making influence: E.g. influencing others to behave in a certain way on social media  
 N/A

**Other (please specify)** .....

How do you feel about the amount of time spent using social networks and the time of use?  
 It is alarming sometimes, especially on weekends.

At what point do you think you cross the threshold of a moderate social networks usage to a risky usage? E.g. in terms of time, i.e. when you check Facebook notifications continually for two hours, after you post a lot on your Facebook wall in a short time  
 I think when you check a very long time, it is risky and un healthy.

When you feel you are on social networks for a long time, what offline activities do you think would help distract you from social networks?  
 Hang out with friends, play sports.

Are there any additional information that you would like to be considered or you think is relevant?  
 N/A

**Template ID: 2**      **Consequences**

As a result of your problematic social networks usage, what negative life experiences have you experienced?

**Emotional Problems**  
 Lowering self-esteem     Aggressiveness     Restlessness     Preoccupation     Anxiety   
 Reduce self-confidence     Inadequacy     Depression     Stress     Irritability

**Elaborate on when the negative experience you select happen?**  
 Negative life experience: Restlessness, Irritability  
 When does it happen: At night when I am tired to sleep. At day time, when I have to finish office work.

**Disrupted Familial**  
 Partnerships and relationship problems     Marital discord     Negligence of children   
 Spending less quality time with family     Affect parent-child relationship depth and strength

**Elaborate on when the negative experience you select happen?**  
 Negative life experience: Partnerships and relationships  
 When does it happen: When I ignore my partner due to activities on social media.

**Personal Problems**  
 Neglect of personal life     Increased loneliness     Distraction     Confused thinking   
 Poor time management     Lack of concentration     Sleep deprivation     Procrastination   
 Irregular sleeping pattern     Increased escapism     Reduced attention to daily life activities   
 Avoidance of facing real-life problems     Other wellbeing issues

**Elaborate on when the negative experience you select happen?**  
 Negative life experience: Neglect of personal life  
 When does it happen: When and if I ignore people in my life due to social media.

**Social Problems**  
 Reduced amount of face-to-face social communication     Disrupted peer relationships   
 Reduced skills of face-to-face social communication     Letting down family and friends   
 Neglecting social contacts

**Elaborate on when the negative experience you select happen?**  
 Negative life experience:      When does it happen:

**Part R: During the study screenshots**



