

The development of ReGoal, a serious mobile game for young people with conduct problems*

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ABSTRACT

Research suggests that serious games can be used as supplementary training tools for young people with complex mental health needs. This study aimed to co-produce a mobile-accessible serious game, ReGoal, in collaboration with young people (11–16 years) and an interdisciplinary team of academic experts and practitioners. ReGoal is aimed to serve as a supplementary tool for improving emotion regulation, goal-orientation, and executive functioning skills. This study consisted of three interlinked co-production phases. First, 122 participants, of which 34% had moderate to high conduct problems, completed an online survey about the role of gaming in managing their emotions. During the second phase, 16 young people attended three focus groups in which their lived experiences shaped the narrative of ReGoal. In the third phase, an online user survey gathered feedback from 72 young people playing the most recent prototype of ReGoal. The key findings suggest that young people valued playing ReGoal as a supplementary aid to improving their mood, increasing empathy towards peers and family, reducing anxiety, anger, and impulsivity, and understanding other people's emotions. Future research should test the applicability and feasibility of ReGoal in reducing behavioural problems with clinical and non-clinical samples.

ARTICLE HISTORY

Received 15 May 2023
Accepted 9 September 2024

KEYWORDS



Serious games; conduct problems; young people; co-production; emotion regulation

1. Introduction

Conduct problems in young people are identified as one of the most common reasons for referral to mental health services and are heavily linked to conduct disorder (CD) (NICE 2017; Ong et al. 2019). CD is a childhood disorder with symptoms ranging from stealing, animal cruelty, truancy, to deviant behaviour and/or pathological lying (American Psychiatric Association 2013). However, conduct problems presentation may vary in young people and existing prevalence rates of CD are not reflective of the single remarks of conduct problems. During childhood and adolescence, CD is strongly associated with school exclusion, poor educational performance, social isolation, substance misuse, and increased contact with the youth justice system (Erskine et al. 2016). Such negative childhood experiences are also then linked with persistent problems into adult life, including relationship problems,

occupational issues, and a high level of comorbid mental health problems. A recent report by NHS England (2017) identified conduct problems as the second most prevalent category of presenting mental health disorders with a 4.6% prevalence rate among boys and girls. The National Institute for Health and Care Excellence (NICE 2013) estimates the prevalence of conduct disorder to be as high as 5% among 5-16-year-olds where 30% of a typical general practitioner's child consultations and 45% of community child health referrals are due to behaviour disturbances. According to Public Health England (2016), the estimated cost of crime attributed to adults who had untreated CD in childhood is £60 billion, and up to £150,000 could be saved per individual case with the use of successful early intervention and prevention models, which should be a national priority for this group.

Serious gaming, a process of playing games for purposes other than entertainment or leisure, with the

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aim of promoting favourable health outcomes, has contributed to several fields, such as education and mental health targeting attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD), eating disorders, anxiety, and depression symptoms (Arnab 2013). Serious games designed for mental health adapt cognitive behavioural therapy (CBT) elements to user experiences, aiming for exploratory learning and behavioural change (Martinez, Menéndez-Menéndez, and Bustillo 2021). These tools are particularly appealing to children and adolescents, who are experienced with technology and drawn to engaging graphics and gameplay. Moreover, advancements in technology and its widespread availability enable the creation of high-quality games for various user devices, including PCs and smartphones. A meta-analysis found that serious games have the potential to enhance knowledge, improve clinical outcomes, and enhance applicability by fostering behavioural changes and enhancing mental health (DeSmet et al. 2014). This aligns with the conclusions drawn from a recently published systematic review, which reported positive effects on social skills improvement in young people with autism through serious games (Carneiro et al. 2024). An online game known as Plan-It Commander, which is designed for young people 8–12 years with ADHD has been used in community samples to complement their outpatient clinical care. The findings from the randomised controlled trial (RCT) evaluation reported improved outcomes in time management, social skills and working memory (Bul et al. 2016). Previous studies have found positive long-lasting effects on brain plasticity and behavioural changes (Kühn et al. 2014; Zheng et al. 2021). The advantage of using serious games is that they expose users to deeply engaging, visually dynamic, rapidly paced, and highly satisfying experiences in comparison to conventional teaching, training, and intervention methods. Serious gaming contributes to learning through digital social interactions and trial-error choices simulating real-world scenarios (Zheng et al. 2021).

Given the vast growing rates of smartphone and mobile application usage among adolescents, digital evidence-based therapeutic interventions show a great potential of optimising mental health problems in this group (Schaeffer et al. 2022). There is good evidence to suggest that adding gamification elements to existing therapeutic interventions can improve treatment effectiveness (Bul et al. 2018). These digital game elements have the potential to facilitate access to important resources and integrate critical components of traditional interventions in the routines of their users, by offering appealing, engaging, and accessible social

experiences (Vajawat, Varshney, and Banerjee 2021). Digital game interventions have been increasingly implemented in mental healthcare to enhance the psychological and emotional well-being of young people, with a recent systematic review finding these approaches to be effective in reducing mental health symptoms and improving outcomes for individuals with anxiety, depression, schizophrenia, and bipolar disorder (Dewhirst, Laugharne, and Shankar 2022). Such approaches are designed to supplement existing behavioural training in natural settings such as schools and home, aiming to increase engagement and participation and modify behaviours and attitudes associated with poor mental health (Ong et al. 2019). Game elements can be particularly therapeutic to young people with disruptive behavioural problems, such as ADHD and conduct problems as they provide novel learning spaces and educational opportunities which are developmentally appropriate for this demographic (Kokol et al. 2020). A recently published study showed that young people value problem-solving games which contribute significantly to their socio-emotional development (Kahila et al. 2020) consistent with the findings of the Emotion Detectives Game designed for young people with neurodevelopmental problems, such as autism and ADHD (Löytömäki, Ohtonen, and Huttunen 2024). This game showed also significant improvement in behavioural problems. Targeting socio-emotional problems can improve peer relationships, making friendships and emotion regulation. While there is a scarcity in literature on serious games specifically tailored for young people dealing with conduct problems, existing serious games designed for individuals with autism, focusing on social-emotional challenges, imply a potential correlation between these difficulties and behavioural difficulties.

Digital game interventions are being increasingly used in the fields of education, training, healthcare, and mental health promotion (Damaševičius, Maskeliūnas, and Blažauskas 2023; Sharifzadeh et al. 2020), and may provide an innovative platform to optimise conduct problems and conduct disorder symptoms. Such interventions have been employed in patients diagnosed with chronic conditions such as diabetes and persistent lower back pain, aiming to facilitate self-management (Maskeliūnas et al. 2022; Tuah, Yoag, and Ahmedy 2021). For instance, MyRelief Serious Game, which is designed for improving self-management of chronic lower back pain has been instrumental in advancing participants' understanding of their conditions and refining their management strategies. Similarly, developing a serious game for conduct problems management may improve the quality of life for this

population and their family environment. Digital serious game interventions have also found applications across diverse populations, including older adults. For instance, a proposed serious game aimed at enhancing self-management healthcare for older adults incorporated visualisation and learning modules to empower users to improve their mobility (Codreanu and Florea 2015).

Young people with neurodevelopmental and conduct problems are more likely to engage in digital game interventions focused on rewarding systems that increase motivation (Granic, Lobel, and Engels 2014). Game goals have the potential to improve executive functioning in young people with conduct problems and co-existing ADHD and/or oppositional defiant disorder (ODD) (Alabdulkareem and Jamjoom 2020). Evidence shows that conduct problems impact negatively executive functioning and, specifically working memory and attentional and inhibitory control, which account for dysregulated behaviour (Deters et al. 2020) and poor emotion recognition. Previous research has identified the inability to recognise emotions in others as a strong predictor for antisocial behaviour and negative emotions (Deters et al. 2020). Negative emotions related to anger, sadness and fear are often associated to impaired emotion recognition found in young people with conduct problems as well as ADHD (Airdrie et al. 2018). Young people with conduct problems are more inclined to risk-taking behaviours resulting in antisocial actions due to constant impulse of pursuing thrill-seeking experiences (NICE 2017). Thus, digital game interventions provide the opportunity to engage young people in fun, immersive and stimulating digital contexts through challenging cognitive and behavioural tasks with the aim of improving emotional regulation and goal-orientation. Additionally, game-based approaches are not only enjoyable and interactive but also effective in promoting motivation for learning, while simultaneously reducing resistance in young individuals who exhibit antisocial and service-resistant behaviours (Barba et al. 2019; NICE 2017; Ong et al. 2019).

While there is growing development and support for the utility and efficacy of digital game interventions in the mental health arena, more specific and tailor-made support is needed for unique conditions such as CD (Damaševičius, Maskeliūnas, and Blažauskas 2023). The purpose, design, and content of a serious game for young people with conduct problems would differ significantly from other mental health-based serious games already being developed and trialled. Firstly, such a game should prioritise goal setting and modelling of prosocial behaviour by creating opportunities to

make optimal choices. Secondly, this game should aim to address the conduct related problems mentioned above including poor executive functioning, emotion recognition, and inhibitory control. Thirdly, the game should focus on enhancing motivation by offering enjoyable and stimulating tasks. It should be designed with the deliberate intention of avoiding excessively challenging or disruptive gamification elements, as these may result in disengagement, particularly among individuals who are already inclined toward impatience, mood volatility, and resistance to service participation (NICE 2017).

Therefore, once harnessed correctly, serious games can be used as digital game interventions by children with conduct problems at their own time, with or without supervision while at the same time providing feedback in the form of reinforcement and correction. However, young people with conduct problems are rarely included in research and service development due to recruitment problems and service misrepresentation (Bonevski et al. 2014). These difficulties stem from various barriers to healthcare including distrust, shame, disbelief, fears of being blamed, poor mental health literacy, stigma around mental illness, structural barriers (lack of access or transportation), and the fear that the young person could be removed by child protective services (Danese et al. 2020). To prevent the onset and development of conduct problems and interrupt its severity among young people in disadvantaged communities, we need to increase their participation in research studies and target their subclinical symptoms before they enter the youth justice system. Current research suggests interventions that are collaboratively developed with mental health professionals and service users can achieve optimising outcomes (McPin Foundation 2018). Therefore, the present study aimed to co-design and develop a novel serious mobile game in partnership with young people presenting with conduct problems.

The proposed serious game ReGoal includes gamification elements where the young person interacts live with presented scenarios targeting conduct symptoms and receiving digital rewards as a reinforcer for prosocial behaviour and corrections for antisocial behaviour. A plot featuring a central character was employed to strengthen the game's purpose and objectives, drawing from research indicating that players are more inclined to identify with characters through recognising and internalising emotions (Martinez, Menéndez-Menéndez, and Bustillo 2021). Young people are prompted to evaluate context-presented situations and integrate multiple perspectives before decision-making. ReGoal aims to address existing gaps in current research and service infrastructure by extending the positive and

promotive benefits seen from game-based apps in other mental health conditions (Damaševičius, Maskeliūnas, and Blažauskas 2023) to the unique and specific needs of youth with conduct problems. For example, ReGoal encompasses multiple dimensions such as social, emotional, and cognitive skills, as well as planning and goal-oriented behaviour. Further, through co-production, it is the aim to engage with this hard-to-reach and typically underserved population and harness their strengths and insight to develop an app that is as tailor-made and need-specific as possible. To our knowledge, this is yet to be done in existing research and app development for this population.

Theoretical framework for developing the ReGoal game ReGoal was developed for young people with conduct problems 11–16 years of age. Self-Regulation Theory and Model of Health and Illness (Hall and Fong 2007) have informed the level of interactions between the main character of the game and other important figures (i.e. parent, friends) to support young people during decision making. Empirical evidence purports that emotional competence composes an integral part of behavioural functioning and emotional regulation that lies at the core of disruptive behaviours. A longitudinal study showed that children exposed to less emotion regulation approaches after experiencing a delayed gratification task, were more likely to develop conduct problems in adolescence (Gilliom et al. 2002). The Self-Regulation Model highlights behaviour and emotion monitoring when aiming towards goal achievement. For example, the main player in ReGoal has a primary task which is to attend a school party. However, their attendance depends on choices they make throughout the game, based on social interactions with their parent, teacher, and peers, and the decisions they make in different scripted scenarios. ReGoal includes specific elements that target emotion regulation and goal-orientation by graded strategies. The young person can practice playing ReGoal multiple times until they master emotion regulation and goal-oriented skills. This process helps young people to deal creatively with frustration given anger outbursts in conduct disorder are often associated with frustration intolerance (Vanzin and Mauri 2019). These gamification elements were developed purposely to nurture emotional regulation and provide an enabling digital environment to the young people attaining transferable skills applicable to their daily routine. Game components were developed in line with Social Cognitive Theory (Espelage et al. 2018) and Bronfenbrenner's Ecological Model (Hyatt-Burkhart, Kolbert, and Crothers 2017) where young people are affected emotionally from their external environments such as

home, school, community, and from interactions with significant figures such as parents, peers, and teachers. The external environment of the young person can facilitate and model positive behaviours resulting in behaviour modifications. These theories were integrated into the game by providing young people the opportunity of collecting coins to reach the ultimate goal (e.g. attending the party). The ecological framework (see Figure 1) is an evidence-based approach implemented in young people with conduct problems across schools and offers a multifaceted approach targeting individual, school, and community triggering factors (Hyatt-Burkhart, Kolbert, and Crothers 2017). Accordingly, each level of ReGoal targets ecological factors at a macro-, meso-, and micro-system. Positive interactions with a prosocial peer throughout the game aim to increase motivation and prosocial attitudes and facilitate cognitive or emotional empathy towards others considering that young people with conduct problems are more likely to associate with delinquent peers (see Table 2 for additional details). Theory of Mind (ToM) purports that young people with neurodevelopmental and/or conduct problems encounter difficulties in recognising and understanding others' emotions and mental states (Frith 2007). Previous research shows a strong relationship between low ToM abilities and antisocial behaviour. In line with this, ReGoal aims to prompt players towards prosocial choices which may increase empathy and understanding towards parents, peers, and teachers. Finally, the fundamental underpinnings of the Good Lives Model (Ward, Mann, and Gannon 2007) were used as the guiding foundations of ReGoal. Specifically, the overall intention of the game works in line with the

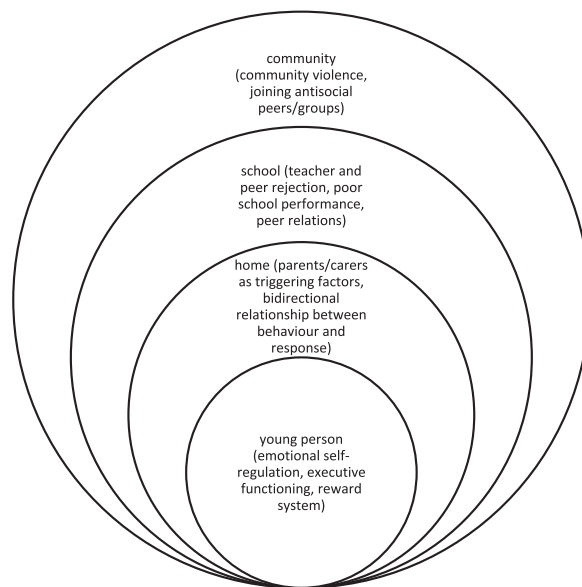


Figure 1. Ecological model of conduct problems.

Good Lives Model's strength-based rehabilitative approach, aiming to help those with disordered behaviour reframe their goals, and work on more productive, prosocial ways to reach their targets, which in this instance is to avoid engagement in antisocial activities.

Previous studies have mostly targeted younger age groups such as children between 4 and 9 years (Wetterborg et al. 2019). The present study included young people between 11 and 16 years to identify perpetuating behavioural issues. Dewhirst, Laugharne, and Shankar (2022) highlight the importance of targeting age groups to increase motivation and engagement. Currently, there is very limited knowledge about the development and usability of serious games for adolescents and the evidence is inconclusive due to small effect sizes.

2. Study aims

The overall aim of the study was to co-produce a mobile-accessible serious game, ReGoal, in collaboration with young people (11–16 years) and an interdisciplinary team of academic experts and practitioners in child and adolescent mental health and game technology.

Sub-aims:

- (1) To provide a supplementary tool for improving emotion regulation, goal-orientation, and executive functioning skills.
- (2) To use a rewarding system, which can be applied in young people with conduct problems.
- (3) To model prosocial behaviour by creating opportunities to make optimal choices.

Study Phases:

This study used a multimethod co-production approach to develop best practices and approaches in designing and producing a serious game that promotes engagement and inclusivity in young people with conduct problems. Three interlinked phases, utilising an iterative approach, were included with the following objectives:

- Phase 1-Initial game and prototyping: To use an online survey to explore young people's game preferences and the relationship between feelings of anger, aggression, and relationship with others with conduct problems.
- Phase 2-Design refining and prototyping: To use three online focus groups to inform the design and story of the game.
- Phase 3-Game development and testing: To pilot ReGoal with young people and receive feedback to

personalise and tailor gamification elements according to the specific needs of the young people.

3. Methods

3.1. Design

3.1.1. Pre-design and development phase

Collaboration in ReGoal Development Game development requires a holistic approach with extensive interdisciplinary knowledge and expertise from several fields, such as psychology, gaming, and computer science. We developed ReGoal within a multidisciplinary team across four UK-based universities consisting of three academic psychologists in child and adolescent mental health and education, a game developer, and two experts in game design and creative technology. Multidisciplinary collaboration is considered a key factor in serious game design (Bul et al. 2016) and, therefore, we included young people in the co-production of ReGoal. We received professional advice from three practitioners (two forensic psychologists and one forensic nurse) with extensive clinical experience of young people with behavioural difficulties and conduct disorder and three forensic psychiatrists from forensic medium secure hospitals for adolescents and adults. These professionals as well as the expertise of one of the authors in forensic child and adolescent mental health and another one in developmental psychopathology provided input pertinent to questionnaire items and focus groups interview guides used in the development phase. Focused interactive meetings between the academic psychologists and game designers and developer deepened the team's understandings around the specific needs of young people with conduct problems and how we can make ReGoal meaningful and relatable to them. In addition, we had three meetings with five parents of young people with conduct problems who identified emotion regulation, impulsivity, and poor frustration threshold as ongoing triggering factors. The meetings focused on three main themes: *What should be the main story of this game? What outcomes should we aim for? Who should play this game?* Four prototypes were developed based on the above-mentioned co-production and collaboration steps of feedback, focus groups and discussions. Then these were piloted within the team and eight undergraduate psychology students. The final prototype was then piloted with a subsample of 72 young people. Child and adolescent practitioners were actively engaged in discussing and assessing the therapeutic relevance and suitability of ReGoal. They acknowledged its usability as a supplementary mental health tool within Child and Adolescent Mental Health

Services (CAMHS), particularly in light of the long waiting lists among young people with behavioural problems and additional comorbidities waiting for receiving an assessment and a diagnosis and commencing treatment. Young people on the CAMHS waiting list could be introduced to ReGoal which is aligned with the waiting-list interventions (WLI) post-pandemic initiative (Thomas, Schroder, and Rickwood 2021). Please see Figure 2 for steps undertaken to co-design and develop ReGoal.

The present study is comprised of three separate phases specifically designed to align with the defined objectives. Employing a mixed-methods sequential design, participants first had to complete an online survey about game preferences (Phase 1). This survey shaped the questions and prompts of the second phase of the study involving online focus groups. Participants were invited to take part in focus groups to reflect on the content of preferred games (Phase 2). Recommendations and feedback about game preferences were

carefully considered in the development of ReGoal aiming to accommodate suggestions regarding the storyline and main player. Finally, participants were invited to share their views and experiences with the most recent prototype of ReGoal through an additional online survey (Phase 3). Young people and parents were asked to provide consent in case they wished to participate in the study at phase 1 and then the follow-up focus group and online studies.

Participants We recruited young people aged 11–16 years old to participate in the study through leaflets shared on social media platforms (Twitter, Instagram, Facebook) and snowballing techniques. The data collection took place between March 2022 and January 2023. Young people with and without conduct problems took part in the study based on the Strengths and Difficulties Questionnaire (SDQ) screening process. Eligible young people could express interest by contacting the research team at the project dedicated email. Parental consent forms were collected for young people 11–15 years old

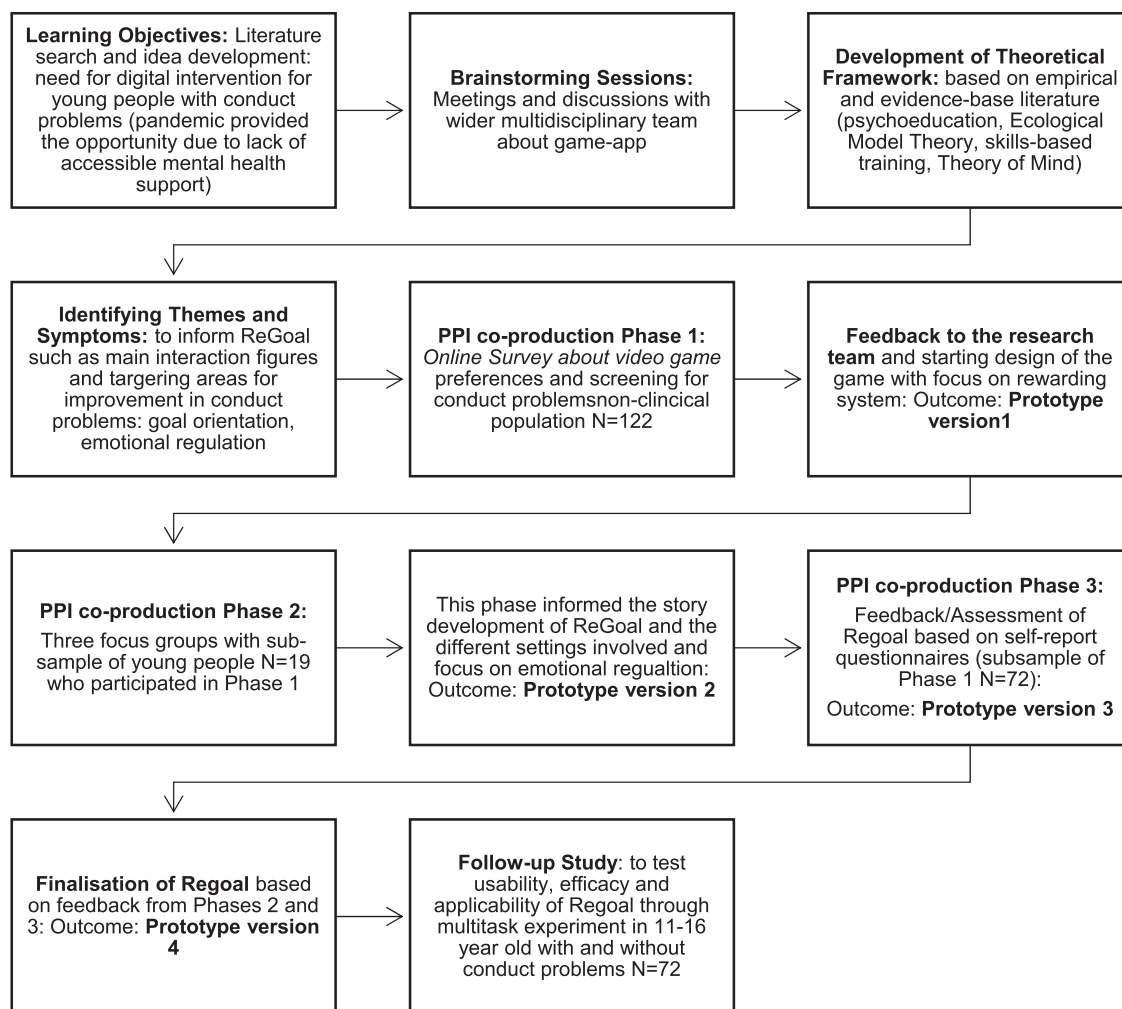


Figure 2. Development of ReGoal: coproduced steps and processes within a multidisciplinary team.

and consent from all participants. All parents contacted the research team via email and discussed the study or any relevant concerns.

Phase 1- Initial game designing and prototyping The sample for this study comprised 122 participants 11–16 years old ($M = 14$, years $SD = 1.50$) who completed an online survey using Qualtrics including a socio-demographics self-report, the SDQ (Goodman and Goodman 2009) and a self-report questionnaire on game preferences. The socio-demographics questionnaire included questions about age, gender identity, ethnicity, whether participants have siblings or not, whether both of their parents are alive or not, type of school attending (mainstream or mainstream with special resourced provision), parents' educational levels, and any previous diagnosis of mental health problems. Please see Table 1 which summarises participant characteristics. The SDQ assesses the emotional wellbeing and behaviours of adolescents, can be administered by non-clinicians, and typically takes 5 min to complete. SDQ consists of 25 items divided between five sub-categories including emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems and prosocial behaviour. The items are totalled to construct the total difficulties scale. Items can be scored on a 3-point scale; 0 = 'not true', 1 = 'somewhat true', and 2 = 'certainly true'. We used the four-fold categorisation where higher ratings on the prosocial behaviour subscale indicate strengths, and higher scores on the remaining four subscales indicate challenges. In this study, we will only focus on conduct problems in the results but will show only the prevalence of the other SDQ subscales. The online survey also sought information about participants' favourite video games, frequency of playing video games, associated feelings and experiences, and their platform of choice for playing games. Young people answered the following questions on a 1–5 Likert-type scale (1 = none, 2 = little, 3 = somewhat, 4 = much, 5 = very much): *how much do these video games affect your feelings of anger; how much do these video games affect your understanding of other people's feelings; how much do these video games affect your relationships with their peers/parents/their selves; how much do these video games affect your feelings of empathy towards other people and animals.* This phase of the study took between 10 and 30 min and participants received a £10 Amazon voucher for their time and participation.

Phase 2-Design refining and prototyping Young people from the first phase were invited to participate in an online focus group if they had agreed to be contacted for follow-up studies. Three online focus groups ($N = 16$: focus group 1: $n = 3$; focus group 2: $n = 7$; focus

Table 1. Sociodemographic characteristics of participants at baseline.

Variable	Number of respondents	n	%
What is your gender identity? (n = 121)			
Female		61	50%
Male		60	49%
Missing		1	1%
What is your age? (n = 113)			
11–13 years		48	42%
14–16 years		65	58%
What is your school grade? (n = 122)			
Year 7		17	14%
Year 8		13	11%
Year 9		27	22%
Year 10		39	32%
Year 11		26	21%
What is your ethnicity? (n = 121)			
White		60	49%
Mixed/multiple ethnic groups		13	11%
Asian or Asian British		7	6%
Black/African/Caribbean/Black British		38	31%
Arab		2	2%
Any other ethnic group		1	1%
What type of school are you currently attending? (n = 122)			
Mainstream		73	59.8%
Mainstream with special resourced provision		49	40.2%
Have you ever been diagnosed with a mental health problem? (n = 122)			
Yes		9	7.4%
No		113	92.6%
Are both your parents alive? (n = 122)			
Yes		106	86.9%
No		16	13.1%
Mother's educational qualification (n = 122)			
None		2	1.6%
GCSE(s)/O-Levels(s)/GCE(s)		1	0.8%
A-Levels/AS-Levels		3	2.5%
Diploma (HND, SRN, etc.)		26	21.3%
Degree		70	57.4%
Postgraduate degree/diploma		20	16.4%
Father's educational qualification (n = 122)			
None		1	0.8%
GCSE(s)/O-Levels(s)/GCE(s)		3	2.5%
A-Levels/AS-Levels		19	15.6%
Diploma (HND, SRN, etc.)		72	59%
Degree		25	20.5%
Postgraduate degree/diploma			
Do you have siblings? (n = 122)			
Yes		16	13.1%
No			

group 3: $n = 6$) were convened on the Microsoft Teams platform. The first group included three participants (one female, two males), the second had seven males, and the third consisted of six females. The ages of the participants varied from 12 to 16 years old ($M = 13.25$, $SD = 1.88$). Young people were prompted to use the microphones and/or the chat in case they needed a break and/or wished to withdraw. The focus group guide included questions about game preferences in terms of story and characters, motivations, and recommendations for ReGoal. These questions were informed from the first phase of the study and the multiple meetings with stakeholders. Example items were: *What are your three favourite video games? How would you describe the content of your favourite video*

**Table 2.** Description of game levels, description and acquired skills with the equivalent matching theoretical framework.

Level	Description	Task	Possible outcome	Possible rewards	Skills	DSM-5 CD Clinical symptoms & associated risk factors/triggers	Theoretical framework
Home	The player has a chat with their friend and mom.	Find the key and leave the house.	Be polite/rude with mom	Keep the change (£10) (Y/N); Find 1 coin hidden in the house (Y/N)	Emotional regulation; Goal orientation	Aggressive behaviour towards others and animals (often initiates physical fights)	Self-Regulation Theory; Model of Health and Illness
Bus stop	The player does not have the bus pass but needs to take the bus to get to the school.	Get to school without a bus pass or money for the ticket.	Be polite/rude with the bus driver; Game over	Get a free ride (Y/N)	Informed decision making; Emotion regulation	Aggressive behaviour/ anger/ impulsivity; Sense of entitlement; Serious violation of rules	Ecological Model; Self-Regulation Theory
School	The player attends the award ceremony in the classroom.	Go to the classroom and choose whether to congratulate the winner.	Congratulate Will (Y/N); Steal coupons from an office (Y/N); Game over	Get the voucher from the teacher (Y/N); Find 4 coins scattered in the school (Y/N)	Developing cognitive empathy; Frustration tolerance; Goal orientation	Deceitfulness; Deception/ stealing/ aggressive competition; Lack of concern for others	Ecological Model; Model of Health and Illness
Local neighbourhood	The player walks through the park and sees a group of children abusing a cat.	Do not engage with the abusers and report them to the police.	Engage (Y/N); Report abuse to the police officer (Y/N); Game over	Get £5 from the old lady (Y/N); Find 3 coins scattered around the neighbourhood (Y/N)	Developing emotional empathy; Conflict resolution; Goal orientation	Deliberately physically cruel to animals; Antisocial behaviour; Understanding feelings of others	Theory of Mind; Ecological Model
Local shop	The player buys groceries for their mom and notices a group of shoplifters.	Get the bread and report the shoplifters.	Report the shoplifters (Y/N); Game over	Get the bread for free and keep the money (Y/N)	Developing prosocial skills;	Involvement in non-confrontational retail theft; Making prosocial choices versus adversity	Good Lives Model; Ecological Model

games? Why do you like these three specific video games? Do you prefer playing against others (competitive) or with others (co-op)? Could you, please, describe how these video games affect your feelings of aggression? Could you, please, describe how these video games affect your understanding of other people's feelings? Could you, please, describe how these video games affect your relationship with your parents? We also asked participants how they could provide feedback on the final ReGoal prototype and which specific areas they would prefer to prioritise. All participants received a £20 Amazon voucher for participating in a 60–90-minute online focus group.

Phase 3-Game development and testing: The sample included 72 young people 11–16 years old ($M = 14.24$, years $SD = 1.34$) recruited from the first and second phases of the study. The feedback survey was developed in collaboration with the mental health team of the research group and a professional carer with lived experience. Subsequently, it was piloted with a sample of 10 young people to gather feedback and check for inconsistencies. Thirty items were developed aligning with ReGoal's key performance indicators, including emotional regulation and conduct problems (e.g. *This game made me feel frustrated; This game helped me control my emotions*). The development of these items was also informed from the findings of the online focus groups following the co-production framework that guided the present study. Pearson's correlations were conducted among items to validate the internal consistency of the feedback survey (refer to Tables 5 and 6). Young people received a link through Qualtrics which directed them to the most recently developed ReGoal prototype, and they were asked to provide feedback after playing the game. We asked them about the quality, content, graphics, accessibility, applicability, and appropriateness of ReGoal for the proposed age-group. Example questions were the following: *How did you feel about the length of each session in the game? Which behavioural issues do you think this game could help with? What age group do you think this game is appropriate for?* Participants were also asked how their individual and personal emotions and skills (e.g. anxiety, mood, creativity, concentration, controlling their emotions), and their empathy and relationships with others (parents, peers, animals) were affected after playing the ReGoal game. These questions were specifically developed by the team to address young people's needs and suggestions after playing ReGoal and to assess the key performance indicators of the study's sub-aims (e.g. goal-orientation, rewarding and prosocial behaviour). These answers contributed to the final amendments of the game. Young people

Table 3. Means and standard deviations in feelings of anger, aggression, and relationship with others by levels of conduct problems.

Measure	No conduct problems		Low		Moderate		High		F	η^2
	M	SD	M	SD	M	SD	M	SD		
Feelings of anger	2.30	1.13	3.40	1.08	3.29	0.99	3.33	1.09	8.87***	0.18
Feelings of aggression	2.11	0.99	2.60	0.52	3.06	0.66	3.30	0.82	12.92***	0.25
Feelings about self	2.56	1.08	3.60	0.84	2.94	0.97	3.04	0.81	4.05**	0.09
Empathy towards other people's feelings	2.56	1.13	3.40	0.84	2.94	0.97	3.42	0.88	5.11**	0.12
Relationship with parents	2.46	1.05	3.30	1.06	3.06	0.83	3.29	0.86	5.91***	0.13
Relationship with peers	2.73	1.15	3.40	1.17	2.94	0.97	3.25	0.94	2.09	0.05
Relationship with others and animals	2.48	1.22	3.40	0.84	3.24	0.75	3.63	0.71	8.90***	0.18

*** $p < .001$.** $p < .01$.**Table 4.** The relationship of feelings of anger, aggression, and relationship with others with conduct problems before and after adjusting for demographic and parental factors.

	Unadjusted		Adjusted+	
	B (SE)	Beta (95% CI)	B (SE)	Beta (95% CI)
Feelings of anger	0.399 (0.086)	0.388 (0.227–0.570)***	0.371 (0.088)	0.357 (0.197–0.545)***
Feelings of aggression	0.596 (0.096)	0.496 (0.407–0.786)***	0.581 (0.097)	0.480 (0.389–0.773)***
Feelings about self	0.237 (0.106)	0.199 (0.026–0.448)*	0.182 (0.113)	0.150 (–0.042–0.406)
Empathy towards other people's feelings	0.338 (0.098)	0.301 (0.144–0.532)***	0.289 (0.103)	0.256 (0.085–0.492)**
Relationship with parents	0.388 (0.101)	0.331 (0.188–0.589)***	0.320 (0.109)	0.268 (0.103–0.537)**
Relationship with peers	0.200 (0.100)	0.179 (0.002–0.399)*	0.105 (0.103)	0.093 (–0.100–0.310)
Relationship with others and animals	0.438 (0.089)	0.410 (0.262–0.615)***	0.360 (0.095)	0.336 (0.170–0.549)***

*** $p < 0.001$; ** $p < 0.01$; +Adjusted for gender, age, ethnicity, parents' educational levels, whether parents are alive or not, whether has siblings or not, whether diagnosed with mental health problems or not, and whether attended mainstream school or mainstream with special resourced provision.

provided recommendations and feedback that facilitated the finalisation of the game. Participants received £5 Amazon vouchers for this online survey, which typically required between 5 and 15 min for completion.

3.2. Data analysis

All quantitative data were analysed with SPSS 28 statistical software. For Phase 1, descriptive statistics were used to understand young people's game preferences, SDQ conduct problems scores and the impact of playing games on their levels of aggression, anger and understanding feelings of others. One-way ANOVAs were conducted to explore the effect of severity of conduct problems (close to average population, low, moderate, high) on anger, aggression, relating to others. Means, Standard Deviations effect size were reported. A linear regression was carried out to investigate the relationship between personal emotions and relationships with others (IV) and conduct problems (DV) before and after adjusting for demographic and parental confounding variables. Standardised coefficient with standard errors (SE) and unstandardised coefficient with 95% Confidence Interval (CI) are reported. For Phase 2, we conducted thematic analysis to identify themes pertinent to the role of playing games in social interactions and socio-emotional development and game suggestions. For Phase 3, descriptive statistics were performed to present feedback of playing ReGoal and participants reported how they felt after

playing ReGoal, commented on special features of the games and assessed what age groups it is appropriate for. We conducted bivariate Pearson correlations to examine the relationships of the impact of playing ReGoal on mood, emotion regulation, anxiety, anger, aggression feelings in young people, and relationships with and empathy towards others.

ReGoal game design and content ReGoal is a 2D exploration game accessible through Android devices in which young people can create their own gender-neutral character (Figure 3) and are exposed to different scenarios taking place at home, bus stop, school, local neighbourhood, and local shop (Figure 4). The outcomes and game performance depends on their interactions with family, friends, teachers, and other 'unknown' people.

There are four options for the skin colour, 18 for the hairstyle, and six for outfit.

Participants can earn points/money based on choices (e.g. engaging in verbal or physical argument or not). The player can explore each level and interact with objects in the game world. The amount of 'explorable' game area varies based on the level. The player is given the quest of 'collecting' £20 to participate in a big party taking place once a year. To do so, the player will have to collect hidden coins spread around the levels as well as through monetary rewards following dialogue interactions. The amount of money obtained through dialogues will change depending on the circumstances and choices taken. ReGoal is structured



Table 5. Correlations between how the ReGoal game improved personal feelings and emotions and how the game's features and content helped the participants improve some related skills.

The game/made me	The game/made me													
	Feel angry	Feel less impulsive	Helped to control my emotions	Improved my mood	Feel relaxed	Feel frustrated	Feel lonely	Feel creative	Feel motivated	Escape from reality	Easy to navigate	Enjoyable	Rewarding	Educational
Feel angry	–													
Feel less impulsive	.551**	–												
Helped to control my emotions	–.061	.091	–											
Improved my mood	.005	.042	.349**	–										
Feel relaxed	–.279*	–.245*	.250*	.252*	–									
Feel frustrated	.667**	.353**	–.008	–.106	–.337**	–								
Feel lonely	.603**	.558**	.046	–.031	–.199	.566**	–							
Feel creative	.085	.026	.202	.279*	.405**	–.197	–.047	–						
Feel motivated	–.043	–.146	.410**	.336**	.347**	–.213	–.180	.571**	–					
Escape from reality	.023	.081	.406**	.357**	.559**	–.068	–.046	.411**	.345**	–				
Easy to navigate	–.033	–.044	.339**	.436**	.377**	–.127	.064	.331**	.451**	.430**	–			
Enjoyable	–.123	.113	.312**	.520**	.513**	–.221	–.004	.398**	.403**	.499**	.605**	–		
Rewarding	–.044	.020	.376**	.352**	.561**	–.226	–.052	.379**	.484**	.508**	.588**	.568**	–	
Educational	.000	.125	.381**	.388**	.497**	–.145	–.041	.380**	.449**	.597**	.478**	.610**	.727**	–
Liked the story of the game	–.099	–.126	.290*	.323**	.599**	–.158	–.205	.272*	.408**	.520**	.378**	.535**	.591**	.670**
For a good cause	.009	.114	.228	.400**	.515**	–.130	.074	.340**	.292*	.407**	.362**	.575**	.480**	.413**
The text is helpful	.024	.171	.338**	.557**	.259*	–.137	.033	.236*	.344**	.332**	.369**	.574**	.532**	.405**
Liked the graphics	–.218	–.102	.271*	.306**	.383**	–.248*	–.166	.225	.353**	.324**	.401**	.380**	.532**	.531**
Liked the main character	–.140	–.110	.427**	.418**	.399**	–.191	–.122	.349**	.554**	.437**	.522**	.485**	.559**	.686**
Helped me concentrate	.019	.138	.347**	.230	.328**	–.133	–.085	.241*	.413**	.465**	.305**	.508**	.390**	.510**
Challenging	.163	.207	.500**	.435**	.162	.107	.177	.183	.371**	.413**	.346**	.435**	.362**	.374**
Sections were all predictable	.229	.168	.305**	.330**	.277*	.090	.179	.265*	.331**	.483**	.342**	.237*	.391**	.263*
Competitive	.132	.130	.396**	.344**	.342**	.064	.129	.338**	.479**	.562**	.515**	.406**	.573**	.567**
Reduced my anxiety	.011	.193	.450**	.361**	.384**	–.257*	.015	.314**	.419**	.536**	.361**	.478**	.472**	.557**
Friendly interface	.089	.129	.324**	.401**	.152	–.046	–.005	.389**	.489**	.258*	.250*	.405**	.366**	.454**
Recommend to a friend	–.067	.071	.403**	.354**	.432**	–.064	–.003	.359**	.468**	.600**	.453**	.456**	.404**	.661**
Pace too slow	.064	–.059	.310**	.019	.362**	.161	.202	.187	.172	.314**	.110	.160	.241*	.327**
Pace too fast	.431**	.145	.211	.176	.130	.215	.335**	.126	.306**	.248*	.350**	.329**	.310**	.308**

The game/made me

	Liked the story of the game.	For a good cause.	The text is helpful	Liked the graphics	Liked the main character	Helped me concentrate	Challenging	Sections were all predictable	Competitive	Reduced my anxiety	Friendly interface content	Recommend to a friend	Pace too slow	Pace too fast
Feel angry														
Feel less impulsive														
Helped to control my emotions														
Improved my mood														
Feel relaxed														
Feel frustrated														
Feel lonely														
Feel creative														
Feel motivated														
Escape from reality														
Easy to navigate														
Enjoyable														
Rewarding														
Educational														
Liked the story of the game	.517**	–	–	–	–	–	–	–	–	–	–	–	–	–
For a good cause	.298*	.400**	–	–	–	–	–	–	–	–	–	–	–	–
The text is helpful	.553**	.346**	.487**	–	–	–	–	–	–	–	–	–	–	–
Liked the graphics	.536**	.468**	.390**	.567**	–	–	–	–	–	–	–	–	–	–
Liked the main character	.505**	.320**	.339**	.378**	.528**	–	–	–	–	–	–	–	–	–
Helped me concentrate	.319**	.321**	.345**	.410**	.482**	.487**	–	–	–	–	–	–	–	–
Challenging	.093	.297*	.314**	.066	.314**	.246*	.439**	–	–	–	–	–	–	–
Sections were all predictable	.440**	.387**	.426**	.378**	.478**	.268*	.453**	.541**	–	–	–	–	–	–
Competitive	.428**	.445**	.397**	.321**	.397**	.418**	.350**	.359**	.461**	–	–	–	–	–
Reduced my anxiety	.479**	.307**	.418**	.397**	.376**	.371**	.419**	.346**	.430**	.328**	–	–	–	–
Friendly interface content	.494**	.318**	.234*	.390**	.526**	.417**	.361**	.232*	.518**	.549**	.391**	–	–	–
Recommend to a friend	.288*	.176	.020	.068	.286*	.081	.156	.299*	.251*	.196	.163	.308**	–	–
Pace too slow	.278*	.209	.288*	.059	.266*	.178	.272*	.341**	.396**	.233*	.263*	.123	.387**	–
Pace too fast														

Correlation is significant at the 0.01 level (2-tailed).

Correlation is significant at the 0.05 level (2-tailed).

The higher the scores the more likely to disagree

around small missions and a final mission by presenting ongoing scenarios to the player where he can develop important skills towards problem solving emotion regulation, planning/goal-orientation, and prosocial behaviour Table 2.

3.3. Levels and aesthetics

The game is top-down and uses pixel art asset packs acquired from the Unity Asset Store. This decision has been taken due to technical considerations, players' age range and the feedback received during the co-production phases. Please see Figure 3 for character customisation and 4 for level information and game scenarios.

Five main environments for the game scenarios (top left to bottom right): home; bus stop; school; local neighbourhood; local shop.

3.4. Mechanics and UI

The main mechanics of the game are movement, interaction with Non-Player Characters (NPCs) and coin collection. The player can move in eight directions. The directions are selected by touching and sliding the joystick on the device, while the interaction with NPCs is triggered by touching the Action button (Figure 5). A step sound effect is reproduced when walking.

The player can move in 8 directions using the virtual Joystick (left). The HUD elements consist of the virtual joystick, player's current goal, total money earned, pause button and action button (right).

The User Interface (UI) is designed for mobile device screens. It consists of a Start screen, Character Section screen, Heads-Up Display (HUD) and the End screen (Figure 6).

The end screen summarises the outcome of the game, which indicates players behaviour and the choices made in five situations dealing with: the mother, bus driver, classmate, bullies and the shoplifters.

4. Results

4.1. Phase 1-initial game designing and prototyping

Table 1 presents the demographics of the participants in the first phase. Descriptive statistics from the SDQ measure showed that 59% of the participants experienced peer problems and 22% reported emotional problems and scored moderate to high compared to the general population (see Table 3 for additional details). Thirty-four percent reported moderate to high conduct problems and 58% were close to average population.

Prosocial behaviour rate was prevalent in 22% and 65% scored close to the average population. Hyperactivity was prevalent in 7% of the sample. Forty-one percent scored moderate to high in internalising problems (peer and emotional problems) and 22% in externalising issues (conduct and hyperactivity scores). No significant gender differences were found between females and males in means and standard deviations of SDQ scores.

Figure 7 shows what is the most common electronic device young people use when playing games and Figure 8 show to what extent young people's emotions and relationships are affected by playing games.

In the first phase, 57% reported that they prefer to play games with company, 45% spend most of their spare time playing games and 46% spend some of their spare time playing games where 75% prefer to play against others in competition. Figure 8 displays the responses of young people about the effect of playing games in relation to feelings of anger, aggression, empathy, and relationships with significant others. Most importantly, 67% responded that playing games impacts their relationships with people and animals at some level and 65% reported that the feelings they develop about themselves are affected as well. Sixty-two percent stated that playing games affected their relationship with their parents.

A one-way ANOVA was conducted to compare the effect of the severity of conduct problems on anger, aggression, feelings about self, empathy towards other people's feelings, relationship with parents, relationship with peers and relationship with others and animals.

Levene's test was not significant for anger ($p = 0.859$), self ($p = 0.067$), empathy towards others ($p = 0.115$), and peers ($p = 0.232$), which means that the assumption of homogeneity of variance was met. The findings showed that severity of conduct problems had a significant effect on all categories in all four groups but not for relationship with peers. Levene's test was significant for aggression ($p = 0.017$), animals and others ($p = 0.001$), and parents ($p = 0.022$), which means that the assumption of homogeneity of variance was violated, and the obtained Welch's adjusted F ratio was used. These findings indicated that the severity of conduct problems did have a significant effect on aggression $F_{\text{Welch}}(3, 34.71) = 13.47, p < 0.001$, on the relationship with parents $F_{\text{Welch}}(3, 30.21) = 5.98, p = 0.003$, with others and with animals $F_{\text{Welch}}(3, 32.60) = 10.67, p < 0.001$. Planned contrasts showed that adolescents with high conduct problems showed significantly higher scores of anger when playing games compared to the average population, $t(24) = 3.63, p < 0.001$. However, adolescents with low conduct problems were more significantly affected than those who were high in conduct

problems in their relationship with peers $t(10) = 7.92, p = 0.02$.

Regression analyses showed that feelings of anger, aggression, feelings about self, empathy towards other people's feelings, relationship with parents, peers, others and animals were significantly related to higher conduct problems. These relationships were significant (except for feelings about self and relationship with peers) even when adjusting for demographic and parental factors (see Table 4).

4.2. Phase 2-design refining and prototyping

Through thematic analysis, two main themes were identified for the focus groups conducted in this phase: (1) The effect of playing games on socio-emotional development, and (2) Suggestions for the content of ReGoal (see Figure 9). The emphasis of the first theme was on the feelings participants developed when playing games, as well as the critical role games play in their socio-emotional development including forming social interactions with peers. The second theme focused on participants' suggestions for the development of ReGoal. All recommendations from participants helped the research team develop and refine the story of ReGoal and the final version of the game.

4.2.1. The effect of video games on socio-emotional development

Participants described a wide range of conflicting feelings when playing video games:

It makes me feel happy, sad when I play games kind of mixed emotions sometimes, depending on how I play, how other people play. So sometimes I'm happy. Sometimes I'm angry. Sometimes I feel distracted because I feel like I could be playing better (Male, 12 years, focus group 2).

Specifically, participants' feelings ranged from anger and intense competition to feelings of relaxation and promotion of prosocial behaviours. A participant of focus group 1 explained that games can be very competitive leading up to feelings of anger and sadness when players lose: *And then it's really competitive. So, people do, if they lose, they do get a bit angry, and I see why they get a bit sad because they lose.* (Male, 12 years, focus group 1). The same participant also highlighted that using rewards in the game can intensify game competition and feelings of frustration as players ultimately want to win and earn additional points:

But sometimes there's games where there's competitive mode. It's like you've got points and everything. Can

you win things. So, people do get angry sometimes because they lose so people can get competitive about it. (Male, 12 years, focus group 1)

Participants of focus group 2 also referred to personal examples when playing games which can exacerbate feelings of anger and frustration, such as not receiving support from their peers when losing the game ... *they don't revive me or something and then I'll get a bit mad* (Male, 12 years, focus group 2). Anger feelings developed when participants played with people who *don't really play the game properly* (Male, 12 years, focus group 2) or tried to eliminate them during the game *the other person is really bad and they eliminate me, I'll get angry* (Male, 12 years, focus group 2). In addition, participants associated feelings of anger with multiple attempts to complete the game successfully: *I personally believe that, like, the more hours you play, then you kind of get angrier in a way because you keep trying.* (Female, 12 years, focus group 1). As a participant of focus group 2 described, it is evident that the adolescents in this study were more likely to feel happy and proud when they win: *They make me feel proud if I win. Because I know I'm the best in the server.* (Male, 12 years, focus group 2).

On the other hand, participants reported that competitive games can also be fun and promote the development of forming social relationships with their peers: *I am just going to meet people through games. It's actually very fun for me because most of the people I get to play with, I don't even know them.* (Female, focus group 3). There were also distinct dialogues between adolescents about the critical role video games play in socialising. As the quote below illustrates, participants discussed how video games facilitated their social interactions with their peer group: *Like chat to them and playing with them because it's kind of like instead of like going to his house and some stuff, you can just play online with them, which is not the same.* (Male, 12 years, focus group 2). A few participants reported situations where playing and trying to complete a video game alongside their friends also promoted prosocial behaviours among adolescents, such as peer support and empathy:

When we played together in competitive or like stick together, we need to do stuff together ... We don't get angry at each other, and we just tell we just help each other and tell each other what we need to do to help each other when playing the game. (Male, 12 years, focus group 1).

Furthermore, participants connected their involvement in video games with feelings of relaxation that seemed to improve their concentration: *It (playing*

Table 6. Correlations between how the ReGoal game improved the understating and empathy with others and how the game's features and content helped the participants improve some related skills.

	The game/helped me/made me													
	Empathise with others	Connect with others	More understanding towards my peers	More understanding towards my parents	More empathetic towards animals	Feel relaxed	Feel frustrated	Feel lonely	Feel creative	Feel motivated	Escape from reality	Easy to navigate	Enjoyable	Rewarding
The game/helped me/made me														
Empathise with others														
Connect with others	.497**													
More understanding towards my peers	.269*	.594**												
More understanding towards my parents	.345**	.303**	.426**											
More empathetic towards animals	.301**	.484**	.454**	.326**										
Feel relaxed	.333**	.509**	.488**	.183	.444**									
Feel frustrated	-.071	-.170	-.160	-.049	.000	-.337**								
Feel lonely	.048	-.041	.058	.015	.116	.566**								
Feel creative	.219	.346**	.370**	.218	.106	-.197								
Feel motivated	.394**	.441**	.405**	.243*	.100	-.213	-.047							
Escape from reality	.507**	.485**	.350**	.310**	.496**	-.068	-.180							
Easy to navigate	.422**	.336**	.474**	.410**	.331**	-.127	.064							
Enjoyable	.436**	.506**	.509**	.228	.398**	-.221	-.004							
Rewarding	.421**	.536**	.526**	.395**	.455**	-.226	-.052							
Educational	.481**	.546**	.459**	.296*	.384**	-.145	-.041							
Liked the story of the game	.473**	.511**	.487**	.327**	.498**	-.158	-.205							
For a good cause	.328**	.588**	.585**	.289*	.391**	-.130	.074							
The text is helpful	.309**	.348**	.360**	.298*	.352**	-.137	.033							
Liked the graphics	.403**	.412**	.309**	.320**	.246*	-.248*	-.166							
Liked the main character	.378**	.456**	.421**	.329**	.263*	-.191	-.122							
Helped me concentrate	.368**	.379**	.359**	.298*	.319**	-.133	-.085							
Challenging	.502**	.293*	.242*	.313**	.169	.107	.177							
Sections were all predictable	.244*	.282*	.370**	.364**	.275*	.090	.179							
Competitive	.409**	.403**	.402**	.226	.351**	.064	.129							
Reduced my anxiety	.451**	.553**	.620**	.331**	.369**	-.257*	.015							
Friendly interface content	.400**	.452**	.394**	.329**	.245*	-.046	-.005							
Recommend to a friend	.552**	.558**	.364**	.218	.312**	-.064	-.003							
Pace too slow	.192	.262*	.182	.117	.189	.161	.202							
Pace too fast	.187	.146	.239*	.066	.201	.215	.335**							

The game/helped me/made me

	Liked the story of the game	For a good cause.	The text is helpful	Liked the graphics	Liked the main character	Helped m
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Educational
 Correlation is significant at the 0.01 level (2-tailed).
 Correlation is significant at the 0.05 level (2-tailed).
 The higher the scores the more likely to disagree

games) helps me concentrate and it's very relaxing. (Female, 12 years, focus group 3). Several participants also stressed that games with an educational character can be very beneficial as they provide a learning space which contributes to their personal development:

Like for example there's words on there that you might know for example there's this place where you could go, and it's called Frenzy Farm, or you could or there's another one called reed. So, I asked my mum what they mean and actually learned words from there. (Male, 11 years, focus group 1)

A female adolescent explained that playing video games increased her sense of freedom and self-agency given that autonomy she had through the character of the game in contrast to real life:

Like all the things I've been told, I cannot do in real life. I can actually see myself doing them in games and just some games that I get to choose what I want to be, how I want to dress, and how I choose to look. Even if my mom will not permit me doing that in real life, I get to live the life of video game so. (Female, 15, focus group 3)

4.2.2. Suggestions for the content of ReGoal

The adolescents who participated in this study made their own suggestions about the development of ReGoal. These recommendations were pertinent to the proposed content as well as the main character of the game, the provision of visual and auditory feedback throughout the game and the inclusion of virtual points and social rewards.

First, in all three focus groups, participants highlighted the importance of developing educational games that will foster their imagination and creativity: *Some of the scenes that you like drive through. They're very creative, so you get a lot of imagination from there.* (Female, 12 years, focus group 1). Participants described potential video game scenarios with specific themes that could have a meaningful impact on people's lives such as environmental awareness and animal rights:

I love the environment to a point where I think I would like to educate people younger than me about the impact of environment. (Female, 16, focus group 3).

Likewise, participants emphasised the need to give children and adolescents the autonomy to develop their own characters and avatars when playing ReGoal. According to our participants, this strategy could give players the opportunity to develop video game characters with the characteristics of their own preference:

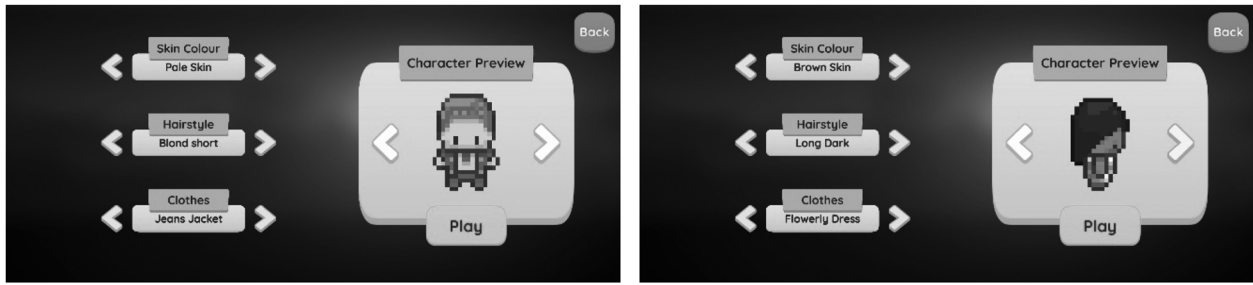


Figure 3. A preview of the character customisation screen.

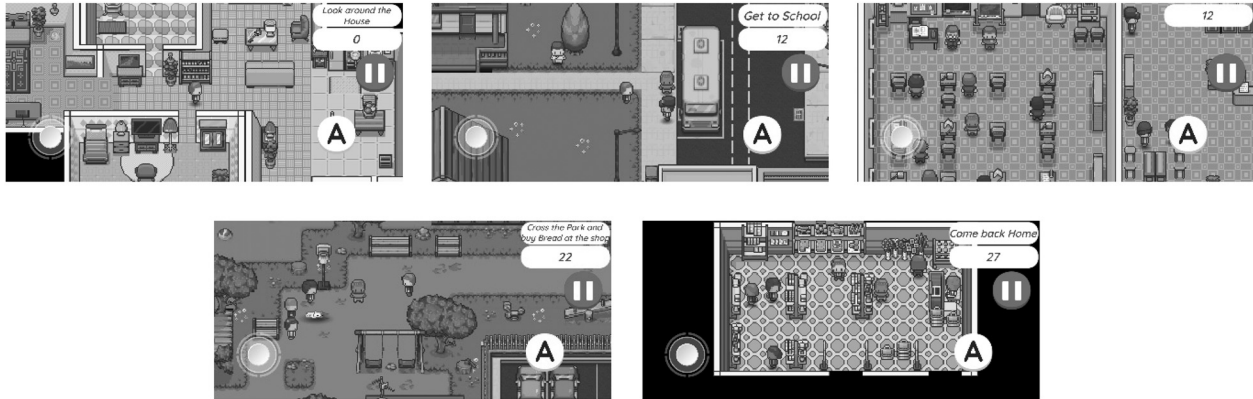


Figure 4. Game scenarios.



Figure 5. User interaction and HUD.

So, if you have a community of different people like wanting to play your game, maybe make a choice, ask them for choice and what they want like a skin like a new skin. Ask if they want one of them, then they'll pick one. (Male, 12 years, focus group 2)

Several adolescents also explained that the use of colourful video game characters can help ReGoal players feel happier: 'I think the features in the game too can actually help because when I want to play game and I get to see some very colourful characters ... they actually help me calm down ... Makes me smile when I'm sad ...' (Female, 15, focus group 3).

Participants also mentioned that an educational game with multiple levels, where players can develop their own stories and invite their friends to complete each story with them, could be interesting for them:

Maybe I think you should put a creative mode when they can create their own levels and then they can make their friends come and complete the level. It's like they make their own map and then their friends or cousins or anybody playing it can try and play the play their levels. (Male, 12 years, focus group 1).

However, they explained that it would be useful not to include stories which would be hard for children and



Figure 6. The start (left) and end screen (right).

adolescents to complete as it may cause them feelings of anxiety: *I think you shouldn't make the levels too hard because if someone tries over and over again and just can't beat the level, they might get stressed.* (Male, 12 years, focus group 2).

Participants described the feedback and the rewards that they would like to receive when playing ReGoal. As the two quotes below show, two participants explained that including a short motivational speech at the beginning of the game and another short speech at the end of the game would encourage players to engage more with the game and complete it:

Maybe if it's like a level you could say like at the start and good luck. And then when they get to the end of it, well done, you complete this level now go on to the next level. (Male, 12 years, focus group 1)

So maybe after the game, instead of saying obviously not saying so like something like you did terribly maybe like so you have to try to keep trying again. Keep going. Here's another game to help you with this skill or something like that. (Female, 12 years, focus group 1)

Adolescents elaborated that the use of special rewards, such as love stars, virtual flowers, and monetary raffles, could provide a strong incentive to play ReGoal: *I think sometimes they should reward people with money, Oh, stars, anything like love stars, stuff like that that send flowers, things like that would be*

OK... (Female, 16, focus group 3). A participant of focus group 2 emphasised the importance of developing video games with positive content that would increase participants' self-esteem. This young male mentioned that it would be motivating for them to play video games where players receive rewards for participating in the game rather than winning:

Maybe could be like a brighter game but not like it's dark, it's story or what not like in the in context like happier and make you feel more good about yourself. Like if you lose maybe, you still get rewards for playing that game. (Male, 12 years, focus group)

Participants of focus group 1 also referred to the importance of adding examples of constructive discipline and educational character to ReGoal that could help players better understand the rules of the game: *So if you are going to be like, you would probably have to add a punishment would be like 2 min not to play maybe* (Male, 11 years, focus group 1).

4.3. Phase 3 game development and testing

Seventy-two adolescents aged 11–16 years ($M = 14.24$; $SD: 1.34$) participated in the third phase of this study. Participants were asked to complete a quantitative measure and reflect on the content of ReGoal and its special features, its pace and length, and their personal emotions and feelings they developed while playing

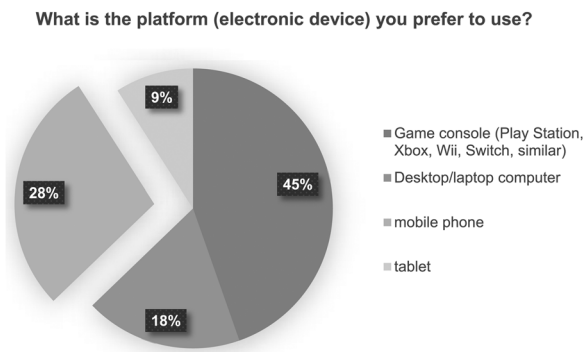


Figure 7. The participants' preferred platform (electronic device) used for gaming.

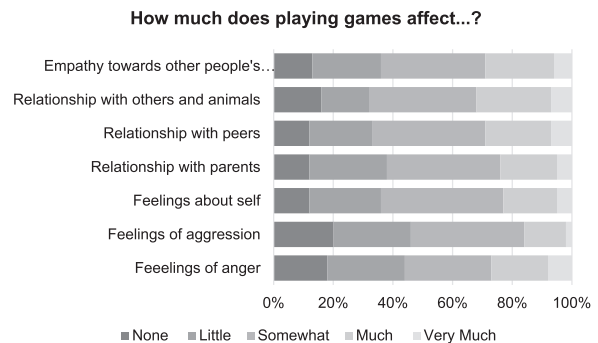


Figure 8. Playing games and developing an understanding of other people's feelings.

ReGoal, and the effect on empathy and understanding towards others (parents, peers, and animals). Participants were also asked to select the age group for which they thought ReGoal was suitable and whether they would recommend it to a friend.

As Figure 10 shows, most participants agreed or strongly agreed that ReGoal is a competitive game (54.7%) and also found it challenging (58.7%). The majority of adolescents also reported that they liked the main character (66.7%) and the story (73.4%) of the ReGoal game. Furthermore, most participants agreed or strongly agreed that ReGoal is an educational game (66.7%) created for a good cause (72%). Finally, most adolescents found the ReGoal game rewarding (61.3%) and enjoyable (60%).

4.4. Game features of ReGoal

The adolescents who participated in the study evaluated the special features of ReGoal (e.g. text and graphics). Most participants agreed or strongly agreed that ReGoal is characterised by its easy navigation (66.6%), nice graphics (67.7%), helpful text (70.7%) and friendly user interface (70.7%) (Figure 11). As Figure 12 shows, participants also commented on the length of each module included in ReGoal. Most participants were particularly satisfied with the length of the levels held in the park (52%) and in the shop (50.7%). However, 45.3% of participants felt that the last level of ReGoal was too long. Most participants also agreed or strongly agreed that the pace of ReGoal was too slow (56%).

4.5. Emotions associated with playing ReGoal

Adolescents reported the positive and negative feelings they developed while playing ReGoal. Most participants

agreed or strongly agreed that ReGoal reduced their anxiety (58.7%) and helped them develop positive mood (76%), empathy (65.3%), and creativity (65.4%). Most participants also agreed or strongly agreed that ReGoal helped them concentrate (70.7%), connect with others (62.7%), control their emotions (64%), and relax (72%) (Figure 13).

4.6. Correlation between conduct problems components and the ReGoal game features

Correlational analyses were conducted to investigate the relationship between the impact of the ReGoal game on individuals' personal affective states, interpersonal relationships, and participants' attitudes towards specific features of the ReGoal game. The findings revealed a significant association between participants who reported reduced levels of anger, frustration, impulsivity, anxiety, improved emotional regulation, enhanced mood, and increased relaxation as a result of the game, and their propensity to positively evaluate both the features and overarching objectives of the ReGoal game including characters, graphics, educational value, competitiveness, textual elements, content, and other relevant aspects (Table 5). Likewise, individuals who experienced improvements in their understating with peers, parents, and animals, as well as enhanced empathy towards others due to their engagement with the ReGoal game, were more inclined to provide positive assessments of the game's features and purpose, including educational value, competitiveness, textual elements, content, and other relevant aspects (Table 6).

4.7. Behavioural issues

Figure 14 shows all the behavioural problems that participants reported that ReGoal can help them overcome.

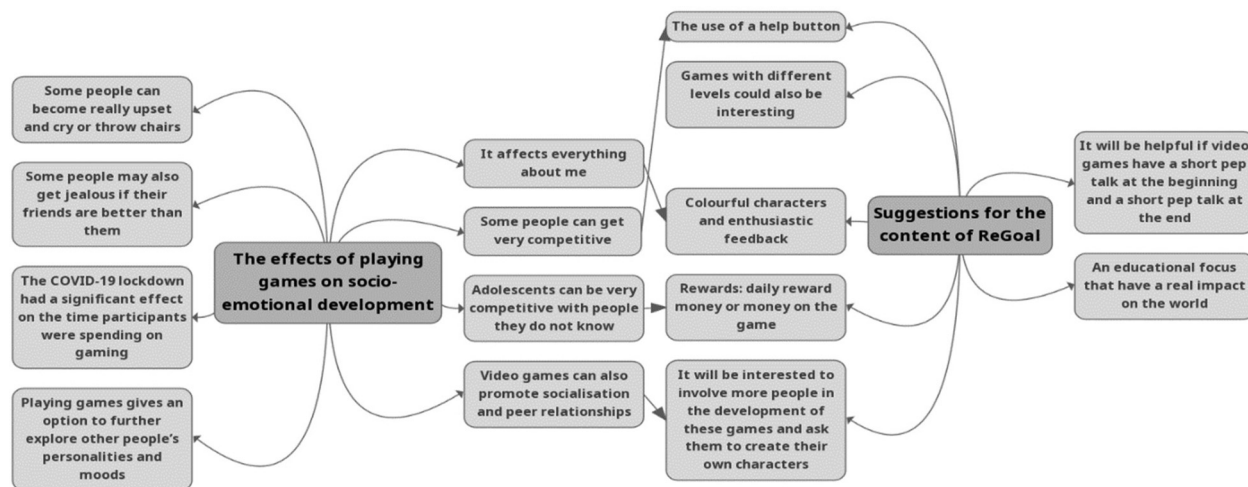


Figure 9. Thematic map illustrating participants' quotes.

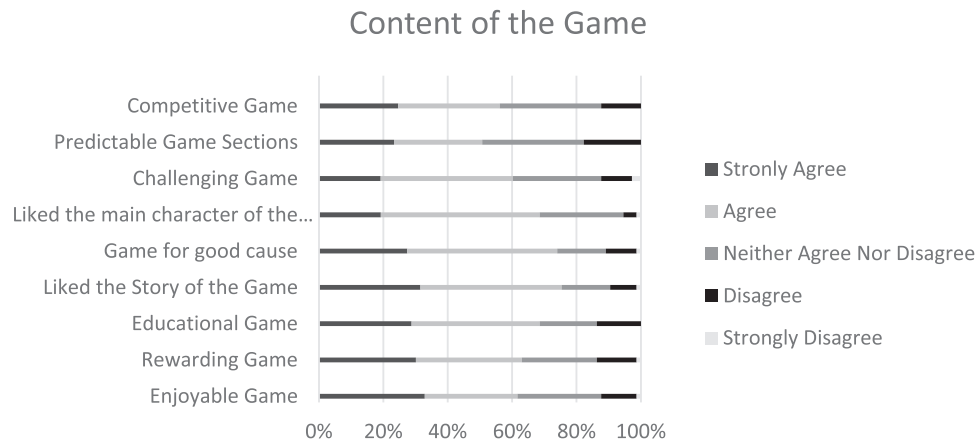


Figure 10. Feedback about the Content of ReGoal.

4.8. Age group that ReGoal is appropriate for

Participants indicated the age group for which they think ReGoal is appropriate (Figure 15). The majority of participants (87.9%) reported that ReGoal is appropriate for children and adolescents aged 6–16 years, which overlaps with the same age range of the participants we included in this study.

4.9. Recommend ReGoal to a friend

Finally, young people were asked to indicate whether they would recommend ReGoal to a friend (Figure 16). Most participants agreed or strongly agreed that they would recommend ReGoal to a friend (66.7%).

5. Discussion

This study aimed to co-produce a mobile-accessible serious game, ReGoal, in collaboration with young people (11–16 years) and an interdisciplinary team of academic experts and mental health professionals,

game developers targeting emotion regulation, goal-orientation, and executive functioning. This study also yielded insights into utilising a reward system, facilitated by ReGoal, aimed at modelling prosocial behaviour by fostering opportunities for making optimal choices. We provided further understanding of ReGoal mechanics and the design of gamification elements exploring how these apply to targeted conduct problem symptoms (Damaševičius, Maskeliūnas, and Blažauskas 2023). The current study addresses an existing gap in the serious gaming literature around specific details about game design and theoretical frameworks underlining such processes (Bul et al. 2015). ReGoal targets psychosocial and emotional functioning in young people with conduct problems through home, neighbourhood, and school encounters which simulate real-world scenarios. Three phases were included in the process of co-production consisting of two online surveys and three online focus groups. Young people aged 11–16 years old offered input and suggestions about game preferences, played the most recently developed prototype of ReGoal, and provided feedback about their

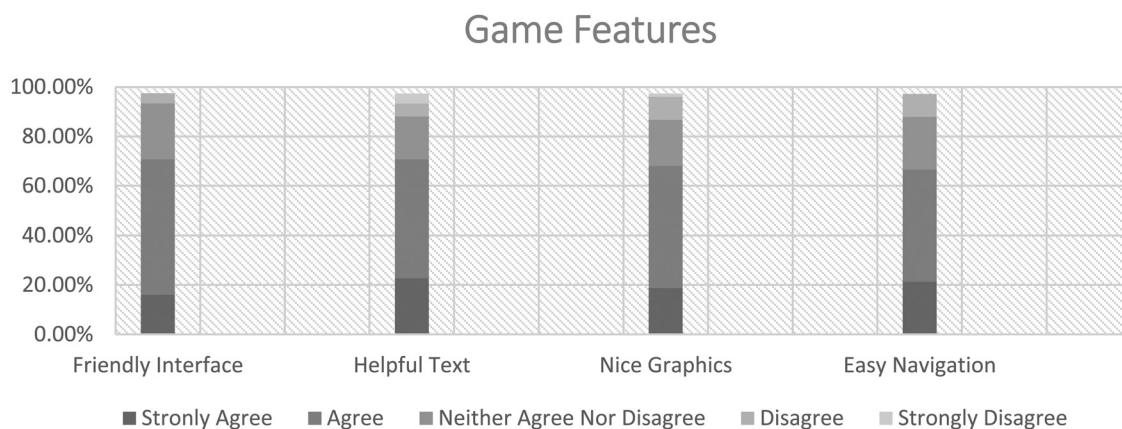


Figure 11. Comments about game features of ReGoal.

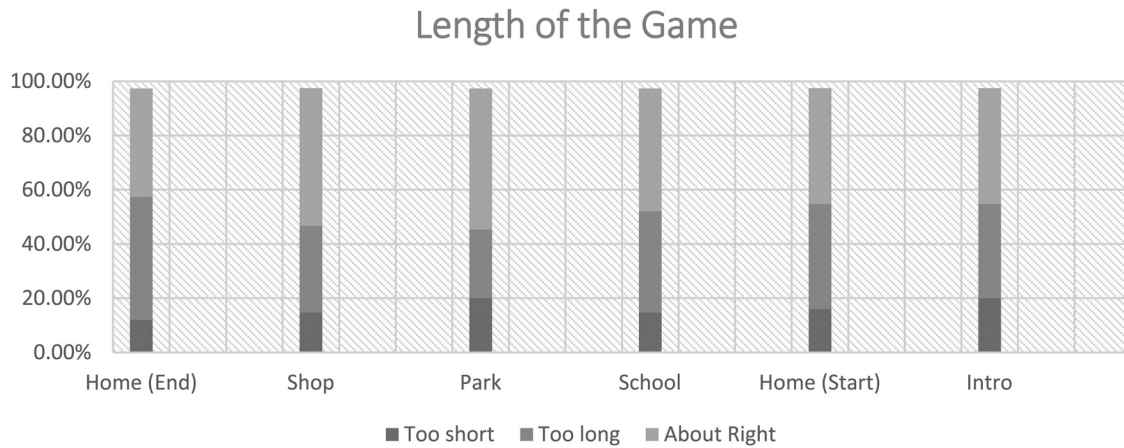


Figure 12. Feedback about the length of the game.

experiences. This feedback has been used to implement user-informed changes and developments to the game, which will inform subsequent phases.

The key findings suggest that young people value playing games as supplementary aids to improving their mood, ways of relating to peers and family, and understanding other people’s emotions. Young people

found ReGoal appropriate for the age group it is designed for and thought it can help with reducing negative feelings, behavioural problems, anxiety, and with anger management. The content of ReGoal was overall well-received and was rated as easy and friendly to navigate. These findings are aligned with the relevant literature about developing serious games as

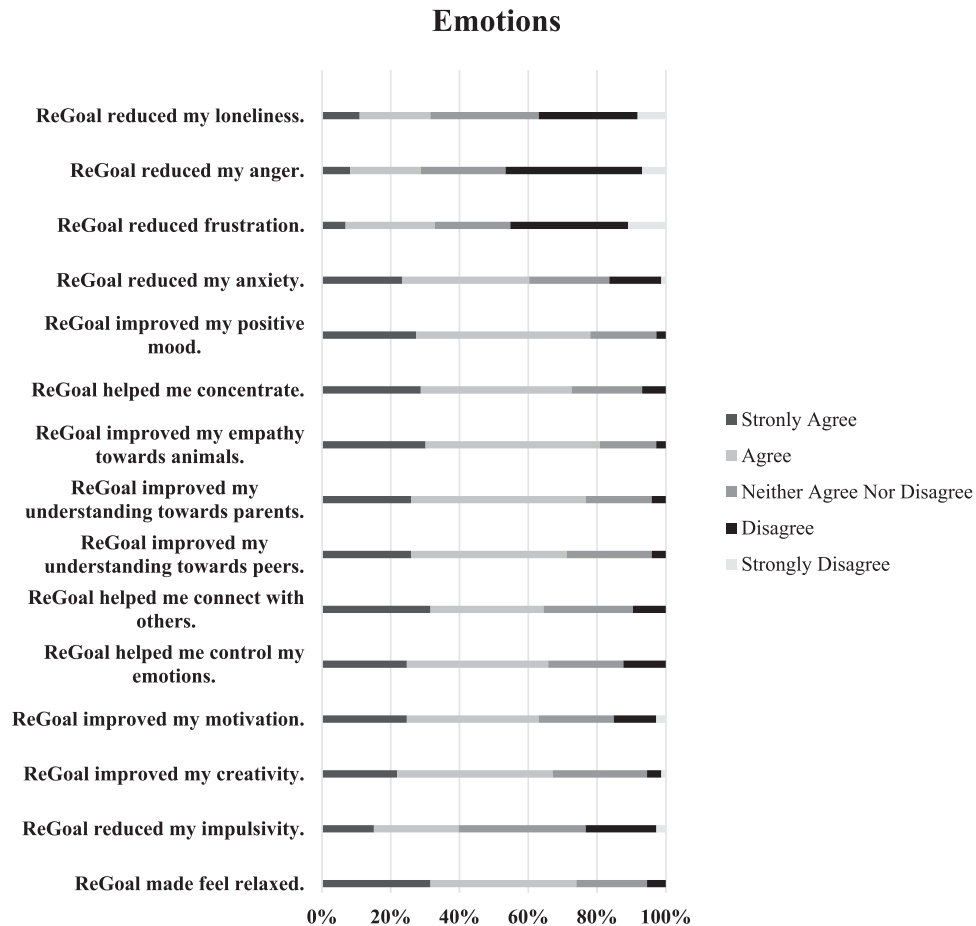


Figure 13. Positive emotions associated with playing ReGoal.

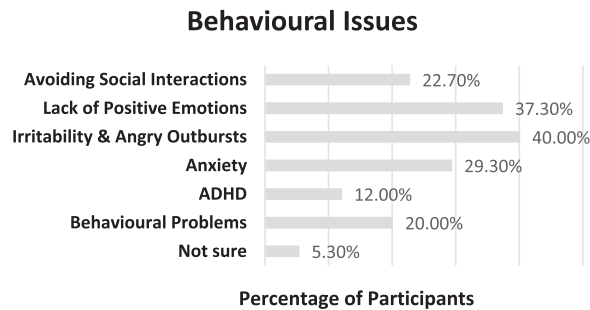


Figure 14. What problems could ReGoal help with?.

supplementary tools to improve young people's mental health (Ong et al. 2019).

ReGoal can be utilised as an additional mental health resource for young people referred to CAMHS, in a UK context and beyond, waiting for assessment and treatment especially in the wake of the unprecedented surge in mental health problems among the youth post-Covid (Thomas, Schroder, and Rickwood 2021). Previous research recommends the use of digital channels with existing therapeutic frameworks such as cognitive-behavioural therapy (CBT). Excessive waiting lists are linked to exacerbating mental health symptoms and adverse outcomes. Thus, CAMHS WLI comprise a national priority aiming to overcome barriers to treatment and improve access to care. Child and adolescent staff highlight the importance of receiving guidance and training on digital platforms to support better young people on waiting lists. Currently, there are limited interventions offered to young people on waiting lists but not specifically tailored around conduct problems.

This paper highlights the key aspects which are relatable and meaningful to young people with and without behavioural problems when developing new serious games targeting emotion regulation and executive functioning elements. These aspects concern differences between young people who scored higher on conduct problems compared to the adolescents reporting average scores like the general population. Young people with higher conduct problems were more likely

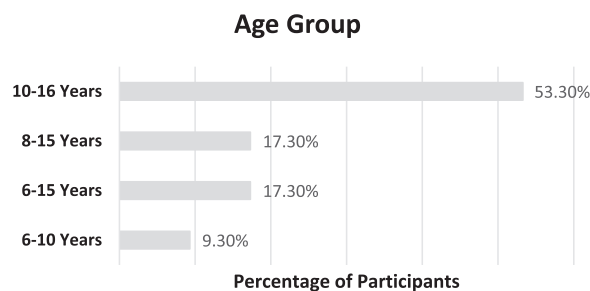


Figure 15. What age group do you think is ReGoal appropriate for?.

to experience greater levels of anger, aggression and worse relationships with self and others when playing games, even when adjusting for demographic and parental factors. This is consistent with previous research findings highlighting that young people with conduct disorder are more sensitive towards rewards and punishment as motivational drives, as they are likely to overemphasise reward cues (Frick and Loney 2000). The results also indicate that playing games can lead to negative behaviours that can amplify conduct problems. Therefore, finding a positive alternative such as our ReGoal can help young people overcome these problems. ReGoal was developed in line with suggestions from serious games design frameworks for vulnerable groups (Tsikinas and Xinogalos 2020), which underline (1) participatory design by including targeted group in the game design process and prototype testing with young people, (2) clear objectives as in ReGoal where the player aims to collect coins to attend the school party, and (3) feedback and rewards which was demonstrated through coins and (4) personalised audio-visual feedback throughout the game and at the end of the game (Derks, Willemen, and Sterkenburg 2022).

5.1. Phases 1 and 2- initial game designing and prototyping and design refining and prototyping'

As stated, the primary aims of these phases was to obtain feedback from the targeted group regarding their preferences in the design phase of the ReGoal game. Questionnaires and focus groups with the experts by experience generated vital insight into what the target user expects in a serious game, and how they want to use it. As such, findings from phases one and two provided valuable understandings which were used to develop and improve ReGoal further.

Firstly, the most recent version and storyline of ReGoal was developed based on young people's suggestions elicited from the online focus groups and the

Recommend the game to a friend

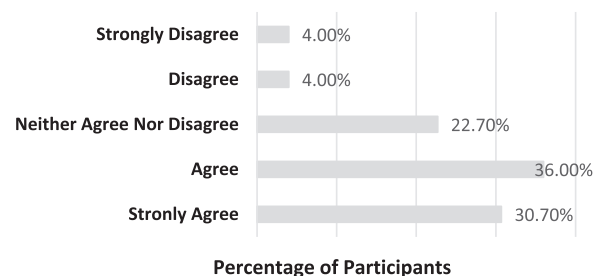


Figure 16. Would you recommend ReGoal to a friend?.

subsequent feedback. The young people who participated in the focus groups expressed openly their preferences about the storyline of games they felt were inclusive and relatable with a particular emphasis on diversity of scenes in between different levels. We embedded this suggestion by adding five separate levels where the main character has encounters at home, school, neighbourhood, park, and local shop. Young people valued creativity and thought this element could be combined with the educational nature of the game. We developed a creative learning environment through different game elements where the player can experience and practice new skills to achieve a goal-orientated task that is to collect enough coins and attend the party. Further, we aimed to keep young people engaged and motivated throughout the gameplay by providing a stimulating learning environment through interactions with other characters replicating ordinary daily life scenarios. The game elements were informed by relevant theoretical frameworks including Theory of Mind, Regulation Theory, and the Ecological Model, reflected on positive interactions and rewards. The player encountered several choices at separate levels and had to make decisions based on their understanding of other people's feelings and personal reactions. For example, the player walks into the park and comes across deviant peers abusing a cat and they are called to make a prosocial or antisocial choice.

Additionally, findings from phases one and two indicate that young people value creativity and autonomy in games. Therapeutically, these are also highly valued phenomena when considering emotional regulation, with research showing beneficial effects on emotion regulation when service users are empowered with creativity and autonomy in their therapeutic journeys (Savard et al. 2013). This is also echoed in previous app-based research where individuals with autism and intellectual disabilities showed preference towards increased creativity and personalisation in their app-based intervention (Tsikinas and Xinogalos 2020). These findings were integrated in the further development of ReGoal whereby the game now allows players to create their own character with changeable features such as skin colour, hairstyling, and clothing. Not only does this promote creativity, but it also fosters diversity and allows more personable identification with the avatar in the game. This gives young people the opportunity to explore their identity and create a fictional character they feel most identified with in a non-threatening environment (LeRouge et al. 2016).

Further, the participants specified in their feedback that they had a preference for challenges, with an increase in quantity and difficulty. Previous studies highlight the significance of flow in games as an indicator of

enjoyment increasing motivation and engagement (Sweetser and Wyeth 2005). Game flow entails aspects focused on challenges and skill mastering where players can engage in self-directed learning and progress through the game by acquiring new skillsets. ReGoal provides a stimulating game environment where players have the opportunity to experience flow and enhance skills for which they are rewarded throughout. Again, these findings are similar to previous serious game research based on supporting individuals with autism (Hulusic and Pistoljevic 2012; Tsikinas and Xinogalos 2020). Players remain engaged and intrigued when they are challenged more, and experience greater enjoyment through the achievement of overcoming said obstacles (Hung, Sun, and Yu 2015). In line with this feedback, ReGoal has been developed further to include additional challenges with greater difficulty, where players are met with further scenarios which illicit potential antisocial choices and are required to reflect on previous lessons to make corrected goal-oriented choices.

5.2. Phase 3-game development and testing

ReGoal provides a self-directed learning experience by allowing young people to explore new skills and practice emotion regulation through trial-error choices. Specifically, coins acted as motivators in ReGoal which are highly recommended for neurodivergent individuals, and we considered a similar approach to young people with conduct problems given executive functioning models and Theory of Mind. Across all levels of the game, players received audio-visual feedback based on their choices which increased immersion in the experience and engagement (*flow*) with the aim of reducing distraction and irritability commonly presented in young people with behavioural difficulties (NICE 2017). Serious games have been used previously for young people with ADHD symptoms targeting poor executive functioning skills including working memory and planning. For example, games such as the Brain-game Brian (Prins et al. 2013) and Plan-It Commander target emotion regulation and aim to reduce impulsivity. However, ReGoal stands out due to its comprehensive approach, encompassing multiple dimensions such as social, emotional, and cognitive skills, as well as planning and goal-oriented behaviour, specifically designed to aid young individuals dealing with behavioural challenges. This is evident from the current study, which demonstrates that when using the ReGoal game there is a clear link to enhanced emotional well-being and improved interpersonal relationships coupled with their favourable attitudes towards the game's features. Participants showing reduced negative emotions and

better relationships due to the game were more supportive of the educational, competitive, and content-related features of the ReGoal game. These findings highlight the potential of gamified interventions like ReGoal not only to impact emotional states but also to foster positive social interactions. This can also hold promising implications for its broader applicability. Beyond immediate effects, the study suggests gamified interventions could effectively address other psychological issues characterised by emotional, behavioural, and social challenges. Leveraging these positive outcomes, ReGoal and similar interventions may serve as initial psychological aid avenues for various problems, extending the potential impact of such gamified approaches in the realm of mental health interventions. Further exploration and validation could pave the way for innovative and holistic strategies in treating psychological conditions, with potential insights into specific underlying mechanisms for refining and optimising the design of gaming interventions.

ReGoal was developed as a supplementary aid to existing evidence-based therapeutic techniques with the aim of improving emotion regulation and practicing prosocial skills. At this stage, we do not propose that ReGoal should be used as a first-line treatment or primary therapeutic intervention in young people with conduct problems. Instead, it should be viewed as a supporting tool which can be accessed in natural settings such as home and school. The preliminary findings generated from the third phase of co-production look promising given that 58.7% of young people reported that ReGoal helped with their anxiety, 70.7% that it improved their concentration, 62.7% that enabled them to connect with others, and 64% stated that it facilitated emotion regulation. ReGoal enabled young people to practice empathetic approaches and make informed choices when interacting with significant others (parents, friends) which also increased motivation and creativity; 69.3% reported that ReGoal helped with their peer relationships and 74.6% with parents. These outcomes may suggest that engaging in a fun and educational learning space can facilitate developing new skills towards goal achievement through promoting prosocial attitudes and empathetic approaches towards relating to peers. Social skills training interventions and models purport that behavioural change is feasible when emotion regulation skills are implemented in context (Jeffrey 2020).

Overall, these findings highlight that young people viewed ReGoal positively and were able to reflect on the positive impact the game had on their socio-emotional well-being. These findings are consistent with previous studies developing games to reduce anger

and improve emotion regulation amongst younger children (<12 years) (Nicolaidou, Tozzi, and Antoniadis 2022; Ong et al. 2019), extending support for the utility in a game app tailored to teenagers with conduct problems targeting emotion regulation, goal-orientation, and executive functioning. With the added layer of personalised feedback based on player performance and decision making throughout the game, ReGoal has the potential to increase self-awareness, understanding towards self and others and emotional maturity even further (DeMink-Carthew, Netcoh, and Farber 2020; Protogerou, McHugh, and Johnson 2020).

5.3. Limitations, strengths and future directions

Certain limitations should be taken into account when interpreting the findings of the present study in line with the extant literature on serious games. First, it is worth highlighting that although young people who participated in the study reported positive experiences overall with playing ReGoal, ReGoal was not fully tested out and evaluated at the time of data collection. Subsequent studies should assess the feasibility and usability of ReGoal employing an experimental design with associated cognitive tasks measuring attitudinal and behavioural changes. This study will take place in a non-natural environment such as a research laboratory, to account for behaviour, attitude, and feelings before and after playing ReGoal. Next, a clinical sample should be used for comparison purposes in future studies. In this study, participants were not required to have a diagnosis of conduct disorder and a mixed sample was included, which means that the sample is less likely to be representative of the clinical conduct disorder population. However, during this stage our aim was to facilitate the co-production and development of ReGoal by actively involving young people and mental health professionals. Future evaluations are crucial for ongoing advances of the ReGoal game and in order to determine the feasibility and appropriateness of this serious game for young people with conduct problems. It is worth mentioning that there is a lack of standardised approaches and methods in developing serious games for mental health which extends to replication and evaluation issues in comparison studies (Damaševičius, Maskeliūnas, and Blažauskas 2023). In the third phase of this study, young people were sent a downloadable link with the game which they were instructed to play up to three times to identify challenges and facilitators. We allowed young people to use and play ReGoal at their own time and pace in their natural environment (e.g. home) to avoid associated biases generated from a

controlled setting. Accordingly, young people provided feedback on practical aspects of the game. The more recent ReGoal prototype was developed post-feedback. Another limitation of this study is that the sample size restricts findings generalisability and future studies should recruit a larger sample to account for group differences within the clinical population. Yet, to the best of our knowledge, this is the first study that focuses on developing a novel multifaceted serious mobile game focusing on conduct problems.

Our findings from the first phase showed that conduct problems and peer problems were moderate to high in this age group. Yet, we need to account for the impact of Covid-19 and associated implications when interpreting these trends. Data collection for the first study took place during 2021 when young people were still in lockdown and there is good evidence to suggest that conduct problems increased during this period with a UK-based study reporting a 35% increase in conduct problems in preadolescents and 8% in adolescents (Waite et al. 2021).

Game features and length of the game preferences varied as some young people found ReGoal too slow or too fast based on baseline characteristics such as previous gaming experience, developmental and emotional needs, and personal expectations. Nonetheless, most young people agreed that game features such as graphics, text, interface and content met their needs.

An interesting suggestion generated from the focus groups was to include a creative mode where the player can create their own levels in which they should make prosocial choices to complete each level. In that case, young people can develop a personalised story that meets their needs and is meaningful to their life experiences. Our game model has the potential to be further developed and create additional learning skills for young people with conduct problems based on such recommendations.

It is worth mentioning that 45% of young people reported that they prefer game consoles in contrast to 28% who would choose to play a game on a mobile device. This is something to consider for future research and development of ReGoal.

6. Conclusions

ReGoal provides a self-directed mobile serious game for young people which does not require any specific guidance and/or training. The present study shows that serious games such as ReGoal may have the potential to optimise mental health outcomes for young people with behavioural problems and emotion regulation difficulties when used in alignment with therapy. ReGoal is designed to

be a user-friendly, engaging, and dynamic serious game which is accessible and relevant to a diverse sample of young people aiming to increase inclusivity and participation. The third phase of the present study showed promising preliminary results about the effectiveness of using ReGoal in improving the emotional states of the participants such as empathy and understanding towards others. Future research should test its applicability, usability, and feasibility in modifying antisocial attitudes and reducing behavioural problems with clinical and non-clinical samples. Lastly, conducting an evaluation of ReGoal through a randomised controlled trial (RCT) is essential. This should involve a control group and compare ReGoal with other serious games or evidence-based therapies to thoroughly assess its distinct advantages and efficacy.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by Bournemouth University; King's College London; Kingston University.

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