A Cloud-Based Collaborative Virtual Learning Environment for the Higher Education Institutions in the Sultanate of Oman

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"*IN THE NAME OF ALLAH (THE GOD) THE MOST GRACIOUS, THE MOST MERCEFUL*".

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulation of Bournemouth University. The work contained in this thesis is the result of my own investigations and has not been accepted nor concurrently submitted in candidature for any other award.

I declare that while registered as a candidate for the research degree, I have not been a registered candidate or enrolled student for another award of the university other academic or professional institution.

ABSTRACT

Advances in cloud computing have made it possible for collaborative environments to be developed for educational services. However, some HEIs are still using traditional VLE tools which receive minimal utilisation by users mostly for uploading and downloading course materials. This study focuses on challenges and concerns that limit or even prohibit the use of a cloud-based collaborative virtual learning environment (CBCVLE). More specifically, this study considers the influences of Omani culture upon utilisation of CBCVLEs.

A mixed methods research approach is adopted which includes a preliminary study, a questionnaire-based survey, and a set of interviews. The issues are identified by reviewing the related literature and the surveys and grouping them under five headings: (1) ICT infrastructure and services, (2) operational environment, (3) user's experience and expectations, (4) factors affecting the use and acceptance, and (5) cultural influences.

The findings indicate lack of sufficient ICT infrastructure and services, as well as insufficient financial resources in some higher education institutions for establishing their own ICT infrastructures. Moreover, the findings highlight users' experience as an important influence for utilisation of CBCVLEs. Regarding the operational environment, a wide range of concerns and challenges are identified by participants in the surveys. A number of issues are found to have an effect on the use of VLE tools and collaborative environments. Factors affecting the use and acceptance of a CBCVLE are also identified and classified as motivators or deterrents. Most importantly, cultural influences are found to be critical and vital for the use of CBCVLE. Family, religion, language, customs and traditions and gender can have a critical effect on users' participation in collaborative projects. The study's findings contribute to a better understanding and promotion of high utilisation and acceptance of CBCVLEs.

A novel framework is proposed which incorporates key elements and their relationships associated with a cloud-based collaborative environment. The framework aims to mitigate issues and factors influencing low utilisation and the acceptance of CBCVLEs.

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LIST OF APPREVIATIONS

BYOD	Bring Your Own Device
CBCVLE	Cloud-Based Collaborative Virtual Learning Environment
CMS	Content/Course Management System
CSP	Cloud Service Provider
DBMS	Database Management System
df	Degree of Freedom
ECM	Expectation-Confirmation Model
ECT	Expectation-Confirmation Theory
ELaaS	E-Learning as a Service
ELMS	E-Learning Management System
EsaaS	Educational Software as a Service
HEI	Higher Education Institution
HTTP	Hypertext Transfer Protocol
IaaS	Infrastructure as a Service
ICT	Information and Communication Technology
IT	Information Technology
LMS	Learning Management System
OMREN	Oman Research and Education Network
OS	Operating System
P2P	Peer-to-Peer
PaaS	Platform as a Service
PC	Personal Computer
SaaS	Software as a Service
Sig	Significance
SMS	Short Message Service
SPSS	Statistical Package for the Social Sciences
SSO	Single Sign-On
SSP	Survey Service Provider
t	“t” statistic for One-Sample T-Test
TOE	Technology Organization Environment
VCL	Virtual Computing Laboratory
VICoL	Virtual Infrastructure for Collaborative Learning
VLE	Virtual Learning Environment
VM	Virtual Machine

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

A virtual learning environment (VLE) is increasingly seen by higher education institutions (HEIs) as an essential support to academic programs as well as the collaborative environment. HEIs, on the one hand, are expected to employ the latest advancement in technology to enhance the VLE. Following global trends, HEIs in Oman compete to employ VLE tools utilising the latest advancements such as cloud computing. On the other hand, individual initiatives have been applied but with issues surrounding the utilisation. Very few HEIs have allocated their resources to implement and use a unified VLE which is in-house based and a purely traditional. However, it is anticipated that the users pay more attention to use VLE tools in their educations. However, challenges and concerns cannot be disregarded in such environment. As an academic in an HEI, the researcher has sought the need in the real status of users disregarding using VLEs which are not used to full potentials in HEIs in Oman.

It is becoming increasingly difficult to ignore the demand to migrate or to adopt cloud computing into not only companies but also HEIs. Cloud computing has been seen as urgently desirable by organisations throughout the globe to replace the traditional way of utilising Information and Communication Technology (ICT) resources. New trends in this promising field have been playing significant and critical roles in delivering educational services and applications to stakeholders. Examples of successful implementations across the world are stated by literature such as Seattle cloud (Cappos et al. 2009), Drexel University cloud (Educause and Nacubo 2010) and BlueSky cloud (Dong et al. 2009; Vrable et al. 2012) that illustrate better alternatives to local data centres for more efficient, scalable, reliable, secure, and cost-effective services (more potential benefits are outlined in section 2.2.4).

The gradual growth of mobile devices as well as the ubiquitous broadband Internet connectivity will shape the delivery of educational services as reflected from Titcomb (2016) who states that websites become more visited through mobile devices than by desktop computers. Consequently, this fact will support and enhance the collaborative VLE. Despite this, some challenges such as risk, security and governance that delay the process of cloud computing implementation by HEIs or even prevent any type of this utilisation. In this regard, several factors including technical, organisational, environmental can be best directed to enhance and facilitate institution' services.

HEIs would make massive savings in their software and hardware upgrade budgets as well as reducing ICT service and labour costs. Potentially, HEIs would utilise cloud computing for

hosting VLEs such as Blackboard (Blackboard 2017) or Moodle (Moodle 2017), access to courses, exams, tests, homework and projects (Dong et al. 2009 cited by Isaila 2014). However, most cloud-based services are provided globally by major cloud computing vendors whereas some of them are free of charge and hosted in public clouds (Alshwaier et al. 2012; Luna and Sequera 2015).

In the education context, several cloud-based models have been proposed by researchers such as Education as a Service (EaaS), Education Software as a Service (EsaaS), Education and Learning as a Service (ELaaS) and Software as a Service (SaaS) for education (Ahmed 2015; Chang and Wills 2013; Fern´andez et al. 2012; Kurelović et al. 2013; Masud et al. 2012). These models as well as others will be analysed and explored to come up with a suitable model for HEIs in Oman. This will be further discussed in Chapter two.

Oman and other developing countries could benefit from a collaborative VLE where students and faculty members could have access to online facilities to collaborate effectively achieving the potential aims of their courses and programs. Even though the wide spread of mobile devices would encourage and enhance the utilisation of cloud-based collaborative VLE (CBCVLE), there are still some concerns that would limit or even eliminate the whole initiative based on the fact that every technology or project would face during different phases of the implementation.

As an element of Oman National Broadband Strategy, the initial phase was launched to offer fixed broadband services at lowered prices (Oxford Business Group 2017). G-Cloud is another national project based on cloud computing technology to offer a shared infrastructure for all Omani public agencies and institutions to publish their e-services (AlRahbi 2015; ITA 2016a; ITA 2016c; ITA 2016d; e.oman 2016).

However, statistics of 2018 showed that Oman ranked 173 in global mobile data pricing conducted by cable.co.uk with an average of £-8.37 per 1GB (Cable 2019). This implies that the dissemination of data through mobile is extremely expensive and unaffordable at a low price which may be a barrier to many users. Moreover, 31 public and private HEIs spend about 6 million Omani Riyal (equal to £-12 million) per year for Internet service and library services subscriptions (Al Kharusi 2016). Similarly, Al Kharusi (2016) highlights the high cost of 570000 Omani Riyal (equal to £-1.14 million) that one HEI in Oman is paying annually for 34 Mbps Internet access. This is regardless of 124000 Omani Riyal (equal to £-248000) paid by the same HEI for annual maintenance and systems and devices purchases.

Malfunctioning and frequent interruption of VLE tools in Colleges of Applied Sciences (CAS), Oman, for example, encouraged faculty members to seek alternative tools (Al Naibi et al.

2015). This is besides several features that are extremely inactive, such as virtual classrooms, as well as incompatibility with different web browsers.

Factors related to collaborative VLE are also considered important affecting users including lack of motivation (Popov et al. 2012), user experience (Sweeney et al. 2008), lack of incentives, lack of training, lack of support and lack of knowledge sharing (Castro 2016), lack of connectivity Group (2017). Further challenges and concerns are identified by Doelitzscher et al. (2011) to include security, privacy, recovery, Integrity, security of user data and transactions, regulatory compliance, and data auditing. The factors, challenges and concerns will be further discussed in chapters 2 and 3.

The implementation of VLE must be accompanied by taking into consideration the local culture. Hofstede (1984) emphasises that the system designed for one culture would not necessarily fit others. For example, some VLE tools could have been designed by people using a different language. Therefore, cultural influences such as language, customs and traditions, family, age, gender and religion are investigated to determine to what extent culture has an impact on the use of a CBCVLE in HEIs in Oman (see section 2.5 in Chapter 2).

This research critically assesses the current ICT infrastructure and cloud-based collaborative initiatives used in Universities and Colleges in Oman and attempt to explore the existing VLEs in HEIs in Oman. In addition, the ICT infrastructure in HEIs in Oman will be investigated as an influencing factor of the collaborative VLE. Furthermore, the research will develop a framework for CBCVLEs for the HEIs in the Sultanate of Oman to enable sharing resources and services and to facilitate collaborated work among users in HEIs. The need for such a framework arose from: firstly, the potential benefits and features of cloud computing and its potentials for deployment by HEIs to support collaborative VLE. Secondly, most HEIs are implementing traditional VLEs whereas their users are steps forward. Thirdly, the minimum or standard requirements of ICT infrastructure and services are not provided by HEIs. Finally, there is a limited published research in this context implies the real need for this study.

This framework will adopt the contribution from analysing any related frameworks and models in the field or in adjacent areas. The proposed framework is aiming to make a rise in the use of VLEs that can be utilised extremely by users in HEIs in Oman. This also will enable them to exchange and share educational resources among themselves and make HEIs to reduce the cost of IT expenses in software, hardware and technical support, and therefore, will contribute to filling this gap in knowledge where a framework for CBCVLE will be developed. Thus, this research is aiming to get the maximum benefits of cloud computing to be applied in collaborative VLEs and use it to improve the current IT infrastructure

implemented in this environment. Moreover, challenges and concerns are considered by the framework provide HEIs with the opportunities to maximise the use of collaborative VLEs. Also, the proposed framework can be adapted and adopted by similar developing countries with modification whereas applicable.

It should be noted that this study investigates challenges and concerns in the context of a CBCVLE between HEIs related to cloud computing, VLE, collaboration, and local culture. As this study is inter-disciplinary, it is anticipated that these issues may be suitable to be inherited into the proposed CBCVLE. Challenges within collaborative VLE for example, would be combined from two or three contexts such as cloud computing, VLE, and collaboration.

1.2 DEFINITIONS

For the context of this research, this section provides concise definitions for most important terms used within this thesis. Further definitions and explanations are provided in Chapter 2.

Virtual Learning Environment (VLE) indicates the provision and support of education through electronic mediums and it mostly incorporates web-based applications that allow interaction and communication between users.

Collaborative VLE represents the environment with which users are effectively collaborating online either locally in an HEI or nationally (or even globally) with other users in other HEIs. Users or HEIs are provided with electronic tools that promote and facilitate collaboration and sharing resources.

Cloud-Based refers to any application or service that is delivered to users through the cloud computing technologies which are scalable, flexible, shared computing resources and also compatible with different platforms and devices using Internet.

Local culture determines a set of values, beliefs, customs and traditions … etc. that are embraced by local people across a country or a region. This culture also may differ from one city to another in the same country. For the context of this research, the term local culture mainly relates to the Omani culture.

1.3 RESEARCH AIM

To develop a framework for a CBCVLE for HEIs in Oman and to provide guidelines to improve the use and acceptance of a CBCVLE. This will assure the facilitation and enhancement of collaborative sharing of educational and research materials and resources within a unified virtual learning environment.

1.4 RESEARCH PROBLEM AND OBJECTIVES

Despite the availability of cloud computing in our life nowadays, educational services and activities are partially or not fully enhanced by such advancements. Moreover, the collaborative activities in HEIs would be enhanced and promoted by incorporating cloud computing technologies and applications. Hence, the gap between users' latest learning habits and the way of providing learning and educational services would be mitigated. It is noteworthy that the current VLEs are not cloud-based and they are not used to their full potentials. Furthermore, several features and functionalities are currently disabled on those VLEs. This may lead users to discourage using their VLEs for collaborative activities.

The research will propose a framework to overcome the challenges and concerns for a collaborative VLE for HEIs in Oman using cloud computing (see Table 1.1). This framework will provide more opportunities for HEIs and users to extend their collaborative activities within cloud environment. As stated by Leedy and Ormrod (2010), research problems are always complex and consequently require breaking them down into sub units. Walliman (2011) highlights that a research problem can be specified based on a gap in knowledge whereas investigations can be run, and conclusions are possible to be extracted.

Research Problem and opportunities:

• Collaboration
  ○ Between users
  ○ Between institutions
  ○ With other entities and individuals

• Opportunity for shared resources between individuals and institutions
  ○ Collaborative academic environment
  ○ Courses Materials
  ○ Computing resources
  ○ Storage
  ○ Open source software

• Limited/No utilisation of cloud computing

• Limited /No utilisation of cloud-based applications
• Existing VLEs are not cloud-based
• Higher cost of traditional ICT solution
• Current VLEs are not used to full potential
• Several features and functionalities are currently disabled
• Lack of collaborative activities over VLE tools
• Insufficient ICT infrastructure in HEIs
• Many challenges and concerns to overcome to improve VLE utilisation
• Opportunity for developing a CBCVLE
• Extending users' experience
• Promoting incentives in education
• Effects of local culture on collaborative VLE
• Mitigation of cultural influences

Table 1.1: Research problems and opportunities.

Hence, the research objectives are:

1. To review the literature on cloud computing and its applications in VLEs within HEIs throughout the world, including its application theories and experiences other Universities and Colleges have had in utilising cloud computing in VLEs.
2. To investigate the IT infrastructure and cloud-based collaborative initiatives currently in use in the HEIs in Oman.
3. To explore the existing CBCVLEs in HEIs throughout the world.
4. To identify and evaluate the constraints that would limit the use of CBCVLE for HEIs in Oman.
5. To identify the cultural influences that have an impact on the use of a CBCVLE in Oman.
6. To identify and compile features for a CBCVLE for HEIs in Oman.
7. To analyse and compare top ranked VLEs and select the most suitable one for illustrative purposes in terms of cloud-based collaborative environment.
8. To develop a framework and a prototype for a CBCVLE to help HEIs to mitigate related effects and to promote the use of CBCVLE.
9. To test and evaluate the framework and the prototype.

1.5 RESEARCH QUESTIONS

The main questions addressed in this study are:

1. To what extent is the existing ICT infrastructure and services able to support CBCVLEs in Oman?
2. What is the extent of the application of collaborative VLEs in HEIs in Oman?
3. What are the challenges that may affect the successful utilisation of CBCVLEs in Oman?
4. What would be the most suitable VLE to support a cloud-based collaborative environment in Oman?
5. What are the features of this CBCVLE that make it suitable for the HEIs in Oman?
6. To what extent the local culture may influence the use of a CBCVLE in Oman?

1.6 METHODOLOGY

This research adopts a mixed methods approach that includes a survey (questionnaire) with open-closed and open-ended questions, interviews within a preliminary study, and review of VLEs published in the official websites of HEIs in Oman. A qualitative survey is conducted to cover several aspects of the research. Another core element of this research is the development of a framework including a prototype. This is further discussed in Chapter 4.

1.7 CONTRIBUTION TO KNOWLEDGE

This research is unique in examining the use of CBCVLEs by HEIs in Oman. Thus, the research focuses its investigation on the current infrastructure of ICT and cloud computing for HEIs concerning VLEs in Oman, which is considered as a developing country (Curtiss 1995).

Initial research indicates that there is a limited number of articles on cloud computing services and applications for collaborative activities in Oman. Their scope is limited to general outlines of cloud computing initiatives without reference to its educational context. This research focuses primarily on examining aspects related to collaborative VLEs in HEIs in Oman. Moreover, there has been no significant research that show investigations into factors, challenges and concerns that may affect the utilisation of a CBCVLE in HEI in Oman. The research examines HEI's capabilities of its ICT infrastructure to support cloud computing services by which HEIs would have a gateway for their VLEs services, systems and applications.

Finally, the research, which focuses primarily on Oman, develops and proposes a framework for a CBCVLE. It does not mainly depend on a specific currently used VLE, but instead combines the collaborative features of the most commonly used VLEs. The framework will be of an immense value to the academic community of faculty members, students and researchers in Oman and developing countries. Although some researchers have addressed cultural issues and their effects on VLE globally, no research was found to focus on cultural influences that may affect the use and acceptance of a CBCVLE in HEIs in Oman.

Figure 1.1 summarises the research gaps analysis from four different perspectives: theoretical, empirical, Omani context, and VLE environment aspects.

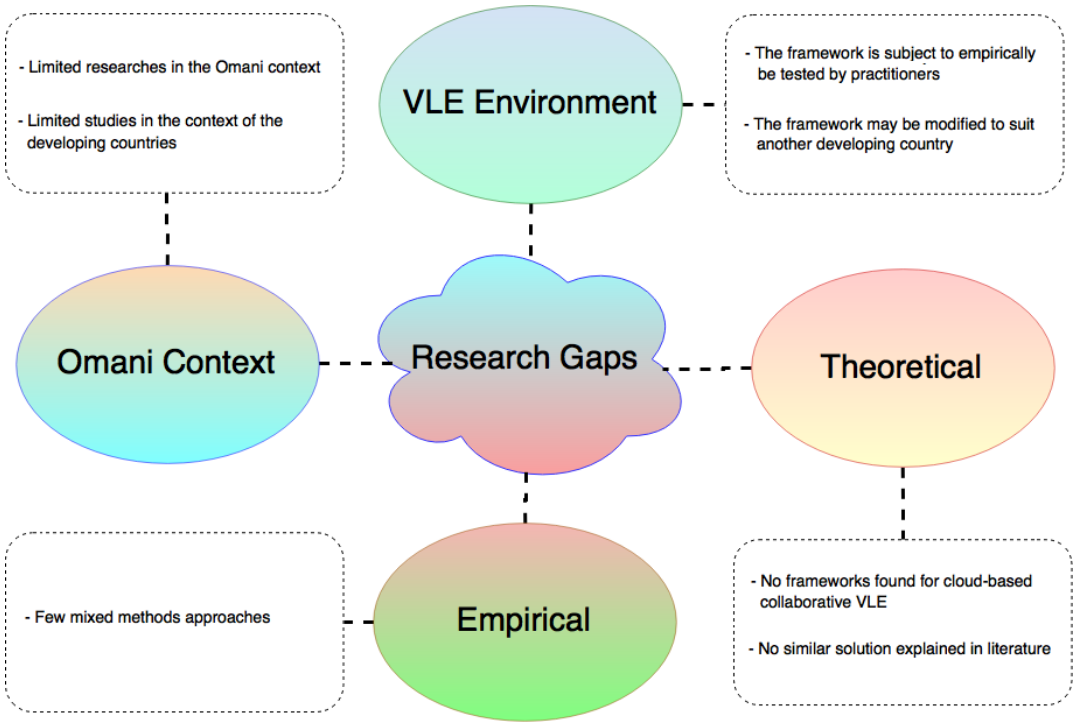


Figure 1.1: Research Gaps.

Therefore, the contribution of the study is:

- A conceptual framework to assist HEIs to realise challenges and factors that may be crucial for users to accept and use a CBCVLE.
- To contribute towards filling the empirical gap in the literature.
- To investigate issues in the Omani context that have not been explored. These issues include but are not limited to the use of cloud computing in HEIs, current ICT infrastructure and services, VLEs, collaboration in education.

- Addressing cultural issues resolving some of the cultural concerns that distract users from using collaborative VLEs.

1.8 SIGNIFICANCE OF THE STUDY

This study employs a mixed methods approach to investigate issues that relate to what causes users to be hesitant or even not to utilise VLE tools. The rational for choosing Oman for this context:

- The limited published research about cloud computing, VLE, collaborative learning, and culture.
- Applications of cloud computing in education in HEIs in Oman are ambiguous and not yet revealed.
- Collaborative VLE in Oman has not been given a focus on literature.
- The investigation of challenges in general and cultural influences in particular would provide HEIs and researchers an excellent framework of the concepts.

Thus, the significance of the study can be concluded as follows:

- It is anticipated to provide a valuable contribution by relating theory to practice and developing a framework for effective implementation and use of a CBCVLE.
- To explore users' views with which improvements can be made and recommendations can be outlined for HEIs.
- The future researchers are expected to modify this framework to serve different developing country or educational context.

1.9 THE MOTIVATION AND IMPORTANCE OF THE RESEARCH

The motivation for this research developed from a personal interest of the researcher in the field of VLE and related enhancements in education employing up-to-date technologies. Applications of cloud computing technologies have attracted the researcher to investigate various issues and relate them to such advancements. Collaborative VLE, as well, had a portion from the ever-changing technologies to support education.

The researcher believed that by proposing a framework for CBCVLE, HEIs in Oman will be able to tackle various issues and influences to attract their users to employ tools and applications

in a sustainable manner. There is also a motivation to increase research and studies concerning the Omani context.

1.10 THESIS STRUCTURE

Chapter Two synthesises the background of this multi-disciplinary research from literature. The chapter articulates definitions, facts and theories associated with the related disciplines. A special attention was given to cultural influences that may have an impact on the extent to which the users accept and use a CBCVLE.

Similarly, *Chapter Three* outlines with details the previous studies and researches concerning CBCVLE as well as the related concerns and challenges. Additionally, it highlights the importance of collaboration in VLEs and articulates its potential applications within HEIs.

Chapter Four presents the research methodology used in this study including mixed methods used to answer the research questions. It explains all research methods used within this research which include quantitative (questionnaires) and qualitative (interviews) as well as brief details about the development of the framework and the prototype. Ethical considerations and limitations of the study are also presented.

Chapter Five provides an analysis of survey 1 which comprises mostly quantitative questions as well as some open-ended questions. ICT infrastructure and services of HEIs in Oman were explored as well as the use of cloud computing, collaborative environment, and the potential features of CBCVLE.

Chapter Six discusses the analysis of the qualitative survey (interviews) with HEIs' users who reflect their views regarding several aspects that relate to the research topics. This chapter presents four themes as follows: ICT infrastructure and services, operational environment, user experience and expectations, and factors affecting the use and acceptance of a CBCVLE. This chapter is considered as the first part of a draft version of the final framework which will be enhanced and further explained in Chapter 8.

Chapter Seven covers the cultural influences which is classified as the fifth theme revealed from survey 2. Cultural issues were identified based on the users' views and discussed in relation to the supported literature. This chapter represents the second part of a draft version of the final framework which will be also additionally discussed in Chapter 8.

Chapter Eight summaries the framework for a CBCVLE. The framework consists of five main elements which represent the outcome of literature review and the surveys. These elements are: ICT infrastructure and services, operational environment, user experience and expectations, factors affecting the use and acceptance of a CBCVLE, and cultural influences.

Chapter Nine outlines the prototype which is considered to partially deal with some aspects stated in the framework. Some cultural influences were taken into consideration to present how such issues can be tackled within VLEs.

Chapter Ten emphasises a critical stage of this research where the framework and its associated prototype are validated by some users. The results of the questionnaire are analysed, and the findings are presented to validate the main elements of the framework and their associated sub-elements.

Finally, *Chapter Eleven* concludes the thesis findings and outlines recommendations for HEIs concerning the implementation and the use of a CBCVLE. The chapter also discusses the limitations of the research and suggests future work.

1.11 CHAPTER SUMMARY

The importance of adopting a technology into higher education necessitates discussing factors, challenges, concerns, and issues that may affect the user's acceptance and the use of a CBCVLE. This chapter presented an introduction to topics related to the focus of this thesis. The research aims to develop a framework for a CBCVLE for HEIs in Oman and to provide guidelines to improve the use and acceptance of it. A set of objectives were defined to be achieved by this research as well as six questions to be answered through Investigation. A conceptual framework is proposed as the main contribution to knowledge amongst others.

CHAPTER 2: LITERATURE REVIEW

This chapter gives the base for this research from the literature. It starts by outlining cloud computing definitions, benefits, characteristics, uses in education, and associated challenges and concerns. Then, VLEs are highlighted including the most popular tools used globally including examples of utilisation within education. The popularity of VLEs among HEIs in Oman is investigated. The chapter also includes general introduction about Oman, as well as, the current situation in respect of utilisation of cloud computing in the country and the HEIs. The chapter concludes with cultural influences and issues that may have an effect on the utilisation of a CBCVLE.

2.1 INTRODUCTION

The diverse and crucial impact of cloud computing into life including education requires institutions to utilise such technologies and change their ordinary plans accordingly. In addition, collaboration becomes important whereas it is now more facilitated than ever. This chapter outlines the reality of cloud computing and its elements, benefits, characteristics, and uses especially in the field of education. Additionally, attention has been given to virtual learning environment and its potential features and characteristics. The Omani context is also explored in regard to cloud computing, ICT infrastructure, HEIs, and the popularity of VLEs in Oman. This chapter also gives a special attention to cultural influences which can affect the use and acceptance of a CBCVLE. The chapter also discusses some definitions that relate to related research areas.

The literature reveals a diversity of definitions for the most important terms used in this research; cloud computing, virtual learning environment, and collaborative learning environment. There are differences in definition of terms from one author to another as well from one organisation to other. Moreover, the concepts in which a term is used, the background from which the author reflects on, are two from among many representing determinants of every definition. The next section (2.2.1) as well as others (2.3.1 and 2.5.2) give precise definitions to the related terms as they are widely adopted by researchers.

2.2 CLOUD COMPUTING CONCEPT

2.2.1 DEFINITIONS

Cloud computing has been a controversial issue and it has been discussed extensively by researchers. The Gartner Group has defined the term as "*a style of computing where scalable and elastic IT-related capabilities are provided as a service to external customers using Internet technologies*" (Gartner 2010, p.2).

National Institute of Standards and Technology (NIST) Cloud Research Team had proposed another definition: "*Cloud computing is a pay-per-use model for enabling convenient, on-demand network access to a shared pool of configurable and reliable computing resources (e.g., networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal consumer management effort or service provider interaction*" (Mell and Grance 2009, p.8).

An early example of the cloud computing model was peer-to-peer (P2P) in 1990s where users' computers were used to provide decentralized storage and processing capabilities with the availability of single domain servers for management (Marinescu 2013). In a later stage of cloud, users pay per usage like paying for using other utilities such as Water, Electricity, Gas, and Telephone. It has been recognized as utility computing till 2007 when it was replaced by the term cloud computing (Buyya et al. 2013). Importantly, some researchers emphasise other related technologies to cloud computing such as Grid Computing, Utility Computing, Virtualization, and Autonomic Computing (Logofatu et al. 2017; Zhang et al. 2010).

2.2.2 CLOUD COMPUTING LAYERS

Cloud computing has multiple desirable and essential characteristics such as on-demand self-service, resource pooling, rapid elasticity, (measured service) pay-as-you-go pricing, (Marinescu 2009; Williams 2010; CISCO 2012) and broad network access (Williams 2010).

Williams (2010) defines a simple three-layer pyramid model of cloud computing; First, Infrastructure which is the lowest layer that includes the physical hardware such as processors, storage, networks, etc. Second, Platform which is purpose-built software development environments and consists of an operating system environment for running development tools. Third, Software that includes a wide range of web-based applications available for users.

This is while other researchers define a layered model of cloud computing of four layers: (1) The hardware layer, (2) The infrastructure layer, (3) The platform layer, and (4) The application layer (Zhang et al. 2010).

The vast majority of researchers and papers agree that Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) are currently employed as business models (delivery models/layers) for Cloud Computing (Buyya et al. 2013; CISCO 2012; Curry and Laws 2016; Jin et al. 2010; Jalgaonkar and Kanojia 2013; Kurelović et al. 2013; Lakshminarayanan et al. 2013; Le Roux and Evans 2011; Marinescu 2013; Sultan 2010; Rimal et al. 2010; Williams 2010; Zhang et al. 2010). The latter can be divided into three sub-models: sub-categories: Computing as a Service (CaaS), Storage as a Service, and Database as a Service (DaaS) (Chen et al. 2010).

A shared IaaS would be the best choice for a group of HEIs forming a consortium to reduce the high cost of establishing an individual infrastructure for each HEI. This also will enable members to save a high portion of their budget that they would have spent in IT, human resources, technical support, and annual maintenance.

2.2.3 CLOUD COMPUTING DEPLOYMENT MODELS

Most studies (e.g. Buyya et al. 2013; CISCO 2012; Jalgaonkar and Kanojia 2013; Jin et al. 2010; Lakshminarayanan et al. 2013; Marinescu 2013; Williams 2010; Zhang et al. 2010) agree that cloud computing deployment models are as follows: private cloud, public cloud, community cloud, and hybrid cloud. In public cloud, resources, IT infrastructure, and IT services are provided for public use in a metered usage while in a private cloud they are solely reserved for the use of an institution. The hybrid cloud incorporates both public and private clouds whereas resources and services are utilised from two sides (Jin et al. 2010). As illustrated in Figure 2.1, Cunsolo et al. (2010) propose a homogeneous clouds scenario where numerous coexisting and interoperable clouds are combined into one cloud system. However, community cloud would best fit HEIs in Oman either for hosting a unified VLE to serve all institutions or for other educational services and systems as all HEIs are subject to one authority (Ministry of Higher Education). Public clouds services can be incorporated as well.

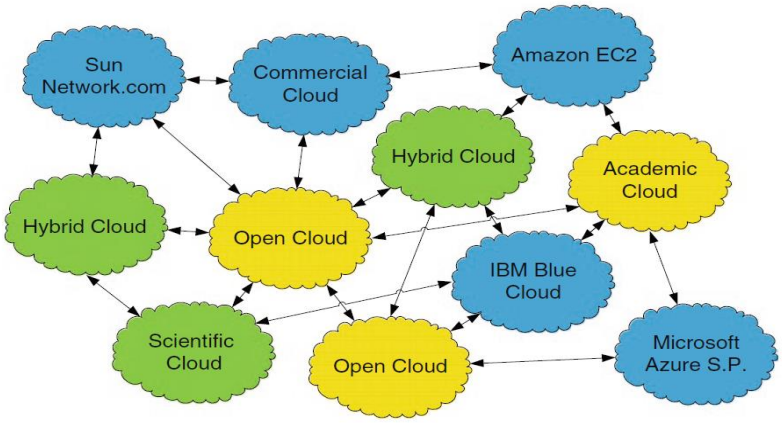


Figure 2.1: Anticipated clouds for the Cloud@Home Scenario (Cunsolo et al. 2010, p.6).

2.2.4 CLOUD COMPUTING BENEFITS AND CHARACTERISTICS

Williams (2010) categorizes benefits of cloud computing under four categories as follows: (1) financial (pay-per-use IT, operational expenditure and reduced IT management costs), (2) technological (rapidly scalable computing on demand, access anywhere and future proofing), (3) operational (fewer IT administration tasks, remote access, online collaboration and faster software development and deployment), and (4) environmental (sharing resources and reduced travel) benefits.

In regard to education context, Al-Zoube et al. (2010) assert that cloud computing would deliver low-cost solution for HEIs and their community members. Moreover, NIST declares other common characteristics of cloud computing: (1) Massive scale, (2) Resilient computing, (3) Homogeneity, (4) Geographic distribution, (5) Virtualization, (6) Service orientation, (7) Low cost software, (8) Advanced security (Williams 2010).

In this regard, a large and growing body of literature has investigated the benefits of cloud computing which has been attracting various stakeholders due to its potential benefits as shown in Table 2.1 below.

Benefit	Reference
Cost savings - lowers capital and total IT costs	(Chang and Wills 2013; CISCO 2012; Educause and Nacubo 2010; Gagliardi and Muscella 2010; González-Martínez et al. 2015; Isaila 2014; Jalgaonkar and Kanojia 2013; Karim and Goodwin 2013; Leadbeater 2010; Logofatu et al. 2017; Rimal et al. 2010; Talukder et al. 2010; Vance 2011; Williams 2010; Yadegaridehkordi et al. 2015; Zhang et al. 2010)

Ease of implementation	(CISCO 2012; Williams 2010; Yadegaridehkordi et al. 2015)
Less management overhead	(Luna and Sequera 2015; White et al. 2009)
Flexibility (Elasticity)	(Chang and Wills 2013; CISCO 2012 Cunsolo et al. 2010; Educause and Nacubo 2010; Gagliardi and Muscella 2010; González-Martínez et al. 2015; Isaila 2014; Rimal et al. 2010; Talukder et al. 2010; Williams 2010; Yadegaridehkordi et al. 2015)
Scalability	(Buyya 2013; CISCO 2012; Educause and Nacubo 2010; González-Martínez et al. 2015; Hew et al. 2016a; Jin et al. 2010; Logofatu et al. 2017; Valcheva et al. 2015; Williams 2010; Yadegaridehkordi et al. 2015; Zhang et al. 2010)
Mobility and Ease of Access	(Gagliardi and Muscella 2010; González-Martínez et al. 2015; Isaila 2014; Jalgaonkar and Kanojia 2013; Leadbeater 2010; Vitkar 2012; Yadegaridehkordi et al. 2015; Zhang et al. 2010)
Risk Reduction	(Yadegaridehkordi et al. 2015; Zhang et al. 2010)
Redeployment of staff	(CISCO 2012)
Focusing on core competencies	(CISCO 2012)
Sustainability	(CISCO 2012; Yadegaridehkordi et al. 2015)
Efficiency	(Chang and Wills 2013; Pamieri and Pardi 2010)
Increased availability	(Cunsolo et al. 2010; Isaila 2014; Logofatu et al. 2017)
Enhance quality of service	(Chang and Wills 2013; Pamieri and Pardi 2010; White et al. 2009)
Share the load and resources (Resource Pooling)	(Chang and Wills 2013; Yadegaridehkordi et al. 2015)
On-demand self-service	(CISCO 2012; Educause and Nacubo 2010; White et al. 2009; Williams 2010; Yadegaridehkordi et al. 2015)
Promotes standardization	(Educause and Nacubo 2010)
Simplifies (Simplicity) and optimizes IT	(Educause and Nacubo 2010; Gagliardi and Muscella 2010; Jin et al. 2010)
Protection of the environment by using green technologies	(Antonopoulos and Gillam 2010; Cunsolo et al. 2010; Jalgaonkar and Kanojia 2013; Rimal et al. 2010; Talukder et al. 2010; Vitkar 2012)
Fault tolerance	(Buyya 2013; Cunsolo et al. 2010; Jin et al. 2010)
Agility	(Rimal et al. 2010; Yadegaridehkordi et al. 2015)
Collaboration	(Gilbert and Austin 2010; González-Martínez et al. 2015; Jayasena 2012; White et al. 2009; Yadegaridehkordi et al. 2015)
Usability	(Yadegaridehkordi et al. 2015)
Measured service	(Vitkar 2012; Yadegaridehkordi et al. 2015)

Interoperability	(Cunsolo et al. 2010; Jin et al. 2010; Valcheva et al. 2015)
Adaptability	(Pamieri and Pardi 2010; Valcheva et al. 2015)
Extensibility	(Cunsolo et al. 2010; Doelitzscher et al. 2011; Valcheva et al. 2015)
Reliability	(Cunsolo et al. 2010; González-Martínez et al. 2015; Talukder et al. 2010)

Table 2.1: Potential benefits and characteristics of cloud computing as identified by researchers.

These benefits listed above are relevant for the requirements of a CBCVLE environment. As seen in Table 2.1, cloud computing technologies provide an enriched environment by which a collaborative VLE can truly be facilitated to become more involved and embraced by it. The table above also highlights the most popular benefits that inspired the authors. These benefits are: cost savings, flexibility (elasticity), scalability, ease of access, on-demand self-service, and protection of the environment. It is anticipated that if users are aware of the overall benefits of cloud computing, they will be encouraged to accept and use a CBCVLE. Subsequently, users, then, will be more likely to use their VLE tools to support their education.

2.2.5 EXAMPLES OF CLOUD SERVICES

Cloud computing providers such as Amazon, Google, IBM, Microsoft and Sun Microsystems have established cloud-based data centres all over the world to offer a flexible service delivery where users have no knowledge about the entire infrastructure (Al-Zoube et al. 2010). Many cloud-based services are currently provided free of charge either for educational or personal use. HEIs would use a variety of cloud-based applications such as Microsoft Office (Word, Excel and Access DBMS), YouTube, Google Docs or any other web-based application (Al-Zoube et al. 2010). The most popular cloud services that can be beneficial to educational institutions and other organisations are Microsoft Live@edu, Google Apps and Amazon Web Services (Lakshminarayanan et al. 2013).

The list of cloud-based applications and services is considerable. Table 2.2 shows some examples of public cloud services that are available for use by individuals and institutions (Al-Zoube et al. 2010; Apple, 2017; Arpaci 2019; Chen et al. 2010; Curry and Laws 2016; Denton 2012; González-Martínez et al. 2015; Hew et al. 2016a; Le Roux and Evans 2011; Logofatu et al. 2017; Luna and Sequera 2015; NDG 2019). HEIs could utilise and incorporate these tools into their learning and teaching activities for better performance in delivering their educational services.

Vendor	Service	Details	Delivery Model
Amazon	Amazon Web Services	Delivery of infrastructure services	IaaS
Microsoft	Azure	Provision of cloud-based development environment for developers	PaaS
Microsoft	OneDrive	Cloud storage service	SaaS
Google	Google Docs	Cloud-based applications	SaaS
Dropbox	Dropbox	Cloud storage service	SaaS
Google	Google App Engine	Cloud-based applications environment	PaaS
Microsoft	Office 365	Cloud-based applications	SaaS
Google	Google Docs	Cloud storage service	SaaS
Apple	iCloud	Cloud storage service and devices synchronisation	SaaS
NDG	NETLAB+	Enhanced environment for students' exercises with hands-on training	SaaS

Table 2.2: Examples of public cloud services.

2.2.6 CHALLENGES/CONCERNS FOR UTILISING CLOUD COMPUTING

In spite of the fact that cloud computing has reached ultimately an enormous number of individual users who use mobile devices either for leisure or educational purposes, challenges and concerns and even fears lie behind the use and utilisation of these advancements of technology either from individuals or institutions.

In regard to the risk and limitations of cloud computing, Vitkar (2012) and Jalgaonkar and Kanojia (2013) identify issues in this context as follows: (1) not all applications run in cloud, (2) risks related to data protection and security, (3) organizational support, (4) dissemination politics, intellectual property, (5) security and protection of sensitive data, (6) maturity of solutions, (7) lack of confidence, (8) standards adherence, (9) offline usage with further synchronization opportunities, and (10) speed/lack of Internet can affect work methods.

It should be noted that several papers intensively highlight barriers inhibiting the adoption of cloud computing which includes but not limited to: (1) Security of Cloud Services and Data Privacy, (2) Interoperability (Lack of Standards), (3) Control (Loss of Control), (4) Performance, (5) Reliability, (6) Risk and Compliance Issues, (7) Barriers inhibiting the Adoption of Cloud Computing, (8) Lack of Internal Expertise and Knowledge, (9) Poor Internet Access and Connectivity Lack of Trust, (10) Integration with In-house and Existing Systems, (11)

Differences in International Statutory Laws and Regulations, (12) Delay in the Transfer and Migration of Data, and (13) Lack of Confidence in Ability and Promise of the Cloud (Educause and Nacubo 2010; CISCO 2012; Isaila 2014; Yeboah-Boateng and Essandoh 2014).

According to IDC (2009), a survey carried out to rate the challenges/issues of the cloud/on-demand model reveals the following issues ordered respectively in importance: Security, Availability, Performance, On-demand payment model may cost more, lack of interoperability standards, bringing back in-house may be difficult, Hard to integrate with in-house IT, not enough ability to customize.

Any adoption of cloud computing may be faced with some/most of various barriers (factors) including as categorized by Tornatzky and Fleischer (1990) cited by Lippert and Govindarajulu (2006) and Yeboah-Boateng and Essandoh (2014), Technological Factors, Organizational Factors, and Environmental factors. However, this research will adopt these categories and any possibly relative barrier.

In a similar study, Isaila (2014) discusses the Technology Organization Environment (TOE) model by declaring challenges of Adopting Cloud Computing to three categories: technical, institutional, and environmental. The technical challenges contain: (1) Account, Service and Traffics, (2) Audit and Compliance, (3) Availability and reliability issues, (4) Data security (Transfer and storage), (5) Infrastructure security, (6) Internet connectivity, (7) Legal and regulatory issues, (8) Privacy and trust, (9) Unknown risk profile, and (10) Uncertainty with new technology. The institutional challenges cover: (1) Lack of understanding, (2) Management commitment, (3) Organizational Readiness, (4) Processes and control, (5) Migration strategies, (6) Skills and personnel, (7) Departmental downsizing, and (8) Budget and funding. The environmental challenges comprise: (1) Service level agreement, (2) Compliance and auditability, (3) Standardisation, (4) Pricing and total cost, (5) Data protection controls, and (6) Society, culture and perception. Karim and Goodwin (2013) emphasise the lack for proper ICT infrastructure as a major challenge for adopting cloud technologies for education.

Furthermore, Isaila (2014) develops eight-point strategies/challenges of cloud adoption which consist of: (1) Security, privacy and trust, (2) Internet connectivity, (3) Service availability, (4) Organization readiness, (5) Compliance and regulatory, (6) Management Commitment, (7) Lack of Understanding, and (8) Cost of migration. However, geographical separation of student group's members is not considered as a barrier in the presence of cloud applications (Luna and Sequera 2015).

The model proposed by Tornatzky and Fleischer (1990) cited by Lippert and Govindarajulu (2006) is based on the three dimensions; TOE framework to support the construction of eleven issues that may affect the adoption and employment of web services. This includes: "(1) technological factors (security concerns; reliability; deploy ability); (2) organizational factors (firm size; firm scope; technological knowledge; perceived benefits); and, (3) environmental factors (competitive pressure; regulatory influence; dependent partner readiness; trust in the web service provider)" (Lippert and Govindarajulu 2006, p.1).

In their study, Yeboah-Boateng and Essandoh (2014) stressed and gave a substantial attention to the use of TOE framework to determine the importance of different factors influencing the adoption of cloud computing. First, the technological factors which include: (1) Trialability of Cloud Services, (2) Existence of Required IT Infrastructure and Resources, (3) Compatibility with Existing Systems, (4) Strength of In-built Security Systems, (5) Learning Capability of Employees, (6) Limited Technical Knowledge about Similar Technologies, and (7) Non-performance of Cloud Services to support Operations. Second, the organizational factors which include: (1) Top Management Support and Involvement, (2) Resistance towards New Technologies, (3) Conformity with Work Culture and Style, (4) Impact of Organizational Structure and Size, and (5) First Adopters in Our Industry. Third, the environmental factors which include: (1) Adequate User and Technical Support from Provider, (2) Choice of Skilled and Expert Cloud Vendors, (3) Influence of Market Scope, (4) The Nature of Industry, and (5) Relationship with Providers, Government and Competitors.

Doelitzscher et al. (2011) highlight an example of Hochschule Furtwangler University (HFU) which have two IT departments in the University to manage the entire IT resources. Each department has a different responsibility over IT hardware and software including personal computers (PCs), servers, data centres, networks, firewall rules and IP subnets. Thus, the institution may end up with lacking some resources that belong to one department while it is difficult to utilise substitutes from other zones.

Overall, Table 2.3 classifies concerns and challenges into three categories; technological, organizational, and environmental. The table was constructed based on comments and issues revealed from literature (CISCO 2012; Educause and Nacubo 2010; IDC 2009; Jalgaonkar and Kanojia 2013; Isaila 2014; Lippert and Govindarajulu 2006; Jayasena 2012; Karim and Goodwin 2013; Luna and Sequera 2015; Tornatzky and Fleischer 1990 cited by Lippert and Govindarajulu 2006; Yeboah-Boateng and Essandoh 2014).

Technological	Organizational	Environmental
Not all applications run in cloud	Organizational support	On-demand payment model may cost more
Not all mobile devices support cloud	Intellectual property	Unknown risk profile
Security and protection of sensitive data	Maturity of solutions	Legal and regulatory issues
Security of cloud services	Lack of confidence	Adequate user and technical support from provider
Limited/lack of Internet connectivity	Standards adherence	Choice of skilled and expert cloud vendors
Lack of interoperability standards	Lack of internal expertise and knowledge	Influence of market scope
Control (Loss of Control)	Differences in international statutory laws and regulations	The nature of industry
Integration with In-house and existing Systems	Delay in the transfer and migration of data	Relationship with providers, government and competitors
Hard to integrate with in-house IT	Uncertainty with new technology	Service level agreement
Not enough ability to customize	Lack of understanding	Compliance and auditability
Infrastructure security	Management commitment	Standardisation
Vendor lock-in	Organization readiness	Pricing and total cost
Availability and reliability issues	Processes and control	Data protection controls
Trialability of cloud Services	Migration strategies	Society, culture and perception
Existence of required IT infrastructure and resources	Skills and personnel	Competitive pressure
Compatibility with existing systems	Departmental downsizing	Regulatory influence
Strength of in-built security systems	Budget and funding	Dependent partner readiness
Learning capability of employees	Top management support and involvement	Trust in the cloud service provider
Limited technical knowledge about similar technologies	Resistance towards new technologies	
Non-performance of cloud services to support operations	Conformity with work culture and style	
Service reliability	Impact of organizational structure and size	
Service availability	First adopters in our Industry	
Data privacy		
Performance	Compliance and regulatory	
Compliance issues		
Lack of proper ICT infrastructure	Lack of understanding	
	Cost of migration	

	Firm size
	Firm scope
	Technological knowledge
	Perceived benefits

Table 2.3: Concerns and challenges of cloud computing adoption/migration.

Overall, concerns and challenges related to cloud computing will be discussed and incorporated with the support from users' views within HEIs. Moreover, these challenges will be combined with other concerns and challenges related to collaborative VLE.

2.2.7 USES OF CLOUD COMPUTING IN EDUCATION

An HEI does not need to have technical expertise to retain their systems running to keep a regular maintenance of infrastructure. Instead, an HEI could subscribe to on-demand cloud services which allow institutions to extend their use at any time and the investment in building and maintaining data centres are not anticipated (Al-Zoube et al. 2010). Moreover, there are many applications of cloud computing in HEIs. These include hosting VLEs such as Blackboard or Moodle, access to courses resources, exercises, virtual laboratories, examination papers, tests, homework or projects (Dong et al. 2009 cited by Isaila 2014). Accordingly, HEIs would save a considerable amount of their budgets concerning upgrading software and hardware as well as reduce ICT services and labours costs. Al-Zoube et al. (2010) assert that by employing cloud-based services, an HEI would overcome the shortage of proprietary and expensive software that can be accessed by several types of devices from anywhere.

Sultan (2010) asserts that HEIs are pushed to adopt cloud computing due to the possibility of the collapse in global financial systems. Sultan (2010) also indicates that students, teaching staff, management, research staff, and software developers would benefit from the implementation of cloud computing in universities and colleges which for instance would save enormous amounts of their budgets regarding upgrading software and hardware as well as reducing ICT services and labours costs. Users in HEIs are no longer required to buy licences or install Microsoft Office applications in their PCs, instead, they can run them online from Microsoft or Google clouds (Isaila 2014).

By selecting a public cloud deployment model, an HEI would have concerns regarding security, privacy, interoperability, or performance. As an alternative solution, HEIs should go for private cloud to eliminate any possible risk as well to achieve a stable deployment (CISCO 2012). However, this is considered as a costly solution which may be available only for large universities but not for small HEIs.

An example of a cloud-based educational network is Seattle that was created for the benefits of academics and students. It is a free, flexible and portable platform that is widely deployed, and it replaces dedicated infrastructure by a wide range of machines and operating systems (Cappos et al. 2009). An example of employing cloud computing in HEIs is Drexel University, which offered hosting systems for other institutions (Educause and Nacubo 2010). This model indicates that a HEI would go beyond its boundaries and will look forward to expanding its investments in such project. Dong et al. (2009) propose 'BlueSky' which is a cloud-based framework where physical machines are virtualized and provisioned for an e-learning environment. BlueSky has helped to overcome the challenges that encounter e-learning systems by improving their performance, availability and scalability.

A study conducted by Kurelović et al. (2013) focuses on SaaS for education as it investigates the students' needs and uses of cloud applications and reflects their desires to use the cloud. In their study, Chang and Wills (2013) argue that utilising cloud computing can deliver better services in higher education. A case study of the University of Greenwich (UoG) is employed to investigate the appropriate business models for education known as EaaS. Fern´andez et al. (2012) describe cloud-based e-learning systems as "Education Software –as-a-Service". Another study carried out by Masud et al. (2012) proposes a model known as EsaaS and Ahmed (2015) proposes ELaaS (see Figure 2.2). A study conducted by Kurelović et al. (2013) focuses on SaaS for education. The study investigates students' needs and use of cloud applications.

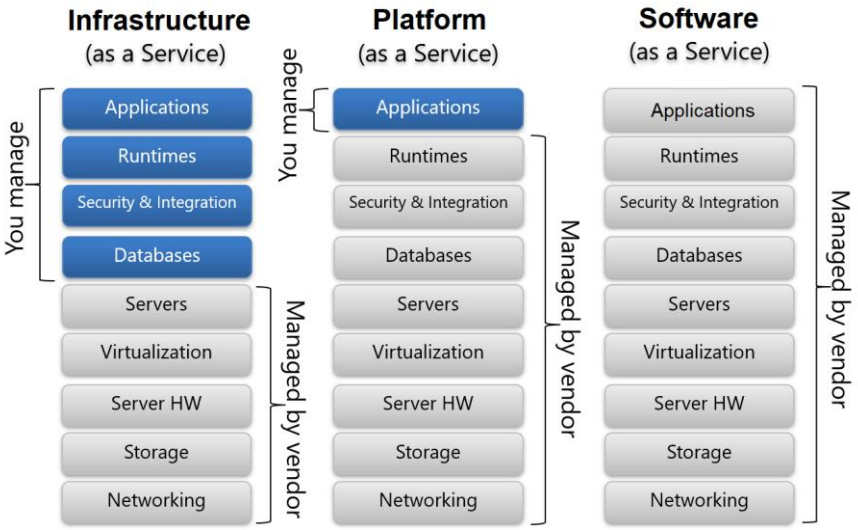


Figure 2.2: The base layer of e-learning cloud (Ahmed 2015, p.371).

Alshwaier et al. (2012) state that many students and researchers are currently using at least one cloud-based application. Most of these services are provided globally by major cloud computing vendors whereas some of them are free of charge and hosted in a public cloud.

Jalgaonkar and Kanojia (2013) express the view that cloud computing is anticipated to be vital for educational computing in the next decade. Therefore, migration to the cloud would be a good solution for the HEIs in Oman, either individually or in a consortium resulting in reduced expenditure and improved services. Table 2.4 identifies examples of uses of cloud computing in education from literature.

Topic	References
BlueSky cloud	(Doelitzscher et al. 2011; Dong et al. 2009; Vrable et al. 2012)
Cloud Infrastructure and Application (CloudIA)	(Doelitzscher et al. 2011; Sulistio et al. 2009)
Virtual Computing Laboratory (VCL)	(Averitt et al. 2007; Doelitzscher et al. 2011; Dreher et al. 2009; Jayasena 2012)
Snow Leopard Cloud	(Cayirci et al. 2009; Doelitzscher et al. 2011)
Repositories	(Buyya et al. 2013; Educause and Nacubo 2010; Li et al. 2014; Marinos and Briscoe 2009)
Collaborative Note-Taking	(Orndorff III 2015)
Unified communications and collaboration (UCC)	(Gilbert and Austin 2010)
Collaborative Editing	(Buyya et al. 2013; Fadil et al. 2015; Li et al. 2014; Razak 2009; Shahzad et al. 2014)
On-Demand Collaboration Software (CollabSoft)	(Doelitzscher et al. 2011)
Virtual Infrastructure for Collaborative Learning (VICoL)	(Valcheva et al. 2015)
iLabCentral virtual science lab	(Young 2009)
Online authoring tools for e-learning systems (WEBELS)	(Chunwijitra 2013)

Table 2.4: Summary of uses of cloud computing in education from literature.

2.3 VIRTUAL LEARNING ENVIRONMENTS (VLEs)

2.3.1 DEFINITIONS

Virtual Learning Environment (VLE) can be defined as a designed information space and it is a social space where students are actors and heterogeneous technologies are integrated (Dillenbourg et al. 2002). The Joint Information Systems Committee (JISC) defines VLEs as "*the components in which learners and tutors participate in "online" interactions of various kinds, including online learning*" (O'Leary and Ramsden 2002 p.2).

Other terms have been widely used such as Learning Management Systems (LMSs) which "*combine a range of course or subject management and pedagogical tools to provide a means of designing, building and delivering online learning environments*" (Coates et al. 2005). LMSs also referred to as *''learning platforms'', ''distributed learning systems'', ''course management systems (CMSs)'', ''content management systems'', ''portals'', and ''instructional management systems''* (Chunwijitra 2013; Coates et al. 2005; Muhsen et al. 2013; Subramanian et al. 2014; Unal and Unal 2011).

Another definition that highlights collaboration as a component: "*A Virtual Learning Environment (VLE) is a system for delivering learning materials to students via the web. These systems include assessment, student tracking, collaboration and communication tools*" (Oxford University Press 2017).

All the above definitions are complementary, and they can be adopted for the purpose of this study collectively. While some definitions do not include teachers, others indicate their role in education.

2.3.2 VLEs AND CLOUD

Effective learning encourages reflection, allows dialogue, promotes collaboration, applies the theory learned into practice, creates a community of peers, allows creativity, and motivates students (Conole and Unido 2013 cited by Luna and Sequera 2015). VLE's data may be stored in a single domain while the same data is subject to be shared by other domains (Valcheva et al. 2015). VLEs "*are facing challenges of optimizing large-scale resources management, according to the huge growth of services, users and educational resources*" (El Mhouti et al. 2016, p.1).

Ahmed (2015, p.370) highlights steps required for shifting a traditional e-learning system to cloud: *"(1) planning and designing e-learning materials, (2) organizing resources for e-learning environment, (3) designing distributed learning systems, corporate universities, virtual universities and cyber schools, (4) designing LMS, LCMS and comprehensive authoring systems (e.g., Omni), (5) evaluating e-learning courses, and programs, (6) evaluating e-learning authoring tools/systems, LMS and LCMS, (7) designing and evaluating blended learning environments".*

The sections below explore VLEs and their applications which are currently used in HEIs globally. Moreover, precise indications of the popularity of VLEs among HEIs in Oman are presented to highlight the most commonly used VLEs in the country.

2.3.3 VLE TOOLS/PACKAGES

The number of Universities and Colleges adopting a VLE is obviously increasing while the debate lies in the potential features that would best serve an institution beside the cost and whether it meets the budget limit or favourably a free open source package.

Academic institutions that are in favour of Moodle or any other open source VLE would have reasonable facts towards their decision. Valcheva et al. (2015) highlight some features that may be available in collaborative VLEs in general and in open-source VLEs in particular. These include: (1) ease of customization, (2) extensibility through third-party add-ons, (3) ease of localization, (4) flexibility, (5) free licensing costs, (6) faster bug fixes, (7) safe from vendor collapse, and (8) safety from product disruptions or discontinuations.

The proposed Collaborative Learning (VICol) adopts Moodle as an open source learning management system (LMS) (Valcheva et al. 2015). There was no explanation on the reasons that Moodle was chosen as the main core the proposed infrastructure except that Moodle has a good repetition over other LMSs. However, Moodle and Blackboard as described by Al-Zoube et al. (2010) are the most used VLEs in HEIs and the most dominant LMSs (Gedera and Williams 2013). Erturk (2016, p.2) states that *"Open source software provides more freedom and flexibility to schools and users, as to ownership and customization of content"*. YouTube videos, for example, are easy to be implemented in Moodle (Erturk 2016). Moodle is an open source Learning Management system (LMS) and therefore, it can be customised by users to meet their needs (Freire et al. 2012). On the other hand, Blackboard represents a popular closed source system that can be modified only by their developers (Freire et al. 2012). In a study conducted by Unal and Unal (2011), the participants were in favour of Moodle over Blackboard for all the features with the exception of the discussion forums. Similarly, Muhsen

et al. (2013) found that Moodle as an optimal e-learning platform is more suitable among other LMSs. Further, in their comparison study, Subramanian et al. (2014) also conclude that Moodle was the best among other VLEs in terms of communication tools, productivity tools, and student involvement tools.

In general, the ease of integration with other applications is considered as a preference by students in their preferred VLE (Chawdhry et al. 2011 cited by Chawdhry et al. 2012). In their comparative study, Chawdhry et al. (2012) indicate that there is "no technology is perfect" where technology refers to VLE.

Table 2.5 (adapted from Ion 2012; Moodle 2016) illustrates some statistical facts about Moodle and shows the gradual increase of adopting this VLE from institutions around the world between 2012 and 2016.

Topic	2012	2016	Increase (%)
Registered sites	65,940	72,269	9.60
Countries	218	232	6.42
Courses	5,866,855	10,914,808	86.04
Users	57,064,214	94,490,110	65.59
Enrolments	-	307,178,796	-
Forum posts	97,176,642	191,782,924	97.35
Resources	52,563,498	97,562,824	85.61
Quiz questions	112,539,965	509,119,727	352.39

Table 2.5: Moodle statistics.

NVivo was used to search through 89 articles and papers published during 2005 to 2016. These papers and articles extensively cover VLEs and related issues. The aim of the search was to count the number of times the VLEs (Moodle, Blackboard, Sakai and ATutor) have been referred to in those sources.

N. of Article/ Paper	Moodle		Blackboard		Sakai		ATutor	
	Year*	Occ.	Year*	Occ.	Year*	Occ.	Year*	Occ.
1	2010	**229**	2010	**135**	2009	**78**	2012	**19**
2	2011	**151**	2015	**125**	-	**41**	2016	**17**
3	2011	**141**	2011	**122**	2008	**40**	2005	**14**
4	2013	**128**	2005	**109**	2008	**26**	2009	**5**
5	2010	**128**	2012	**88**	2016	**25**	2008	**5**
6	2015	**125**	2014	**81**	2014	**19**	2011	**4**
7	2010	**122**	2014	**59**	2012	**15**	2008	**3**
8	2005	**101**	2010	**59**	2008	**11**	2008	**3**
9	2008	**99**	2016	**48**	2008	**10**	2009	**3**
10	2005	**96**	2006	**43**	2009	**7**	2012	**3**
Total:		1320		869		272		76

Table 2.6: The VLEs tools as appeared in literature. The "Year" shows the year of publication.

The result as shown in Table 2.6 indicates a considerable difference between the four VLEs. Moodle and Blackboard achieve very high number of occurrences compared to Sakai and ATutor. However, there is a noticeable difference between the top two VLEs whereas Moodle has been mentioned 451 times more than Blackboard. As a result, this statistic would be working as a partial proof that indicates the high acceptance of Moodle as a VLE from researchers' perspectives in the field and, therefore, it reflects the wide spread of this VLE in different types of educational institutions in the world.

2.3.4 POPULARITY OF VLEs AMONG HEIs IN OMAN

As shown in Table 2.7 which is derived from the review of HEIs' websites in Oman, more than a third of HEIs are currently using Moodle for their learning and teaching activities while 14.52% have employed Blackboard as their VLE. Only 4 institutions have adopted their customised solutions such as EduWave, Smart-UMS, EduPortal and E-Learning System.

VLE	No. of HEIs	%	Comments
MOODLE	24	38.71	
BLACKBOARD	9	14.52	
OTHERS	4	6.45	EduWave, Smart-UMS, EduPortal and E-Learning System
Unknown/None	25	40.32	

Table 2.7: Popularity of VLEs among HEIs in Oman.

More details about the VLEs that are being used by HEIs from users' perspectives will be provided in Chapter 5 and Chapter 6.

2.3.5 COLLABORATIVE VLE

"**Collaborative learning** *is an umbrella term for a variety of educational approaches involving joint intellectual effort by students, or students and teachers together. Usually, students are working in groups of two or more, mutually searching for understanding, solutions, or meanings, or creating a product. Collaborative learning activities vary widely, but most centre on students' exploration or application of the course material, not simply the teacher's presentation or explication of it"*. (Smith and MacGregor, p.1)

Collaborative learning is "*The term applies to any pedagogical theory or method that advocates or involves using groups, everything from free group discussions to teach close observation to adults to highly structured systems for organizing lower elementary classrooms*

into teams of students who have their progress regularly charted in order to earn rewards for their achievements" (Smit 1994).

Dillenbourg (2002, p.1) describes Collaborative learning as "*a situation in which two or more people learn or attempt to learn something together*." The author also asserts that this definition is broadest and unsatisfactory due to the possibility of interpreting its main element in different ways.

A study performed by Margaryan et al. (2015) investigating 76 Massive Open Online Courses (MOOCs), highlights that only eight courses were identified to include collaborative activities. Another study conducted by Al-Atabi and Deboer (2014) shows that the utilisation of MOOC reveals a considerable level of student collaboration. The idea behind this is that the learner collaborates with other learners taking the same course or with others within the community (Margaryan et al. 2015).

The potentials of VLEs which support collaborative learning are unfortunately not utilised by educational institutions and their respective stakeholders (Darwaish and Wang 2012).

HEIs extensively focus on investing and implementing VLE as a whole system, but in fact they pay less attention to improving ways of fully activating features of it to improve the delivery of education (Darwaish and Wang 2012).

M'Ballo et al. (2017) investigate issues related to Mobile Computer Supported Collaborative Learning (MCSCL). The management of the learner groups was mainly highlighted due to the frequent changes of geographical position of learners and disconnection of the network.

Google Drive, for example, can improve students' involvement in creating course materials, and therefore, they will become more engaged in peer teaching as well as collaborating with their group members. Moreover, students are also involved in forming the learning activities for future students (Erturk 2016).

The ordinary concept of collaboration using a VLE (e.g. Erturk 2016) consists mainly on splitting students into groups and therefore they collaborate accordingly based on assignments or activities given by their teacher. This view is very limited as it looks at collaboration from a narrow angle and unintentionally neglects various features of collaboration that can be extended and employed by teachers and students in the learning environment.

2.3.6 VIRTUAL INFRASTRUCTURE

Virtual infrastructure tools are developed by some institutions for managing and monitoring Virtual Machines (VMs) within a specific pool of resources (Jin et al. 2010) upon the user's request (Cunsolo et al. 2010).

Valcheva et al. (2015) state that the utilisation of virtual infrastructure in learning would increase the opportunities for participation and enhances student engagement to a wide range of real learning activities. The virtual infrastructure also can provide quicker students feedback and allows them access to more course materials than being on campus (Valcheva et al. 2015).

Virtual infrastructure gives students and faculty members the opportunity to access any specific desktop or virtual computer/server from the web (Valcheva et al. 2015). This means that from anywhere and anytime certain computer systems can be accessed and used beyond boundaries. Simulation software installed in a University's local servers for instance can be accessed by students in their free and flexible time and therefore the same infrastructure can be utilised by unlimited number of students regardless of their presence in campus.

Valcheva et al. (2015) proposes a VICoL which is based on SaaS and consists of a front end (Students Interface) and a back end (Teachers Interface). The back end aims to give teachers the ability to monitor student's progress.

VICoL as proposed by Valcheva et al. (2015) intends to have an intuitive, easy and understandable user interface (UI). VICol tends to have relations with external platforms which rely on three layers; data base transactional layer, XML data API's exchange, and Joint-documents management open convention.

A generic activated middleware, tools and mechanisms are adopted by VICol to prevent any external attack from malicious access, viruses, worms and other Internet threats (Valcheva et al. 2015).

2.3.7 VIRTUAL LABORATORIES

Luna and Sequera (2015) conducted a study that focuses on improving collaborative work of lab groups using cloud tools aiming for writing reports. The results indicate an improvement of 46% of cloud-based implementation in writing reports compared with traditional way as well as improvements of 22% and 40% of the quality of reports and advantage of knowledge respectively. Alamri and Qureshi (2015) state that cloud-based laboratories would remove the geographical boundaries where students carrying out experiments virtually.

2.3.8 PERSONAL LEARNING ENVIRONMENT (PLE)

Personal Learning Environment (PLE) plays a crucial role in changing the nature of learning and teaching whereas learners create and control their learning including goals, content, communication with others and practising social skills (Al-Zoube et al. 2010). The PLE is a learner-cantered approach of learning and is essentially different from ordinary LMS or VLE (Attwell 2009).

Al-Zoube et al. (2010) proposed a cloud computing-based e-learning system that consists of three components, the Content Management System (CMS), the Personal Learning Environment (PLE) and the Smart Agent. The CMS provides registered students with a learning environment and subsequently they are able to get course materials including word documents, PowerPoint presentations, video and others. The PLE is based on the utilisation of Web 2.0 technologies and adopt them in the way that learners get the control over their learning goals, styles, communications and contents. The proposed system employs iGoogle and gadgets as a platform where learners have the choice to use the suitable among them. The third component of the mentioned system is the smart agents; the personalised learning path generation and the generator of multiple-choice questions for exams.

2.3.9 STUDENT LEARNING CULTURE CHANGE: HABITS AND STYLES

Currently, students' tendencies are is to replace traditional ways of learning by incorporating technologies (devices and applications) into their education. As a consequence, "*Today's online students have very different thinking styles and ways of processing information from their predecessors*" (Prensky 2001 cited by Al-Zoube et al. 2010, p.59). Heaton-Shrestha et al. (2007) point out that student learning styles may affect their use of VLEs. Students nowadays are using several devices and platforms to access services and resources via the Internet either for leisure or learning. This tendency can increase the use of VLE tools and collaboration. However, at the same time we cannot assume that all students will have the same view. Therefore, some students who have difficulties working with the new advancement of technology will be hesitant to proceed with it.

2.3.10 GROWTH OF MOBILE DEVICES

Lee and Benbasat (2003) stated that "*Technology development is seriously challenged when users are slow to adopt the new technology*". This applies on the use of mobile devices by

learners and teachers in the context of collaborative learning environment. Undoubtedly, the wide growth of mobile devices and notable acceptance of users to such devices either for accessing information or for educational purposes will facilitate an improving ground for collaborative learning environment.

Statistics on computing platforms (Chaffey 2017) show that the number of global users of mobile devices compared to those using desktop computers has dramatically increased from 400 million in 2007 to reach nearly 1.9 Billion users in 2015 as shown in Figure 2.3. Bosomworth (2015) indicates that 80% of Internet users own a smartphone while 89% of their time spent on media through mobile applications. Khalaf (2017) emphasises that the growth of mobile use in 2005 was 58% and the time spent on mobile has increased by 117% in the same year.

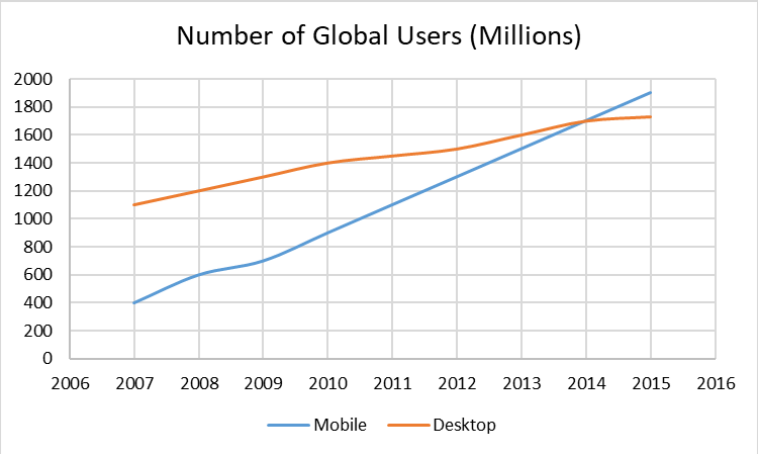


Figure 2.3: Statistic of mobile users compared to desktop users (Chaffey 2017).

Not surprisingly, the dramatic and emerging tendency towards using mobile devices may be considered as a potential indication that to some extent individuals are digitally capable to be involved in collaborative environments. However, it was hardly to find education listed as a target topic for mobile users within these statistics. This can be referred to the small percentage of users seeking education through their mobiles and therefore, education was excluded from the most common statistics in the field.

2.4 THE OMANI CONTEXT

Currently, there is no dedicated and fast network between HEIs in Oman (Al Kharusi 2016). The provision of CBCVLE can subsequently be extended to facilitate services via establishing a high-speed link network between HEIs.

2.4.1 THE SULTANATE OF OMAN

Oman occupies the south-eastern coast of the Arabian Peninsula and in is located in the west of Asia sharing the borders with Saudi Arabia, United Arab Emirates, and Yemen (see Figure 2.4) (Britannica 2016; Ministry of Information - Oman 2016; TheFactFile 2016). The Sultanate joined the League of Arab States in 1971 followed by the Cooperation Council for the Arab States of the Gulf in 1981 as a founding member (Ministry of Information - Oman 2016). Oman as described by Baker (2015) and BBC (2018) as the oldest independent state In the Arab world.

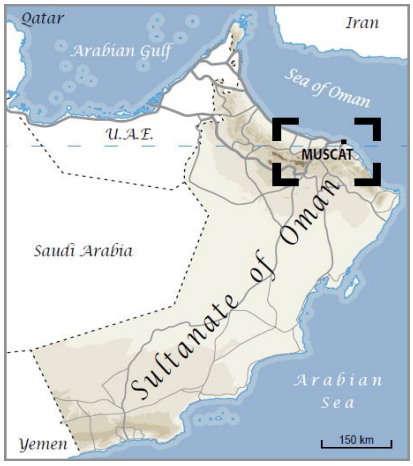


Figure 2.4: Map of Oman.

Source: http://www.tourofoman.om/img/img_5.jpg

Oman, with a total area of 309,500 sq. km and 3,165 km of coastline, is regionally divided into eleven governorates which are subsequently composed of several districts (61) called "Wilayat(s)", each of which is ruled by a "Wali" (local governor) (Ministry of Information - Oman 2016; NCSI 2019).

Table 2.8 (derived from: Britannica 2016; Ministry of Information - Oman 2016; NCSI Oman 2017; TheFactFile 2016) shows diverse facts and statistics about Oman including demographical, geographical, political, and technological issues which in a whole create a comprehensive profile for the country.

Aspect	Details
Capital City	Muscat 23°36'N 58°33'E
Largest City	Muscat 23°36'N 58°33'E
Total area	309,500 sq. km
Coastline	3,165 km
Population	4,432,380 (2016)
Internet users	2.438 million Percent of population: 74.2% (July 2015 est.)

Table 2.8: Facts and statistics about Oman.

As a developing country, Oman has been giving the high attention to almost every single aspect in life especially education which is considered as the keystone of sustainable development. Therefore, higher education in Oman is provided free of charge for Omani students enrolled in public institutions and with provision of local bursaries for enrolment in private Universities and Colleges.

The government has been promoting digital systems, projects and services such as “digital society”, “e-government” (US Commercial Service 2016), and “G-Cloud” (AlRahbi 2015; ITA 2016a; ITA 2016c; ITA 2016d; e.oman 2016) throughout the country.

Oman has been trying to cope with the recent fall in the price of the crude oil (Katzman 2016), and therefore it is expected that governmental support for higher education, and in particular for digital projects, will be affected, especially if this fall continues for the next few years. Hence, it is important for HEIs to be more realistic by promoting an efficient use of a unified CBCVLE. This will help narrowing the gap between HEIs’ expectations and any fall in the local economy concerning financial constraints and political instability.

2.4.2 CLOUD COMPUTING AND ICT INFRASTRUCTURE

The utilisation of cloud computing for VLEs is critical in its significance over traditional methods, particularly in Oman, as stated by Sarachandran (2012), public cloud services were introduced and implemented by several HEIs. The results of a study of 30 organisations in the years 2010 to 2012 indicate a growth of 200% of uses of cloud computing that have increased dramatically (Sarachandran 2012).

Furthermore, Alkindi et al. (2015) explored whether HEIs in Oman have the desire to adopt cloud computing in their services delivery. They noted that a few of HEIs have started adopting cloud computing for learning and teaching purposes, and many are planning to employ cloud computing in the future. Additionally, Alkindi et al. (2015) propose a Higher Education Hybrid Cloud (HEHC) Framework which comprises of four layers: (1) User Interface Layer, (2) SaaS Layer, (3) PaaS Layer and (4) IaaS Layer. The proposed solution incorporates the local infrastructure for HEIs as a private cloud while any public cloud can be utilised within the system. Thus, Alkindi et al. (2015) hope that the Ministry of Higher Education in Oman take the lead and implementing their proposed initiative.

Sarrab et al. (2016) investigate the influencing factors of adopting and accepting Mobile learning by students in higher education institutions in Oman. They adopted a Technology

Acceptance Model (TAM) as a theoretical framework to evaluate the factors concerning M-learning.

In regard to national initiatives, G-Cloud is an Oman's national initiative project of cloud computing which was established in 2015 to serve the Omani government entities for sharing infrastructure and hosting services benefiting from all features of this technology. G-Cloud, which is managed by the Information Technology Authority (ITA) and consists of the main cloud service delivery models (IaaS, PaaS, SaaS) in addition to Business Process as a Service (BPaas) as the fourth model (AlRahbi 2015; ITA 2016a; ITA 2016c; ITA 2016d; e.oman 2016). This initiative concerning cloud computing in Oman can potentially help in hosting VLE tools either for individual HEIs or for a group of HEIs forming a consortium.

Figure 2.5 shows five phases of the G-Cloud project.

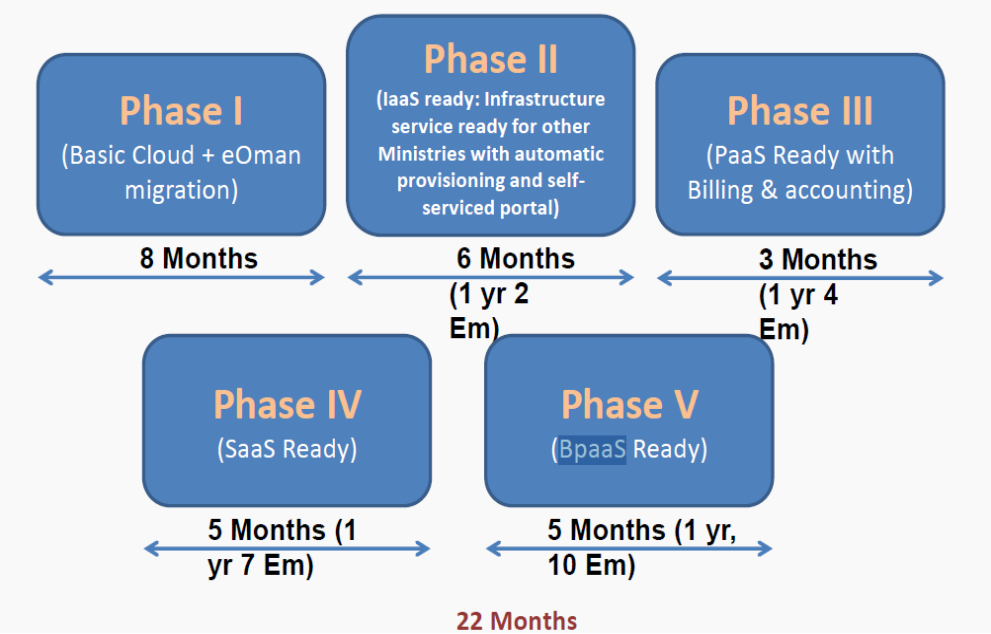


Figure 2.5: G-Cloud Project Phases in Oman (AlRahbi 2015, p.4).

The existence of the G-Cloud project in Oman does not mean that there have not been any other cloud initiatives in the country. There are some individual projects implemented by various companies, government authorities and educational institutions.

The preliminary study for this research indicates that some institutions such as Sultan Qaboos University (SQU), Nizwa University (NU) and Ibra College of Technology (ICT) have built their own private clouds. Unfortunately, these private projects are solely used for the institutions' purposes and are not shared regionally, and they are not supported to go beyond the institution's boundaries.

The dissemination of mobile devices among students would facilitate a good base for collaboration in learning environment. Sarrab et al. (2016) indicate that 47.4% of students surveyed in HEIs in Oman use their smart phones for accessing the Internet.

Recently, Oman has been regarded as one of those countries that offer Internet connections reaching above 100 Mbps while 1 Gbps connections are also available (Oxford Business Group 2017). However, Al Balushi (2010) highlights some challenges that delay the development of ICT in Oman such as lack of essential infrastructure, technical awareness, funding for applied research, and the high cost of ICT services.

The Oman Research and Education Network (OMREN) which is adopted by The Research Council (TRC) in Oman (The Research Council 2019), is the only planned project intended nationally for education purposes. OMREN aims to provide the ICT infrastructure and services for research and educational centres across Oman (Al Kharusi 2016). The Research Council (2019) do not provide the extent to which this initiative has reached so far since 2016 when the idea was developed. Figure 2.6 illustrates all areas covered by the proposed unified educational system through OMREN. Although it is mentioned that this project will be supported by cloud platform infrastructure (Al Kharusi 2016), there is no detailed information about the cloud deployment methods that will be used. Also, it is unknown whether HEIs' private clouds will be incorporated in this national network. Furthermore, by referring to Figure 2.6, it can be noticed that collaborative VLE is not directly and entirely targeted by this initiative even though collaboration is specified and anticipated. In addition, OMREN focuses only on aspects that relate to HEIs and national infrastructure and services. No indications were found to promote the availability and dissemination of users' personal devices and Internet access outside campuses.

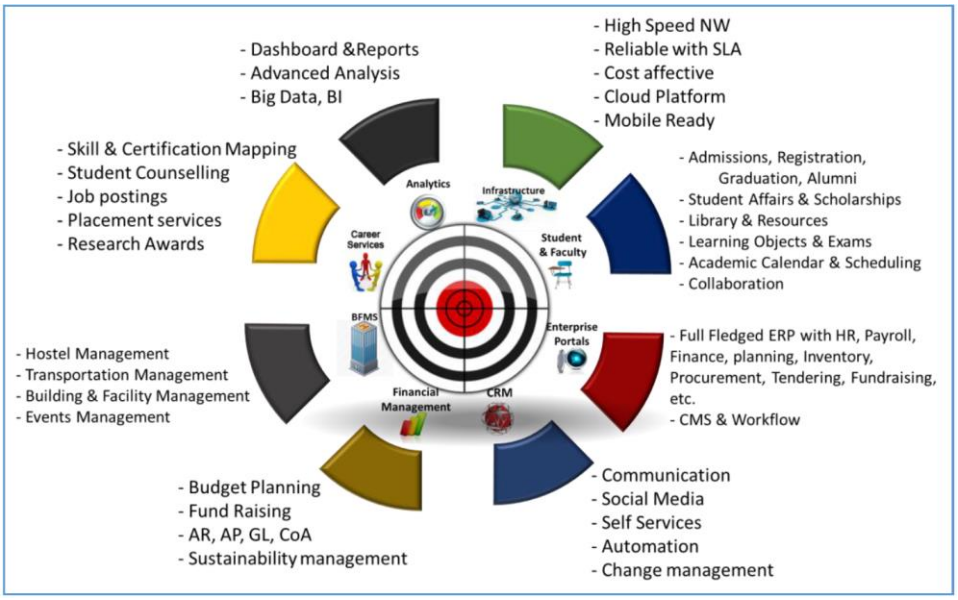


Figure 2.6: Unified Educational System – OMREN (Al Kharusi 2016, p.6).

2.4.3 HIGHER EDUCATION INSTITUTIONS IN OMAN

Oman had its first Higher Education Institution (HEI) in 1986, Sultan Qaboos University (SQU) and during the following three decades, the number of HEIs has increased gradually to reach over 54 institutions (Al Sarmi 2014). This excludes nursing institutes, health centres and academies and training centres managed by Royal Oman Police, the Ministry of Defence and the Ministry of Manpower (Al Shmeli 2009; Baporikar and Shah 2012) as shown in Table 2.9 (adopted from Al Shmeli 2009; Baporikar and Shah 2012; MoHE 2019) and Table 2.10 (Al Shmeli 2009; Baporikar and Shah 2012; MoHE 2019).

Institution Type	No. of Institutions	Affiliation
Public University	1	Semi-Independent
Private University	8	MoHE
Public College/Institute	48	MoHE (7), CBO (1), MoMP (15), MOH (17), MOD (5), ROP (1), MARA (1), DRC (1)
Private College	19	MoHE (17), MoMP(1), MOH (1)
Total:	76	

MoHE: Ministry of Higher Education, CBO: Central Bank of Oman, MOD: Ministry of Defense, MOH: Ministry of Health, ROP: Royal Oman Police, MoMP: Ministry of Manpower, MARA: Ministry of Awqaf and Religious Affairs, DRC: Diwan of Royal Court.

Table 2.9: Types and number of HEIs in Oman.

It is likely that HEIs under the jurisdiction of one authority implement the same solution or system. Examples are presented in Table 2.10 such as Colleges of Applied Sciences and Colleges of Technology.

Under the Jurisdiction of	Higher Education Institutions	No. of Institutions
Independent	Sultan Qaboos University (Government)	1
Ministry of Higher Education	Colleges of Applied Sciences (Government)	6
	Private Universities	8
	Private Colleges	17
Ministry of Manpower	Higher College of Technology (Government)	1
	Colleges of Technology (Government)	6
	Vocational Colleges (Government)	8
Ministry of Health	Nursing Institutes (Government)	11
	Health Science Institutes and Colleges (Government)	6
Ministry of Defense	Sultan Qaboos Air Academy Command and Staff College Air Force Technical College Institute of Topographical Sciences Military Technical College	5

Table 2.10: Examples of Government and private HEIs in the Sultanate of Oman.

2.5 CULTURAL INFLUENCES

This section sheds the light on the importance of incorporating culture and related issues into systems or technologies. It also highlights the possible cultural issues within collaborative VLE and their consequences in such an environment.

2.5.1 INTRODUCTION

Oman as a developing country is different from any developed country in terms of culture, economy, religion, and educational system. This will provide a good opportunity for examining the influence of national culture on the use of a CBCVLE.

The different attitudes towards any aspect of our life as stated by Zivkovic and Zivkovic (2017), is the result of behaviour and values shaped by the cultures. Therefore, the local culture in every society plays a critical role either in welcoming the newcomer of technology or delaying its progress. The users of any VLE are intended to be members of the local community within which thoughts, beliefs, ideas, stories, images, customs and traditions are ultimately embraced by the majority of people. Therefore, cultural aspects can be barriers to acceptance and the use of VLE tools. This is while some other cultural factors may encourage users to utilise such an environment. Local language, for example, can be a common barrier for communities to accept a new technology. Olaniran et al. (2010) argue that cultural factors such as customs and traditions can increase user's uncertainty in respect of VLEs. Therefore, these cultural factors should be considered when designing VLEs.

Some cultural aspects in the West such as movies and music have been adopted by fans from other cultures (Leadbeater 2010). However, the Eastern culture and particularly in Oman including religion, language and family beliefs, values, customs and traditions and practices should be taken into account. Additionally, Oman can be considered as a conservative society (Culture Trip 2019) whereas Omanis have kept their national culture with very little influence affecting it by neighbouring countries. Having this conservative environment, we can say that the local culture of Oman is expected to have a significant impact over the use of a CBCVLE. In a study conducted by Castro (2016), cultural differences such as time zone and languages were further highlighted by several participants as the most relevant issues in collaboration.

This section explores the extent to which the local culture in the world in general and in Oman in particular can affect acceptance and the use of a CBCVLE. One can anticipate that considering cultural influences will produce more culturally aware CBCVLE.

2.5.2 DEFINITIONS

The literature is rich with definitions for culture as authors/writers look at it from different perspective. Here are some definitions:

Edward Tylor is considered the author who provided the first definition of culture in terms of anthropology: (Vatrapu and Suthers 2007) "*culture or civilization, taken in its wide ethnographic sense, is that complex whole which includes knowledge, belief, art, morals, law,*

custom, and other capabilities and habits acquired by man as a member of society" (Tylor 1920, p.1).

One of the most common definitions for culture used in literature is: "*Culture is the collective programming of the mind which distinguishes the members of one group or society from those of another*" (Hofstede 1984, p. 82). Another complementary definition is given by Leadbeater (2010, p. 35) "*Culture is our ever-evolving store of images, texts and ideas through which we make sense and add meaning to our world*."

In addition, Robbins (2008, p.10) states that "*Anthropologists have noted that culture consists of all learned beliefs and behaviors, the rules by which we order our lives, and the meanings that human beings construct to interpret their universes and their place in them*". Further, "*Culture represents the beliefs, ideologies, policies, practices of an organization*" (MSG 2018). Figure 2.7 shows the potential components of culture as highlighted by literature (Hofstede 1984; Hofstede 2007; Khan Academy 2018; MSG 2018; Robbins 2008; Tylor 1920; Weinberger et al. 2007). The various aspects shown in Figure 2.7 indicate the importance of culture in implementing any project as it touches even the people's beliefs and behaviour. For the context of this research, all the above definitions have been adopted.

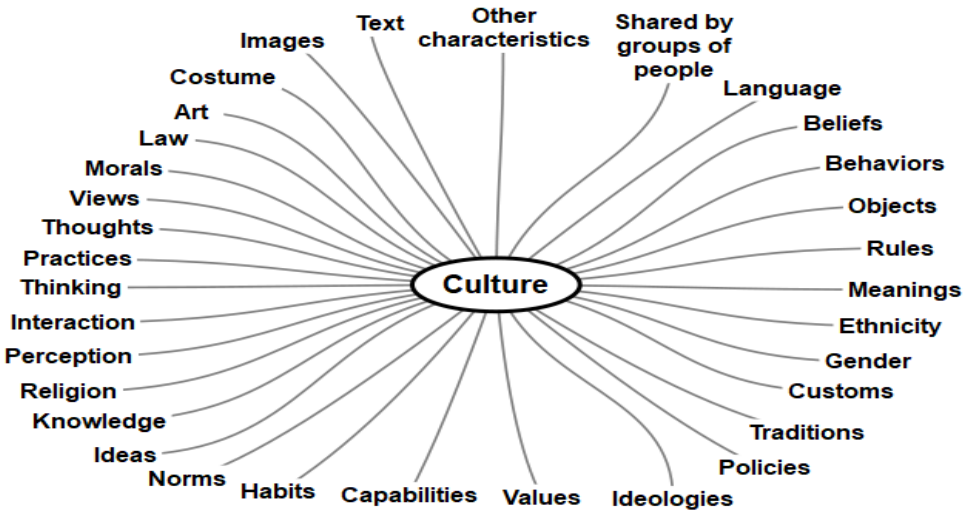


Figure 2.7: Components of culture.

2.5.3 CULTURAL ISSUES

It is not only that HEIs procure VLEs to serve and enhance the educational activities and experience, but various issues must be taken into consideration. Cultural issues among others are anticipated to form barriers/obstacles for the utilisation of collaborative VLE. Hofstede

(1984) states that it is not necessarily that a philosophy which is developed for one local culture would fit another. Culture shapes our life and interests and we find ourselves attached to it (Leadbeater 2010). Therefore, to some extent, the use of a CBCVLE can be affected by cultural influences. This is supported by the fact that all VLE tools employed by HEIs in Oman are imported and not specifically designed to suite Omani culture. As stated earlier in Chapter 2, HEIs in Oman are primarily using Moodle and Blackboard for their VLEs. Blackboard (Blackboard 2017) is a commercial software which comes as a closed package and cannot be modified by clients. Moodle (Moodle 2017) on the other hand, is a set of open source VLE tools which can be fully customised to the HEI's needs including cultural requirements.

There is no doubt that one's culture can be a barrier to accept or reject a system or a service which is originally designed for people with a different culture.

> "*In much of the world young consumers want Western brands. In some parts of the world the new cool is to reject them in favour of tradition*" (Leadbeater 2010, p. 43).

Cultural diversity can be identified by, but not limited to, national culture, ethnicity, language, gender, age (Cox 1994 cited by Oetzel 2001). The local language plays a crucial factor for pushing a project or a program to succeed. An example from the Kenyan County, Kitui, was expressed by Nthiga and Fender (2015) where the local language was used rather than English in a government project. It showed that the response through Short Message Service (SMS) from residents was greatly increased. Hiring a local translator of a destination language will guarantee transference of the exact information and message regardless of conceptual differences of the two cultures. Furthermore, this will ensure avoiding misrepresentation of information (Courage and Baxter 2005).

Research has shown that certain thoughts can be considerably different within one language than in another (Khan Academy 2018) in terms of the design of VLE tools. Therefore, we cannot expect users in HEIs whom mother language is Arabic to achieve their educational goals in the same manner compared to those who are English native speakers. Khan Academy (2018) also asserted that our native language highly affects the way we think.

GALA (2018) defines localisation as: "*The process of adapting a product or content to a specific locale or market. The aim of localization is to give a product the look and feel of having been created specifically for a target market, no matter their language, culture, or location*". Hence, GALA (2018) considers translation as one step within the localisation process beside others such as adapting content and graphics, adapting design and layout, employing local units and measures, and addressing local regulations. Web localisation is described by Sandrini (2005)

as a challenge in using websites while Valcheva et al. (2015) emphasises the ease of localisation as one of required features in collaborative VLE.

Google Maps (Google 2019) demonstrates a good and popular example of cloud-based collaborative navigation tool. It is an evolving application where users have the chance to participate in adding new locations, suggest modification, upload images, give reviews, and collaborate globally. Figure 2.8 shows a map of Muscat, Oman whereas the users' contributions serve for the localisation of the map.

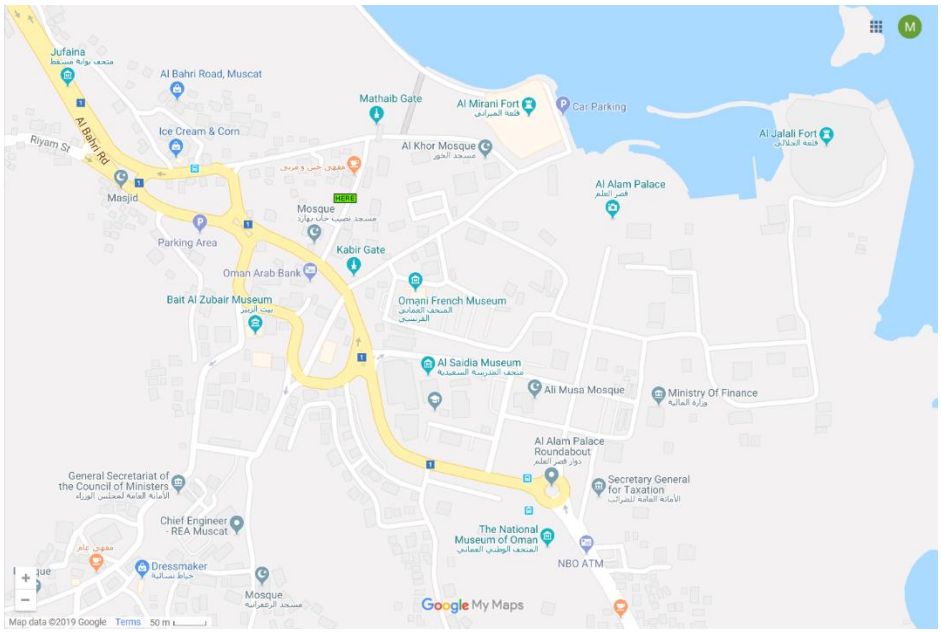


Figure 2.8: Google Maps, an example of partial localisation of a cloud-based collaborative tool (Google 2019).

The potential end users of Google Maps, for example, cannot be expected to ultimately use the app if the text in it is written only in English. Additionally, not all users have the same English language skills that may consider adequate to navigate the English version of the map. However, the localisation in this case (use of local language such as Arabic) attract many users to select the app among other apps. This localisation is not only about translating names of cities, roads and locations into the Arabic language, but rather it combines other issues such as traffic signs, alerts, voice navigation, images, landmark guidance and the user interface.

Another cloud-based collaborative service is Wikipedia (Wikipedia 2019) which consists of millions of articles in several languages. Different versions of this Encyclopedia are extremely localised to meet specific cultures and languages. Figure 2.9 shows the entirely different articles presented in the homepage of both English and Arabic versions which reflect the target audience cultures and interests. Although some articles have translated versions into other languages, however, articles in Arabic, for example, may not have an English version and

vice versa. This is due to various reasons such as the nature of the article, subject, popularity etc.

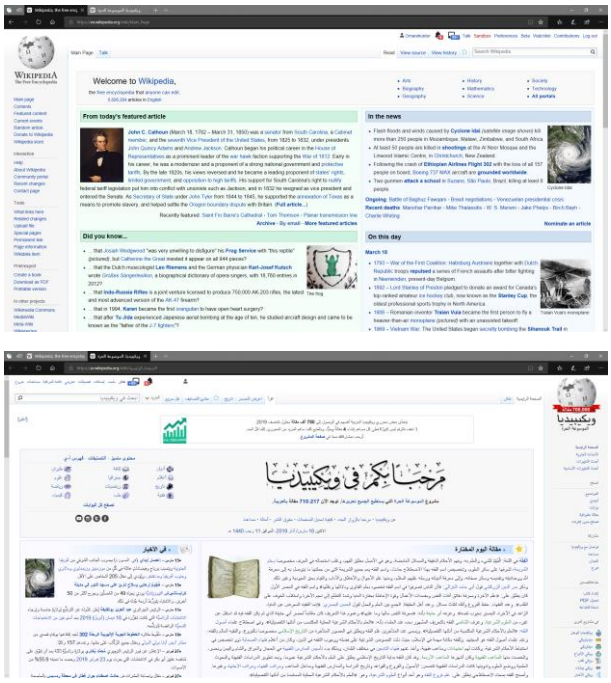


Figure 2.9: Localisation of Wikipedia, English and Arabic versions (Wikipedia 2019).

Sun (2016) argues that a religion is the lead and the root of a culture. Hence, one cannot neglect the religion's impact and domination on cultural aspects of a society. In a Muslim society like Oman, the actions, beliefs and habits of some foreigners who visit the country may contradict with local religious values and instructions. It cannot be expected that, for example, assigning a female student with male students and vice versa is acceptable in HEIs in Oman. Whilst others may disapprove a male student contacting a female student who is not a close member of their family. This may be religiously considered unacceptable action.

Ahuja and Thatcher (2005, p.433) state that "*cultural and social factors influence how men and women view themselves in relation to their work*", therefore, some countries have masculine tendencies compared to others that tend to be more feminine societies.

In a conservative society like Oman, people respect their values and traditions which are inspired by Islam as a religion (Culture Trip 2019; Worrall 2012; McColl 2014). The originality and uniqueness are part of the personality of Omanis which are also supported by their beliefs, habits, customs and traditions. As a Muslim society, Omanis show a huge respect to women and don't allow strangers to even talk to them in any unacceptable way (Culture Trip 2019). The religion and tribal structures are behind the conservativity of this young population society (Worrall 2012).

> "*The patriarchal state, however, fails to recognize the transformative power of women's contemporary behavior, which pushes the definition of "accepted" or "traditional" behavior beyond that found in official documents and local and regional legislation, with their largely male audience*" (Chatty 2000, p.241).

The masculine power supported by the local culture seems to impose itself in various ways of daily life in Oman. Although it is decreasing over the years, however, it can be noted that the potential effects can perceived differently from one region to another in the country.

Chatty (2000) highlighted an example of traditions' effects on the Omani society. After a few years of opening Sultan Qaboos University (SQU) in 1986 and admitting students into the College of Engineering in, female students were suddenly banned from attending or continuing in that College. There was a pressure from some local groups of the society with the reason that such a field of study is not culturally appropriate for women. Consequently, most female students were forced to move to other schools.

Hofstede (2014) emphasises the role of family in the feminine society compared to masculine society:

> "*In feminine society people try to balance family and work. In masculine societies the work clearly prevails over the family and work is an acceptable excuse to neglect the family*" (Hofstede 2014).

The role of family in a conservative society cannot be neglected especially with the clear support from the religious instructions that requires the one to obey and serve their parents for the sake of God. This can be seen when one member helps other members in the family, and sometimes some commitments such as work, or study may be postponed due to a family emergency case.

As in any medium of technology, some users may misuse it intentionally or accidentally. Having implemented a VLE, an HEI would expect their users to use all available tools for educational purposes only. However, this cannot be guaranteed as we cannot assume all users will follow the regulations and use the tools accordingly.

The local community may consider some jobs appropriate for women, and therefore, female staff may be able to contact males. University/College teachers, Nurses and bank staff among others are examples of careers that are culturally accepted even with reservations by some local people.

Oetzel (2001) indicates that members in a multicultural group use different communication styles which may differ or contradict with those that other members may have. Therefore, it

can be assumed that one cannot guarantee appropriate or consistent types of communication and consequently expect the nature of communication to be clear between members of a collaborative group.

In regard to personal differences, Morris and Venkatesh (2000) claim that age differences have been significantly important to researchers. Morris and Venkatesh (2000) argue that different age groups are *cross-culturally* labelled differently which indicates the perception of local community of age groups. According to Morris and Venkatesh (2000), taking cultural factors into consideration when approaching new technology might help to eliminate the difficulties faced by older users.

Younger users tend to show a greater tendency towards technology (Venkatesh et al. 2012). Moreover, unlike elderly people, the teenagers and young adults are anticipated to absorb new technologies. This is supported by the number of the new generation who embrace mobile devices (O'Dea 2019) and deal with ever changing applications and games. In regard to VLEs, one may anticipate the same advantage but in fact other issues such as digital divide and ICT knowledge gap may be present and have an effect on their use and acceptance.

Publishers monetize the delivery of their web-based content and applications where advertisers pay them based on the total number of impressions (Goldstein et al. 2013). Users browsing a website or using a mobile application may be annoyed by advertisements interrupting their browsing continuously when using these free services. Users in HEIs are expected to employ some 3rd party content in their teaching and learning activities. Therefore, some adverts' content may collide with the religion, values, customs and traditions. As a result, some users may not rather use these tools as their cultural values are not considered. This is asserted by Goldstein et al. (2013) who argue that annoying adverts would decrease the number of users visiting a website. Unsolicited advertising is classified by Jayasena (2012) as a risk and a limitation of cloud computing. Although currently there are no tools capable of fully blocking them, there is a possibility that future tools will be able to block them.

"Social loafing" was identified culturally by Tsaw et al. (2011) as a challenge that have effects on collaborative learning where some members tend to show less efforts within a group. A study by Gabrenya et al. (1985) indicated that less social loafing was exhibited by Chinese students compared to American students. Female students recorded less social loafing than male students across cultures. Therefore, a link can be found between gender and members' behaviour within a collaborative group.

Collis (1985) cited by Ahuja and Thatcher (2005) claims that gender differences generated by cultures start at a young age affecting attitudes towards computers. Additionally, Straub

(2000) cited by Ahuja and Thatcher (2005, p.433) sates that "*gender-related differences and stereotypes can be strong enough to create predetermined communication styles that are expected of women and men in many societies*".

Insufficient English language skills are highlighted by participants in a study by Popov et al. (2012) as the most important challenge facing the members of cross-cultural collaborative groups in learning. Again, it can be concluded that the language plays a crucial role in collaborative VLEs. Hence, this might be the case in HEIs in Oman where students, for example, are forced by the education system to use English in VLE including courses materials and communications.

Regarding the gender, it is anticipated that there are some differences between group's members when collaborating online in terms of cultural background. Popov et al. (2012) stated that heterogeneous group composition was emphasised by students as an important challenge within their collaborative environment. Popov et al. (2014) also stated that women's overall perceptions of collaborative learning are negatively affected by the diversity of culturally different group's member. Popov et al. (2013) emphasise that misunderstandings and coordination difficulties are noticeable in mixed-culture collaborative groups.

Chatty (2000) argued that women in Oman are under the influence of their husbands and fathers where cultural constrains may influence whether gender separation can be adopted. Even though there was a considerable decrease in gender segregation in many public and private institutions during the last two decades, still this partially exists in most hospitals and schools. This masculine domination is anticipated to have a negative impact on the overall use of a CBCVLE particularly by female students.

Research has shown that "*age and gender reflect people's differences in information processing (i.e., cue perception and processing process) that in turn can affect their reliance on habit to guide behavior*" (Venkatesh et al. 2012, p.165). As discussed earlier in this section, the conservative culture of the Omani community partially limits female involvements in HEIs. Apart from collaborative activities, video recorded lectures, for example, would by opposed by female students. They may show some levels of resistance and hesitation to collaborate in this context. Consequently, less efforts may be made by female students and possibly some of the features of VLE may be partially used or even disabled.

Popov et al. (2013, p.45) argue that "*Long-term residence in a foreign country can be assumed to create at least some cultural assimilation towards the host culture*". However, this argument may not be applicable to the context of this research as the vast majority of students

are residing in the local HEIs. However, it may apply to faculty members who are mostly non-Omanis and have a different culture.

2.5.4 HOFSTEDE'S CULTURAL DIMENSIONS

Hofstede's cultural dimensions incorporate six measures as follows: (1) Power Distance Index (PDI), (2) Individualism versus Collectivism (IDV), (3) Masculinity versus Femininity (MAS), (4) Uncertainty Avoidance Index (UAI), (5) Long Term Orientation versus Short Term Normative Orientation (LTO) and (6) Indulgence versus Restraint (IND) (Hofstede 2018b).

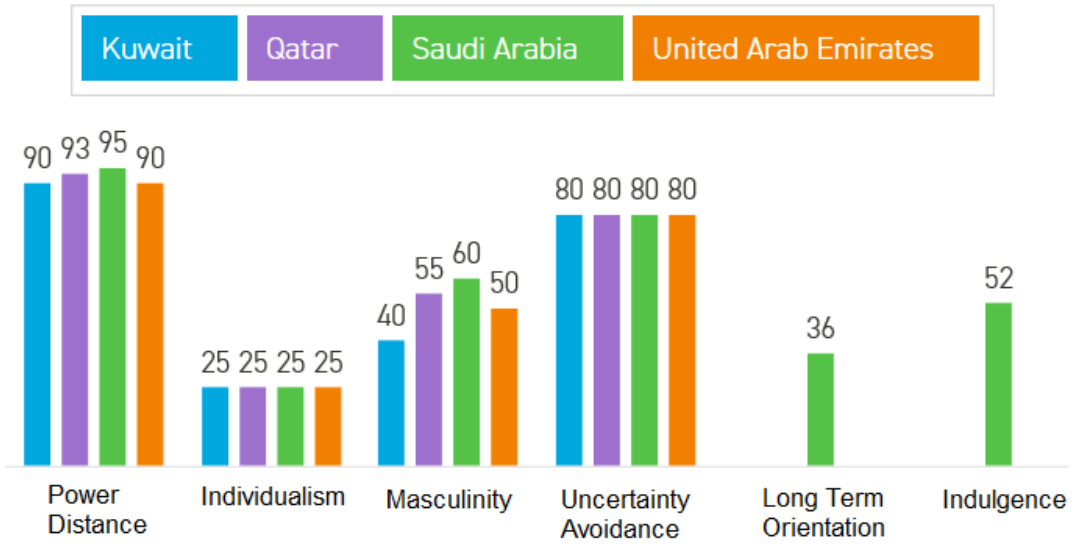


Figure 2.10: Country comparison using Hofstede's cultural dimensions for people in four countries (Hofstede 2018b).

Figure 2.10 presents a country comparison using Hofstede's cultural dimensions between four neighbouring countries; Kuwait, Qatar, Saudi Arabia, and the United Arab Emirates. Oman was excluded from the six dimensions.

In countries with a high-power distance, users tend to have fears to become involved with technology systems which they consider as a threat to their traditional methods (Olaniran et al. 2012). This is due to their local customs, traditions, values and possibly social habits. Hofstede cultural dimensions cannot be used in the context of this research due to the exclusion of Oman in his studies from the six dimensions. Moreover, applying the results of the six dimensions for any neighbouring country on Oman will be ultimately inaccurate as any geographically close countries could be, as stated by Zivkovic and Zivkovic (2017), may be different in relation to their economy and global competitiveness.

2.5.5 CULTURE AND TECHNOLOGY

The emerging technologies during the last two decades have impacted user's perceptions. These, for example, include e-commerce, e-learning, mobile technologies, and the Internet (Wheeler and Keegan 2009).

The implementation of a Western technology or a web-based application in a culturally different country is considered as invasion to the local cultural values and traditions (Olaniran et al. 2010). Urevbu (1997) outlines the nature of relationship between culture and technology whereas the local culture of a region affects any development of technology as well as the changing technological culture. Burley (2010) states the reversible relationship between culture and technology where any evolvement of culture is affected by the advances of technology while the former contributes to shape a new technology. Hence, culture and technology shape and create one another (TEDx Talks 2012).

Neglecting culture can be described as pushing a rock up to a hill as technological tools and culture may not be consistent. Tools built for one culture don't mean that they will be accepted by another culture (The New Stack 2018). Furthermore, Lacort (2016) asserts that a fellow citizen of a region or a country would be the best to identify local problems and provide solutions accordingly. Additionally, the provision of collaborative activities in online learning is highly recommended to initiate the social interaction in VLE (Zhu et al. 2009).

Macfadyen (2006) asserts that users in communications bring their behavioural cultural practices when contacting others online. Therefore, contradiction with other cultural practices is anticipated. Hence, users online and collaborative activities should be culturally tailored (Zhu et al. 2009) to avoid collision with local norms and values.

2.5.6 PREVIOUS STUDIES AND RESEARCHES

The existing research has focused on different aspects of cultural influences within collaborative learning such as: culturally homogeneous and heterogeneous groups in regards to age, gender, and ethnicity (Oetzel 2001, p.19), cultural differences in argumentative knowledge construction (Weinberger et al. 2007), culturally heterogeneous groups within computer-supported collaborative learning (CSCL) (Popov et al. 2012; Popov et al. 2019; Zhu et al. 2009), cultural challenges in collaborative learning (Olaniran et al. 2010; Popov et al. 2012; Popov et al. 2014), effect of culture and gender on collaborative group members behaviour (Gabrenya et al. 1985; Tsaw et al. 2011), collaboration in culturally mixed groups (Popov et al. 2013), culturally mixed group's members using the collaboration script (Popov et

al. 2013). Most of these studies are cross-cultural based, but their focus is different to this research.

Zhu et al. (2009) conducted a study with an experiment to measure how two culturally different groups perceive online collaborative learning. The experiment investigated a Flemish group (N=217) at a Belgian University and a Chinese group (N=165) at Beijing Normal University. The results confirm that the first group perceived the target environment more positively than the second group. Therefore, cultural factors have a crucial impact on the user's perception with regard to online collaborative learning. The study recommended that special consideration should be given during the design and implementation of VLEs across cultures.

Olaniran et al. (2010) examined cross cultural challenges in the implementation of Web Based Instruction for collaborative learning. Their study employed Hofstede's cultural dimensions and perceptions of culture and technology. It also covered language barriers and user's cultural preferences. The study pointed out that if cultural factors are not considered, the users will face distraction, discouragement, unwillingness and even rejection of the whole technology.

Khashman and Large (2012) studied some design characteristics of 100 governmental Web Portals of 10 Arabian countries including Oman using Hofstede's cultural dimensions. The study conducted content analysis to investigate similarities and differences between the selected sample of websites. The study concluded that Hofstede's cultural dimensions do not reflect the design features of user interfaces of these websites' interfaces.

Popov et al. (2012) examine possible challenges in multicultural student groups in HEIs and how students culturally perceive the challenges. Students (N=141) from 40 different countries have ranked the challenges. "*Insufficient English language skills*" and "*students not communicating*" were the most important challenges rated by students. It was concluded that student's perception of the importance of challenges are impacted by their cultural background.

Another study conducted by Popov et al. (2014) employed a mixed method approach to investigate the students' perception within CSCL. The sample includes 56 Dutch and 64 international students. The results indicate that the students' perception on collaborative learning was affected by intercultural students who were members in the same group. Moreover, female students had a more negative perception for collaborating online in cross-cultural learning groups. Therefore, culture can have an effect on students on how to manage their collaborative learning virtually and interculturally.

The above studies in general have adopted several approaches to investigate cultural effects. However, those studies have not directly addressed some cultural influences and challenges such as family influence, attitude, occupational position of users, VLE content including commercial adverts, and the religion. In fact, Popov et al. (2012) have considered both cultural and non-cultural challenges in the way that the study comprised a combination of challenges encapsulated in a cultural context. Popov et al. (2014) focused only on investigating challenges affecting collaborative learning groups that include diverse cultural background of associated members. Accordingly, this thesis investigates various cultural influences pursued by literature as well as the views of the delegate users in HEIs.

2.6 CHAPTER SUMMARY

This chapter discussed various concepts of this research including cloud computing, virtual learning environment, collaborative VLE, the Omani context, and cultural influences. Examples of cloud services and applications in education were discussed and challenges and concerns were highlighted. Brief information about collaborative VLEs was given while more details will be presented in Chapter 3. Relevant definitions related to this research were stated and features of cloud computing and VLE were explained. The chapter also outlined the status of cloud computing in Oman as well as HEIs. Finally, culture was emphasised as a very important feature in respect of a collaborative environment and issues that may have an impact on the use of a CBCVLE were discussed.

CHAPTER 3: CLOUD-BASED COLLABORATIVE VLE

This chapter focuses on the literature review of the core concepts of this research. It discusses differences between traditional and cloud-based VLEs. It then focuses on the capabilities of collaborative VLE, collaborative tools and resources as well as users' perception of collaborative environment. Users' experience and expectations are also discussed and their effects on the users' attitude toward using and accepting collaborative VLEs are investigated. Finally, concerns, challenges and factors that may affect the utilisation of this collaborative environment are identified and discussed.

3.1 INTRODUCTION

The traditional VLE, nowadays, may be implemented in almost every HEI (Subramanian et al. 2014), but the question raised is the extent to which collaborative learning is supported by VLE tools. It is expected that HEIs would support collaborative activities in their academic programs, however, it is debatable whether users can find the tools and applications provided supportive and suitable to use for their education.

The nature of VLE would be an important factor towards attracting students and teachers to explore most of the collaborative activities available for them. Unsurprisingly, both teachers and students would expect more than are available to which they lack specific requirements that would be beneficial if exist. For instance, mobile application to access VLE if does not exist is required by users to be implemented.

Challenges surrounding this environment are anticipated and can be managed by HEIs to facilitate a hassle-free collaborative VLE. Cultural influences as well as other challenges may limit the use of such environment. For example, some users may be reluctant to accept a global tool or application that has no support provided for localisation.

Universities and colleges require a collaborative cloud service which investigates challenges such as risk, security, and governance as well to decide which academic activities would be best available on the cloud (Educause and Nacubo 2010). Such challenges apparently exist in every organisation and should be analysed and treated carefully to achieve a stable implementation of cloud computing.

In their study, Sinex and Chambers (2013) implemented Google Drive spreadsheets and forms to invoke online collaboration between chemistry students during lab experiments. They also adopted Google Chat without the need for students' registration. The experimental data are gathered collaboratively and entered by the teacher in a Google Spreadsheet which can be

downloaded and analysed whenever required. In such an environment, a student would be more encouraged to be involved in collaborative activities including anonymous participations in online forums' discussions or chats.

The most important feature of using cloud-based applications and tools is that it highly supports collaboration and sharing files and documents between users in HEIs (Al-Zoube et al. 2010). Google Docs for example, facilitate collaborative editing between students and researchers and eliminate any difficulties that were exist in traditional system. Heaton-Shrestha et al. (2005) noticed that the main use of VLE is broadly to deliver course content only and not to encourage collaboration among students. Al-Zoube et al. (2010) highlight the issue that cloud computing has influenced the technique used in developing and accessing applications. Therefore, this issue should reflect on current versions of VLEs especially those hosted in cloud environment besides other systems that may be capable for cloud but are hosted locally. Some collaborative editing software require desktop web browsers to support advanced functions and consequently, this will limit their use by mobile users (Li et al. 2014).

Despite of the debate that multicultural collaborative groups are identified to have better performance compared to monocultural groups (Thomas 1999 cited by Salas et al. 2004), challenges and concerns are perceived by members of culturally heterogeneous collaborative groups (Salas et al. 2004).

3.2 PREVIOUS STUDIES AND RESEARCHES

Collaboration is described by Jeong and Hwa-Hong (2012) cited by Yadegaridehkordi et al. (2015) as a great feature of cloud computing that is a considerable motive for delivering attractive educational services to an HEI's users. White et al. (2009) highlight the rapid progress that cloud computing is achieving in utilising this technology as a collaboration tool in universities. Therefore, collaboration plays an important role in utilising a cloud-based solution in HEIs. This collaboration may be extended to include any collaborative work in establishing the cloud-based solution, and also to cover any collaborative activities in learning and teaching.

Vance (2011) also states that initial barriers such as cost of infrastructure to adopt collaboration in institutions were removed by cloud computing characteristics. Moreover, the users will remain using the same applications that they have been using but within a cloud-based environment (Vance 2011).

Liao et al. (2013) state that a collaborative cloud would additionally have more infrastructure elements than those in any typical cloud such as storage, hardware, servers and computer networking. Nonetheless, in their proposed model, they consider users (e.g. collaborators such as students, instructors and teaching assistants) to be important resources in a collaborative e-learning environment.

Although cloud-based collaborative tools such as Google Documents are freely available for use especially for the education community, it can be argued that a large number of institutions are not utilising such tools for their learning and teaching activities. White et al. (2009) state that public cloud applications have been an attractive solution for managers due to its low or no switching costs and training.

Cloud computing affects the way teaching and learning can be provided using VLEs due to its crucial impact (Tuncay 2010 cited by Hossain and Huang 2012). This environment can produce a new generation of e-learning systems which may be accessed via a variety of electronic devices (Masud and Huang 2012). The cloud-based education environment is described by Fern´andez et al. (2012) as a natural platform to support e-learning systems and to be an accurate alternative to conventional data centres. From the same perspective, Taheri and Parsaei (2015) assert that a cloud-based e-learning solution would help Universities and Colleges to reduce the cost of the infrastructure, software and human resources.

Subsequently, geographical separation of students group's members is not considered as a barrier in the presence of cloud applications (Luna and Sequera 2015).

Users in HEIs are potentially considered as a fundamental element in collaborative environment as pointed out by White et al. (2009). The more satisfied and happier the users are with cloud-based collaborative methods, the more productive and engaged they are with the project and other team's members. In their study, Luna and Sequera (2015) emphasise that cloud tools give learners more availability to work in groups and to achieve self-responsibility demonstrations and motivation. It is apparent that employing the SaaS model will reduce the cost of traditional VLE licenses and eliminate the need for investing in hardware, local networks, security solutions, upgrade and maintenance expenses (Ahmed 2015).

Meske et al. (2014) argue that there is a high degree of distrust of commercial cloud providers compared to public academic institutions. Therefore, to provide an alternative to commercial providers HEIs should host an in-house cloud solution for the academic community. By implementing this initiative, HEIs would compete with other commercial cloud providers if issues such as storage volume, functions and features, data protection, work in mobile,

interdisciplinary and distributed dimensions, are taken into consideration, and hence, it will represent a stable and efficient collaborative tool for HEIs.

When choosing a technology to be introduced in an institution, managers usually explore issues concerning cost benefit analysis while other collaborative environment members inspire the potential features of the technology which may help achieving their tasks (White et al. 2009).

Sarrab et al. (2016) express "digital collaboration" among other areas of ICT such as "computer-based learning, virtual classroom, web-based learning and other learning technologies" can change the users' style of learning towards mobile learning. Al-Zoube et al. (2010) assert that cloud computing would deliver low-cost solution for HEIs and their community members. Moreover, Sarrab et al. (2016) state that "feeling of isolation, separation, or of being out-of-the-loop" is one of the future concerns of mobile learning adoption as a result of working separated from others. In fact, this can be true for some learners or specifically for the minority of learners, but in the same time it opens the door of diverse opportunities for plenty of learners to work collaboratively on a course's assignments and activities through mobile environment and cloud technologies.

Doelitzscher et al. (2010) state that the utilisation of Single Sign-On (SSO) would be beneficial to an organisation as multiple authorisation gateways will be avoided, and the focus of users' management will be primarily on a single gateway. In this context, Shibboleth is open source software used for single sign-in web-based applications whereas organizations can perceive a decision of an individual access and issue an informed authorization decision accordingly. (Internet2 2016) Even though Shibboleth is free, but organizations are required to join the consortium to perceive the continuity of the system. Academic institutions are required to pay an annual fee of 2000, 4000, or 6000 Euros based on the number of users: up to 10000, 50000 and more than 50000 respectively (Shibboleth 2016).

Sayler et al. (2014) address the deployment of virtualization and software packaging systems for all computer science courses for access and use from Bring-Your-Own-Device (BYOD) which has proven to provide a cost efficient and easy to use development environment.

Luna and Sequera (2015) proposed a model for cloud online learning environments that is based on the Massive Open Online Courses (MOOCs) hosted on cloud supporting large number of students with BYOD. The study employs a practical experiment that consists of using Google Apps services and MOOCs, in conducting laboratory reports for chemistry lab. The study proposes an architecture for e-learning platforms and mechanisms for collaborative

work in the cloud for using laboratories. The proposed architecture consists of four layers; the cloud services, virtualization, MOOCs and BYOD respectively (Luna and Sequera 2015).

In their study, Luna and Sequera (2015) conclude that Universities and Colleges would benefit from the current ICT infrastructure as the base for their private cloud as well the utilisation of public cloud, all of which represent scalable platforms within ecosystems context. Figure 3.1 illustrates the Architecture and mechanism for collaborative work in conducting laboratory reports using cloud computing.

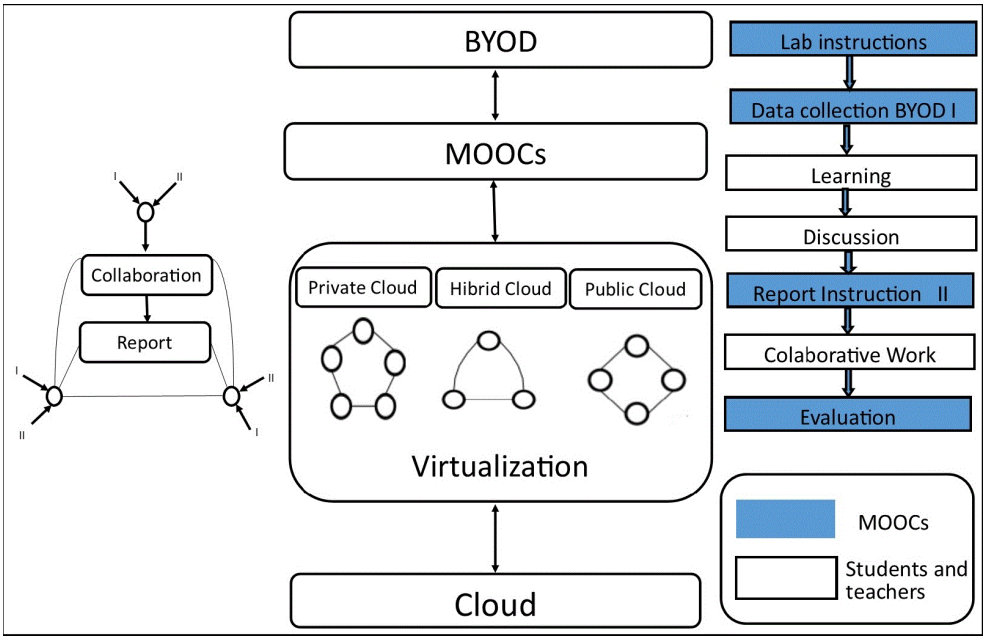


Figure 3.1: Architecture and mechanism for collaborative work in conducting laboratory reports (Luna and Sequera 2015, p.1439).

Botelho et al. (2019) conducted a comparison study to assess users' experience employing collaborative cloud-based tools against traditional ones. The study indicates that the use of collaborative cloud-based is "*more useful, easier to use and learn and more satisfactory than a traditional paper system*".

Bhatia et al. (2018) proposed design and Implementation of a private cloud for higher education using OpenStack. Their solution is based on IaaS which deals mainly with the infrastructure and more specifically with the provision of virtual machines to support IT courses that require more advance and versatile devices, software and operating systems. Figure 3.2 illustrates the actions and the interactions between the users' roles and groups within the proposed private cloud.

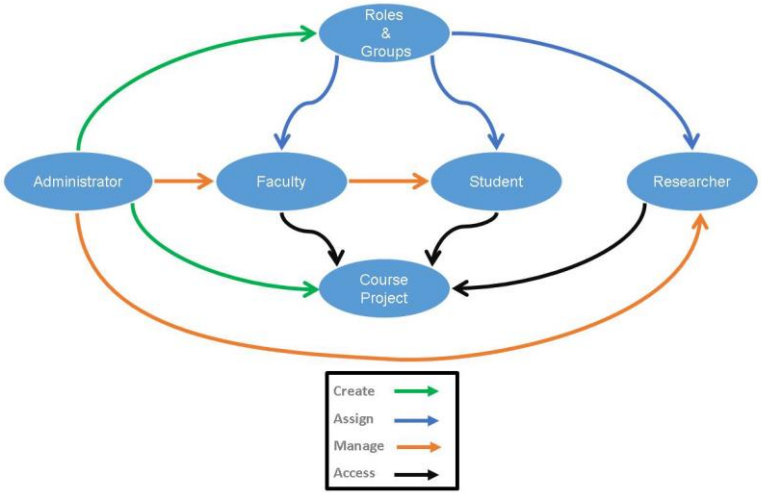


Figure 3.2: HEI Private Cloud Design (Bhatia et al. 2018, p.4).

This proposed design can be collaboratively extended to include more HEIs in the country to help with cost and resources sharing between the members of a consortium. In addition, Aldoayan et al. (2019) outline issues and challenges related to collaborative cloud-based online courses concerning students' learning culture, experience of academic staff and students, learning resources, and the financial aspects.

3.3 ICT TO SUPPORT CLOUD-BASED VLES

It should be noted that running an application or a service in the cloud requires sufficient bandwidth for Internet connection in both ends; the cloud server and the user's device. The cost of the Internet service is one of the important factors as it should remain affordable to both users and HEIs within the country. Furthermore, Spiteri et al. (2016) identifies broadband quality to access the VLEs as a major challenge among others.

Moreover, in a recent investigation conducted by cable.co.uk (Cable 2019) that ranked global mobile data pricing for 1GB of mobile data within 230 countries Oman was ranked 173rd with the average of 11.28 USD while India (a neighbouring country) scored the 1st place with an average of 0.26 USD. With such figures Oman is considered to be one of the most expensive countries in terms of the cost of communicating mobile data. This highlights the possibility that some users in the HEIs especially students cannot afford to buy mobile data plans which are anticipated to help them using VLE tools. This is a situation that has to be remedied as highlighted by authors such as Le Roux and Evans (2011, p.11) who state that cloud computing "*can no longer be seen as a luxury available to only a select few*", pointing out the need for distributing the ICT infrastructure to every part of the country.

3.4 DIFFERENCES BETWEEN TRADITIONAL AND CLOUD-BASED VLEs

As illustrated in Figure 3.3 (derived from White et al. 2009), the traditional system regularly constrains team members to work autonomously and afterward merge their individual contributions to the last edited document. On the other hand, a cloud-based application allows individuals to edit a specific document simultaneously, creating a collaborative work, frequently in less time (White et al. 2009).

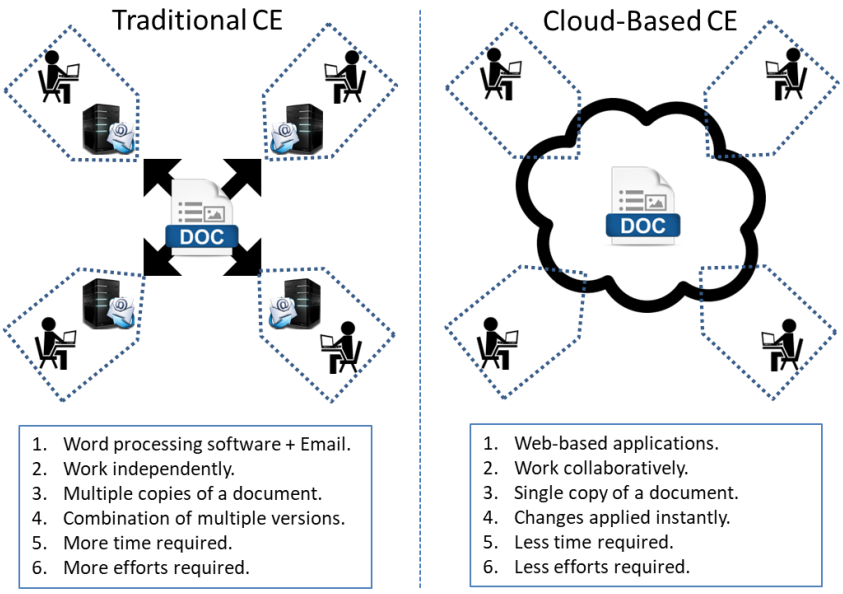


Figure 3.3: Traditional vs cloud-based collaborative environment.

Moving a VLE to cloud seeks potential benefits and features of the entire technology. Table 3.1 shows some of the features and characteristics of e-learning systems before and after migrating to the cloud.

E-Learning Characteristics	**Before Moving to Clouds**	**After Moving to Clouds**
Need for Deployments	✓	×
More Loss of control of any application or resources	×	✓
Conflicts between opposing goals of different clients, either play it together if not need to separate them	×	✓
Higher risks of Resource availability and failure	×	✓
Lack of trust in data alteration before storing	×	✓
Denial of Service attack in critical server health	×	✓
Higher risks of Stress, load and congestion	×	✓

Difficult to audit	×	✓
Monitoring of client logs and information by third party	×	✓
Need for Technical IT Support for Fail over	✓	×
Need for e-Learning System Development Team	✓	×
Need for extra hardware and software Resources	✓	×
Need to configure latest technology updates	✓	×
Need to arrange own extra power and cooling	✓	×
Lack of computation and accuracy Trust	×	✓
Lack of confidentiality	×	✓
Lack of trust on security policies and access control	×	✓
Daily Storage and Backup burden	✓	×
Huge cost	✓	×
High speed Internet connection	×	✓
Subscription and registration charges	×	✓
Need for requirement gathering and Elicitation	✓	×
Need for Project Management	✓	×
Need for Coding	✓	×
Need for Testing	✓	×

Table 3.1: Comparison of an e-Learning system before and after moving on to Cloud (Ahmed 2015, p.373).

3.5 CAPABILITIES OF COLLABORATIVE VLE

Valcheva et al. 2015 state that a typical collaborative VLE would include key features such as adaptability, extensibility, scalability, and interoperability. Cloud-based applications such as Google Apps (Conner 2008) that support and enhance collaboration have great features of usability and accessibility. Such applications have a user-friendly interface and they have been entirely free as well are useful for teachers and students but unfortunately, they have not been employed adequately (Luna and Sequera 2015).

Online forums are considered as a popular collaborative tool in VLEs whereas students can post their questions and comments as well respond to others' posts (Calders and Pechenizkiy 2012). A typical collaborative VLE simply incorporates all features and characteristics in traditional VLEs. Bouras et al. (2001, p.14) define a set of requirements as specified by users and are expected to be found in a VLE:

- *To be easy to use.*

- *To offer user-friendly help.*
- *To easily integrate existing digital materials.*
- *To support audio communication.*
- *To give the lecturer the capability to administer her/his own courses and to monitor the learners' progress and participation.*
- *To support multi-modal interaction between the users through visual communication, realistic user representation, and real-time display of users' movements.*
- *To support application sharing and text communication.*
- *To offer tools for recording the communication in learning sessions as well as whole learning sessions.*
- *To visualize the learning environment as realistically as possible.*
- *To offer an interactive and shared whiteboard.*
- *To support audio and text translation into other languages.*
- *To leave certain degrees of freedom for the learners giving them the option of self-control in order to enable them to work autonomously*.

Appendix 1 contains various features of collaborative cloud-based VLEs that can be expected by users. The features are classified under 11 categories that relate to the proposed framework of this research. These categories namely VLEs, compatibility, cost, design, efficient use of resources, encouragement and motivation, environment, initial values, regulations and compliance, risks and challenges, and technical values.

Within a cloud system, teachers create VMs on demand with "*pre-installed software quickly-to-implement laboratory*" (Bandi et al. 2011 cited by Luna and Sequera 2015). This feature can be linked to the VLE's user interface where an instructor can assign every group of students to a specific VM for practicing the course activities.

Actually, most of the cloud applications are web based and do not require special environment to run. In fact, they only need a web browser to interact with the entire application (Ahmed 2015). This indicates a potential feature of cloud whereas any application can be used broadly through any device that supports the web environment. Hence, once the cloud application is practically compatible with a diverse range of users' devices, it will achieve a high acceptance and a positively a high rate of usage. It can be argued that not all traditional VLEs can be accessed fully from mobile devices. However, moving VLE to cloud will eliminate this gap and will provide the proper environment for hosting and development.

In a study conducted by Darwaish and Wang (2012), the participants highlighted some desired features to be included in their VLEs such as (1) instant messaging, (2) calendar, (3) recorded lectures, (4) online file storage, (5) screen sharing.

So and Brush (2008) assert that students who have difficulties in expressing their views to teachers within traditional learning environment, are more willing to communicate through technological mediums of communications. Examples of these media are but not limited to: Email, chat, and online forums.

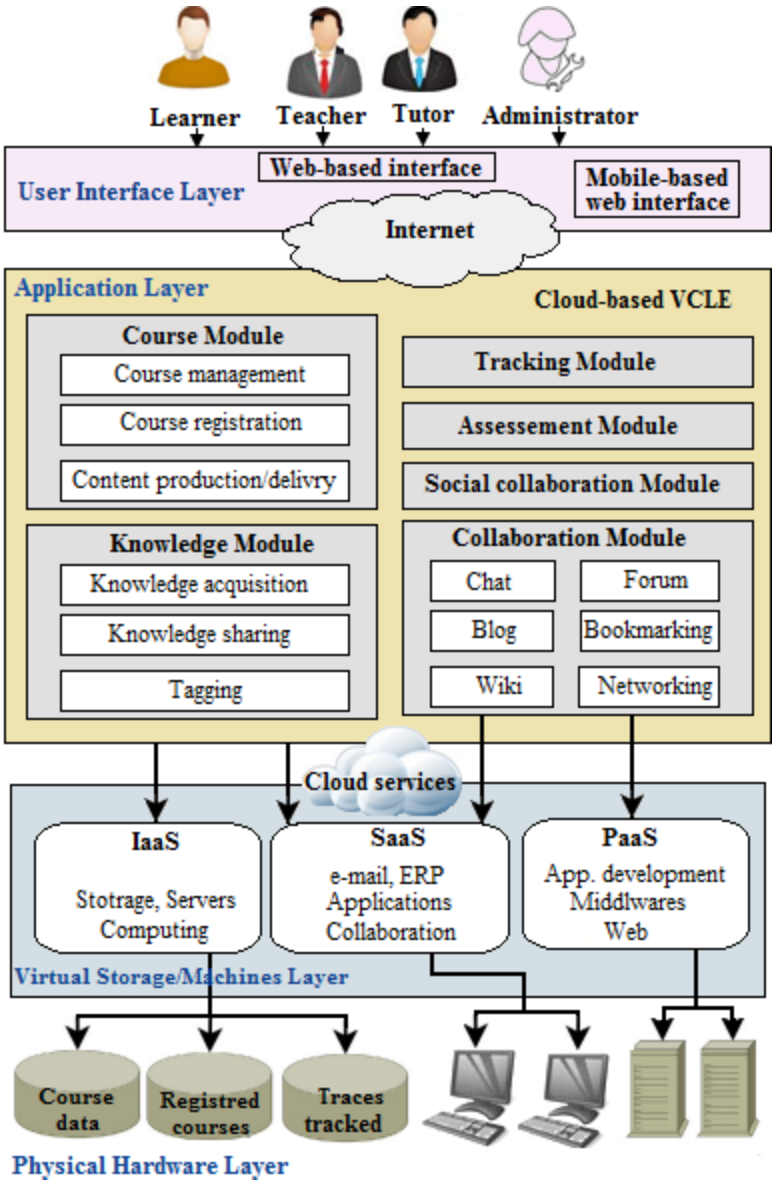


Figure 3.4: Architecture of the cloud-based VCLE (El Mhouti et al. 2016, p.5).

El Mhouti et al. (2016) propose design of a flexible cloud-based Virtual Collaborative Learning Environment (cloud-based VCLE). Figure 3.4 illustrates the architecture of the proposed cloud-based VCLE which is a response to the ever-increasing users' needs in a collaborative VLE.

3.6 COLLABORATIVE SHARED TOOLS AND RESOURCES

The variety of tools and resources within a traditional VLE can be incorporated and extended to services provision for users in this cloud-based collaborative learning environment. In their study, Sinex and Chambers (2013) state that some participants suggest that text chat should be replaced by video chat as the first is time consuming. VMs provides a customisable platform (including OS, web server, database) for end-users to meet their needs (Bhatia et al. 2018; Jin et al. 2010).

Table 3.2 highlights various collaborative VLE shared tools and resources which are revealed from literature. These tools and resources can be adopted and incorporated into the proposed CBCVLE.

Reference / Tools and Resources	Darwaish and Wang (2012)	Doelitzscher et al. (2011)	Sinex and Chambers (2013)	Chibás-Ortíz et al. (2014)	Cunha et al. (2008)	AlCattan (2014)	Lai and Lan (2006)	Jin et al. (2010)	Luna and Sequera (2015)	Malik et al. (2012)	Gilbert and Austin (2010)	Zinnikus et al. (2013)	Stahl et al. (2006)	Pichiliani et al. (2009)
Online discussion (Forums)	✓	✓												
Real time chat		✓	✓	✓										
Calendar	✓	✓		✓										
Wikis and blogs	✓	✓			✓	✓								
E-mail	✓			✓										
Online editor												✓		✓
Attendance record-keeping	✓													
VLE user interface		✓				✓								
Mobile application									✓					
Video (Tutorials, lectures, video conferencing, Audio, images, etc.)	✓	✓	✓	✓										
Teaching resources	✓			✓										
Collaborative peer assessment							✓							

for staff and students														
Collaborative archive of resources (Articles, Essays, reports, spreadsheets, etc.)			✓											
Integration of cloud computing and social media						✓								
Academically related open source software		✓												
Network and ICT infrastructure						✓								
Databases						✓		✓						
RRS Feeds						✓								
Instant messenger	✓													
Voice over IP		✓			✓									
Virtual machines		✓				✓			✓	✓				
Simulation					✓						✓	✓	✓	
Virtual Reality					✓							✓		

Table 3.2: Collaborative VLE tools and resources.

The majority of participants in their study (Darwaish and Wang 2012) highlight instant messaging and calendar as the most features to be added to their current VLEs. This is regardless to the fact that these two features are already provided in Blackboard for example. The authors indicated the reason for this result represents either the complicated design of the software or lack of knowledge of the participants.

3.7 NEW ADVANCEMENTS AND VLEs

Blockchain is considered as a new advancement in computing and related fields. Watters (2016) stresses that "*the blockchain could be utilized to better manage assessments, credentials, and transcripts*".

Examples of universities such as MIT (the Media Lab, specifically) and the University of Nicosia in Cyprus have started utilising blockchain specifically for verification of their cryptographically-signed certificates. Other educational institutions such as University of Nicosia, The King's College in New York, and Simon Fraser University in British Columbia have revealed their intention towards accepting the cryptocurrency for tuition payments (Watters 2016). Levy (2018) stresses that some valuable features of blockchain include identification of individuals and promoting decentralised systems. It should be noted that security and privacy concerns may be eliminated or even controlled by using blockchain which is anticipated to bring a more secure platform for users' data over digital transactions.

The fifth generation (5G) and the applications of Internet of Things (IoT) has also been discussed in literature (Li et al. 2018; Liu et al. 2018) to be a promising advancement to deliver content and services through mobile devices. Ultra-high-definition video and virtual reality (Liu et al. 2018) are examples of applications among others which require the presence of this new evolving technology. This advancement of technology would be considered essential to collaborative VLE whereas new applications require a high bandwidth data.

3.8 USER EXPERIENCE AND EXPECTATIONS

A question is raised to what extent the user's experience and expectations would improve the collaborative environment and also contribute to motivating users to use a CBCVLE. In this context, several factors have been discussed by literature. Tsaw et al. (2011, p.1) claim that "*The connection between motivation loss and culture has proven to be especially robust*". Unal and Unal (2011) assert that the users' experience can be affected as their HEI goes for a cheaper or lighter version of VLE tools to cope with decreased budgets. Members of a collaborative group first pay attention to the group interest before their personal interest and consider the group's success as theirs (Tsaw et al. 2011). This indicates the situation where individuals are gathered to work collaboratively to achieve some common goals as a group and regardless of their personal agendas. In addition, Heaton-Shrestha et al. (2005) emphasise that faculty members who are less familiar with ICT would be less determined to use VLE tools. Vitkar (2012) argues that the implementation of cloud computing in HEIs can enhance the user's engagement in VLE. However, Heaton-Shrestha et al. (2005) emphasises the workload of faculty members is a demotivating factor that discourages them from using the VLE. Another discouragement is mentioned by Hewagamage et al. (2012) who highlight the

dissatisfaction of users (teachers and students) towards the facilities and interface of the m-learning compared to their existing e-learning.

A number of authors have identified "group membership" as an important factor influencing satisfaction. Oetzel (2001, p.19) points out that an "*equal participation and respect were related positively with the level of satisfaction in a group*". A positive participation of a collaborative member is anticipated if accompanied by satisfaction and vice versa. Additionally, Dennis et al. (2008) indicate that understanding the factors that have an impact over the personal satisfaction in collaborative environment, would help to identify factors that may affect the adoption of technologies. Similarly, Lee (2010, p.506) asserts that "*satisfaction has the most significant effect on users' continuance intention, followed by perceived usefulness*". In addition, Dağhan and Akkoyunlu (2016) found that the user's confirmation and satisfaction are significantly affected by information quality, system quality and service quality in the online learning environment. Furthermore, satisfaction with group collaboration is influenced negatively by challenges such as social loafing and lack of trust (Kirchner and Razmerita 2015).

It can be observed that the future participation of group members is affected by their level of satisfaction, and the group performance is affected accordingly (Gouran 1973 and Jurma 1978 cited by Oetzel 2001). It is highly expected that awareness and promotion programs conducted by HEIs would increase the level of satisfaction with users of VLE. However, a decrease in users' satisfaction may result from several factors internally or externally. So and Brush (2008) argue that the users with a high expectation of collaborative learning have positive satisfaction and perceptions of social presence. On the other hand, Williams and O'Reilly (1998) cited by Oetzel (2001) claim that the diversity of gender in a group will result in a negative effect on the effectiveness and males are almost affected. Oetzel (2001) points out that the gender diversity of a group is accompanied by a low level of satisfaction and commitment of members.

User's commitment to the VLE tools and collaborative groups is anticipated to have a positive impact their use of the collaborative environment. Erturk (2016) conducts a study and focuses on preserving satisfaction and commitment of users while using collaborative technologies. User's level of commitment was investigated and found the greater commitment to the technology/tool; the more satisfaction is anticipated. Hew et al. (2016a, p.11) stressed "*Perceived ease-of-use and perceived usefulness influence confirmation and satisfaction*".

Some users show more competence than others, for example, they have easier access to computer, software, and Internet, and their familiarity with computers also reflects their

competence (Zhu et al. 2009) with the aim of ensuring a sustainable learning environment (Schuster et al. 2015). This view is supported by Hew et al. (2016b, p.997) who state that "*Perceived competence has positive and significant influence on behavioral intention to use VLE*".

Engaging the user's confidence has been discussed by many authors. Dennis et al. (2008, p. 23) emphasizes that "*higher levels of ability and confidence will contribute to more favorable performance expectancy*". Further, Rossing et al. (2012) claim that the exchange of training and knowledge between student peers can increase their engagement and confidence. Hence, Vitkar (2012) identifies lack of confidence as a limitation of the use of cloud computing in HEIs. This limitation can be referred to the lack of sufficient training and proper knowledge of users. User's expectations represent the prior stage to using a technology followed by confirmation stage to value its performance compared to the initial expectations (White et al. 2009). In this regard, knowledge and training may help to extend the user's background in order to gain a better judgment. However, in their study, White et al. (2009) indicate that the participants revealed that the systems did not meet their initial expectations.

Lee (2010) claims that users' intentions to continue using VLE tools is very low and even users stop using such tools after a while regardless of their initial acceptance. The users' perception of the usefulness of VLE tools will continuously enhance their intention to use (White et al. 2009). This also confirmed by Joo et al. (2017) who found that the more satisfied expectations, the more the perception of usefulness. Satisfaction has an important role in linking expectation and usefulness, and continuance intention to use. In a different study conducted by Denton (2012) student teachers were found to be willing to use Google Docs in order to enhance their future career of teaching. The understanding of assessments concepts by the same students also found to be enhanced by the use of cloud computing.

The user implementation of technology is directly affected by Task-Technology Fit (discussed in section 3.9), and therefore, the better the fit between collaborative tasks and cloud computing characteristics, the higher the intention to use the cloud-based collaborative applications (Yadegaridehkordi et al. 2014).

Wang and Huang (2016) found that social influences greatly affect the student's intention to use computer-supported collaborative learning. The differences in a student's intention, as argued by Wang and Huang (2016), must be analysed in order to identify their choices concerning the technologies. Hew et al. (2016a) argue that when users trust a VLE (perception of security, reliability and trustworthy), their intention to use will be increased.

Overall, it is anticipated that user's experience and expectations play a critical role in directing them to either accept a CBCVLE or to build barriers that may distract them from using such environment. The whole experience can be reflected through the user's confidence, satisfaction, engagement, intention to use, continuous intention, competence, perceived benefits/usefulness, perceived ease of use, and commitment.

3.9 USER PERCEPTION OF COLLABORATIVE ENVIRONMENT

Yadegaridehkordi et al. (2015) stated that "*it is expected that cloud solutions that exhibit powerful collaboration capabilities result in higher task-technology fit and in turn improve user performance and satisfaction*". This indicates the potential features of cloud computing to meet the changing style of learners in particular and teachers in general within the collaborative learning environment.

Vance (2011) asserted that "*the rise of cloud computing is fundamentally changing collaboration*". This points out the high number of potential features that strengthen the base for employing collaboration between users for multiple activities.

No.	Theory	Reference
1.	Task Technology Fit (TTF)	Yadegaridehkordi et al. (2014) Yadegaridehkordi et al. (2015)
2.	Technology Acceptance Model (TAM)	Lee (2010) Yadegaridehkordi et al. (2015) Sarrab et al. (2016) Unal and Unal (2011)
3.	Perceived usefulness (PU)	Davis (1989)
4.	Perceived ease-of-use (PEOU)	Davis (1989)
5.	3C Model	Fuks et al. (2005)
6.	TOE Model	Isaila (2014)
7.	Expectation-Confirmation Model (ECM) Expectation-Confirmation Theory (ECT)	Bhattacherjee (2001) Jiang and Klein (2009) Jiang et al. (2012) Hossain and Quaddus (2012) Lee (2010)
8.	Planned Behavior (TPB) Subjective Norm (SN) Perceived Behavioral Control (PBC)	Ajzen (1991) Morris and Venkatesh (2000)
9.	The Unified Theory of Acceptance and Use of Technology (UTAUT)	Venkatesh et al. (2012)

Table 3.3: Theories applied by researchers in literature.

The expectations of faculty members and students in HEIs towards continuous and promising teaching and learning methods is a reality that necessitates the favourably change (Razak

2009). A study conducted by White et al. (2009) measures the users' satisfactions and perceived usefulness of using collaborative activities through cloud computing compared to those of traditional collaboration systems. The results of the study indicate that the participants' rating of collaborative tasks using cloud computing systems were higher than those of traditional systems. Table 3.3 highlights theories adopted to measure the users' perception in CBCVLEs.

A qualitative study conducted by Yadegaridehkordi et al. (2015) measured the users' perceptions of technology characteristics based on Task-Technology Fit (TTF) model in a cloud-based collaborative learning environment. The coding and analysis of interviews with users resulted in that collaboration, mobility, and personalization features were indicated by participants while other characteristics have not attracted the users' attention completely.
As illustrated in Figure 3.5 (derived from Yadegaridehkordi et al. 2015), the result of above study using task technology fit to measure the users' perceptions of cloud-based collaborative learning environment in higher education shows that the higher level of a characteristics the higher task technology fit is.

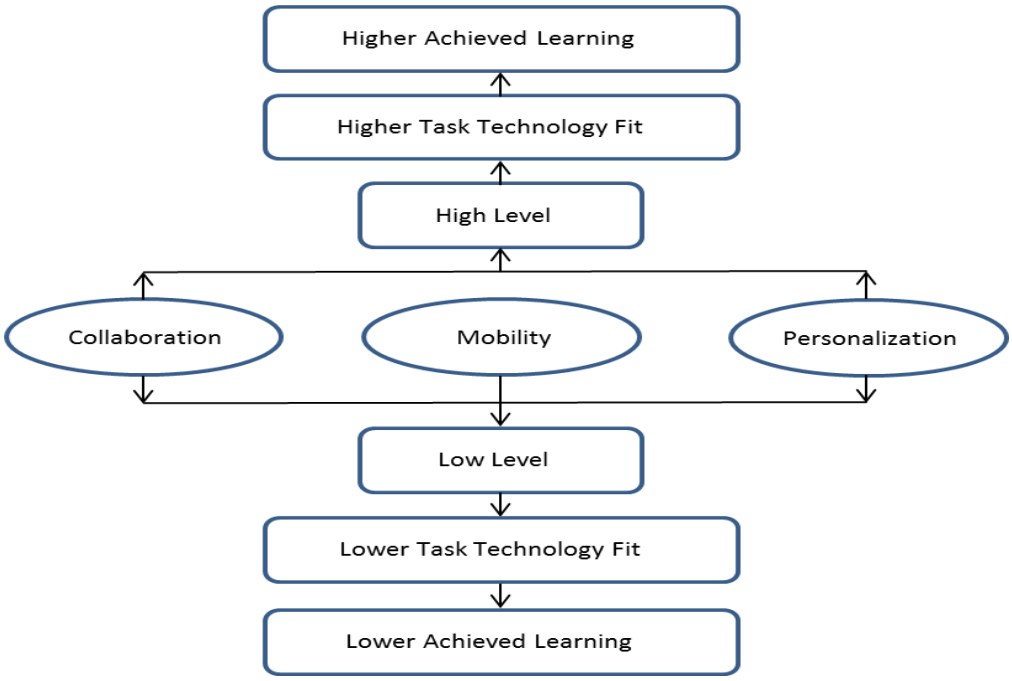


Figure 3.5: Cloud computing characteristics in a collaborative learning environment.

A study conducted by Yadegaridehkordi et al. (2014) adopts TTF model to determine the most important factors that can be used as predictors for the student adoption of cloud-based collaborative learning technologies in a university. The result of study stated that task "non-

routineness" has negatively influenced TTF while other tasks such as "Interdependence" and "Technology characteristics (Personalization, Collaboration and Mobility)" have positively controlled TTF. Significant relationships are existent to be determined when adopting cloud-based collaborative learning technologies under the direct effect of characteristics of task and technology.

As illustrated in Figure 3.6, ECT consists of four constructs, namely expectation, perceived performance, (dis)confirmation of expectation, and satisfaction (Bhattacherjee 2001). Figure 3.6 also illustrates the relationships between the four constructs within this theory.

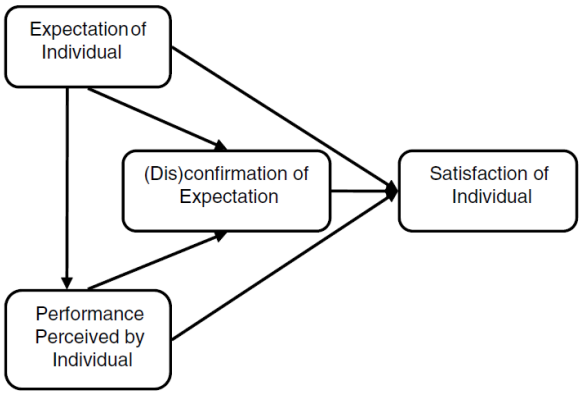


Figure 3.6: Generic expectation-confirmation model (Jiang et al. 2012, p.369).

The simplicity of ECT lies in the level of satisfaction which relies on whether the expectation is met in a positively or negatively manner (Jiang and Klein 2009).

Meske et al. (2014) express that participants (Students – Employees) rated the feature "simultaneous editing of documents" as "very important" (Students: 50% – Employees: 45%) and "rather important" (Students: 32% – Employees: 31%). The same participants also expressed the significance of the feature "data sharing with other students" as "very important" (Students: 70% – Employees: 66%) and "rather important" (Students: 23% – Employees: 23%).

These two indicators prove that collaborative tools are accepted by users who also have willingness to use such features for their learning activities. Furthermore, Venkatesh et al. (2012, p.166) argue that "*the effect of behavioral intention on technology use will decrease as experience increases*".

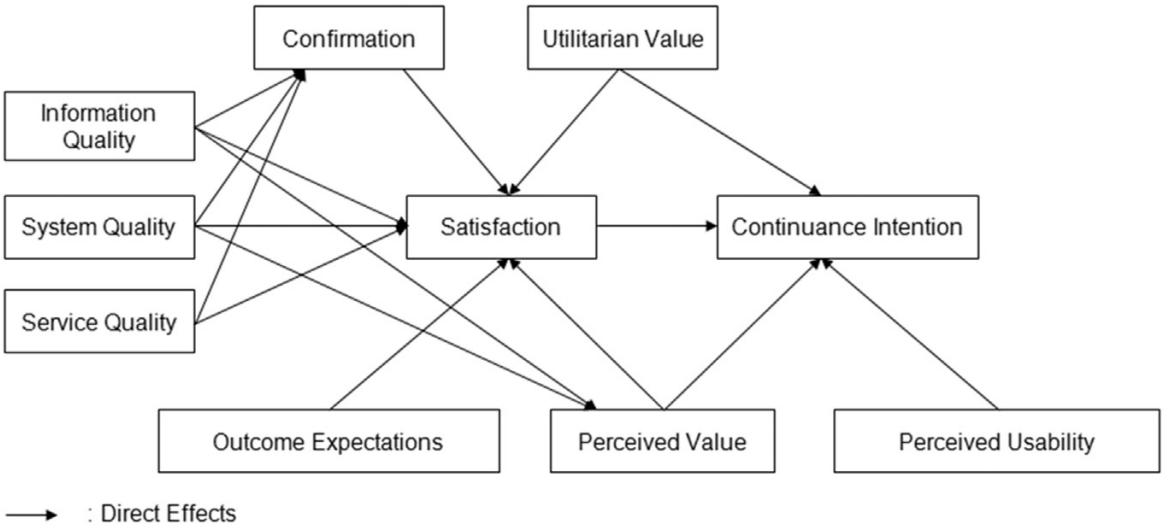


Figure 3.7: Modeling the intention for continuance usage of online learning environments (Dağhan and Akkoyunlu 2016, p.202).

Another model was proposed by Dağhan and Akkoyunlu (2016) for investigating continuance usage intention of online learning environments. The model explains the variance of the satisfaction variable was explained by various constructs including information quality, system quality, service quality, confirmation, utilitarian value, outcome expectations and perceived value (see Figure 3.7).

3.10 CONCERNS AND CHALLENGES OF CBCVLE

This research relates to cloud computing, and therefore most of the concerns and challenges of developing any CBCVLE are the same as those for migrating to cloud computing as highlighted earlier in literature (CISCO 2012; Educause and Nacubo 2010; IDC 2009; Isaila 2014; Jalgaonkar and Kanojia 2013; Lippert and Govindarajulu 2006; Luna and Sequera 2015; Tornatzky and Fleischer 1990 cited by Lippert and Govindarajulu 2006; Yeboah-Boateng and Essandoh 2014). Table 3.4 shows relevant concerns and challenges that the implementation of a CBCVLE may face. In the Omani context, Oxford Business Group (2017) states that "*lack of connectivity and low connection speeds*" were identified as challenges for the government entities to establish and expand their e-services across the country.

In their study, Doelitzscher et al. (2011) highlight some concerns that, if well treated by institutions, would support the desire to adopt CBCVLE. These concerns are but not limited to: security, privacy, recovery, Integrity, security of user data and transactions, regulatory compliance, and data auditing.

It is recommended that when migrating to cloud, HEIs should choose a trusted Cloud Service Provider (CSP) as well as a robust service level agreement (SLA) and to guarantee accordingly availability, transparency, compliance and the quality of service (Al-Ghatrifi 2015).

Al Naibi et al. (2015) states that malfunctioning and frequent interruption of the Blackboard learning system forced faculty members in CAS in Oman to seek alternative tools. CAS (6 colleges) share one VLE which is administered by MoHE which governs CAS. None of the colleges have control over the VLE's ICT infrastructure.

The vendor of commercial VLEs such as Blackboard normally controls the full functionality of software from being implemented and utilised by users. Virtual classrooms, for example, remained inactive for a long time as the vendor delayed to respond to their client requests. This is in addition to the problem of incompatibility of Blackboard with different web browsers where some functions work only with one but not with other browsers (Al Naibi et al. 2015).

In the context of collaboration, Castro (2016) identifies 34 issues which may have an effect on a collaborative group. These issues, for example, include lack of incentives, lack of training, lack of support and lack of knowledge sharing.

CONCERNS AND CHALLENGES	
Not all applications run in cloud	
	Not all mobile devices support cloud
Level of security and protection of sensitive data	
	Security of cloud services
Lack or limited training	
	Lack or limited institutional support
Lack of mobile device	
	Lack of a proper computer to use
Lack of incompatibility	
	Complexity or bad of user interface design
Lack of awareness	
	Not all mobile devices support cloud
Limited/lack of Internet connectivity	
	Hard integration with in-house and existing systems
Not enough ability to customize	
	Availability and reliability issues
Compatibility with existing systems	
	Learning capability of students
Limited technical knowledge about similar technologies	
	Compliance issues
Intellectual property laws	
	Standards adherence
Lack of internal expertise and knowledge	

	Uncertainty with new technology
Institutional readiness	
	Budget and funding
Top management support and involvement	
	Resistance towards new technologies
Conformity with learning culture and style	
	Lack or limited awareness of perceived benefits
Unknown risk profile	
	Legal and regulatory issues
Lack or limited adequate technical support	
	Trust in the cloud service provider
Dependent partner readiness	
	Lack or limited willingness for collaboration
Social Loafing	
	Lack of coordination
Lack of trust	
	Different backgrounds of team members
Cultural differences in the team	

Table 3.4: Concerns and challenges of CBCVLE.

Table 3.4 illustrates the overall concerns and challenges highlighted by several studies (Al Naibi et al. 2015; Castro 2016; CISCO 2012; Doelitzscher et al. 2011; Educause and Nacubo 2010; Group 2017; IDC 2009; Isaila 2014; Jalgaonkar and Kanojia 2013; Kirchner and Razmerita 2015; Lippert and Govindarajulu 2006; Luna and Sequera 2015; Tornatzky and Fleischer 1990 cited by Lippert and Govindarajulu 2006; Yeboah-Boateng and Essandoh 2014).

The composition of heterogeneous groups in collaborative learning is advantageous as it allows investigating problems from several viewpoints as well as widening the related knowledge domain (Van den Bossche et al. 2006). It also enables students to extend their knowledge and experience (Sweeney et al. 2008) in the use of collaborative VLE. Although these benefits are appreciated and anticipated, potential problems might result from challenges and concerns including cultural influences. In a study conducted by Popov et al. (2012), a low level of motivation was described by students as one of the most important challenges that may affect their use and acceptance in collaborative environment.

3.11 MORE DRIVERS AND BARRIERS IN COLLABORATIVE ENVIRONMENT

Beside user's experience issues which can be affected by both internal and external factors, a variety of drivers and barriers are also to be considered within a CBCVLE. Some factors are

considered as motivators while others may discourage the user's participation and involvement.

Lack of incentives was identified by Castro (2016) as an issue in collaboration whereas members are not motivated. Moreover, the lack of training also creates a barrier for group members to accomplish related tasks (Castro 2016). Popov et al. (2014) suggested that an increase in awareness between collaborators in regard to the differences in communication styles can minimize efforts to complete collaborative tasks.

Dillenbourg (2002) identifies various aspects that may affect the collaborative environment. These are: gender, same viewpoint, self-development and skills, knowledge, type of learning, learning medium, software features, and nature of collaborative task. Further, So and Brush (2008) indicate that the type of communication medium used in collaborative learning affect the users' social presence and writing styles. Motivation for student participation in collaborative projects is supported by social interaction between group members (So and Brush 2008).

Peer support which is now more facilitated through social networking and communications applications to exchange information (Arpaci 2019), as described by So and Brush (2008) is supportive to exchange various perspectives among collaborative group members. This is asserted by Al-Atabi and Deboer (2014, p.263) "*Respondents indicate a high level of peer support. This is indicative of considerable level of students' collaboration*". Moreover, providing learners with the procedural knowledge will help them on how to interact and learn collaboratively (Weinberger et al. 2007).

The ICT Knowledge gap that is created by the digital divide has been indicated in literature (Mendonca and Cowan 2007; Wei and Hindman 2011) as a critical factor whereas it is anticipated that users with different skills and technical knowledge to collaborate in VLE. Digital divide is defined as "*inequalities in the meaningful use of information and communication technologies*" (Wei and Hindman 2011, p.217). This dilemma may put users of VLE against unequal opportunities to use the associated tools that mainly depends on Internet and some ICT skills regardless of the needed proper knowledge. Nkanu and Okon (2010) assert that the Internet has become the dominant space for digital age and a necessity in the same time to be accepted and used to bridge the knowledge gap. However, Solutions are required to minimise or even eliminate this gap throughout a country. Jayasena (2012) argue that cloud computing would be the promising solution for bridging the digital divide.

White et al. (2009) claim that the use of cloud computing may be accompanied by uncertainty in respect of, e.g., security. However, this uncertainty can be reduced by trust that influences

the members of collaborative groups (Pankiewicz et al. 2009). The importance of institutional support towards knowledge sharing was emphasised by Hew et al. (2016a) as a key influence on users' intensions to use VLE tools.

3.12 CHAPTER SUMMARY

The chapter outlined collaborative VLE by highlighting issues related to this environment. Differences between traditional and cloud-based VLEs were briefly discussed. Capabilities of collaborative VLE, collaborative tools and resources as well as users' perception of collaborative environment were also highlighted. User's experience and expectations were also given attention to present their effects on the users' attitude toward using and accepting collaborative VLEs. Finally, concerns and challenges that may affect the utilisation of this environment were identified and presented. The results of the literature review have identified a number of influences on the use of collaborative VLEs. Chapters 5, 6 and 7 examine these areas in more depth by surveying users' views in regard to the underpinning issues related to this thesis. The next chapter outlines the research methodology that has been employed in this research.

CHAPTER 4: RESEARCH METHODOLOGY

This chapter discusses the research methodology, research design, research stages including the preliminary study, and further investigation needed for collecting data to answer the research questions. The nature of this research is multidisciplinary where several disciplines contributed namely cloud computing, virtual learning environment, and collaboration environment. All research methods employed in this thesis are highlighted in this chapter and briefly discussed.

4.1 RESEARCH DESIGN

Research design as defined by Yin (2003) is "*the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of study*". It is also defined as "*a logical plan to maximise the validity of research findings*" (Du Toit 2015, p.61). It must be flexible and adaptive (De Munck 2009) to deal with any unanticipated issue during the research. Generally, the use of a specific design depends on the nature of the problem investigated within the research (Walliman 2011) and also the nature of the research question (Anastas 1999) as these will primarily help to answer the research question clearly and support them with evidence (De Vaus 2001).

This research adopted a mixed methods methodology which incorporates quantitative and qualitative methods for data collection. The nature of this research combines explanatory and exploratory approaches to achieve the objectives. De Vaus (2001) asserts that explanatory research focuses on "*why*" questions for which casual explanations will be developed. Saunders et al. (2009) elaborates that exploratory research is used by the researchers to clarify their understanding of the research problem by searching the literature for example beside other ways. Precisely, this research follows the sequential exploratory design.

4.2 TRIANGULATION AND MIXED METHODS APPROACH

Creswell (2013, p.212) defines a mixed methods research as "*an approach to inquiry that combines or associates both qualitative and quantitative forms of research. It involves philosophical assumptions, the use of qualitative and quantitative approaches, and the mixing of both approaches in a study*". Both quantitative and qualitative methods are used by

researchers to end up with a wide understanding of the research problem (Creswell 2009) in a single or multiphase study (Hanson et al. 2005).

Generally, both quantitative and qualitative methods are compatible (Howe 1988 cited by Saunders et al. 2009) and complementary to each other (IVSZ 2012; Stew 2009) and give the research a more comprehensive understanding of a research problem (Creswell 2013; Given 2008). In fact, great advantages accompany many research questions when the research combines both approaches (Given 2008; Park 2006). This is triangulation (Dawson 2002; Ritchie 2003) whereas the researcher investigates an issue from several perspectives using more than one research method aiming for a broad view of the problem. It also allows researchers to gather data from different sources (Rothbauer 2008).

Furthermore, "*neither is better than the other – they are just different, and both have their strengths and weaknesses*" (Dawson 2002, p.16). Hence, both approaches should not be considered as inflexible (Creswell 2013). For example, a primarily quantitative approach can be extended by implementing simple qualitative methods such as open-ended questions where illustrative quotations can be used by the researcher within the quantitative body (Howitt and Cramer 2011). In general, every research tool can be powerful, if it is used correctly for the data and research questions that it was originally designed for (Leedy and Ormrod 2010).

4.3 QUALITATIVE VERSUS QUANTITATIVE RESEARCH

Quantitative methods such as the use of questionnaires are more cost-effective than qualitative methods such as interviews, especially if the research involves a large geographical area (De Vaus 2002). Therefore, selecting a questionnaire as a primary instrument for this research was to overcome the wide geographical distances between HEIs which reach sometimes nearly 1000 km long.

As outlined in Table 4.1 (Blaxter et al. (2006); Creswell 2009; Creswell 2013; Dawson 2002; Goodwin 2010; Howitt and Cramer 2011; IVSZ 2012; Walliman 2011), great features are notable for both quantitative and qualitative methods. Nevertheless, there are a few disadvantages that should be taken into consideration by researchers during the research design phase.

	QUALITATIVE	QUANTITATIVE
Researcher's role	More subjective	More objective
Contact participants	Contact with participants tends to last a lot longer	Contact with participants is much quicker
Interaction	Direct interaction with respondents	Indirect interaction with respondents
Questions Type	Open-ended questions	Closed-ended questions
Questions Words	How and why	Who, how much, and how many
Examples/ Instruments	Focus groups, field observation, in-depth interviews and case studies	Questionnaire, structured interviews
Sample	Small	Larger study population
Analyses Nature	Inductive analyses	Deductive analyses
Analysis type	Thematic analysis	Statistical analyses
Analysis techniques	Cannot be manipulated mathematically	Analysed using the techniques of statistics
Data collected	Collect qualitative data	Collect numerical data
Appropriateness	In the early stages of research	When theory is well developed
Dealing with	Words	Numbers
Data	Observation notes, interview transcripts, literary texts, minutes of meetings, historical records, memos and recollections, documentary films, document data, audio-visual data	Population counts, economic data, scientific measurements, Census figures, performance data, all measurements, observational data
Interpretation	Themes, patterns	Across databases
Other characteristics	Used to obtain information-rich data Data collected in the participant's setting Focus on characteristics Explores attitudes, behaviour and experiences Often used as a preliminary step to plan research Interpretation can be quite demanding and dependant on the researcher	Generates statistics Requires a great deal of time and work Limits the degree to which respondents participate Maximum control over the questions Researcher is considered completely external to the actual research

Table 4.1: Comparison of qualitative and quantitative research.

In the context of this research, a mixed methods approach is adopted to combine the benefits of quantitative and qualitative methods and to mitigate the disadvantages where they are found.

4.4 RESEARCH METHODS IN RELATED LITERATURE

Table 4.2 highlights examples of methodologies used in studying cloud-based collaborative learning environment and related issues in literature.

No.	AUTHOR(s)	CONTEXT	METHODs
1.	Darwaish and Wang (2012)	Investigating building effective online collaborative virtual learning environments. Evaluating the features of the current VLE and the functionalities desired by University students.	Mixed Approach Prototype Design
2.	Gital et al. (2014)	The study outlines the design of architectural framework of Collaborative Virtual Environment (CVE) based on cloud computing. The proposed architecture aims to improve the effectiveness of the conventional CVE by allowing users to access more ICT resources in a cost-effective solution.	Theory-based analysis
3.	Karadimce and Davcev (2013)	The study mainly focuses on M-learning as a motive for collaboration, and therefore it proposes multi-tenancy group collaboration within the cloud-based learning platform which is based on PaaS cloud model.	Quantitative
4.	Valcheva et al. (2015)	The study highlights the cloud-based virtual infrastructure for building a collaborative learning. It also highlights the specifications and requirements needed for the entire purpose. The study outlines the main advantages of utilising virtual infrastructure in learning environment as well as the disadvantages. The study proposes VICoL which is based on a front-end for students and a backend designed for teachers.	Theory-based analysis
5.	Luna and Sequera (2015)	The study is focused on a proposed model for cloud Online Learning Environments that is based on the massive open online courses (MOOCs) hosted on cloud supporting by the large number of students with own device (BYOD). The study employs a practical experiment that consists of using Google Apps services and MOOCs, in conducting laboratory reports for chemistry lab. The study proposes architecture for platforms e-learning and mechanisms for collaborative work in cloud applied to the laboratories. The proposed architecture consisted of four layers; the cloud services represent the first layer while the second layer is based on virtualization. The third and fourth layers are related to MOOCs and BYOD respectively.	Mixed Approach Practical Experiment
6.	Doelitzscher et al. (2010)	The study introduces the private cloud infrastructure in the Hochschule Furtwangen University (HFU) which is called Cloud Infrastructure and Application (CloudIA). The target users are staff and students of the HFU. The study outlines examples of harnessing the potential of cloud	Theory-based analysis

		computing into academic purposes. The study also concentrates SSO as an important feature of the proposed system.	
7.	Yadegaridehkordi et al. (2015)	The study measures the users' perceptions of technology characteristics based on task technology fit model in a cloud-based collaborative learning environment. The coding and analysis of interviews with users resulted in that collaboration, mobility, and personalization were indicated by participants while other characteristics did not attract the users' attention completely.	Qualitative
8.	White et al. (2009)	The study measures the users' satisfactions and perceived usefulness of using collaborative activities through cloud computing compared with those of traditional collaboration systems. The results of the study indicate that the participants' rating of collaborative tasks using cloud computing systems were higher than those of traditional systems.	Meta-Analysis Focused Groups
9.	Yadegaridehkordi et al. (2014)	The study adopts Task-Technology Fit (TTF) model to determine the most important factors that can be used as predictors for the student adoption of cloud-based collaborative learning technologies in a university. The result of study stated that task "non-routineness" has negatively influenced TTF while other tasks such as "Interdependence" and "Technology characteristics (Personalization, Collaboration and Mobility)" have positively controlled TTF. Significant relationships are existent to be determined when adopting cloud-based collaborative learning technologies under the direct effect of characteristics of task and technology.	Quantitative
10.	Sarrab et al. (2016)	The main focus of this study is the influencing factors of adopting and accepting Mobile learning by students in higher education institutions in Oman. Technology Acceptance Model (TAM) is adopted as a theoretical framework to evaluate the factors concerning M-learning adoption.	Quantitative
11.	Edwards (2011)	The study investigates the students' perceptions of Google Documents as a collaborative tool to write a research assignment in a University level course. The students revealed their satisfaction about using such a tool for collaboration which became easier online and maintained a social presence for students.	Mixed Approach
12.	Liao et al. 2013	The study proposes new e-learning model based on collaborative cloud concerning solving the problems of instructors and students within e-learning applications. The knowledge model is adopted as well as the economic model in the proposed collaborative cloud where virtual resources can be	Mixed Approach

		selected by users effectively. The study explores a solution to overcome the limitation of instructional resources and learning support needs.	
13.	Zhu et al. 2009	The study examines whether the students' perception of collaborative e-learning environment is culturally affected. Issues investigated are: group discussion, critical thinking, problem-based learning, peer learning, interaction and help seeking/provision. The findings indicate that the culture has an effect on the students' perception of collaborative e-learning environment.	Questionnaire
14.	Chunwijitra 2013	The study proposes new online authoring tools for e-learning systems (WEBELS) to (1) improve performance of online meeting system, and (2) solve the limitations of existing authoring tools for video-based learning content in the developing countries which have low Internet speeds.	Experimental study
15.	El Mhouti et al. 2016	The authors propose a design of a flexible cloud-based Virtual Collaborative Learning Environment (cloud-based VCLE) Based on a cloud computing architecture. The proposed design supports students' task-driven learning in a more collaboratively manner by responding to the learner's dynamic needs.	Theory-based study

Table 4.2: Examples of methodologies used in studying cloud-based collaborative learning environment and related issues.

4.5 ADOPTED RESEARCH METHODS

This research has adopted a mixed approach (Quantitative and Qualitative) which includes the followings:

1. Literature review of:
    a. Cloud computing and relative issues in general and higher education in particular.
    b. Applications of cloud computing and VLEs in HEIs.
    c. Collaborative virtual learning environment.
    d. Oman (ICT, HEIs, collaborative VLE, Higher Education, …etc.)
    e. Cultural influences (Language, Customs and traditions, Gender, …etc.)
2. Mixed Methods Approach Primary Research:
    a. A qualitative preliminary study: Semi-structured interviews with IT managers. Questions have focused on the current state of VLEs in Omani Universities and Colleges as well investigate the existing infrastructure.

b. First survey (quantitative) using questionnaires: was designed to gather information in respect of the HEIs stakeholders such as faculty members, students, researchers, and admins/technicians.
c. The second survey (qualitative) is used to gather information for issues not covered by the first survey, or issues identified by the first survey which require further investigation.

3. Development of a framework: A set of recommendations for HEIs in Oman are derived from the research outcome.
4. Developing a prototype: To demonstrate some of the key issues that are included in the proposed framework and also to simulate a VLE for a collaborative environment taking into consideration some cultural aspects.
5. Evaluating the framework and the prototype: some Omani academics, students, admins/technicians, and parents participated in the evaluation of the purposed framework.
6. Modification to the framework and the prototype: As a result of the outcome of the evaluation of the prototype and the proposed framework some modifications were made to both the framework and the prototype.
7. Writing up the thesis.

Table 4.3 shows the research question and respective research methods by which the answers to questions were achieved.

Research Question		**Research Method**
1.	To what extent is the existing ICT infrastructure and services able to support CBCVLEs in Oman?	Survey 1 Survey 2
2.	What is the extent of the application of collaborative VLEs in HEIs in Oman?	Survey 1 Survey 2
3.	What are the challenges that may affect the successful utilisation of CBCVLEs in Oman?	Literature Review Survey 1 Survey 2
4.	What would be the most suitable VLE to support a cloud-based collaborative environment in Oman?	Literature Review Survey 1 Prototype
5.	What are the features of this CBCVLE that make it suitable for the HEIs in Oman?	Literature Review Survey 1 Survey 2 Prototype
6.	To what extent the local culture may influence the use of a CBCVLE in Oman?	Literature Review Survey 2

Table 4.3: Research questions and associated research methods.

Figure 4.1 illustrates the road map of the methodology used for the thesis which is illustrated graphically in the figure and will be discussed later in this chapter.

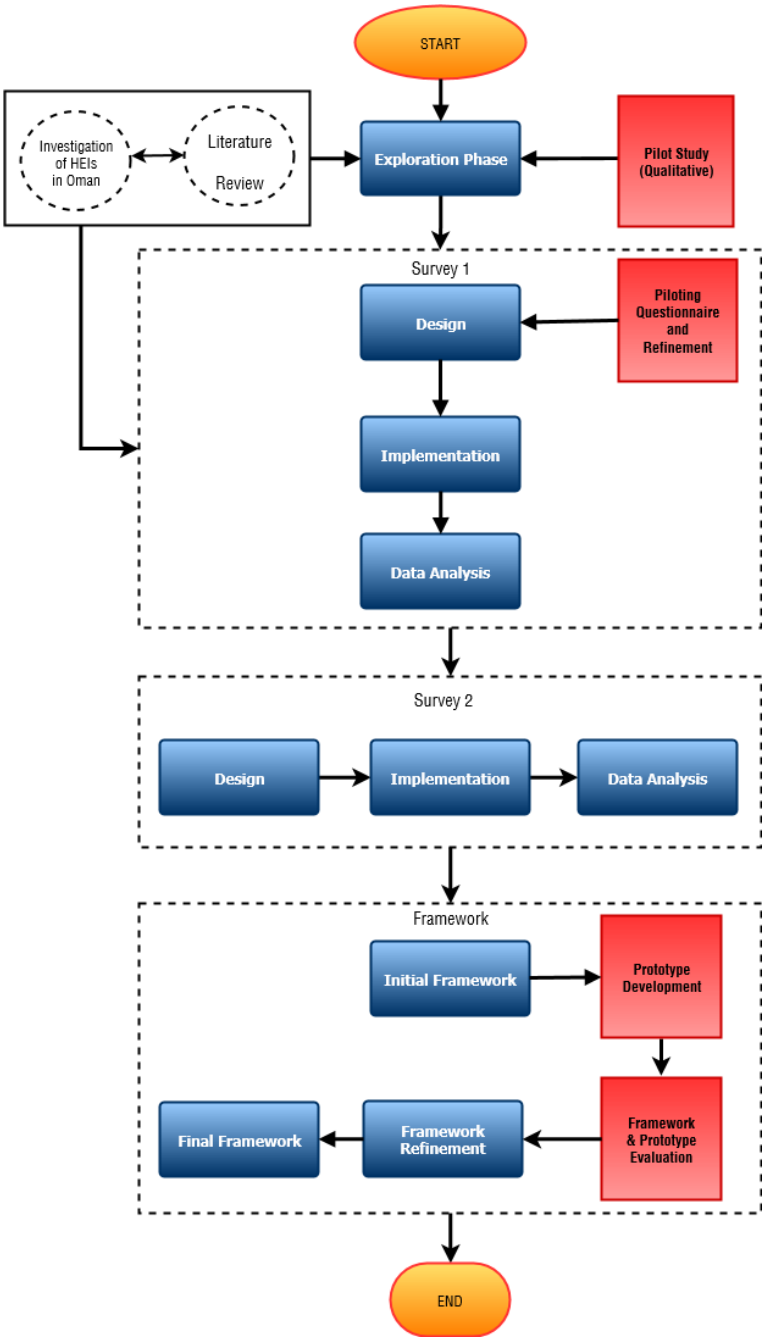


Figure 4.1: Research Design.

As listed in Table 4.4, this research adopted various methods which were found to be suitable for collecting data and conducting further investigations and development. These methods were selected for their appropriateness for this research based on views revealed from the literature and other related studies as mentioned earlier in this chapter.

1.	Literature review.
2.	Explore cloud-based collaborative learning initiatives globally.
3.	Investigation of HEIs in Oman.
4.	Preliminary study interviews (Design, Implementation).
5.	Survey 1 (Design, Implementation, and data analysis).
6.	Survey 2 (Design, implementation, and data analysis).
7.	Evaluate Virtual Learning Environments packages.
8.	Develop an initial framework for CBCVLE.
9.	Develop a prototype of CBCVLE.
10.	Evaluate the prototype and the framework.
11.	Revise the framework.
12.	Produce the final framework.
13.	Write up thesis.

Table 4.4: Research Stages.

4.6 LITERATURE REVIEW

The literature review has offered a good ground to this research where different issues where theoretically investigated and supported by real examples and experiences. This approach of data collection as asserted by researchers (Blaxter et al. 2006; Marczyk et al. 2005) was extremely important to enrich the research with information, ideas, perspectives, highlights, illustrative diagrams and tables, etc. The literature review was expanded in chapters 2 and 3 where the former focused on cloud computing and learning environment including VLEs as well as local culture, the latter highlighted issues related to collaborative VLE which is the main topic of this research.

4.7 INVESTIGATION AND RESEARCH

This research has employed an investigation into HEIs' websites to determine what type of VLE is being used for learning and teaching activities. Content analysis is "*a research technique for making replicable and valid inferences from data to their context*" (Krippendorff 1989, p. 403). Content analysis is based on counting the frequency of an aspect to measure its importance with other issues (Walliman 2011) and to identify themes and how every theme is treated and offered and then linked to independent variables (Berelson 1952 and Robson 2002 cited by Spencer et al. 2003) to identify the relationships between themes and variables within a study (Given 2008). Content analysis helps researchers to seek "*valid knowledge or practical support for actions and critique*" (Krippendorff 2019, p.2).

This research has partially employed content analysis to identify the frequency that "Moodle" and "Blackboard" are used in the literature in the relevant subject domains. The research also has employed documentary analysis which as stated by Ritchie (2003) involves the review of existing documents such as public media reports, government reports, and procedural documents. The outcome of these investigations is discussed, where applicable, in chapters 2 and 3.

4.8 PRELIMINARY STUDY

A preliminary study which is a small-scale rehearsal of an actual study, requires less time for implementation and fewer participants (Given 2008). Moreover, Blaxter et al. (2006) emphasise the necessity for conducting piloting prior to collecting real data. This phase identifies weaknesses and shows how the research techniques and methods will empirically work and give indications to respond accordingly. Given (2008) argues that a pilot study can be used in any type of research.

In this research, a preliminary study was conducted through interviews with IT managers and specialists in four HEIs (see Appendix 2). The aim was to prepare the base for the next stage of data collection method, which relies mainly on the main survey questionnaire. In this stage, the purpose was to obtain relevant information from IT practitioners to help in directing the next steps of this research.

Although there were some hesitations from some IT managers to participate, the interviews provided some useful information for incorporation into the questionnaire, several aspects were explored and important facts were revealed.

The content of interviews' questions covered the following sections:

- **Section 1: General Information**, this includes 11 questions about the interviewee and their roles, their institutions such college, department, the number of academic staff, IT staff, students and administrative staff.
- **Section 2: Collaboration**, this includes 9 questions about collaborative environment, its uses, types and limitations.
- **Section 3: Information Systems and VLEs**, this includes 10 questions about VLEs that are currently used in the institution as well as other information systems.
- **Section 4: ICT Infrastructure**, this includes 5 questions about the current ICT infrastructure in these institutions.
- **Section 5: Cloud Computing**, this includes 28 questions about their views on cloud computing, its applications, its services, institution's plans and related issues.
- **Section 6: Student Learning Culture**, this includes only 2 questions about students' learning approaches/habits and related change.

The structure and the style of the interviews adopted, and the questions were guided by literature which highlighted crucial issues. HEIs in Oman were carefully considered and sampled to included 4 institutions to represent both public and private. Accordingly, the selection covers the only public university, 1 private university, 1 public applied science college, and 1 public technical college.

The outcome of the preliminary study indicated a few but valuable elements and facts which have been considered when designing the main instrument of data collection in this research. The key issues emerged are:

- Some institutions pay high and considerable attention to offer high qualified team of technicians and programmers and other human resources to deliver better online educational services.
- Some institutions lack the financial resources.
- Some institutions seem to have a very well ICT infrastructure including data centres and networks.
- One institution is using two VLEs simultaneously.
- The majority of these institutions are using Moodle as a VLE.
- Some institutions were clearly cautious to reveal data about their data centres and networks.

- Most of these institutions they have increased their Internet speeds over the last few years, and they have at least two physical communication links per institution from different Internet Service Providers (ISPs).
- Some IT departments/centres do not have control over the institution's VLE including contents and management; they are only responsible for the infrastructure, networking and servers while another department has the full responsibility of VLE.
- Some institutions have already used cloud services.

4.9 SURVEY 1

Survey 1 incorporates a questionnaire to collect data in respect to ICT infrastructure and services, use of cloud computing, collaborative learning environment, and potential features that are expected by users in HEIs in Oman. Both quantitative and qualitative questions, which included open-ended and closed-ended types were utilised in this survey (see Chapter 5 for details).

4.10 SURVEY 2

Schuster et al. (2015, p.19) emphasise that "*The qualitative research on collaboration in virtual environments gives deeper insights into the relationship of personal preferences for VLEs*". After the analysis of data obtained from survey 1 and the literature, it was a necessary step forward to investigate issues that are not covered by the first survey. Survey 2 aims to extensively explore issues that relate to concerns and challenges within CBCVLE. This survey also investigates factors that may affect the use and utilisation of a CBCVLE (see chapters 6 and 7 for details).

4.11 FRAMEWORK DEVELOPMENT

The main aim of this research was the development of a framework for CBCVLE for HEIs in Oman. The development of the framework is a vital step that will empirically enrich this research with the data obtained through both theoretical and practical outlooks. The literature on the one hand provided substantial examples and other institutions' experience globally. On the other hand, the proposed prototype stands in combining the theory into real practice. The anticipated features of cloud computing are inherited into the proposed

framework as well as other collaborative features of traditional VLEs. The prototype involves the use of a suitable VLE for illustrative purposes. User testing is performed to evaluate the prototype and the framework. Subsequently, any necessary modification to the framework are carried out (see Chapter 8 for details).

4.12 PROTOTYPE DEVELOPMENT

"*We build lots and lots of imperfect prototypes not because we think we've got the right answer, but to get responses from buyers and users*" (Myerson 2001, p.32 cited by Kimbell and Stables 2007, p.266). This sheds the light on the importance of such method during the design phase and it is can be reflected into any related field. The development of a prototype was found to be essential to show the role and suitability of the framework in respect of culture. A selection of particular cultural aspects discussed in Chapter 7 were chosen to be applied in the prototype to illustrate how cultural influences can be tackled and mitigated in regard to the use of CBCVLE. These aspects were selected because there were highly indicated by participants and also they were found easy and practically applicable to be implemented in the prototype. The prototype is further explained in Chapter 9.

4.13 FRAMEWORK AND PROTOTYPE EVALUATION

Hammersley (2008, p.45) stated that "*validity is a crucial standard by which the findings of research should be judged*". Other synonyms such as evaluation, validation and assessment have been also used in literature (Hammersley 2008). The evaluation of the framework and the prototype is used to validate the suitability and relevance of the framework. Evaluators were chosen to represent a diversity of users in HEIs in Oman. An online questionnaire was used to collect data. More details about the evaluation study are provided in Chapter 10.

4.14 ETHICAL CONSIDERATIONS

This thesis including all methods have gone through the University ethical review process. A brief introduction is given in every interview or questionnaire, and participants are informed about the purpose of data collection and how their data will be used. They also were informed about their anonymous identity with which they will be identified during the analysis and

presentation of data. In interviews, the participants were asked for permission to record their voices. All records will be deleted according to Bournemouth University code of practice.

4.15 LIMITATIONS OF THE STUDY

"*Every study has a set of limitations*" (Leedy & Ormrod, 2005 cited by Ellis and Levy 2009, p.332). Therefore, this thesis has some limitations that may affect its overall comprehensiveness and investigations. The scope of this research was to investigate issues related to CBCVLEs. Thus, some aspects were not considered including specific technical details of cloud computing, users' attitude towards online collaboration, and other stakeholders' views and perspectives. Discussing the technical aspects of cloud computing is outside of the scope of this thesis. Furthermore, the accessibility to some information such as the specifications of ICT infrastructure within HEIs is restricted due to the confidentiality of policies.

In addition, this research focuses on Oman, and hence, the framework was not tested by external audience to whether it fits other developing countries.

4.16 CHAPTER SUMMARY

This chapter outlined the methodology adopted for this study which was based on a mixed-method approach. Data collection started with a preliminary study including semi-structured interviews with IT managers. Then, the first survey using questionnaires was conducted to gather information on respect of the HEIs users. The second survey collected data through interviews with users on aspects that are not covered by the first survey. This led to the development of a framework which was followed by the development of a prototype to illustrate specific cultural issues identified in the framework and how can be tackled within VLE tools. Evaluating the framework and the prototype was a very important stage to see whether the conclusion drawn from the surveys is confirmed and to verify the framework. Overall, the chapter in general concluded every single approach used in the research and justified the importance and the selection of each step.

CHAPTER 5: SURVEY 1

This chapter discusses the implementation of survey 1. The results are then presented and analysed. Significant issues are presented based on users' perceptions and views. The discussion of the survey findings focuses on (1) current ICT infrastructure and services of HEIs in Oman, (2) current use of cloud computing in HEIs in Oman, (3) collaborative environment in HEIs in Oman, and (4) the potential features of CBCVLE.

5.1 INTRODUCTION

As discussed earlier in Chapter 4, questionnaires are widely used to collect quantitative data primarily. However, they are also used to collect qualitative data alternatively when open-ended questions are included in the survey and much more diversity of data can be collected. The primary research instruments are mainly represented in survey 1 as well as survey 2 which is discussed in chapters 6 and 7. The preliminary study was also an instrument that directed the primary research positively besides other investigations such as the review of HEIs' websites.

5.2 SURVEY 1

Questionnaires as highlighted by De Munck (2009) are the most common methods used for collecting data from people who are given the "*exact same stimuli*". The potential power of survey data lies in its characteristic of quantitative analysis whereas results can be generalised to an entire population (Park 2006). For more accurate quantitative results, a larger sample is needed, as well as taking into consideration the non-response percent (Dawson 2002). The sample should be selected in unbiased manner as this can lead to unrepresentative findings (Rubin and Babbie 2011). Questionnaires may include closed-ended, open-ended, or a mixture of both types of questions (Stew 2009).

Survey 1 investigated users' perception of a CBCVLE in universities and colleges in Oman. The survey focuses on faculty members, students, researches and administrators/technicians as the target audience for exploring the related aspects of this research and to better understanding the relationships between variables. A mixed methods approach (as described in Chapter 4) was utilised via an online survey that had mostly closed-ended questions, but also includes 3 open-ended questions and 1 contingency question (Student's current year).

The preparation and design of an effective survey as stated by Park (2006) and Hutchinson (2004) takes quite a long time which is considered as a pitfall in questionnaire design. The

questionnaire that is designed using five-point Likert scale is described by Brace (2008) as the most commonly used approach by researchers and it is easy to understand by respondents.

The scale used in this survey consists of 5 points (5-Strongly Agree, 4-Agree, 3-Neutral, 2–Disagree, 1-Strongly Disagree). The Likert scale which was developed by Psychologist Rensis Likert in 1932 (Brace 2008), has been widely used by researchers as shown in literature. This scale allows respondents to indicate the level of their agreement or disagreement to a statement (Saunders et al. 2009).

In random selection of the sample as is in this survey, everyone has an equal opportunity of being selected without any intervention into the selection process (Beins and McCarthy 2012; Bernard 2006; Blaxter et al. 2006; Creswell 2009; Rubin and Babbie 2011; Walliman 2011) and therefore the sample is intended to be representative of the entire population (Saunders et al. 2009).

The questionnaire was primarily piloted using five respondents and experts to identify weaknesses and to receive feedbacks on different sections of the questionnaire. The questionnaire went live late in November 2016 and the survey was closed in late February 2017. Social media as well as email were used to reach the potential participants for the survey, encouraging them to participate. 205 participants completed the questionnaire while 84 left the survey incomplete providing partial responses, and therefore, they are omitted from the analysis. Five cases were discarded from the dataset as they were not representative for the target contributors to the survey. These respondents belong to institutions other than Omani HEIs such as primary schools of education (N=3) and some Universities in Asia and the United States of America (N=2).

The questionnaire (see Appendix 3 for details) consists of 7 sections as follows: The first section (A) focused on the personal information of the participant such as (1) Occupation, (2) Educational Qualification, (3) Age, (4) Institution Name, (5) Name of LMS (or VLE) in the participant's institution, (6) Computer skills of the participant, and (7) current year of study (For students only).

The next five sections (B, C, D, E, and F) were used to explore and investigate multiple issues of the research topic as follows respectively: General aspects of IT, Rating of current IT services, Use of Cloud Services, Collaborative Environment, Potential features which may be included in collaborative VLE. The final section (G) gave participants the opportunity to add their views and comments on different aspects of the survey (see Appendix 3 for details).

The first two Sections B and C of the questionnaire relate to the "first research question" of this thesis. The focus of these sections is on ICT infrastructure and services within HEIs. The

third section (D) of the questionnaire is formed to answer the first question of this research. Items of this section focuses on aspects related to the use of cloud services within HEIs. The fourth section (E) of the questionnaire is formed to answer the third question of this research. The scale also consisted of 5 points Likert scale as above. Items of this section focused on aspects related to the collaborative environment within HEIs.

5.2.1 RELIABILITY TESTING

Reliability in research defines whether the measurement is consistent (Hammersley 2008; Howitt and Cramer 2011; Leedy and Ormrod 2010; Marczyk et al. 2005) and the data analysed is normally distributed (Saunders et al. 2009). Moreover, most statistics depend on the assumption of a normal distribution of data (Hancké 2009). Cronbach's alpha coefficient aims to score 0.70 or higher for a satisfactory reliability (Howitt and Cramer 2011). Reliability test is considered one of the most important ways to assess the measurement accuracy (Hammersley 2008). Myers and Well (2003) highlight the probability of finding some variables are not normally distributed where many other variables are found normally distributed within the same study. Subsequently, the data obtained via the survey has been tested for reliability using Statistical Package for the Social Sciences (SPSS).

Table 5.1 shows the Cronbach's Alpha (Reliability Test) using SPSS for the data obtained in the survey. The distribution of the collected data was generally normal. The recorded Cronbach's Alpha coefficients values range between 0.824 and 0.973 which are considered as satisfactory values in this measure (>0.7) and participants were highly consistent within groups.

Section	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
B and C	0.820	0.824	22
D	0.916	0.917	18
E	0.888	0.892	17
F	0.972	0.973	33

Table 5.1: Reliability statistics per section.

5.2.2 TREATMENT OF MISSING VALUES

Missing data, where participants have not answered all the questions, are also coded by the researchers in a similar way to coding of other variables and to identify different types of missing data (Saunders et al. 2009). Computer analysis software employ a default code for

missing values (Saunders et al. 2009). Therefore, and for the purpose of this survey, SPSS gives any missing value a default code to distinguish them from the real values. In this research, missing data includes some personal information in section A. Therefore, the exclusion of this type of missing data in this research does not affect the analysis.

5.2.3 OUTLIERS DETECTION

By examining frequency distributions for the data set, the researcher can observe the way how the participants responded, the most frequent scores, and the shape of the distribution of scores which identifies outliers (*unusual, unexpected, or very different from other recorded scores*) (Cozby and Bates 2011). Box plot chart is used to identify values which are relatively different from other scores and these values can be excluded from analysis accordingly (Saunders et al. 2009). This technique was used in this research to ensure viability of the data. However, nothing was found to be abnormal and therefore no data was excluded from the analysis.

5.2.4 DATA ANALYSIS

The questionnaire was implemented online via a commercial Survey Service Provider (SSP) called "SmartSurvey" (Smartsurvey 2016). Online surveys are flexible and can be managed in a time-efficient manner (Evans and Mathur 2005). Such online survey tools as stated by Saunders et al. (2009) provide several formats for exporting data such as Excel, SPSS, and comma-delimited text files. These interactive SSPs as described by Bernard (2013) are easy to build, manage, and analyse data. The statistical features provided by the SSP are limited and therefore SPSS is used for conducting further analysis.

The SPSS software package was utilised to analyse quantitative data gathered through the questionnaire. Several statistical tests such as Cronbach's Alpha and Descriptive statistics including frequencies, descriptive, explore, crosstabs are implemented. Dawson (2002) stated that using SPSS, for example, helps to lessen time-consuming by researchers in data analysis. Such software does not just determine the 0.05 and 0.01 alpha values, but also probability of a specific value can be easily obtained (Meyers et al. 2006).

This research follows an approach known as side-by-side which uses convergent mixed methods as described by Creswell (2013). In this technique, each type of data; quantitative and qualitative is analysed separately starting with the former then moving to the latter. This

approach was applied in this thesis to ensure the clarity and presentation of analysis and findings.

Descriptive statistics such as central tendency (the mode, the median, and the mean) and Variability (the Range, and the Variance and Standard Deviation) are extensively used by researchers as statistical techniques (Anastas 1999; Beins and McCarthy 2012; Cozby and Bates 2011; Goodwin 2010; Saunders et al. 2009; Walliman 2011). These statistics are used to convey statistical data that reflect participants' views regarding an issue or a variable in the study (Beins and McCarthy 2012). "*Qualitative data will provide a deeper understanding of survey responses, and statistical analysis can be used to provide detailed assessment of patterns of responses*" (Bruton and Ellis-Hill 2009, p.63).

5.2.5 HYPOTHESES

A hypothesis which is formulated by the researcher (Cozby and Bates 2011) is a tentative and testable prediction to an answer to a research question (Marczyk et al. 2005; Walliman 2011) and it "*may or may not be supported by the data*" (Leedy and Ormrod 2010, p.6). Hypotheses should be identified in a clear and precise form and to be justified (Howitt and Cramer 2011). In respect of hypotheses and in order to test hypotheses, literature has indicated that H_1 represents the alternative hypothesis that the researcher is aiming to prove while H_0 represents the null hypothesis to be disproved or rejected (Beins and McCarthy 2012; Bernard 2006; Goodwin 2010).

In order to achieve the aims and objectives, a number of hypotheses were formulated to be evaluated in this research.

Hypothesis (H_1): HEIs in Oman have sufficient ICT infrastructure and services to support CBCVLEs.

Hypothesis (H_2): The currently used VLEs in HEIs in Oman are reliable.

Hypothesis (H_3): The majority of users in HEIs in Oman are using cloud computing applications.

Hypothesis (H_4): Users in HEIs in Oman are satisfied with the current implementation of cloud computing in their HEIs.

Hypothesis (H_5): Users in HEIs in Oman are keen to use cloud computing services in their learning and teaching.

Hypothesis (H_6): The majority of HEIs in Oman is currently implementing collaborative VLEs.

Hypothesis (H_7): Users in HEIs in Oman have the ICT skills to incorporate cloud computing services into their learning and teaching.

Hypothesis (H_8): Users in HEIs in Oman are keen to be more involved in collaborative projects in learning and teaching.

"*A statistically significant result means that a value of the test statistic has occurred that is unlikely if H_0 is true*" (Myers and Well 2003, p.82). In Chapter 5 the "Primary Research (survey 1)" and the statistical significance as stated by Myers and Well (2003) and Meyers et al. (2006), which relies on the probability of a statistical outcome such as Pearson *r* or *F* ratio are discussed.

Table 5.2 shows the information in respect of reliability of the data obtained in survey 1. In this respect, Cronbach's Alpha is used to check reliability of the data which is used to test the hypotheses. The Cronbach's Alpha values show that the distribution of the collected data is generally normal, which indicates that the participants views are highly consistent (>0.7), except for H_2 where there are some more variations.

Hypothesis	Cronbach's Alpha	No of Items
H_1	0.869	7
H_2	0.601	2
H_3	0.733	5
H_4	-	1
H_5	-	1
H_6	0.755	2
H_7	-	1
H_8	-	1

Table 5.2: Reliability statistics per hypothesis.

As shown in Table 5.2, Cronbach's Alpha was not recorded for hypotheses of a single item which is asserted by Wanous and Hudy (2001) that the reliability of single-item measures cannot be calculated.

5.2.6 SAMPLE CHARACTERISTICS (DEMOGRAPHIC PROFILE)

As stated by Heppner et al. (2008), variables of a study can be independent, where they can be controlled, or dependent when they can be only observed by researchers. Table 5.3 depicts demographic (Independent) variables related to participants such as occupation, educational qualification, age, VLE, computer skills, and current year (students only).

Variable	Category	Percentage (%) (N)
Occupation/Profession (N=205)	Learner/Student	47.3% (N=97)
	Lecturer/Teacher	39.0 % (N=80)
	Admin/Technician	8.8% (N=18)
	Researcher	4.9% (N=10)
Educational Qualification (N=205)	Bachelor/University-College Degree	32.7% (N=67)
	PhD	23.9% (N=49)
	Master	22.4% (N=46)
	High School Diploma	19.5% (N=40)
	Other	1.5% (N=3)
Age (N=205)	18 – 24	39.5% (N=81)
	25 – 34	15.1% (N=31)
	35 – 44	28.3% (N=58)
	45 – 60	15.1% (N=31)
	Over 60	2% (N=4)
VLE (N=205)	Moodle	31.2% (N=64)
	Blackboard	30.2% (N=62)
	I don't know	26.3% (N=54)
	No VLE is used in my institution	6.3% (N=13)
	Other	5.9% (N=12)
Computer Skills (N=205)	Non-IT user	2.9% (N=6)
	General user	58.5% (N=120)
	IT Professional	38.5% (N=79)
Current Year (Students only) (N=97)	Foundation	15.5% (N=15)
	Year 1	14.4% (N=14)
	Year 2	17.5% (N=17)
	Year 3	20.6% (N=20)
	Year 4	20.6% (N=20)
	Year 5	11.3% (N=11)

Table 5.3: Demographic Profile of Participants, (N=205) N being the number of participants.

5.3 GENERAL INSIGHTS

There were 205 respondents from nearly a half of total of 76 which represent the total number of universities and colleges in Oman. The survey indicates that 31.2% of the respondents are using Moodle while 30.2% use Blackboard as their VLEs. On the other hand, 26.3% of participants indicate that they do not know what VLE is being used or they actually have no VLE in their institutions 6.3% and 5.9% state that other VLEs used by their institutions (see Figure 5.1).

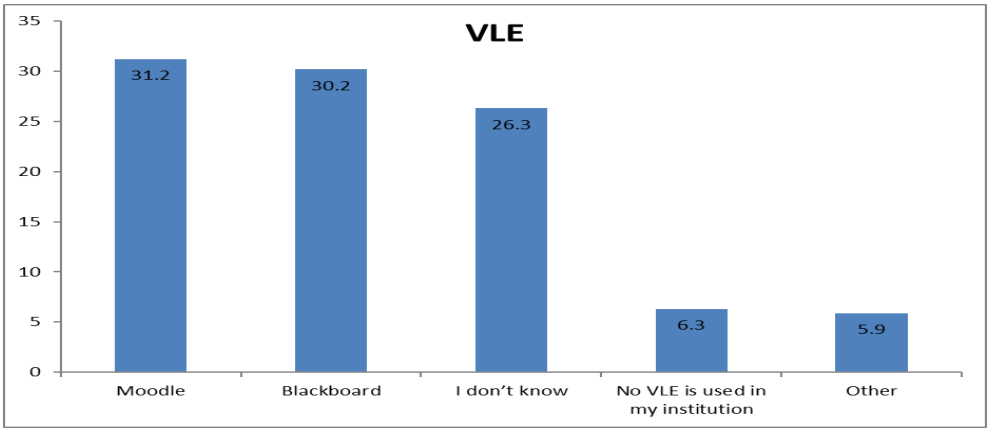


Figure 5.1: VLEs currently used by HEIs.

The results also show that the higher numbers of respondents were students, followed by faculty members, Admins/Technicians and researchers (see Table 5.3). With regards to the age, the highest age category of participants is between 18 and 24 years old followed by the age range 35-44 as shown in Figure 5.2.

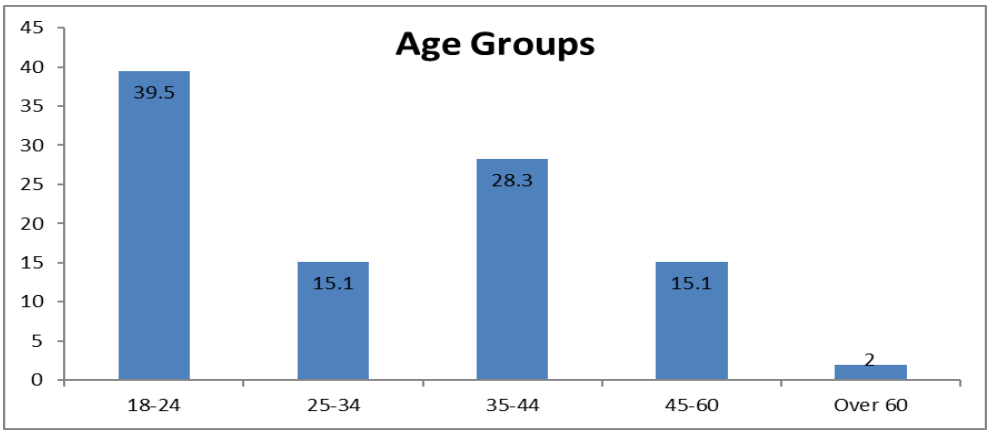


Figure 5.2: Age groups of respondents.

Figure 5.3 shows that a considerable amount of the participants ranks their level of computer skills as "General user" while only a small number of them describe themselves as "Non-IT user". The rest of the participants categorise themselves as "IT Professional".

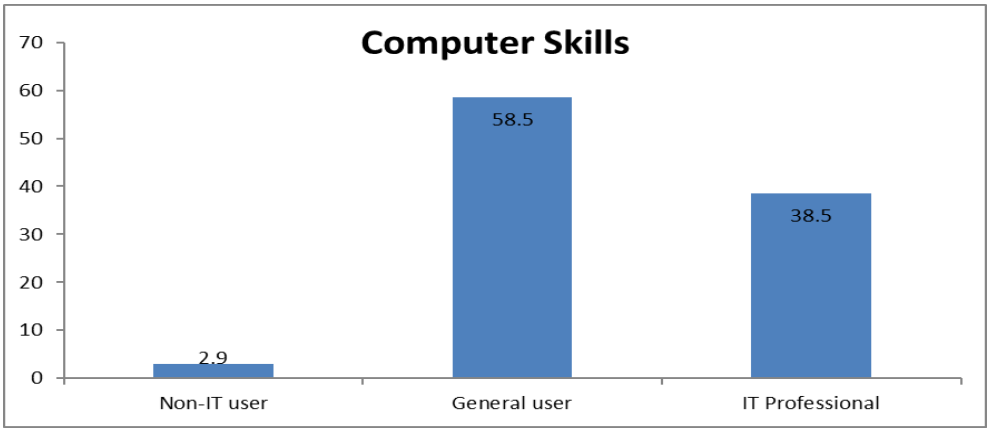


Figure 5.3: Computer skills of respondents.

As listed in Table 5.3, the number of students participated in the survey in respect of their year of study is approximately evenly distributed: Foundation (15.5%), Year 1 (14.4%), Year 2 (17.5%), Year 3 (20.6%), Year 4 (20.6%) and Year 5 (11.3%).

With regard to the VLE that is currently being used by institutions (see Figure 5.1); both Moodle (31.2%) and Blackboard (30.2%) were indicated by participants as their adopted VLE with the favor of Moodle which was approximately 1.2% greater than Blackboard.

Table 2.7 in Chapter 2 shows that more than a third of HEIs are currently using Moodle for their learning and teaching activities while 14.52% of them have employed blackboard as their VLEs. Only 4 institutions have individually adopted their customised solutions such as EduWave, Smart-UMS, EduPortal and E-Learning System.

The reason for choosing the Median relies on the type of data gathered by using Likert scale is ordinal (Laerd 2017; Quickmba 2017), and therefore, the Mean has less advantage than the Median especially for this certain type of data. The Median scores as well as Mean values were calculated for every section as a whole and also for every item (statement) in all sections by using SPSS. As shown in Table 5.4 (see section 5.4), the Median scores were all far above the average which indicates a positively good response to items within each section.

5.4 CURRENT ICT INFRASTRUCTURE AND SERVICES OF HEIs IN OMAN

ICT infrastructure of an institution represents a wide range of resources including hardware, software, services, and other resources that are relatively important for delivering services to users. The ICT infrastructure deals but not exclusively with issues such as Internet Service, Wi-Fi, Technical Support, Awareness of IT Policies, Storage Service, E-mail Service, Mobile Devices, Training, and E-learning Management System.

Items in the first two sections of the questionnaire were mainly categorised under 10 variables (see Appendix 4) which would reveal the answers to the first research question.

Table 5.4 shows the statistical results that have been collected by using tests such as frequencies, descriptive, and crosstabs. As shown in Table 5.4, every row represents a statement which is identified by a variable code. The interpretation of these codes is provided in Appendix 4.

Variable Name	Item Code	Mean	Median	IQR
Internet service	SecB_1	3.459	4	1
Technical support	SecB_2	3.766	4	1
Awareness of IT policies	SecB_3	3.498	4	1
Storage service	SecB_4	3.654	4	1
	SecB_5	2.161	2	2
	SecC_2	3.610	4	1
E-mail service	SecB_6	4.171	4	1
	SecB_7	2.800	3	2
	SecC_1	4.029	4	1
E-learning Management System	SecC_3	3.634	4	1
	SecC_4	2.946	3	2
Wi-Fi	SecC_5	3.634	4	1
	SecC_6	3.068	3	2
Mobile devices	SecC_7	3.410	4	2
	SecC_8	3.112	3	2
	SecC_9	3.888	4	2
	SecC_10	3.137	3	2
	SecC_11	3.356	4	2
	SecC_12	3.434	4	1
	SecC_14	3.171	3	2
Computers	SecC_13	3.912	4	2
Training	SecC_15	3.132	3	2

Table 5.4: Results of statistical analysis (Mean, Median, and IQR).

Table 5.5 presents the users' responses to individual questions in section B and C of survey 1. See Appendix 4 to identify names of variables.

Item Code	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
SecB_1	16.1%	45.9%	15.1%	13.7%	9.3%
SecB_2	21.5%	49.8%	14.6%	12.2%	2.0%
SecB_3	14.6%	43.4%	23.4%	14.1%	4.4%
SecB_4	21.5%	42.0%	21.0%	11.7%	3.9%
SecB_5	29.3%	45.4%	9.3%	12.2%	3.9%
SecB_6	40.5%	44.9%	7.3%	5.9%	1.5%
SecB_7	16.6%	30.7%	19.0%	23.4%	10.2%
SecC_1	34.6%	44.4%	12.2%	6.8%	2.0%
SecC_2	17.1%	42.0%	27.8%	11.2%	2.0%

SecC_3	20.5%	38.5%	28.8%	8.3%	3.9%
SecC_4	8.3%	25.4%	28.8%	27.8%	9.8%
SecC_5	22.9%	43.9%	15.6%	8.8%	8.8%
SecC_6	13.7%	30.7%	20.0%	20.0%	15.6%
SecC_7	22.9%	32.2%	17.1%	18.5%	9.3%
SecC_8	16.6%	24.9%	22.0%	26.3%	10.2%
SecC_9	35.1%	37.6%	14.6%	6.3%	6.3%
SecC_10	15.1%	30.2%	19.0%	24.4%	11.2%
SecC_11	18.0%	36.1%	17.6%	20.0%	8.3%
SecC_12	18.0%	36.6%	22.9%	15.6%	6.8%
SecC_13	29.8%	44.4%	15.1%	8.8%	2.0%
SecC_14	15.6%	25.9%	27.3%	22.4%	8.8%
SecC_15	10.2%	32.2%	26.3%	22.9%	8.3%

Table 5.5: Users responses to survey's questions (Section B and C)

The following provides the analysis of the outcome of sections B and C of survey 1. Figure 5.4 illustrates aspects that relate to ICT infrastructure and services in HEIs as indicated by participants.

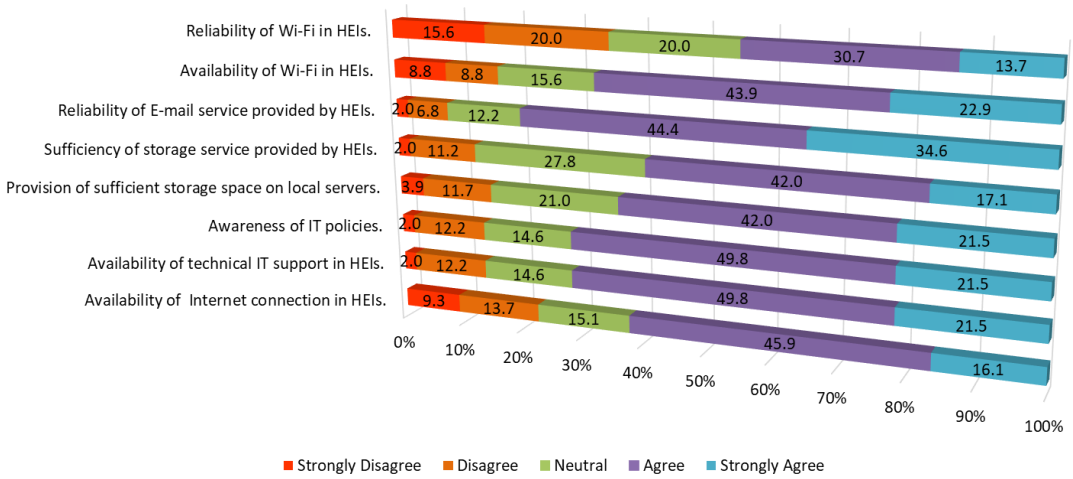


Figure 5.4: Current ICT infrastructure and services in HEIs in Oman.

- **Internet Connectivity**

Internet connectivity represents an important element of ICT infrastructure for any institution as well it is highly recommended to be maintained at a high speed with efficiency and high availability.

It is clear from Figure 5.4 that a considerable number of participants indicated that the Internet connection is available at a high speed in their institutions. This means that nearly half of the participants express their agreement of the availability of a high Internet connection in their institutions as shown in Figure 5.4 and Table 5.4.

- **Technical Support**

Maintaining a high standard technical support would guarantee the continuous use of information systems in an HEI. Users rely on qualified and experienced technical team members who are able to resolve issues and provide information and support whenever required.

From Figure 5.4 and Table 5.4, it is clear that the majority of respondents express their agreement that IT support was available in their institutions.

- **Awareness of IT Policies**

Internet Security Policies among others would define the relationships between HEIs' stakeholders and the services provided to them as well the usage, limitations and others.

From Figure 5.4, it is apparent that slightly more than a half of respondents show their agreement for their awareness of IT policies (e.g. Internet Security Policies) in their institutions. In contrast, few participants oppose the entire argument.

- **Wi-Fi**

Wi-Fi is widely used within HEIs. The application of mobile devices requires such facility to be reliable and available to users within HEIs.

Figure 5.4 indicates a considerable number of the participants confirm that Wi-Fi is available in their institutions. This is while one third of the respondents show their agreement with the fact that the Wi-Fi in their institutions is reliable. Almost one third of the respondents disagree with the fact of Wi-Fi reliability in their institutions.

- **Storage Service**

Storage is one of the services provided by HEIs for their stakeholders. A user would have an allocated storage space in the local server, and their files can be accessed from anywhere within the institution.

As shown in Figure 5.4 above, and Table 5.4, a very considerable number of respondents point out that they receive a sufficient storage space on the local servers run by their institution.

It was more surprisingly that users indicate they are still using USB Flash drives as a primary storage medium. As shown in Figure 5.5 and Table 5.4, a very high percentage of respondents indicate that the use of such a medium.

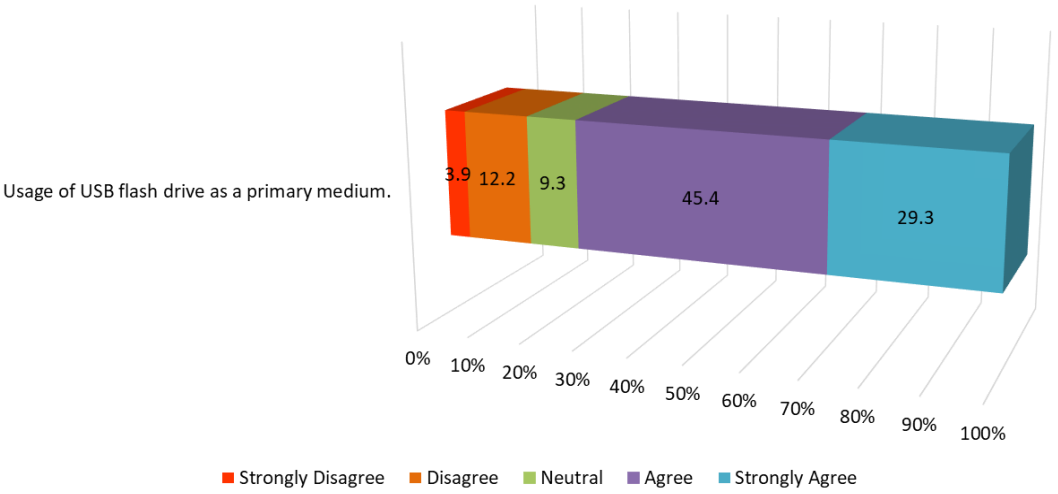


Figure 5.5: Usage of USB flash drive as a primary medium.

- **E-Mail Service**

The e-mail services provided by institutions vary considerably in terms of the technology and the way of hosting. Some institutions employ a local server with all the required software (e.g. Exchange) and hardware to run the mail service. On the other hand, many institutions depend on linking their domain name to a cloud-based mail hosting which are mostly free (e.g. Gmail, MS live) or for a fee. Alternatively, HEIs' stakeholders would use their own (non-institution) mail service for educational purposes.

A considerable number of the respondents indicate the reliability of the e-mail service provided by the HEIs as illustrated in Figure 5.6 and Table 5.4.

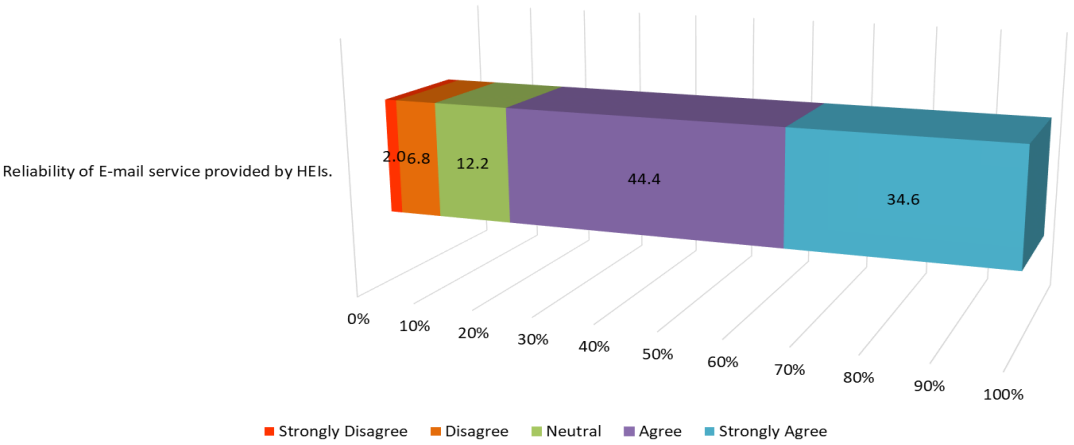


Figure 5.6: Reliability of E-mail service provided by HEIs.

- **E-Learning Management System**

It is apparent that nearly all HEIs have adopted a VLE to deliver courses materials, exams, attendance, chat, forums, and other educational activities. The reliability and usability of a VLE would vary from one institution to another due to technology and solution used in relations to other factors such as technical support, Internet service, and the compatibility for mobile devices.

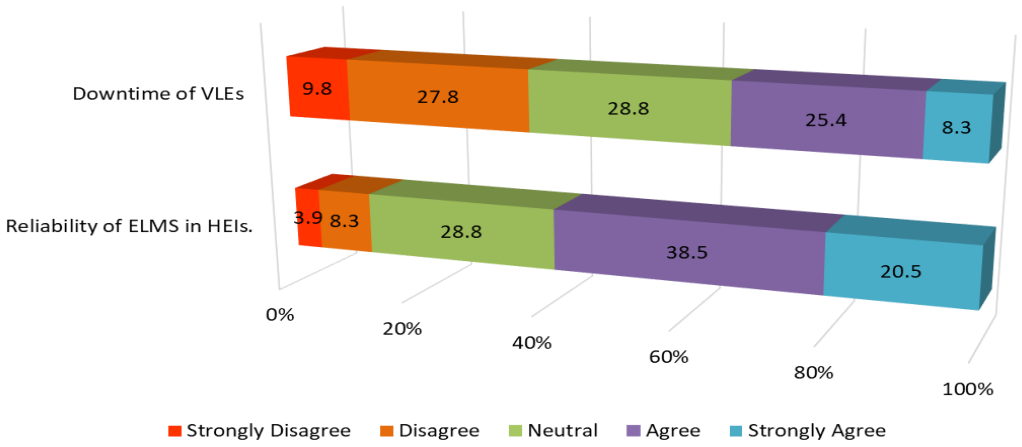


Figure 5.7: Reliability of VLEs.

The results highlight a high number of participants who express their agreement for the reliability of their institution's VLE. On the contrary, only few participants declare that their VLE is not reliable (see Figure 5.7 and Table 5.4).

In regard to users' experience of downtime of their VLEs, the respondents were nearly divided into two equal opposing groups (more than half of the participants) followed by other two nearly equally contradictory groups (far less than a quarter of the participants) as shown in Figure 5.7. The remaining percentage (28.8%) denote nearly a third of respondents who had neither agreement nor disagreement.

Moodle was mostly identified by lecturers/teachers followed by learners/students as their VLE while Blackboard was selected largely by learners/students followed by lecturers/teachers and admin/technicians.

The uncertainty of reporting the name of VLE being used by users is substantial. Nearly one third of respondents, mostly students do not know the name of their VLEs (see Table 5.6).

Occupation	Moodle	Blackboard	I don't know	No VLE is used in my institution	Other	Total
Learner/Student	22	26	41	6	2	97
Lecturer/Teacher	41	15	9	5	10	80
Admin/Technician	1	15	2	0	0	18
Researcher	0	6	2	2	0	10
Total	64	62	54	13	12	205

Table 5.6: VLEs used in HEIs from users' perspectives.

- **Mobile Devices**

The popularity and the increase in ownership of mobile devices between students and faculty members for example, necessitates a shift towards facilitating ways of accessing applications and information systems by these users through the most widely spread devices. Therefore, it was not surprisingly to find out a high number of participants use smartphones to access E-Learning Management Systems (ELMSs) as shown in Figure 5.8 and Table 5.4. Using tablets had a lower acceptance by the participants to access ELMSs as illustrated by Figure 5.8. The highest number of users who used smartphones to access ELMSs were students. However, teachers expressed the first highest disagreement to the use of smartphones for that purpose (see Figure 5.9).

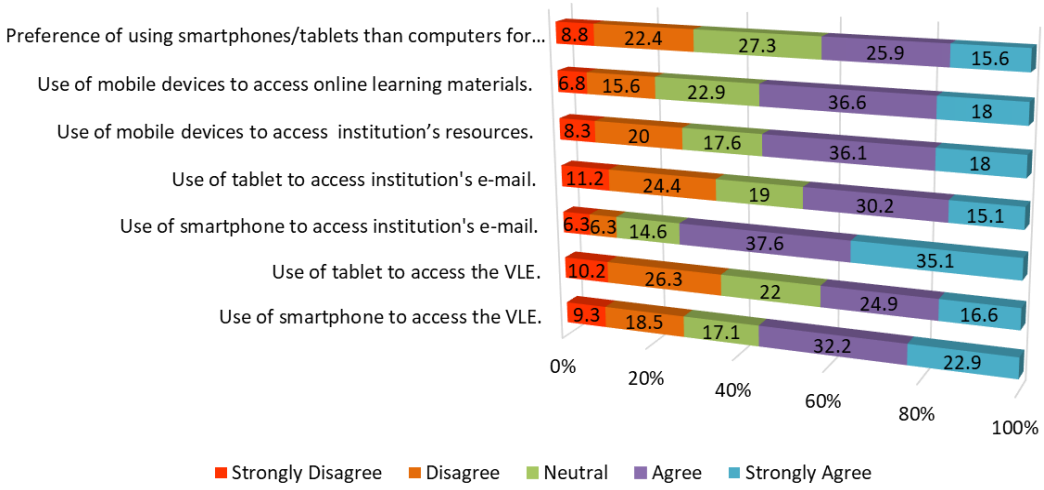


Figure 5.8: Use of mobile devices by users in HEIs.

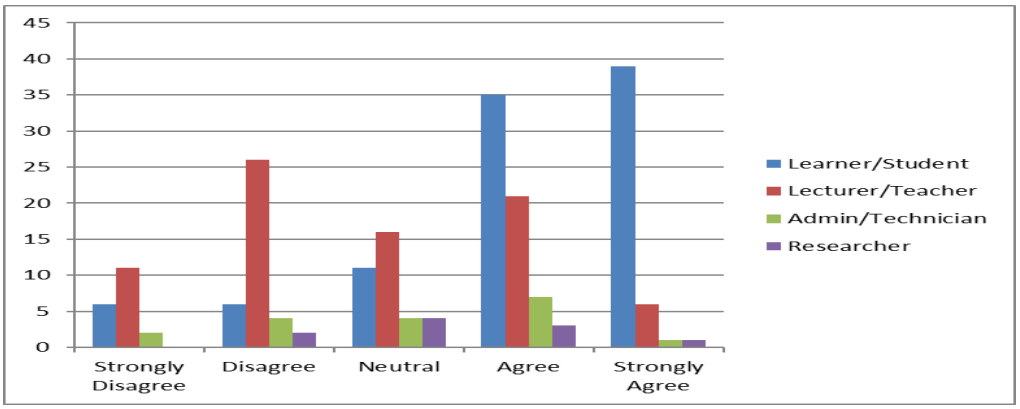


Figure 5.9: Using smartphones to access ELMS (by occupation).

From a different perspective, the 18-24 age group were the highest uses of smartphones, followed by the age groups 35-44 and 25-34 respectively. In contrast the 35-44 age group disagree with the use of smartphones (see Figure 5.10).

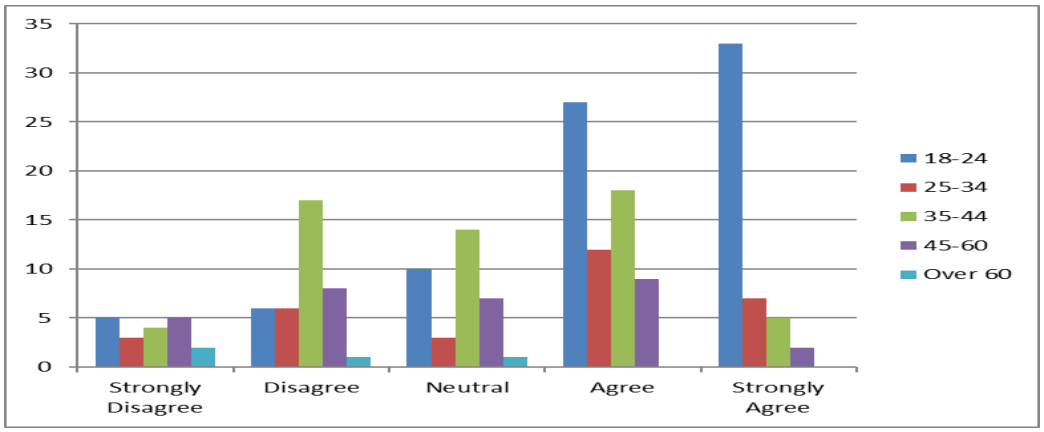


Figure 5.10: Using smartphones to access ELMS (by age).

More than two thirds of the respondents state that their preference for checking their institution's e-mail through smartphones (see Figure 5.8).

From Figure 5.8, it is clear that just less than half of the participants express their use of tablets to access their institution's e-mail. In addition, more than half of the participants indicate their use of mobile devices to access their HEI's resources (see Figure 5.8).

From Figure 5.8, it is obvious that just above a half of the participants use mobile devices to access materials from Internet. In addition, more than a third of participants indicate their preference for using mobile devices over computers in their learning and teaching activities (see Figure 5.8).

- **Computers**

A question was used to explore the usage of computers by users to access learning materials from the Internet compared to the usage of mobile devices.

As shown in Figure 5.11, the results provide an enormous number of participants who agree that they often use computers to access learning materials from the Internet. On the opposite side, only few participants indicated that they use computers for the said purpose.

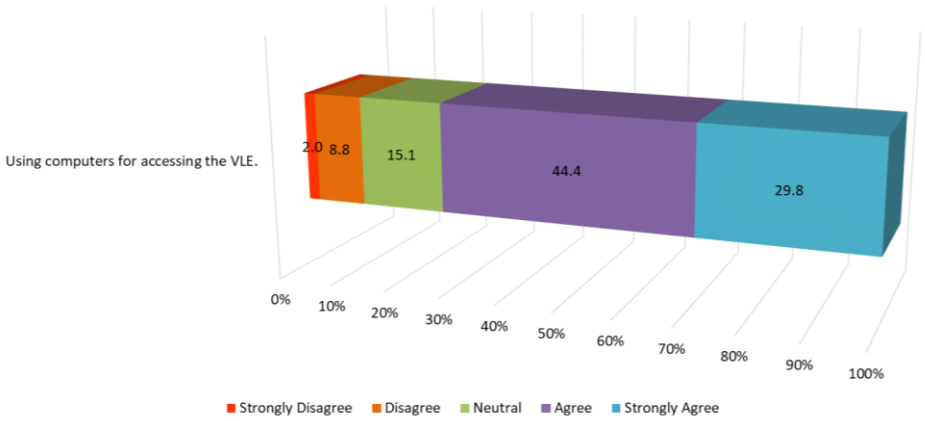


Figure 5.11: Using computers for accessing the VLE.

- **Training**

Undoubtedly, training would play a critical factor for the success for any application or information system. This variable would guarantee a stable achievement of aims and objectives for any project within HEIs.

As illustrated in Figure 5.12, more than a third of participants agree that they receive training for the VLE and other related issues provided by their HEIs. On the contrary, quite a large number of participants have not received any training for the VLE and other related issues.

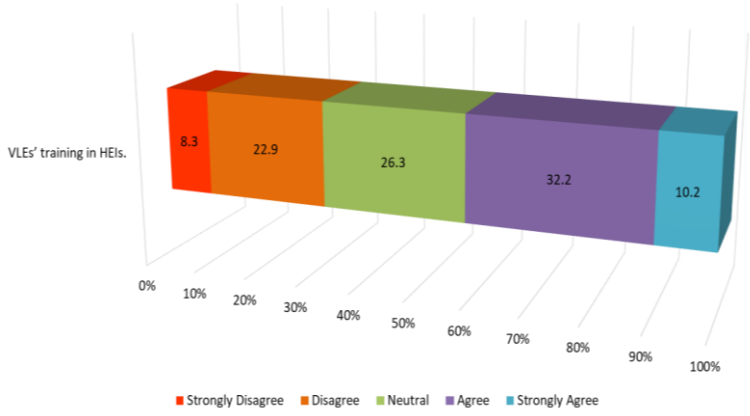


Figure 5.12: VLEs' training in HEIs.

5.5 CURRENT USE OF CLOUD COMPUTING IN HEIS IN OMAN

The responses for the third section of the questionnaire were categorised under 10 variables which consequently would reveal the answers for study question 1.

Table 5.7 shows the statistical results that have been collected by using tests such as Mean, Median, and IQR. As shown in Table 5.7, every row represents a statement which is identified by a variable code. The interpretation of these codes is provided in Appendix 4.

Variable Name	Item Code	Mean	Median	IQR
Cloud-Based E-mail	SecD_1	4.024	4	1
Cloud Storage	SecD_2	3.556	4	1
	SecD_3	3.459	4	1
Social Media	SecD_4	3.990	4	1
	SecD_5	3.439	4	1
Awareness of cloud services	SecD_6	3.507	4	1
	SecD_10	2.756	3	2
Use of cloud computing in education	SecD_7	2.849	3	2
	SecD_8	3.054	3	2
	SecD_11	3.078	3	2
Institutional Support	SecD_9	2.873	3	2
Users' satisfaction	SecD_12	2.829	3	2
Users' experience and readiness	SecD_13	3.117	3	2
	SecD_14	3.522	4	1
	SecD_18	3.483	4	1
Intention to use cloud services	SecD_15	3.893	4	1.5
Perceived usefulness	SecD_16	3.678	4	1
	SecD_17	3.707	4	1

Table 5.7: Results of statistical analysis (Mean, Median, and IQR) for Section D of Survey 1.

Table 5.8 presents the users' responses to individual questions in section D of survey 1. See Appendix 4 to identify names of variables.

Item Code	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
SecD_1	37.6%	42.4%	8.8%	7.3%	3.9%
SecD_2	20.0%	41.0%	21.0%	10.7%	7.3%
SecD_3	19.5%	35.6%	21.0%	19.0%	4.9%
SecD_4	37.6%	39.0%	11.7%	8.3%	3.4%
SecD_5	18.0%	38.5%	19.0%	18.0%	6.3%
SecD_6	18.5%	39.5%	22.0%	14.1%	5.9%
SecD_7	8.3%	17.6%	38.5%	22.0%	13.7%
SecD_8	9.3%	27.8%	33.7%	17.6%	11.7%
SecD_9	7.3%	21.0%	35.6%	23.9%	12.2%
SecD_10	8.8%	16.6%	32.7%	25.4%	16.6%
SecD_11	11.7%	21.5%	40.0%	16.6%	10.2%
SecD_12	7.3%	19.0%	37.1%	22.4%	14.1%
SecD_13	12.7%	34.1%	17.1%	24.4%	11.7%
SecD_14	16.6%	42.4%	22.9%	12.7%	5.4%
SecD_15	24.9%	48.3%	20.5%	3.9%	2.4%
SecD_16	20.5%	40.5%	29.3%	5.9%	3.9%
SecD_17	21.0%	42.0%	28.3%	4.4%	4.4%
SecD_18	16.1%	42.9%	21.5%	12.2%	7.3%

Table 5.8: Users responses to the questions in Section D of Survey 1.

Figure 5.13 illustrates aspects that relate to the use of cloud computing applications in HEIs as indicated by participants. These aspects include the use of cloud-based e-mail, storage, applications and the use of social media in education. The following provides the analysis of the outcome of section D of survey 1:

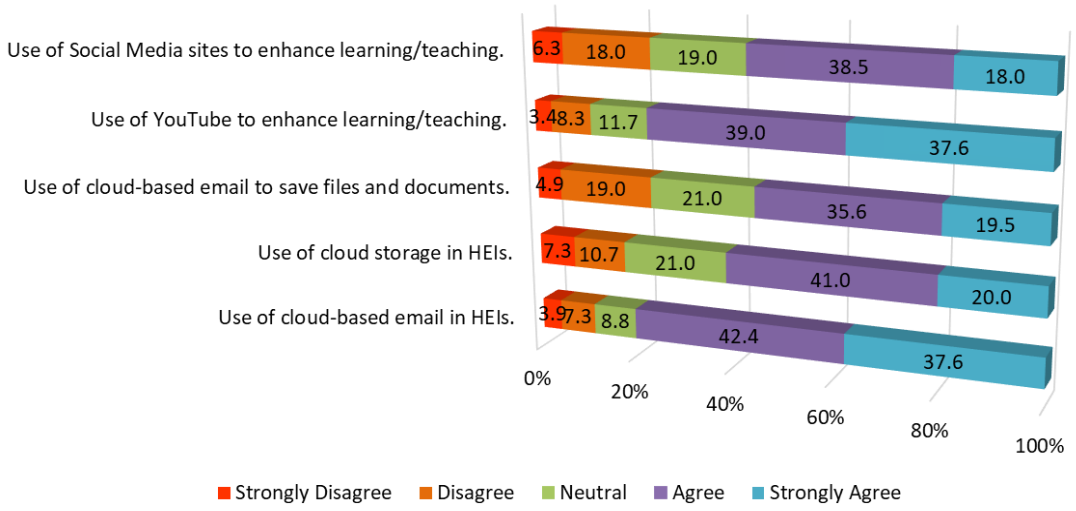


Figure 5.13: Use of cloud computing applications.

- **Cloud-Based E-mail**

As discussed in Chapter 2, many institutions have started hosting their email services with cloud vendors such as Google and Microsoft. In addition, most of email providers such as Google, Microsoft, Yahoo, etc. provide their email services in their public clouds. As illustrated in Figure 5.13, the highest number of participants indicate that they use cloud-based emails. On the other hand, a few participants do not use email services.

- **Cloud Storage**

This variable is important for exploring increasing demands from users for storage in any computer network. The demand for cloud storage is inevitably due the increase of users' needs and the growing size of applications and related documents. This variable highlights the level that users in HEIs are dealing with cloud storage.

From Figure 5.13, it is clear that the majority of respondents express their agreement for using cloud storage. In addition, more than a half of participants reveal their use of cloud-based emails for saving their files (see Figure 5.13).

- **Social Media**

Due to its importance in education, the use of social media is investigated which shows the extent of their utilisation by users in their learning and teaching. Examples considered included, (but were not limited to) YouTube, Twitter, Facebook, and Instagram.

From Figure 5.13, it is apparent that slightly more than three quarters of respondents show their interests in using YouTube to enhance their learning and teaching. In contrast, very few participants oppose the initiative. Additionally, more than half of participants express their views that they use social media to enhance their learning and teaching (see Figure 5.13).

- **Awareness of Cloud Services**

This variable explores whether the users in HEIs are aware of cloud-based educational services or not, and also whether they are informed about new trends and services in cloud computing by their institutions.

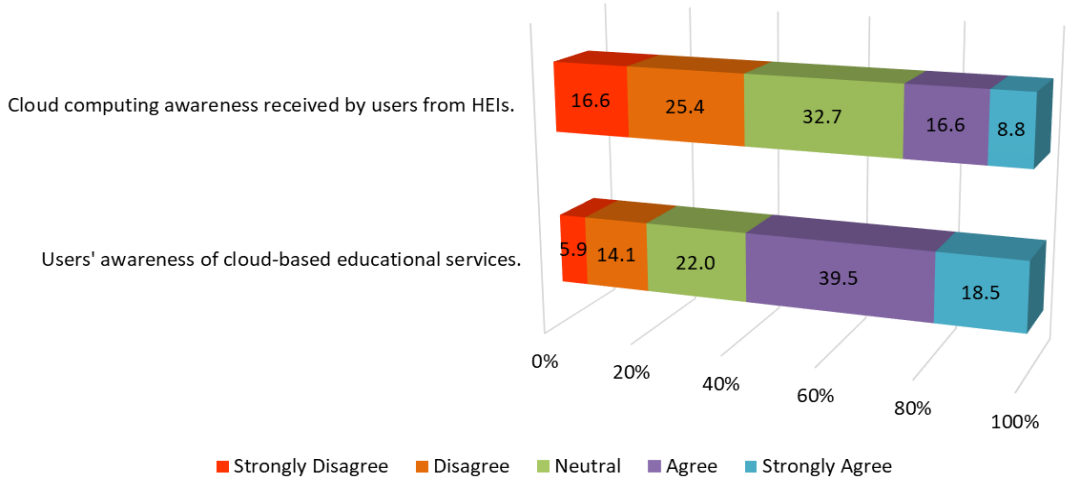


Figure 5.14: Users' awareness of cloud-based educational services.

As shown in Figure 5.14, more than half of participants indicate that they are aware of cloud-based educational services. However, the majority of the participants point out the low or limited awareness received from their HEIs about new trends and services in cloud computing.

- **Use of Cloud Computing in Education**

This variable first highlights the number of HEIs that already provide academic courses through the cloud. Secondly, it indicates the extent of which HEIs encourage users to utilise

cloud services in their learning and teaching activities. Finally, it highlights the availability of cloud services to faculty members and students by HEIs.

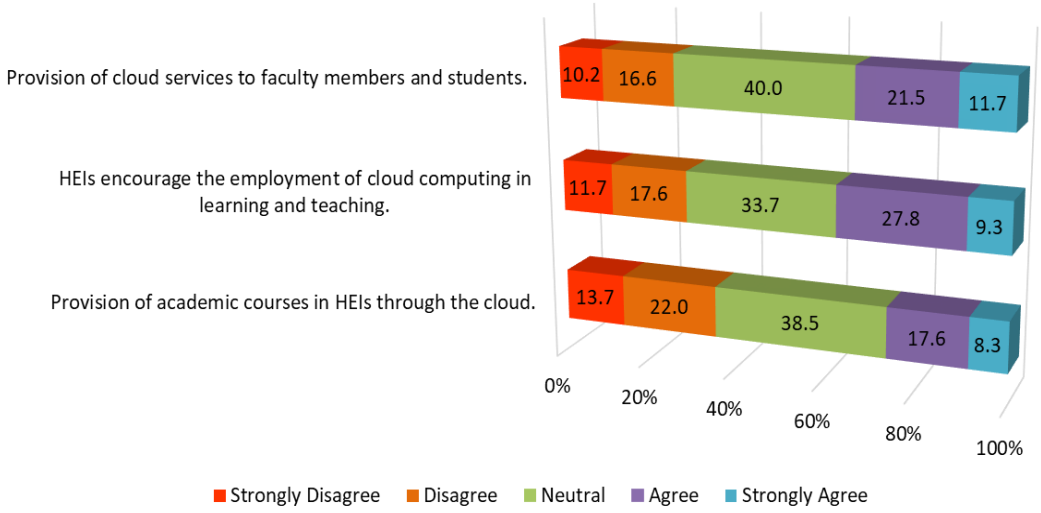


Figure 5.15: Use of cloud computing in education.

Only few participants expressed that their HEIs provide academic courses through the cloud (see Figure 5.15).

Figure 5.15 also illustrates that nearly more than a third of the participants show their agreement for the statement “My institution encourages me to employ cloud services in learning/teaching” while slightly less than a third of the participants agree the statement “My institution offers cloud services to faculty members and students.” (see Table 5.7).

- **Institutional Support**

The institutional support is highly regarded as a crucial factor for employing cloud services and applications into learning and teaching. Therefore, this variable explores the level of which the users in HEIs perceive a notable support that is represented for example in organising events and workshops to bridge the gap between the users and the entire technology used in VLEs.

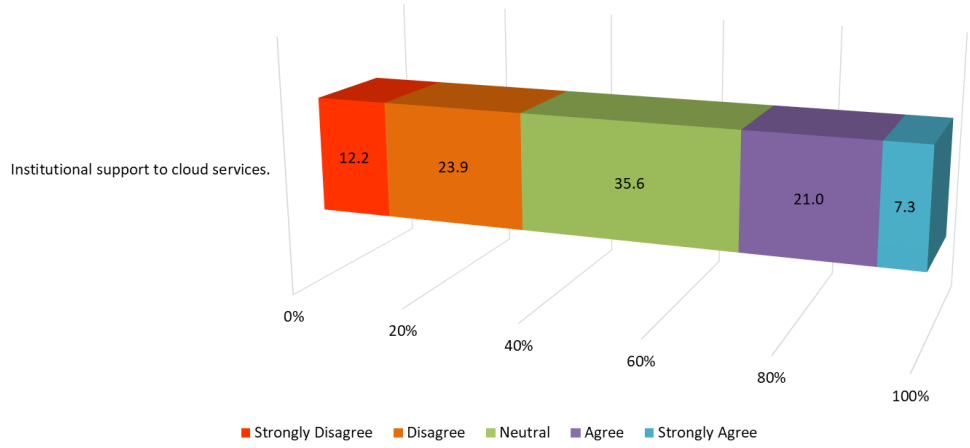


Figure 5.16: Institutional support to cloud services.

Figure 5.16 shows that a few of the participants indicate their agreement for Institutional support for cloud services while almost a third of participants express their disagreement. The majority of participants do not indicate their agreement, or disagreement for the mentioned statement.

- **Users' Satisfaction**

As mentioned earlier in Chapter 2, the users' satisfaction is considerably important to maintain a continuous acceptance of cloud services and their implementation into HEIs. This variable examines users' satisfaction of the current situation of implementing cloud computing services and applications in their HEIs.

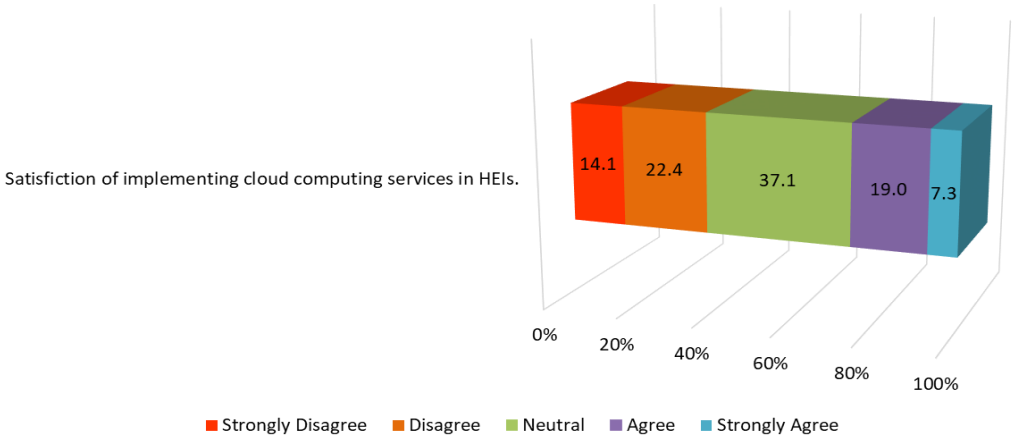


Figure 5.17: Users' satisfaction about the implementation of cloud computing in their HEIs.

Figure 5.17 illustrates that slightly more than a quarter of the participants express their satisfaction about the implementation of cloud computing in their HEIs. However, more than

a third of the participants express their disagreement. Most of the participants do not indicate their satisfaction for the above statement (see Table 5.7).

- **Users' Experience and Competence**

The users' experience and readiness play an important role in delivering services to facilitate the methods of delivery, as well as shorten the time and efforts in this regard. Hence, this variable explores the extent to which users in HEIs are experienced in using cloud services and applications and whether they perceive adequate abilities and knowledge to employ such services and applications.

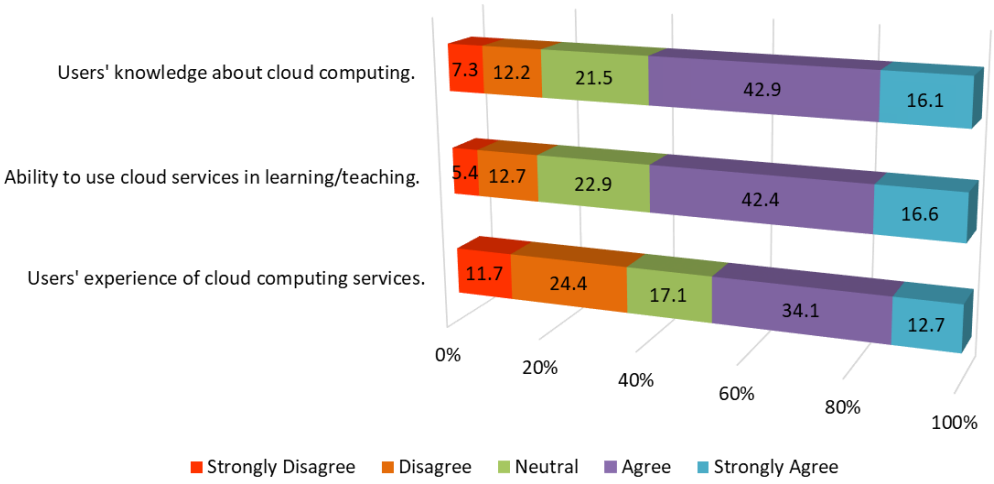


Figure 5.18: Users' experience of cloud computing services.

Figure 5.18 shows that nearly less than half of the participants indicate that they have used cloud computing services before joining their current HEI. Moreover, it illustrates a nearly identical positive response of almost less than two thirds of all the participants for each of the statements "I believe I have the ability to use cloud services in my learning/teaching" and "I am knowledgeable about cloud computing" (see Table 5.7).

- **Intention to Use Cloud-Based Services**

It can be said that there is a positive relationship between users' satisfaction and their intention to use the technology. Figure 5.19 illustrates that nearly three quarters of the participants indicate that they have the intention to use cloud computing services in the future while very few participants have no such intention (see Table 5.7).

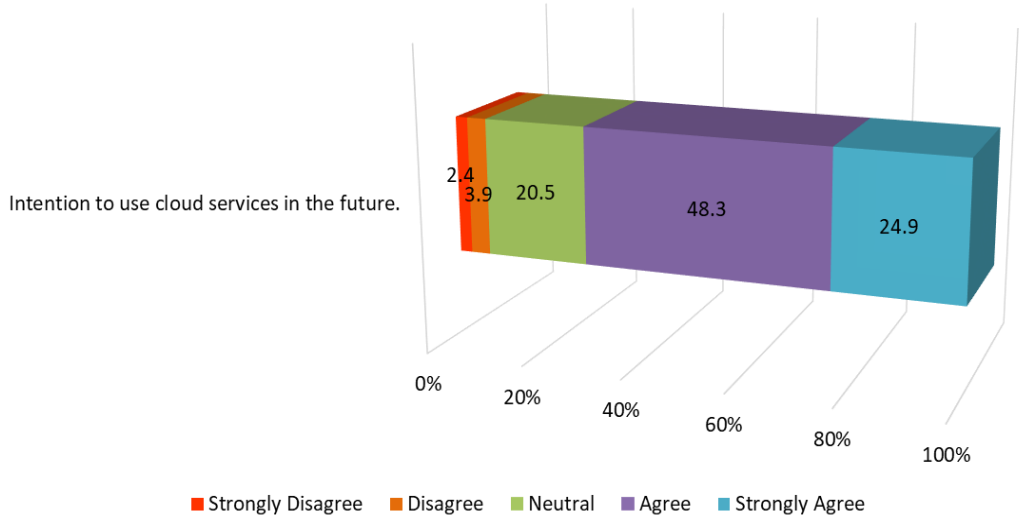


Figure 5.19: Intention to use cloud services.

- **Perceived Usefulness**

This variable indicates whether cloud computing services have enhanced and facilitated the users' learning and teaching activities based on their current and previous experience and use in HEIs. These indicators state the degree of perceived usefulness of such services in the educational environment.

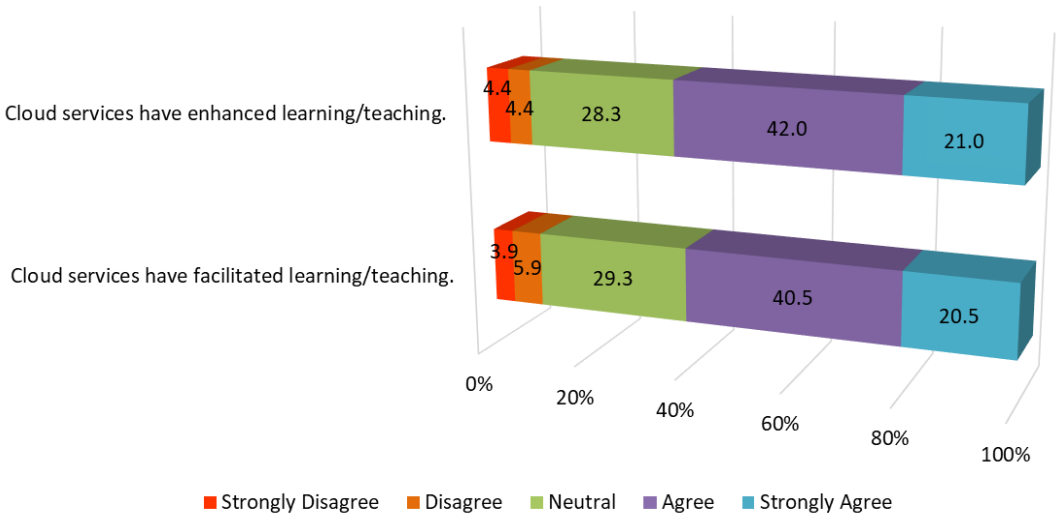


Figure 5.20: Perceived usefulness of cloud computing.

Figure 5.20 shows that there are nearly identical positive responses by almost two thirds of the participants for each statement of the statements “Cloud services have facilitated my learning/teaching” and “Cloud services have enhanced my learning/teaching”.

5.6 COLLABORATIVE ENVIRONMENT IN HEIs IN OMAN

Items in section E of the questionnaire are categorised under 6 variables which accordingly would reveal the answers for study question 2.

Table 5.9 shows the statistical results that have been collected by using tests such as Mean, Median, and IQR. As shown in Table 5.9, every row represents a statement which is identified by a variable code. The interpretation of these codes is provided in Appendix 4.

Variable Name	Item Code	Mean	Median	IQR
Users’ experience and readiness	SecE_1	3.029	3	2
	SecE_2	2.590	2	1
	SecE_3	2.605	2	1
Sharing resources	SecE_4	3.016	3	2
	SecE_5	2.932	3	2
	SecE_10	3.229	3	1
Intention and desire to use	SecE_7	3.737	4	1
	SecE_8	3.727	4	1
Institutional Support	SecE_6	3.376	3	1
	SecE_9	3.502	4	1
Users’ Confidence of Using Cloud-Based Collaboration	SecE_11	3.224	3	1
Factors affecting utilisation of CBCVLE	SecE_12	3.478	4	1
	SecE_13	3.624	4	1
	SecE_14	3.615	4	1
	SecE_15	3.888	4	1
	SecE_16	3.898	4	.0
	SecE_17	4.000	4	1

Table 5.9: Results of statistical analysis (Mean, Median, and IQR).

Table 5.10 presents the users’ responses to individual questions in section E of survey 1. See Appendix 4 to identify names of variables.

Item Code	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
SecE_1	9.8%	28.3%	23.9%	31.2%	6.8%
SecE_2	7.8%	14.6%	21.5%	41.0%	15.1%
SecE_3	8.3%	14.6%	21.5%	40.5%	15.1%
SecE_4	8.8%	32.2%	22.4%	24.9%	11.7%
SecE_5	7.8%	26.8%	23.9%	33.7%	7.8%
SecE_6	8.8%	39.5%	36.1%	11.7%	3.9%
SecE_7	19.5%	48.8%	20.5%	8.3%	2.9%
SecE_8	16.6%	52.2%	22.0%	5.9%	3.4%
SecE_9	12.2%	44.9%	29.3%	8.3%	5.4%
SecE_10	6.8%	38.0%	32.2%	17.1%	5.9%
SecE_11	7.3%	33.2%	42.0%	9.8%	7.8%
SecE_12	12.2%	40.0%	34.1%	10.7%	2.9%
SecE_13	12.7%	47.8%	31.7%	4.9%	2.9%
SecE_14	12.2%	48.8%	29.8%	6.8%	2.4%
SecE_15	22.0%	52.2%	21.5%	1.5%	2.9%
SecE_16	23.4%	53.7%	16.1%	2.9%	3.9%
SecE_17	28.3%	51.2%	14.6%	3.9%	2.0%

Table 5.10: Users responses to the questions in Section E of Survey 1.

Figure 5.21 illustrates aspects that relate to collaborative environment in HEIs as indicated by participants. The following provides the analysis of the outcome of section E of survey 1:

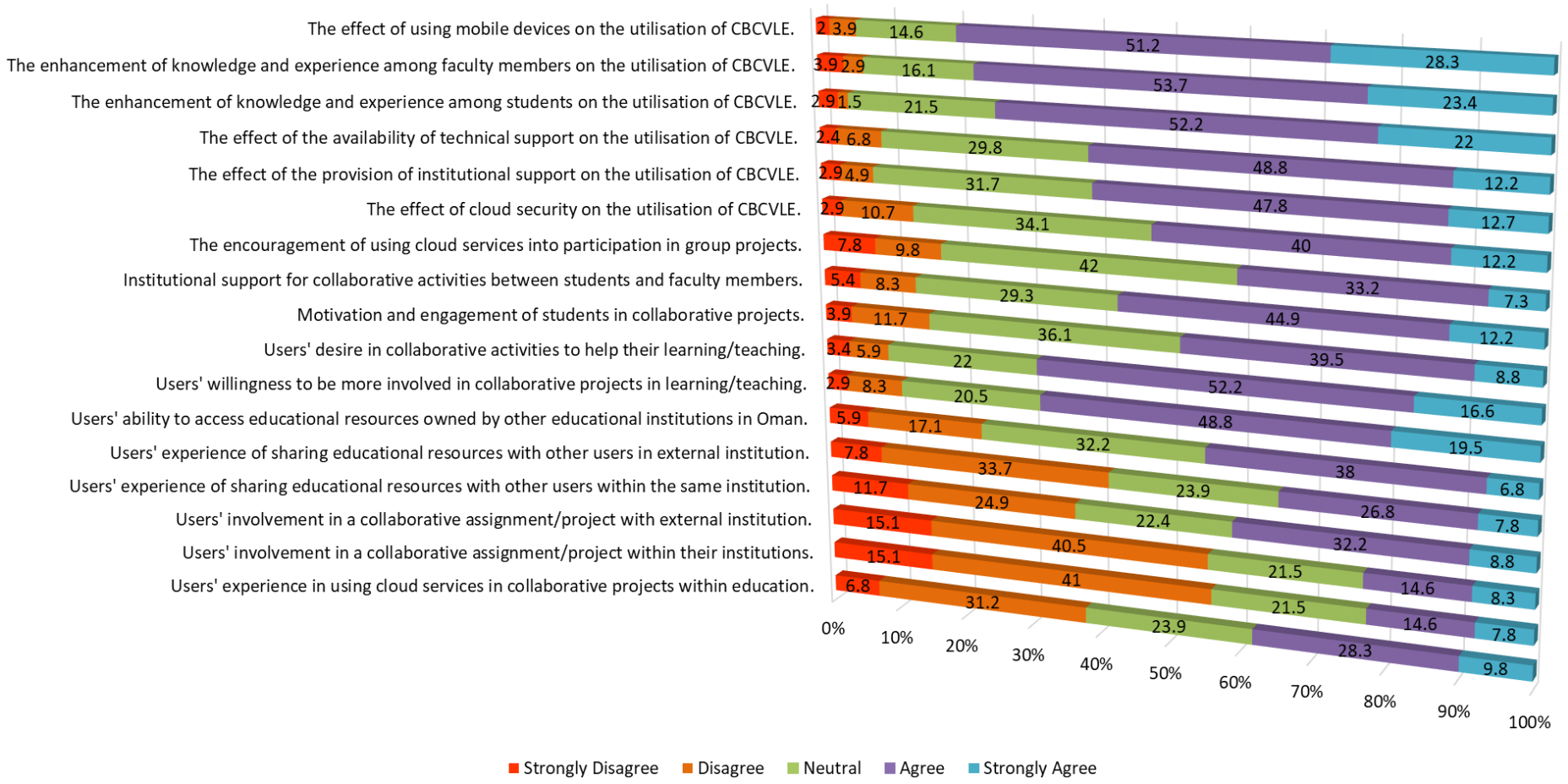


Figure 5.21: Collaborative VLE in HEIs.

- **Users' Experience and Competence**

The users' experience and readiness play an important role in the entire collaborative environment and facilitate its implementation. Hence, this variable explores the extent to which the users in HEIs are experienced in dealing with collaborative activities through cloud services and applications. This variable also measures the involvement of users in HEIs in collaborative learning environment either inside or outside their HEIs.

From Figure 5.21, it is clear that just above a third of the participants express their agreement for their previous experience of using cloud services in collaborative projects in education. In addition, less than a quarter of the participants indicate their involvement in a collaborative assignment/project within their institution using cloud-based services. Nearly the same number of participants indicate their involvement in a collaborative assignment/project with an external institution using cloud-based services (see Figure 5.21 and see Table 5.9).

It was obvious that the majority of users are with disagreement with the previous two statements as shown in Figure 5.21. More than a half of the participants indicate that they have not been involved in a collaborative assignment/project either inside or outside their institutions using cloud-based services (see Table 5.9).

- **Sharing Resources**

Although the traditional VLEs (as discussed in Chapter 3) offer the feature of sharing resources, the proposed framework will extend it. However, this variable facilitates the ground for assessing the current status of sharing resources in HEIs.

More than a third of the participants indicate that they have experience of sharing educational resources with other users within the same institution. However, a considerable number of participants indicated that they have no experience of sharing educational resources with other users in external institution (see Figure 5.21 and Table 5.9).

Figure 5.21 illustrates that nearly a half of the participants indicate that they are able to access educational resources owned by other educational institutions in Oman.

- **Intention and Desire to Use**

This variable explores the users' interests to be involved in collaborative projects in learning and teaching, as well as their desire in collaborative activities to improve their educational tasks as shown in Figure 5.21.

- **Institutional Support**

This part of the survey attempts to find the level of motivation and support provided to students from their HEIs to engage them in collaborative projects.

Figure 5.21 illustrates that almost half of the participants indicate that students are motivated and engaged in collaborative projects in their institutions. More than half of the participants assert that their HEIs support collaborative activities between students and faculty members (see Figure 5.21).

- **Users' Confidence of Using Cloud-Based Collaboration**

This variable measures the users' confidence of using a cloud-based collaboration in their learning and teaching activities such as the participation in group projects.

A few of the participants indicate their agreement for the use of cloud services in education which would encourage them to participate in group projects. The majority of the participants do not indicate their agreement or disagreement for the mentioned statement (see Figure 5.21).

- **Factors Affecting Utilisation of CBCVLE**

The factors that can affect the utilisation of CBCVLE are explored. These factors include cloud security, provision of institutional support, availability of technical support, the enhancement of knowledge and experience among students, the enhancement of knowledge and experience among faculty members, and using mobile devices.

Figure 5.21 illustrates that just above half of the participants express their agreement for the two statements; "Cloud security concerns such as privacy would affect the utilisation of CBCVLE" and "The provision of institutional support would affect the utilisation of CBCVLE" respectively. On the other hand, very low minority of the participants indicate their disagreement for both statements (see Table 5.9).

More than two thirds of participants, as illustrated in Figure 5.21, express their agreement for the two statements; "The availability of technical support would affect the utilisation of CBCVLE" and "More knowledge and experience among students would enhance the utilisation of CBCVLE by them" respectively. On the other hand, very low minority of the participants indicate their disagreement for both statements (see Table 5.9).

More than three quarters of participants, as depicted in Figure 5.21, express their agreement for the two statements; "More knowledge and experience among faculty members would

enhance the utilisation of CBCVLE by them" and "The ability to use mobile devices such as smartphones and tablets would help and encourage utilisation of CBCVLE by students and faculty members" respectively. On the contrary, very low minority of the participants indicate their disagreement for both statements (see Table 5.9).

5.7 POTENTIAL FEATURES OF CBCVLE

The questions in section F of the questionnaire were designed for users in HEIs to rate the potential features of the proposed CBCVLE from their perspectives. This section was anticipated to reveal the answers for study question 5 (see Appendix 3 to identify the feature ID).

Feature ID	Mean	Median	Highly Expected	Expected	Lightly Expected	Not Expected	No views
1	3.346	4	10.7	46.3	23.9	4.9	14.1
2	3.600	4	12.7	56.6	18.0	3.4	9.3
3	3.776	4	19.5	53.7	17.6	3.4	5.9
4	3.815	4	19.0	56.1	16.1	4.9	3.9
5	3.742	4	20.5	48.3	21.5	4.4	5.4
6	3.946	4	26.3	49.8	18.5	2.9	2.4
7	3.693	4	16.6	51.2	23.4	2.4	6.3
8	3.673	4	20.0	43.9	25.4	4.9	5.9
9	3.498	4	11.7	49.3	24.4	6.3	8.3
10	3.488	4	16.6	44.9	21.0	5.9	11.7
11	3.449	4	15.1	42.0	27.3	3.9	11.7
12	3.420	4	13.2	46.3	22.4	5.4	12.7
13	3.668	4	20.0	48.8	18.0	4.4	8.8
14	3.810	4	22.9	53.2	13.2	3.4	7.3
15	3.932	4	28.3	50.7	12.2	3.4	5.4
16	3.834	4	22.0	54.1	15.1	2.9	5.9
17	3.771	4	19.5	53.7	17.1	3.9	5.9
18	3.785	4	22.0	50.7	17.1	4.4	5.9
19	3.737	4	18.5	55.1	15.1	3.9	7.3
20	3.732	4	16.1	57.6	15.1	5.9	5.4
21	3.620	4	15.5	45.9	21.0	4.4	9.3
22	3.566	4	18.0	45.4	20.5	7.3	8.8
23	3.883	4	28.3	46.8	14.6	5.4	4.9
24	3.717	4	22.4	46.8	18.0	5.4	7.3
25	3.639	4	17.1	51.2	18.0	5.9	7.8
26	3.624	4	16.6	50.7	19.0	5.9	7.8
27	3.629	4	23.9	39.5	20.5	7.8	8.3
28	3.527	4	21.5	40.0	19.0	8.8	10.7
29	3.639	4	23.4	42.9	17.6	6.3	9.8
30	3.756	4	23.9	47.8	16.1	4.4	7.8
31	3.498	4	16.6	42.4	23.4	9.3	8.3
32	3.863	4	20.5	57.6	13.7	4.4	3.9
33	3.454	4	14.1	46.3	20.0	9.8	9.8

Table 5.11: Potential features of CBCVLE.

From Table 5.11, taking into consideration the most positive two options "Highly Expected" and "Expected", the majority of users rate all features positively. The minimum percentage of the total responses to the two mentioned options is 57% and the maximum is 79% both combined together. The Mean ranges from 3.346 to 3.946 out of 5 while the Median remains stable at 4 for all features. Therefore, the users' expectation of potential features of a CBCVLE was extremely high.

5.8 HYPOTHESES TESTING

As mentioned in section 5.2.5, a number of hypotheses were formulated to be tested in this research.

Table 5.12 shows the list of the hypotheses and their respective sections which relate to the questions within the questionnaire, as well as the Mean and Median for every hypothesis.

Hypothesis	Respective Items from Questionnaire	Mean	Median
H_1	SecB_1, SecB_2, SecB_4, SecC_1, SecC_2, SecC_5, SecC_6	3.722	4
H_2	SecC_3, SecC_4	3.290	3.5
H_3	SecD_1, SecD_2, SecD_3, SecD_4, SecD_5	3.781	4
H_4	SecD_12	2.829	3
H_5	SecD_15	3.893	4
H_6	SecE_1, SecE_2	2.810	3
H_7	SecD_14	3.522	4
H_8	SecE_7	3.737	4

Table 5.12: Hypotheses testing using SPSS.

Table 5.13 presents the results of Hypotheses testing using One-Sample T-Test. An absolute hypothesised mean value of 2.9 was used in the test.

Hypothesis	Mean	t	df	Sig.(2-tailed)
H_1	3.722	13.001	204	.000
H_2	3.290	6.157	204	.000
H_3	3.781	13.024	204	.000
H_4	2.829	-.906	204	.366
H_5	3.893	15.679	204	.000
H_6	2.810	-.034	204	.973
H_7	3.522	8.259	204	.000
H_8	3.737	12.419	204	.000

Table 5.13: Hypotheses testing using one-sample T-Tests (Test Value = 2.9).

Table 5.13 presents the results which are statistically significant for hypotheses H_1 ($t(204) = 13.001$, $p < 0.001$), H_2 ($t(204) = 6.157$, $p < 0.001$), H_3 ($t(204) = 13.024$, $p < 0.001$), H_5 ($t(204) = 15.679$, $p < 0.001$), H_7 ($t(204) = 8.259$, $p < 0.001$), H_8 ($t(204) = 12.419$, $p < 0.001$). Therefore, it can be concluded that the null hypotheses are rejected and hypotheses H_1, H_2, H_3, H_5, H_7, and H_8 are supported. On the other hand, the results are not statistically significant for hypotheses

H_4 ($t(204) = -0.906$, $p > 0.05$) and H_6 ($t(204) = -0.034$, $p > 0.05$). Therefore, it can be concluded that the null hypotheses for H_4 and H_6 cannot be rejected.

5.9 DISCUSSION

This survey provides an insight into issues concerning the ICT infrastructure and services in HEIs in Oman to support the adoption of cloud computing into collaborative VLE. Moreover, it highlights the current extent of using cloud computing services by users of the HEIs in Oman, as well as the extent to which the collaborative environment and activities are being adopted. The survey also investigates issues that relate to users' experience and expectations in terms of using cloud computing technologies and collaborative VLEs.

With regard to the first research question, the study examined issues related to ICT infrastructure and services that may contribute to a successful implementation and utilisation of a CBCVLE. The results provide evidence that for some HEIs the existing ICT infrastructure and services in some HEIs in Oman is sufficient as a starting point in the way towards shifting services and systems from within the campus to the cloud. Users in HEIs seem to have experience and the interest to use their own mobile devices to access different resources on the Internet.

A strong relationship between cloud computing and collaborative learning environment has been reported in the literature. As stated by researchers (CISCO 2012; Luna and Sequera 2015; Alkindi et al. 2015), the local ICT infrastructure is a crucial factor to start migrating to cloud as it represents the private cloud for an HEI. Hence, this is can be extended by joining public clouds that are considerably popular to offer more educational services to their potential users.

The facts presented above indicate an acceptable level of Internet service that is made available to users in HEIs. This is supported by the fact that some HEIs have introduced this service through two different Internet Service Providers (ISPs) to maintain a continuous and stable service. Although some HEIs provide Internet connectivity in an acceptable level, other HEIs are still below the satisfactory expectations of users. Al Kharusi (2016) asserts that many HEIs are paying huge amounts of money to preserve an acceptable speed for their campuses, and most of private Colleges and Universities cannot afford to spend such amounts from their current budgets.

One unanticipated finding was that the inconstancy of Wi-Fi in HEIs as described by a considerable number of users. This fact raises the importance of a quick action to maintain a

trustworthy Wi-Fi in these institutions. This is asserted by Lung and Shih (2015) who argue that devices must move smoothly throughout a campus, while the number of access points should be increased periodically.

Similarly, USB flash drives are used by a high number of users as their primary storage. This indicates that these users still consider this medium the most practical and ideal for storing their files regardless of the threats to their data and privacy which may not be clear yet. Another implication is that these users have no knowledge or even confidence that cloud storage would be more secure than USB flash drives. Lung and Shih (2015) stresses that this ordinary storage medium may contains viruses, and therefore it is not recommended, and instead a cloud storage is favourable. Moreover, it is asserted by Sultan (2010, p.113) that students are "*more often than not, saving their work to USB memory sticks which are often prone to loss or misuse*".

Sarrab et al. (2016) state that the dissemination of mobile devices among students would facilitate a decent ground for collaboration in learning environment. This study concludes that a number of users in HEIs utilise their mobile devices to access their VLEs, institution's e-mail, and institution's resources and other information systems such as Library, Registration etc. Therefore, this factor will positively affect the adoption of CBCVLEs in HEIs and also will affect the effectiveness of the collaboration between the community members.

The availability of technical support in HEIs as well as IT policies and training will enhance the shift to cloud computing and collaboration in educational activities. HEIs support for these will guarantee the success for such initiatives. Yeboah-Boateng and Essandoh (2014) point out that technical support from the cloud provider would perform as a challenge that may deter HEIs from extensively employing cloud computing technologies and applications.

In respect to the second research question "What is the extent of the application of collaborative VLEs in HEIs in Oman?", the results reveal that users in HEIs have limited or no experience in using cloud services in collaborative projects within education. This finding may be due to the fact that their VLEs are not hosted in the cloud and moreover they do not support collaboration. The fact to support this argument is that the majority of users had no involvement in a collaborative assignment/project within or between institutions using cloud-based services.

Another fact revealed from the results is that users in HEIs had no notable experience in sharing educational resources with other users within the same or external HEIs. This may be due to the fact that the existing VLE tools do not support collaborative activities. Luna and Sequera (2015) highlight that traditional learning which implements practical laboratories has

revealed weak collaboration and sharing of resources. On the other hand, Sarrab et al. (2016) assert that sharing learning material should be easy within e-learning system. It should be noted that sharing resources should be highly supported in a CBCVLE to enhance collaboration among users and between HEIs.

One of the interesting aspects highlighted by the survey's results is that users expressed interest and willingness to be more involved with collaborative projects in learning/teaching. This is confirmed by Sarrab et al. (2016) who point out that users' willingness is a key factor for success, and it is affected by perceived ease of use and usefulness.

Another important finding was that the users are more encouraged to participate in group projects when they are using cloud services in such projects. This is consistent with the potential benefits and features revealed by the literature as highlighted in Chapter 2. The incorporation of cloud computing into collaborative VLEs would assure an increasing utilisation of collaborative work as it is most likely that users will be more familiar and convinced about this enriched environment.

In respect to the third research question which focuses on concerns and challenges that may have an effect on the use and acceptance of a CBCVLE, the survey reveals facts to the related issues. It was clear that some issues such as awareness of IT policies and email services (e.g. free cloud-based email) are relatively easily to implement and require minimal efforts and limited funds. On the other hand, issues including Internet services, technical support, storage, VLE, infrastructure for Wi-Fi, and training require HEIs to increasingly invest either in their private infrastructure or to adopt public clouds. Al Balushi (2010) indicates that the lack of technical awareness contributed to delay in the development of ICT in Oman. Thus, the incorporation of new technologies such as cloud-based VLE tools may by affected if users are less aware of the related technical knowledge. Yeboah-Boateng and Essandoh (2014) also highlight limited technical knowledge with users about similar technologies as a challenge.

To some extent, the awareness of IT policies would help the institutions to direct the users to the right way of using any relative service. Hence, this also would further improve the delivery of educational services to potential users. HEIs' users are not extensively aware of IT policies as outlined by the survey results. HEIs should pay attention to disseminate the awareness of their IT policies among their stakeholders. Sarrab et al. (2016) assert that policies should be established nationally and locally, while the first focusses on structure and guidance, the latter greatly considers the implementation and utilisation. In addition, Doelitzscher et al. (2011) assert that defining IT policies would help in building a cloud infrastructure.

As it was mentioned in Chapter 2, Sarachandran (2012) asserted that the awareness and uses of cloud computing has increased sharply in HEIs in Oman. This fact is supported by the results where the majority of users are aware of cloud-based educational resources. However, the majority of those who participated in the survey asserted that they had not received awareness from their HEIs about new trends and services in cloud computing. The lack of technical awareness was indicated by Al Balushi (2010) as a challenge to the development of the ICT in Oman. It can thus be suggested that the diffusion of technical awareness among HEIs' practitioners would help to lessen the gap between users and the new advancement in cloud computing.

The application of cloud computing in higher education was extensively discussed in Chapter 2. In this regard, it can be observed that low or limited provision of academic courses resources in HEIs is available through the cloud. Bearing in mind the above, it can be concluded that HEIs neither extensively encourage users to use cloud services in learning and teaching activities nor provide faculty members and students with cloud services. Cloud computing applications and services can be incorporated by HEIs to deliver courses benefiting from the potential features to support collaborative VLE. In the same context, the participants in the survey raised the issue of limited events and workshops organised by their institutions to raise awareness. It can therefore be assumed that the HEIs do not give adequate attention to this issue which can promote utilisation of collaborative cloud computing environments.

Agreeing to the importance of users' satisfaction mentioned by White et al. (2009), it can be concluded that the more familiar users are with the environment and the devices, the more productive and engaged with the tools within it. Hence, the participants in HEIs demonstrate a high degree of familiarity with mobile devices to access their VLEs, Internet, email, and other institutional information systems. This familiarity will facilitate easy implementation of initiatives within the cloud-based collaborative initiative. This is consistent with Cagiltay et al. (2006) who claim that learners' path is affected by their familiarity with computer-based tools which may include VLE tools. Therefore, involving users in more training activities as well as keeping them aware of new technologies and tools will help increase their familiarity with such environments.

In regard to the perceived usefulness of cloud computing, a vast majority of participants users in the survey indicated that relevant technologies and services have enhanced their learning and teaching. Therefore, the users' assertion of the perceived usefulness of cloud computing can play an important role in accepting the need for a CBCVLE. This is consistent with Hew et al. (2016a) who assert that perceived usefulness has an influence over users' confirmation and

satisfaction. This perception of usefulness, as pointed out by White et al. (2009), will contribute to the users' intention to use VLE tools.

It was revealed by Lee (2010) that users' satisfaction would lead to their continuance intention to use a technology. The survey results highlighted a lower users' satisfaction with regards to the implementation of cloud computing in their HEIs. This is can be referred to as the limited provision of cloud services, low institutional support, or limited training and awareness. Nevertheless, quite a number of participants (users in HEIs) indicated their experience of cloud computing services before joining their institutions. The majority of them had knowledge about cloud computing and the applications of cloud services in their education. Most of the participants pointed out that their intention was to use cloud services in the future. This can be considered as a good motive for HEIs to offer their respective users more cloud-based educational services.

In regard to the fourth research question, Moodle was preferably selected by the majority of HEIs in Oman. This highlights a considerable financial benefit whereas priorities of funds would be given to cloud computing and any relatively collaborative environment activities. This is supported by Al-Zoube et al. (2010) who highlights the benefits of low cost of introducing cloud computing in HEIs. However, this compares the high cost for establishing the traditional ICT infrastructure (hardware, software, and related maintenance and technical support) with cloud-based services. Moodle as described by Erturk (2016) is an open source and flexible VLE. Hence, Moodle can be extended and customised to meet different needs of users and HEIs in terms of collaborative VLE.

In respect to the fifth research question, the results reveal that a considerable number of participants (users in HEIs) are using cloud-based email such as Yahoo, Gmail, and Hotmail. This reflects the benefits that users get from using such cloud tools including availability, interoperability, compatibility and many of those benefits inherited from cloud technology and its potential features and characteristics. This is confirmed by Sultan (2010) who asserts that the HEIs' decision to use cloud-based applications such as email is economical due to the zero cost of such services.

The above point also indicates an acceptable level of experience with users in HEIs who are able to browse their emails through mobile devices as asserted by the results. These obvious talents would contribute positively to the application of CBCVLE. So and Brush (2008) that some students consider emails as a desirable tool among others to communicate with their teachers. This tool, in addition to others such as chat, student forums, and instant messaging services can be incorporated into a CBCVLE.

The results indicate that more than a half of the participants (users in HEIs) are using cloud-based email for saving their files and documents besides more than two thirds of users are using at least one of the popular cloud storages such as Dropbox, OneDrive, Google Drive, iCloud. This reflects that many users have experience with at least an application of cloud computing that is widely used. The cloud storage is an important feature in a collaborative e-learning environment as described by Liao et al. (2013). This feature as indicated by Darwaish and Wang (2012) is highly desired by users. Further, cloud computing technologies have the potential to support collaborative learning and teaching (Kirchner and Razmerita 2015), and also the collaborative VLE.

The social media is another facility that is indicated by the participants (users in HEIs) to enhance their learning and teaching activities. Almost two thirds of the population use YouTube extensively along with other sites and applications such as Facebook, Twitter, and Instagram. Therefore, it can be concluded that the users in HEIs in Oman will be widely using social media sites in general and especially for educational purposes. This will fit into the proposed CBCVLE as indicated by Erturk (2016) that YouTube videos for example can easily be implemented in Moodle. Thus, YouTube as well as other social media sites, can be integrated into a CBCVLE to support educational activities and to increase the users' participations.

In regards to the factors affecting the utilisation of CBCVLE in HEIs, six factors were included as follows: (1) The effect of cloud security on the utilisation of CBCVLE, (2) The effect of the provision of institutional support, (3) The effect of the availability of technical support, (4) The enhancement of knowledge and experience among students, (5) The enhancement of knowledge and experience among faculty members, and (6) The effect of using mobile devices. It can be concluded that the vast majority of users agreed with the importance of the mentioned factors in respect of utilisation of CBCVLE.

It can be concluded that the factors to support the use of a CBCVLE include: (1) availability and stability of Internet connectivity, (2) users readiness of ICT (experience and devices availability), (3) users awareness of benefits of the cloud and collaboration, (4) users willingness to use a CBCVLE, (5) institution's support and promotion for a CBCVLE, (6) institution's willingness for a CBCVLE, (7) technical support, (8) community support, (9) interoperability, and (10) portability. Finally, it is anticipated that survey 2 provides more answers to research questions that remain unanswered.

5.10 CHAPTER SUMMARY

The chapter started by highlighting the survey 1 process and its characteristics. The results were then, presented and analysed. The findings focused on (1) current ICT infrastructure and services of HEIs in Oman, (2) current use of cloud computing in HEIs in Oman, (3) collaborative environment in HEIs in Oman, and (4) potential features of CBCVLE.

Users in HEIs have knowledge, experience, and the willingness to use their own mobile devices to access different resources on the Internet. Both, private and public clouds can be utilised by HEIs for collaborative VLEs. The current ICT infrastructure and services can be sufficient to start with while users are willing to ultimately move to the cloud. Personal devices such as mobile phones and tablets may facilitate the way for users to utilise a CBCVLE. Moodle was preferred by the majority of the participants. Users' experience is extremely important as it can influence and support the utilisation of a CBCVLE. Generally, the findings were discussed in relation to relevant literature highlighting a set of contributing factors that support the use of a CBCVLE.

CHAPTER 6: SURVEY 2 ANALYSIS – PART 1

This chapter presents the analysis of qualitative data collected via interviews with users in HEIs in Oman. The analysis will be structured in a manner that forms the draft version of the framework. The main drivers for the data collection and analysis were to explore the factors affecting the use and acceptance of a CBCVLE by users in HEIs in Oman. This was used to identify the areas that need consideration when implementing or upgrading such systems. Discussions in respect of culture is presented in Chapter 7.

6.1 INTRODUCTION

The purpose of this survey (see Appendix 5) is to investigate and identify elements which can influence the use of a CBCVLE by users in HEIs in Oman. The survey also explores users' views in respect of current VLE software tools, collaborative VLEs, the employment of cloud computing services and applications in education, and also the cultural influences on a CBCVLE (will be discussed in Chapter 7). A representative slection of quotes of responses are provided in Appendix 6.

Five themes have emerged from the analysis of survey 1 and survey 2 in particular and from literature search in general (see Figure 6.1). The themes are: ICT infrastructure and services in HEIs in Oman, operational environment, user experience and expectations, factors affecting the use and acceptance, and cultural influences. Details of framework will be found in Chapter 8.

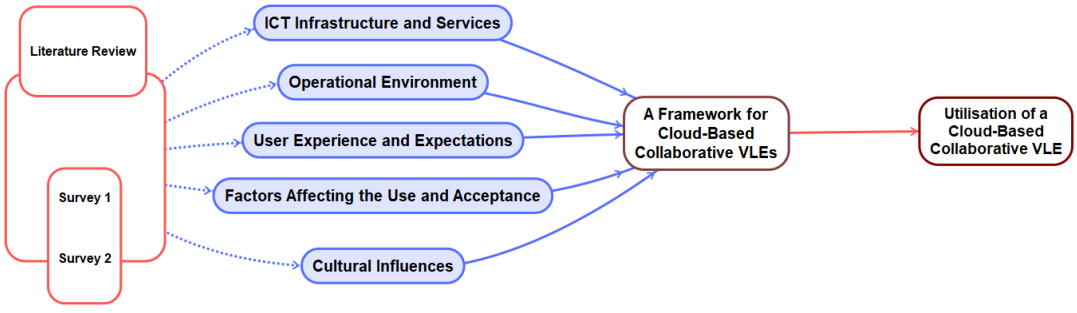


Figure 6.1: Key elements emerged in the research.

6.2 DATA ANALYSIS PROCESS

The analysis of survey 1 (see Chapter 5) has guided the design of qualitative questions (see Appendix 5) in survey 2. Figure 6.2 illustrates the various processes of survey 2 that the researcher went through.

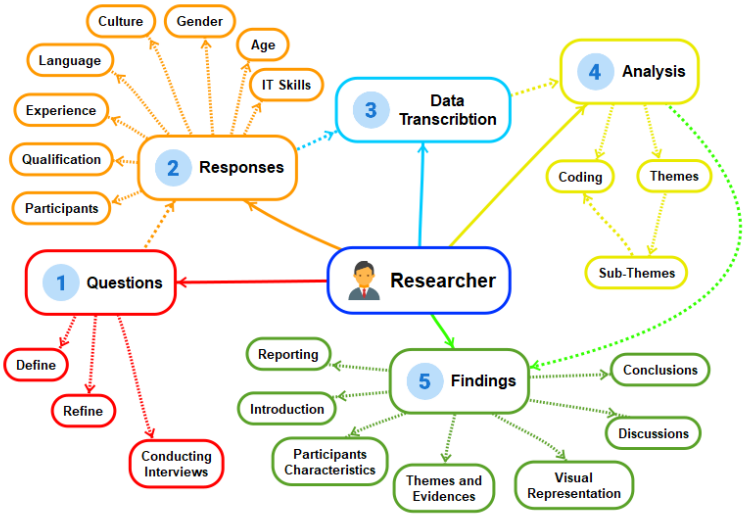


Figure 6.2: Survey processes (phases of qualitative research and analysis).

Conversion of interviews recording into textual form (Poland 2008) was done for all the recorded interviews. Some interviews were conducted in Arabic which required translation into English. This is followed by importing all transcripts from the interviews into NVivo, the software which was developed by QSR International (Bazeley and Jackson 2013; QSR International 2017). NVivo was mainly used for analysing the data collected via survey 2. In analysing qualitative data, NVivo is capable to manage data and ideas, query data, visualize data, and report from the data (Bazeley and Jackson 2013; Richards 1999). Coding is an important step done by researchers seeking clarity, flexibility, and consistency (Saldaña 2016). The coding used in this thesis were to create themes (categories) and sub-themes.

6.3 THEMATIC ANALYSIS

Thematic content analysis as highlighted by Sim (2009) relies on searching ideas in the data and placing them under themes or categories. Thematic analysis also described by Howitt and Cramer (2011) as "*the analysis of textual material (newspapers, interviews and so forth) in order to indicate the major themes to be found in it*" (p. 332). NVivo is a common computer program for analysing qualitative data (Blaxter et al. 2006; Sim 2009).

Content and thematic analyses were used to analyse phrases and expressions given by the participants within the open questions. This analysis highlights insights on different aspects of the study and hence it supports the statistical analysis where applicable.

6.4 PARTICIPANTS CHARACTERISTICS

Thirty-eight users at different HEIs in Oman were interviewed to explore aspects that relate to the use and acceptance of a CBCVLE. This survey aims to explore the challenges that may prevent users from utilising a CBCVLE and any concerns that would affect its use. Therefore, the survey investigates information concerning users' current use and application of cloud computing in their learning and teaching activities. In addition, it explores the current status of collaborative VLE besides the users' views in respect of relevant issues such as the effects of local culture in the use of a CBCVLE. One set of the questions is used for all types of participants. Among 38 interviews, 18 (47%) were conducted in English while 20 (53%) were in Arabic language and then translated into English. Table 6.1 presents the profile of the participants in survey 2.

ID	Language	Profession	Gender	Age Group	Qualification	Computer Skills
TL1	English	Lecturer	Male	35 – 44	PhD	IT Professional
TL2	English	Lecturer	Male	25 – 34	Masters	IT Professional
TL3	English	Lecturer	Male	35 – 44	PhD	IT Professional
TL4	English	Lecturer	Male	35 – 44	Masters	IT Professional
TL5	English	Lecturer	Female	25 – 34	Masters	General user
ST1	Arabic	Student	Male	35 – 44	Bachelor/University-College Degree	General user
TL6	Arabic	Lecturer	Male	35 – 44	PhD	IT Professional
TL7	English	Lecturer	Male	35 – 44	Masters	General user
TL8	Arabic	Lecturer	Male	45 – 60	PhD	General user
ST2	Arabic	Student	Male	18 – 24	High School Diploma	General user
TL9	English	Lecturer	Female	35 – 44	PhD	IT Professional
TL10	English	Lecturer	Male	35 – 44	PhD	General user
TL11	English	Lecturer	Male	25 – 34	Masters	General user
TL12	Arabic	Lecturer	Female	25 – 34	Masters	General user
TL13	English	Lecturer	Female	45 – 60	PhD	IT Professional
TL14	Arabic	Lecturer	Male	45 – 60	PhD	General user
AT1	Arabic	Admin	Female	25 – 34	Bachelor/University-College Degree	IT Professional
TL15	English	Lecturer	Male	45 – 60	PhD	IT Professional
ST3	English	Student	Female	18 – 24	High School Diploma	General user

ST4	English	Student	Female	18 – 24	High School Diploma	General user
AT2	Arabic	Admin	Male	45 – 60	Masters	IT Professional
TL16	Arabic	Lecturer	Male	35 – 44	PhD	IT Professional
TL17	English	Lecturer	Male	45 – 60	PhD	General user
ST5	Arabic	Student	Female	18 – 24	High School Diploma	General user
TL18	Arabic	Lecturer	Male	35 – 44	PhD	General user
TL19	English	Lecturer	Male	25 – 34	PhD	General user
TL20	Arabic	Lecturer	Male	45 – 60	Masters	IT Professional
AT3	Arabic	Admin	Female	18 – 24	Bachelor/University-College Degree	General user
ST6	English	Student	Female	25 – 34	Bachelor/University-College Degree	General user
ST7	Arabic	Student	Female	18 – 24	High School Diploma	General user
ST8	Arabic	Student	Female	18 – 24	Bachelor/University-College Degree	General user
ST9	Arabic	Student	Male	18 – 24	High School Diploma	General user
ST10	Arabic	Student	Male	18 – 24	Bachelor/University-College Degree	IT Professional
ST11	Arabic	Student	Female	18 – 24	Bachelor/University-College Degree	IT Professional
ST12	English	Student	Female	18 – 24	High School Diploma	General user
ST13	Arabic	Student	Female	18 – 24	Bachelor/University-College Degree	IT Professional
ST14	English	Student	Female	18 – 24	Bachelor/University-College Degree	General user
ST15	Arabic	Student	Female	18 – 24	High School Diploma	General user

ID keys: TL = “Teacher/Lecturer”, ST = “Student”, AT = “Admin/Technician”.

Table 6.1: Profile of participants.

Variable	Category	Proportion Rate (%)	(N)
Occupation/ Profession	Lecturer/Teacher	53.00%	20
	Learner/Student	39.00%	15
	Admin/Technician	8.00%	3
Educational Qualification	Bachelor/University-College Degree	24.00%	9
	PhD	34.00%	13
	Masters	21.00%	8
	High School Diploma	21.00%	8
	Other	0.00%	0
Age	18 – 24	37.00%	14
	25 – 34	18.00%	7
	35 – 44	26.00%	10
	45 – 60	18.00%	7
	Over 60	00.00%	0
Gender	Male	55.00%	21
	Female	45.00%	17
Computer Skills	General user	61.00%	23
	IT Professional	39.00%	15

Table 6.2: Demographic profile of participants, (N=38), N being the number of respondents.

The time spent in interviews varied, three of them were exceeded one hour to reach up to 1 hour and 21 minutes while the rest of interviews took between 28 and 56 minutes.

As presented in Table 6.2, almost two thirds of the participants described themselves as general users concerning computer skills. In respect to qualification, slightly more than a third of the participants are PhD holders (34%) followed by Bachelor/University-College Degree (24%), High School Diploma (21%) and Masters (21%) respectively.

Mason (2010) asserted that researchers should be confident of the scope and the limitations of their study. Marshal et al. (2013, p.20) state that "*there is such variation highlights the subjective nature of determining sample size*". This explains fluctuation of sample size rate between fewer responses in some studies and large number in others.

In regard to the data collected for this study, the researcher was confident that the study has achieved saturation in this stage, with which the data sample size is adequate, and representative as claimed by Mason (2010) and Saumure and Given (2008). Normally, the sample size used qualitatively in interviews, for example, is substantially smaller than what is required for quantitative methods such as questionnaires (Dworkin 2012).

The data collected from interviewing the participants were organised in a unique template file where every interviewee's responses are individually allocated in a different Word file. All files were then imported into NVivo project (Bazeley and Jackson 2013; QSR International 2017). Demographic data such as occupation, qualification, age, gender and computer skills were used as cases' classification which will be used later for differentiating cases during analysis. Subsequent to the surveys a number of themes (categories) and sub-themes were defined. However, there are some overlaps between some themes and sub themes, but this does not affect their importance and usefulness to the research. The next few sections highlight these categories as well as their nested themes, sub-themes, and related issues. Cultural influences will be extensively discussed in Chapter 7.

6.5 ANALYSIS

The analysis was organized into five main themes, each one composed by one or more identified sub-themes. Issues within every sub-theme are identified and listed to guide the analysis of data. The analysis of the interviewees' responses revealed five main themes that can affect the use of a CBCVLE. Figure 6.3 highlights issues emerged from the analysis of survey 2 which are also supported by literature. These issues are classified under 14 categories.

Figure 6.3: Issues emerged from the analysis of survey 2 supported by literature.

Four of the themes are discussed in this chapter while the fifth theme (Cultural Influences) will be elaborated in Chapter 7. The above issues helped to define sub-themes which are discussed in the following sections.

6.5.1 ICT INFRASTRUCTURE AND SERVICES IN HEIs IN OMAN

Table 6.3 shows the sub-themes and issues that have emerged from the interviews in respect of ICT infrastructure and services in HEIs in Oman.

Theme 1	Sub-Themes	Issues
ICT INFRASTRUCTURE AND SERVICES IN HEIs IN OMAN	**Lack of sufficient ICT infrastructure and services**	▪ Devices availability ▪ Lack of personal computers (Desktop/Laptop) with users ▪ Slow Internet connectivity in campuses ▪ Low bandwidth and speed in mobile data subscriptions with users ▪ Lack of Internet service outside campus ▪ Technical support ▪ Interpretability problems ▪ Compliance
	Collaborative VLE in HEIs in Oman	▪ Existing collaborative environment ▪ Enhancement of cloud computing in collaborative educational services ▪ Examples of collaboration ▪ Types of useful collaboration ▪ Examples of collaborative assignments and projects
	Factors relate to HEIs	▪ HEIs' readiness including manpower and resources ▪ Institutional support
	Accessing VLE	▪ Favourable device for users to access their VLE ▪ Use of mobile applications by users to access their VLE

Table 6.3: ICT infrastructure and services in HEIs in Oman.

Devices to access VLEs

Question: "Please rank the following devices in the order of preference for accessing the VLE tools in your HEI (1 to 4 where 1 denotes most favourable and 4 represents least favourable).

☐ Smartphone ☐ Tablet ☐ Laptop/Notebook ☐ Desktop PC"

Table 6.4 shows the number of respondents who rate devices in the order of preference for accessing the VLE tools in your HEIs.

Device	1st Choice	2nd Choice	3rd Choice	4th Choice
Smartphone	6	3	6	12
Tablet	1	2	13	11
Laptop/Notebook	11	10	5	1
Desktop PC	10	10	2	5

Table 6.4: Users' preference of devices for accessing the VLE tools in HEIs.

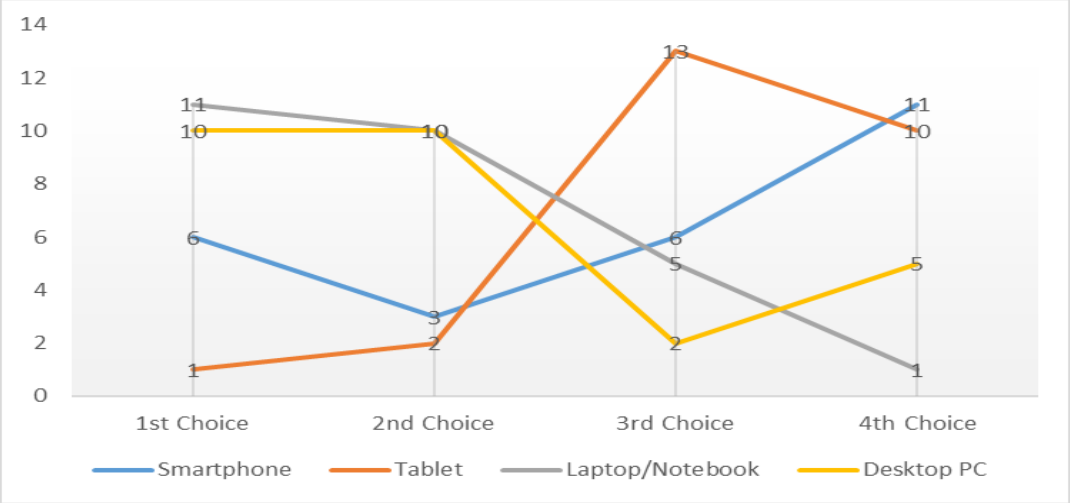


Figure 6.4: Users' favourable devices to access their VLEs.

The majority of participants ranked desktop computer and laptop as their favourable devices (1st choice) to access VLEs. The users also rated the same devices (desktop PC and laptop) as the second choice for accessing their VLEs (Table 6.4 and Figure 6.4). In contrast, the participants ranked mobile devices such as smartphones and tablets as the least favourable choices for the said purpose. This leads to the fact that even mobile devices are widely used, still the VLEs software tools are not conveniently accessed through such devices. The participants expressed the opinion that laptops and desktop PCs were convenient for accessing their VLEs' tools which reflects that these software tools are mainly designed for ordinary devices and not yet compatible with mobile devices. The issue of compatibility has been indirectly addressed by the participants in HEIs.

Question: "What device do you prefer to use for accessing your VLE tools (such as Moodle or Blackboard or any other tools)? And why?"

This question was an open question and the participants decided to provide reasons. Consequently, the participants gave reasons for their preference of using laptops and desktop PCs for accessing the VLEs software tools. The larger size of the screen as mentioned by participant TL3 was an attractive driver to prefer laptops and desktop PCs. Participant TL1 expressed that the navigation (for web-based applications) in their laptop is more convenient compared to a smartphone.

However, some participants (TL2, TL4) are totally convinced with using their smartphones for accessing their VLEs tools. The mobility and the ease of use are the main motives that make them go for mobile devices. Thus, this aspect will be investigated further and will be linked to the outcome of analysing data related to other themes.

Use of mobile applications by users to access their VLEs

Question: "Do you use mobile applications other than web browsers either to access your VLE tools or any other system in your institution? Give details."

In general, the vast majority of participants do not use mobile applications to access their VLEs software tools. Participant TL1 expressed that explicitly as they do not have any mobile application for educational purposes. It is clear from participants' responses that those HEIs which employ Blackboard they do not offer a mobile application for accessing their VLEs. Some participants such as TL5 indicated that they use their mobile phone only for web browsing. Other participants such as TL11, TL12, TL18 and TL20 clearly indicated that they do not use any mobile applications neither to access their VLEs tools nor for educational activities. However, some participants such as TL6 claimed that they use educational mobile applications as well as using social media applications to coordinate educational activities with colleagues and students.

6.5.1.1. Overall Summary

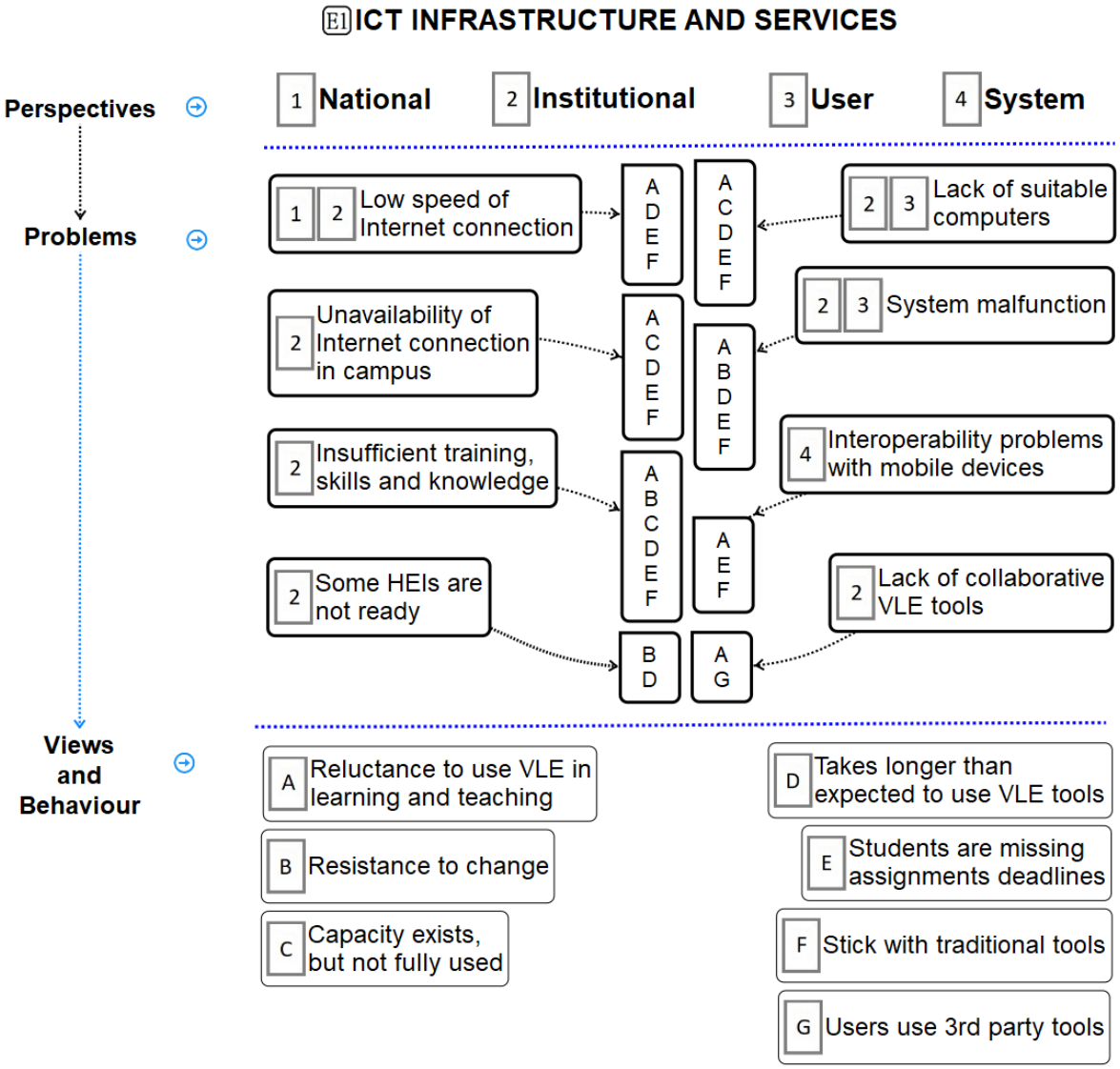


Figure 6.5: ICT infrastructure and services problems/issues.

Figure 6.5 summarises issues and problems from four perspectives (National, Institutional, User and System) in respect of ICT infrastructure and services. These issues and problems are further explained by giving examples based from users' views as they reflect, based on their experience. Some of the issues deal solely with one entity while others relate to more than one entity. The National perspective is concerned with the national ICT infrastructure, while the Institutional perspective deals with laws, policies and logistics inside HEIs. The User's perspective relates to daily aspects and issues that users may conduct or face within a collaborative VLE. Finally, the System's perspective reflects aspects concerning collaborative VLE tools.

6.5.2 OPERATIONAL ENVIRONMENT

Table 6.5 shows the sub-themes and issues that have emerged from the interviews in respect of concerns and challenges affecting the use and acceptance of a CBCVLE. It describes the three-dimension types of concerns and challenges mentioned by the interviewees that have been facing or would be barriers when using their existing or future VLEs.

Theme 2	Sub-Themes	Issues
Concerns and challenges affecting the use and acceptance of a CBCVLE	**Technological**	▪ Compliance issues ▪ Not all applications run in cloud ▪ Not all mobile devices support cloud ▪ Security and protection of sensitive data ▪ Security of cloud services ▪ Limited/lack of Internet connectivity ▪ Lack of interoperability standards ▪ Integration with In-house and existing Systems ▪ Compatibility with existing systems ▪ Hard to integrate with in-house IT ▪ Not enough ability to customize ▪ Infrastructure security ▪ Availability and reliability issues ▪ Trialability of cloud Services ▪ Existence of required IT infrastructure and resources ▪ Strength of in-built security systems ▪ Learning capability of users ▪ Limited technical knowledge about similar technologies ▪ Data privacy ▪ Performance
	Organisational	▪ Organizational support ▪ Lack of confidence ▪ Standards adherence ▪ Lack of internal expertise and knowledge ▪ Control (Loss of Control) ▪ Uncertainty with new technology ▪ Resistance towards new technologies ▪ Lack of understanding ▪ Management commitment ▪ Organization readiness ▪ HEIs strategies ▪ Skills ▪ Budget and funding ▪ Top management support and involvement ▪ Conformity with work culture and style

		▪ Impact of organizational structure and size ▪ Compliance and regulatory ▪ Lack of understanding ▪ Cost of migration ▪ Technological knowledge
	Environmental	▪ Unknown risk profile ▪ Legal and regulatory issues ▪ Adequate user and technical support ▪ Relationship with government and other HEIs ▪ Compliance ▪ Data protection controls ▪ Society, culture and perception ▪ Competitive pressure ▪ Trust in the cloud service provider ▪ Cultural issues

Table 6.5: Concerns and challenges affecting the use and acceptance of a CBCVLE.

General concerns and challenges that affect current VLEs

Question: "What concerns/challenges are currently preventing you from getting the maximum value out of using your VLE tools?"

Most of the participants pointed out one or more concerns and challenges that they have been facing within their existing VLE tools. Participant TL1 has pointed out the long time they spend using the VLE tools. Participant TL2 unveiled the fact that their VLE tools are not utilised thoroughly. TL2 also highlighted the concern in respect of the environment which are currently affected by the technology used by HEIs to deliver ICT services including VLEs.

Another challenge which was specified by participant TL3 is the unavailability of sufficient Internet connectivity. The same participant stressed the absence of notification system with which students are always updated with any new activity within their VLE tools. Similarly, participant ST1 perceived the weakness of the Internet connectivity either in their University or at home. They considered this as a challenge for not being able to access the information on the web.

Similarly, the slow Internet connection was considered by many participants (TL8, TL11, TL12 and AT1) as a common challenge for using the VLEs tools. Participant AT1 indicated the difficulty of uploading assignments as a consequent result of unstable Internet connection.

The lack of time to use VLE tools was emphasized by participant TL5 as a main challenge for them. They explained that they have several teaching and administrative tasks to the extent they would barely find a space for using the VLE tools. They referred this to the nature of the

system either educationally or administratively where there is no demands and pressure from upper administration to employ such VLE tools into daily activities. Participant TL8 pointed out that the administrative duties including teaching, office and consulting hours distract the teachers from using the VLE tools. Similarly, participant TL16 considered the high load in timetables as a challenge for both teachers and students regarding the use of VLE tools. Additionally, participant AT2 indicated the lack of mandatory rule in their HEI with which it becomes necessary for all teachers and students to use the VLE tools in their education.

Several challenges and concerns were substantially highlighted by participant TL6 which users have been facing within their existing VLE tools. Firstly, they indicated that students rarely possess computers and they mainly use computers in campus only, and therefore this results in a rare use of VLE tools by students who take one to two weeks to respond to them accordingly in regard to a course activity such as assignments submission. Secondly, they emphasized the slow communication between them and their students through VLE tools due to students' deficiency of computers. It seems that the VLE tools used in this HEI is not fully compatible with smartphones which are broadly possessed by almost all students. Participant TL6 has found some alternative mobile applications by which they get in touch with their students easily and faster, and consequently, they are distracted from the use of Blackboard which serves as VLE software tools within the HEI. Thirdly, the unavailability of sufficient Internet connection is another challenge for users in HEIs either while they are away of campus. This also, as indicated by the participant, contributes to the slow communication between them and their students. Fourthly, the participant indicated that the current VLE tools are not utilised thoroughly due the challenges and concerns mentioned above and the incompatibility with smartphones. Notification feature for example seems to be not active or not functional as stated earlier by the participant who highlighted the delay of students' response to courses activities. Finally, participant TL6 expressed their alternatives to the scarcity of mobile applications that support their VLE tools. They mentioned that they have employed some other mobile applications (such as Google Classrooms) to offer them and their students some great features that are not exist or not enabled in their VLE tools.

The seriousness of students about the effectiveness of their VLE was stressed by participant TL7 who also confirmed that students lack the proper devices such as laptops and tablets to access their VLE. Additionally, participant TL19 considered the students' preference of traditional tools of learning as a challenge for employment the VLE tools in their education.

The level of technical support that is provided in some HEIs is not adequate as indicated by participant TL8. The participant clearly described it as a low-level technical support in their College.

Participant TL10 indicated that their VLE is not accessible from outside the institution while participant ST2 stressed that their VLE tools do not function all the time. The latter participant also highlighted the issue of compatibility of their VLE tools as they do not run seamlessly in all computers.

In regard to users' expectations of VLE tools features, participant TL9 described the current VLE software used in their HEI as incomplete version. The participant stated the absence of assignment online grading as well as the communication with students through the VLE tools. They are still alternatively using a third-party email for such communication. Participant TL4 emphasized the fact that the technical awareness is not adequately employed, and therefore, they think that the students in their HEI are not aware of VLE tools and respective features.

Participants TL10 and TL14 highlighted training and the lack of information as challenges that would limit the use of VLE tools. More training provided to the users by their HEIs, as stated by the participant, would make them aware of all the potentials of their VLE tools and the ways of implementation in their education. Similarly, participant TL18 raised the issue of complexity within their VLE tools. This might be a result of the previously mentioned issues that relate to training and activities provided by HEIs to the respected users. The same participant went further and indicated another challenge which relates to the less awareness of officials in their HEI to critical role of VLE in education.

Among other technical concerns and challenges, participant TL20 pointed out the lack of integrating their VLE tools with other information systems (e.g. Students Information System) in the HEI. This consequently brings an extra work to the teachers as well as creates chances for inaccurate data entry.

Only one participant (TL13) mentioned security as a concern, but they were not certain whether it is possible in education. The same participant added that there would be some health concerns resulting from the continuous use of VLE tools. Another administrative challenge was stressed by participant AT1 where the VLE tools are controlled and administered centrally by an external organisation.

Participant TL16 stated that they do not have regulations, manuals or even published guidelines for the utilisation of their VLE. The participant indicated that the students are not motivated to use the VLE tools. Participant TL4 mentioned without explanation that there should be some technical challenges. In the same way, participant ST2 highlighted the

slowness of their VLE tools. Participant AT1 declared that there are some users have more than one account in the VLE tools server which may result in confusion of a user's identity. Finally, participant TL20 highlighted the absence of the department in HEIs to produce scientific materials that support the virtual environment. This, as stressed by the participant, will keep the role of VLE limited to a storage medium.

Users' Resistance

Question: "Do you think that there will be a resistance from users towards employing new technologies such as cloud-based services for a collaborative VLE? Please explain."

Nearly half of the participants agreed with the fact that there will be resistance from users when an HEI employs cloud-based services for a collaborative VLE. The remaining participants either believed that the users will not resist the new environment or linked it to the user's experience and knowledge of the new technologies. The participants TL6 and TL8 described the resistance of users as a natural and predictable aspect in the beginning of the implementation of a new VLE tool. They concluded that adequate training provided to users would play a critical role in eliminating any resistance.

It is equally important to mention than the participants TL5, ST1 and TL10, for example, clearly indicated that there will be no resistance from users. The cloud-based environment is anticipated due to its potentials which would eliminate any fear accompanying the implementation of the new technology. The implementation of a CBCVLE with less users' awareness and knowledge of the new environment, as indicated by TL2, TL11 and TL12 will have an impact on the project and consequently it will increase the resistance towards the utilisation.

Limited technical knowledge of users

Question: "Do you think that limited technical knowledge of users will affect the utilisation of a cloud-based collaborative VLE? Please explain."

The vast majority of participants indicated that the technical knowledge is crucial to the utilisation of a CBCVLE. Further, participant ST1 stressed the link between the lack of sufficient technical knowledge and failure in any implementation of technology. Participant TL6 highlighted the necessity for an HEI to improve the level of technical knowledge among their users in regard to the use of a CBCVLE. Another participant; TL7, described the absence of adequate training and technical knowledge as a drawback that must be determined in order the users employ the new environment. Participant TL20 stressed that the more technical knowledge the users have, the more acceptance of a system as well as a less resistance. On the other hand, participant TL3 expressed their view that the popularity of smartphones and PCs among users make them aware of the minimum knowledge to accept and use a CBCVLE.
Finally, participant TL2 indicated that a cloud-based system never requires much knowledge and experience from users due to the nature of cloud computing. The participant concluded that much of the configuration is done by the provider with which it is much easier for the users to accept and use it.

Uncertainty with new technology

Question: "Would uncertainty with new technology be considered as a challenge for users to accept and use a cloud-based collaborative VLE? Please explain."

In response to the above question, the vast majority of participants agreed that there will be uncertainty with the new cloud-based system. Only very few participants had the opposite view, for example, participant TL2 was convinced that the cloud technology has the potentials to overcome any possible uncertainty with a cloud-based system.
The age of users could play a role in either initiating the uncertainty or eliminating it as described by participant TL8. The participant indicated that the new generations have less hesitation in using the technology compared with aged users.

6.5.2.1. Overall Summary

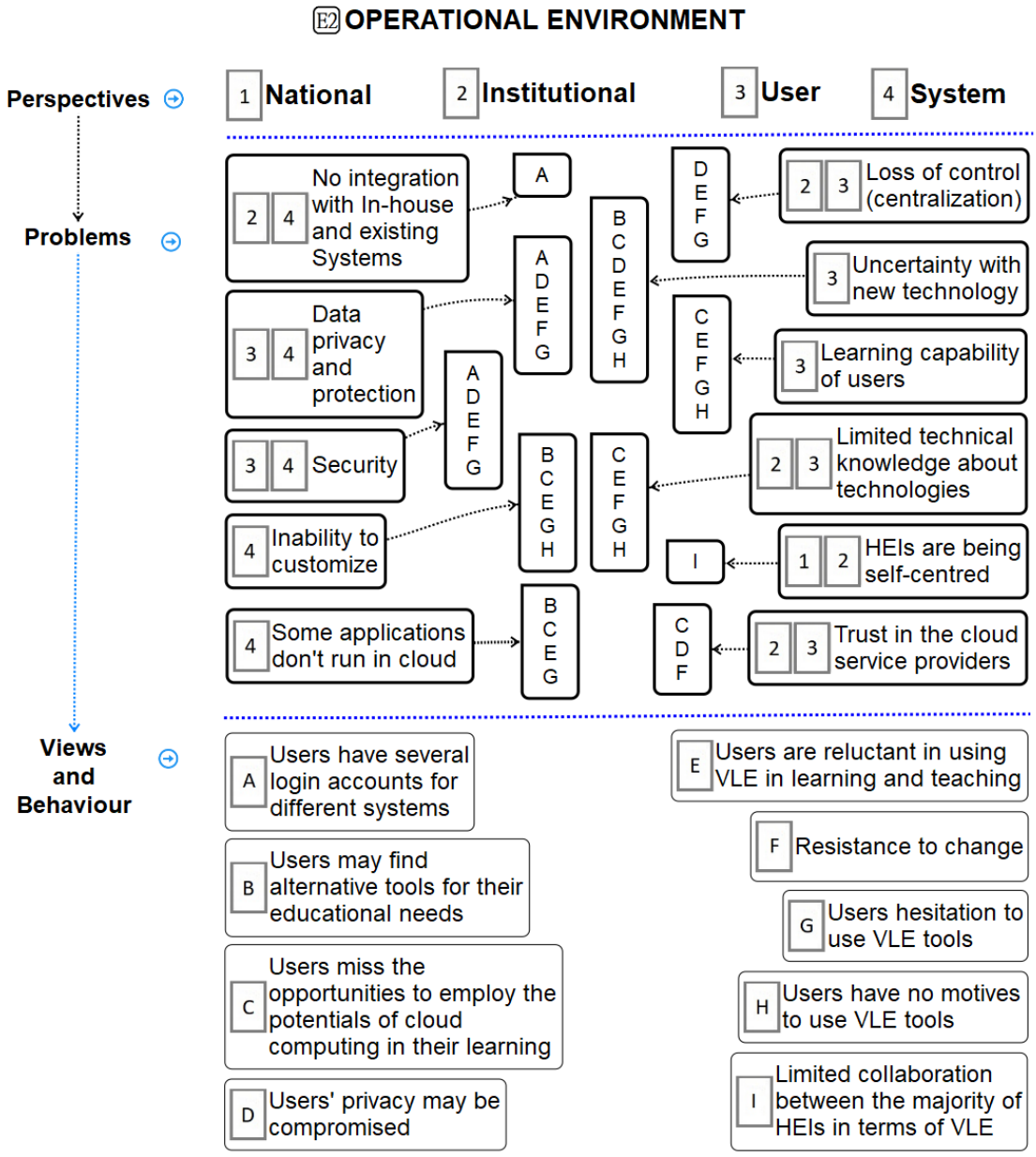


Figure 6.6: Operational environment problems/issues.

Figure 6.6 concludes issues and problems from the four perspectives of national, institutional, user and system in respect of the operational environment.

6.5.3 USER EXPERIENCE AND EXPECTATIONS

Table 6.6 shows the sub-themes and issues that emerged from the interviews in respect of user's experience and expectations with regards to CBCVLE. It illustrates the issues that relate

to user's intention to use, application of cloud computing in education, perceived benefits, user satisfaction, and user's expectations.

Theme 3	Sub-Themes	Issues
User's experience and expectations towards CBCVLE	**User's intention to use**	▪ User's confidence of the importance of cloud computing ▪ User's confidence of the importance of collaborative VLE ▪ User's intention to use a CBCVLE ▪ Continuance intention
	Application of cloud computing in education	▪ Cloud-based apps and sites used by users in HEIs ▪ Current usage of cloud computing in educational for collaborative activities ▪ Motives for use ▪ Discouragement
	Perceived benefits	▪ User's engagement (or lack of engagement) ▪ User's engagement and involvement in collaborative projects ▪ User's competence (skills, knowledge, etc.) ▪ User's experience of sharing resources ▪ User's commitment ▪ Perceived benefits
	User satisfaction	▪ User's satisfaction of the current use of cloud computing in their HEIs ▪ User's satisfaction of the current status of collaborative VLE ▪ User's dissatisfaction
	User expectation	▪ User's expectations of collaborative VLE tools ▪ User's suggestions for improvements ▪ Outcome Expectancy ▪ Future user interface as expected by users ▪ Design issues

Table 6.6: User's experience and attitude in respect of CBCVLE.

User's intention to use

User's confidence of cloud computing

Some HEIs, as revealed by participants, have no pressure on the users to strictly use their respective VLE tools. It should be noted the confidence of using the current VLE tools and extending this to employ third-party cloud-based VLE tools to support and enhance their teaching process. Participant TL6, for example, asserted that the use of such applications and tools are not implemented in the annual evaluation of faculty members. However, the participant's confidence of cloud computing applications can be seen as they acquire more tools which never been asked to implement in their HEI. Participant TL2 stated that the teachers have the knowledge of the technology and are aware of its importance. However, some participants such as TL16 highlighted the lack of such importance among admin staff in their HEI.

User's confidence of collaborative VLE

Participant ST3 indicated that the students are not motivated and engaged in collaborative projects in their HEI due to the lack of collaborative culture among students. The entire culture of collaborative projects or assignments are not present either in some HEIs or in some courses within a single HEI.

Intention to use a CBCVLE

Participant TL10 pointed out that students' willingness and intention to use for learning new technologies that may help them in their education. Participant TL1 emphasized the benefit for all parties within the environment, and this reveals and assures the users intention towards utilising new technologies.

Continuance intention

Participant TL5 indicated that students will not be willing to use CBCVLE tools. The participant pointed out the students' preference to use traditional paper-based tools in their learning.

Application of cloud computing in education

Cloud-based apps and sites used by users in HEIs

The participants in general gave several examples of cloud-based applications and sites that they use either in their HEIs for educational activities or for personal use. Table 6.7 presents a list of 15 cloud-based applications and sites indicated by the participants in HEIs. These applications and sites are classified under 8 categories.

Category	Application/Site
Storage	Google Drive
	Dropbox
Collaborative Editing	Google Documents
Programming	Repl it
Course Management	Google Classroom
Social Media	Facebook
	Twitter
	WhatsApp
	Imo
Multimedia	YouTube
Chat	WeChat
Email	Institutional Email Hosted by Google
	Hotmail
	Gmail
	Yahoo

Table 6.7: Cloud-based applications and sites indicated by users in HEIs.

Current usage of cloud computing in education for collaborative activities

As revealed by the interviewees, the following list includes the types of using cloud computing in educational and collaborative activities that the participants expressed:

- Sharing files and documents
- Files storage
- E-mail
- Communicating with other users
- Collaborative Editing
- Supporting educational activities
- Enhancing teaching and learning
- Providing alternatives for PC software
- Collaborative projects and assignments

- Assisting course management and delivery
- Course assessment
- Scheduling tasks

Motivation for use

It was stated by participant TL6 that the users would need to be motivated to employ their abilities to use a CBCVLE. Another participant, TL20, considered that if the peers are confident and equipped with suitable skills where they are capable to use a VLE, hence, it is a motive for a user to compete and be in the same level of knowledge and experience as well as their peers.

Discouragement

Several participants expressed that the users were highly discouraged by the speed and availability of Internet connection which distracted them from using the VLE tools. The low technical knowledge would also lead to discouragement with which users prefer to use to traditional methods of learning rather than VLE tools. Frustration and doubt about cloud computing, as described by participant AT3, extends users' hesitation from using VLE tools.

Perceived benefits

Users engagement (or lack of engagement)

Participant TL4 pointed out that teachers engage their students to use VLE tools for uploading assignments and distributing the course materials. However, the users particularly students as stated by participant TL8, show a low interest in using VLE tools for learning as their teachers do not integrate such tools into their teaching.

User's engagement and involvement in collaborative projects

Some students in HEIs are motivated and engaged in collaborative projects. Participant TL3 indicated that they provide new students with some training and motivation to be engaged in accessing VLE tools and sharing files.

Conversely, lack of proper communication media has an effect on performing groups for collaborative projects and assignments. This was highlighted by participant TL11 who stated that their students would come back a few days after assigning them to collaborative groups giving the same reason and preferring working individually. Participant ST6 indicated that some students are not engaged in collaborative projects due to the difficulty of using the technology especially in English.

User's competence

The interviewees were asked to rate the readiness/competence of students and faculty members in their institutions in respect of being involved with a CBCVLE. Quite a large number of participants agreed that the students are competent and capable to use CBCVLE.

Even though some participants agreed that students are ready to use a CBCVLE, they also indicated the need to provide them with adequate and sufficient training. On the other hand, some of the participants disagreed to the statement and suggested that HEIs should provide training to students for using such tools, as well as the new environment. Sixteen of the participants indicated that students are partially not ready to use a CBCVLE. Further, twelve of the participants stated that students have no competence to employ VLE tools.

Table 6.8 shows the overall views of the participants regarding the readiness/competence of students in their institutions in respect of a CBCVLE. There were 7 participants students who rated the readiness and competence of their colleagues as a partial compared to only three of them who gave a high rating.

Criteria	Participants	Students	Faculty Members	Actions Required
Competence	5	3	2	• ---
Incompetence	11	2	9	• Students' familiarity and awareness of cloud features and facilities • Improve students' knowledge of electronic systems
Partial Competence	16	7	9	• Enough training to students • Guidance on how to use the VLE • Adequate information and knowledge • Teachers' insistence that students must use VLE tools • HEI's support and encouragement

Table 6.8: Participants views regarding the readiness/competence of students.

Regarding the faculty members, the participants (N=19) indicated that some are not competent to use of a CBCVLE. Very few participants (N=4) clearly stated that faculty members have no competence while some of them (N=9) believed that they are fully competent to deal with such technology and VLE.

In general, Table 6.9 shows the overall participants views regarding the readiness/competence of faculty members in their institutions in respect of a CBCVLE. There were 13 participants who are faculty members rated the readiness and competence of their colleagues as a partial competence compared to only five of them rated it as fully competence. On the other hand, students' views were divided between "competence" and "Partial competence" when rated their faculty members' readiness.

Criteria	Participants	Students	Faculty Members	Actions Required
Competence	9	4	5	• ---
Incompetence	3	2	1	• More training
Partial Competence	18	5	13	• Motivation and time assigned to their timetables • Training and workshops • Further training sessions • Incentives must be present • Presence of technical staff in academic departments

Table 6.9: Participants views regarding the readiness/competence of faculty members.

User's experience of sharing resources

The interviewees were asked whether they had experience of sharing resources with other users in their institutions or external institutions. Almost all the participants agreed that they have practiced sharing resources and gave substantial examples either for type of materials or the applications and software used for sharing those resources.

Users commitment

Some users are more committed to the traditional VLE and even to the ordinary way of teaching and learning as they are against any change of methods and strategies which could require them to provide more time and efforts. On the other hand, there are some users are enthusiastic to use new technology and incorporate it into their education. The commitment to technology was clearly stated by a few participants.

Perceived benefits

When asked whether they are aware of potential benefits and drawbacks when utilising CBCVLE tools, more than a half of the participants indicated several benefits while almost a third of them only highlighted the possible drawbacks.

Table 6.10 presents the benefits of utilising CBCVLE tools as perceived by the participants. "Fast and easy access" was highly rated followed by "Easier to use", "Access to resources", and "Efficient storage".

Benefit	**Frequency**	**Representative responses**
Wide usability and utility	3	"*… wide usability and utility … it can be widely used everywhere …*" TL1 "*… wherever you are you can download it …" TL10* "*… anytime you want …*" TL11
Easier to use	5	"*… it's easier to communicate with them in outside study hours …*" TL2 "*… more easier than exchanging emails …*" TL10
Easier to collaborate	3	"*… it make it easier for students to collaborate for doing some projects …*" TL2 "*… encourages collaboration between students and students and faculty members …*" TL9 "*… makes things easier …*" ST3
Efficient assignment publishing	1	"*… for teachers to give them assignment without sending an email …*" TL2
Real-time notification	1	"*… they have a notification every time …*" TL2
Access to resources	5	"*…can provide access to the course materials, lectures from any time any location from any device …*" TL3 "*… can access them whenever you are and whenever you want …*" TL11 "*… using it anywhere …*" TL13 "*… facilitate the search …*" ST9
Lower cost	2	"*… software cost, financially it will help the institution …*" TL4 "*… Inexpensive …*" TL16
Shared hardware resources	1	"*… storage space, processor where we can reduce resources …*" TL4
Fast and easy access	7	"*… speed of access to information …*" ST1 "*… send students various educational materials and reach the student at the same moment …*" TL6 "*… easy access to the information …*" TL8 "*…access at any time and from anywhere …*" ST2
Fast communication	1	"*… speed of communication with professors …*" ST1
Self-assessment evaluation	1	"*… Self-correction, The student solves and finds its outcome at the same time …*" TL6
Chat and instant messaging	1	"*… chat systems, this is useful in promoting learning …*" TL6
Save time and efforts	3	"*… save time and effort …*" TL8

		"… saves your time …" TL10 *"… reducing the time and efforts in sharing teachings materials, grades, etc …"* TL19
Effective education	1	*"… more effective education …"* TL9
Collaborative editing	1	*"… you can always see what modification is being made …"* TL10
Safe backup of files	2	*"… you are having a safe backup …"* TL13
Efficient storage	5	*"… Greater storage …"* AT1 *"… easily store your data and images and educational videos …"* TL16 *"… virtual space for storing resources without having to use the space available in your device …"* ST13
Easier maintenance	1	*"… ease of maintenance …"* TL16
Effective support	1	*"… fast and effective support by the service provider …"* TL16
Interaction environment	1	"*Increase students' academic achievement by providing a continuous interaction environment with the material outside classroom teaching.*" TL20
Academic achievements	2	*"… train the students to be independents in seeking information they need … training students in using technology in general, and particularly in education.*" TL19 *"… So many tools that help student …"* ST14

Table 6.10: Benefits of utilising CBCVLE tools as perceived by the participants.

Some of the participants stated the possible drawbacks for the utilisation of a CBCVLE. Table 6.11 shows drawbacks and challenges of utilising CBCVLE tools as perceived by the participants. "Security and privacy" and "Internet connection" were highly rated followed by "Network problem".

Drawback	**Frequency**	**Representative responses**
Security and privacy	6	*"…the development in security is not fully fledged …"* TL1 *"… some confidential information is there … some security issues would may arise …"* TL3 *"… privacy of the data …"* TL7 *"… confidentiality of information …"* TL18
Internet connection	6	*"… we need Internet to access them …"* TL3 *"… it depends mainly on the Internet connection … sometimes the speed is a problem …"* TL4 *"… Internet which causes delays in delivery of these duties …"* ST1 *"… don't really have good Internet connection …"* TL11 *"… need to have Internet connection …"* TL12 *"… speed of the Internet …"* TL18
Network problem	3	*"… the network is disrupted …"* TL8 *"… Network problems …"* TL16

		"… Network problem …" ST14
Lack of knowledge	1	*"… Lack of knowledge …"* ST14
Loss of information	1	*"… loss of a lot of information during the infection of viruses …"* ST1
Misuse	2	*"… miscommunication or misunderstanding … Possibility of students accessing each other's grades and private information …"* TL19 *"… give you a wrong assessment …"* TL6
Lack of hardware	1	*"… Lack of hardware …"* TL16

Table 6.11: Drawbacks of utilising CBCVLE tools as perceived by the participants.

User satisfaction

Users satisfaction of the current status of collaborative VLE

The interviewees were asked:

> "To what extent are you satisfied with the status of the collaborative VLE tools used in your institution?
>
> ☐ 5- Strongly Satisfied ☐ 4- Satisfied ☐ 3- Neutral ☐ 2– Unsatisfied ☐ 1- Strongly Unsatisfied"

The participants responses to the above question indicated that nearly a half of them were neutral regarding the statement. The remaining participants formed two groups of nearly equal number of members. The participants of the first group were satisfied with the status of the collaborative VLE tools used in their institution. However, the participants of the second group stressed out their dissatisfaction in the same regard (see Figure 6.7).

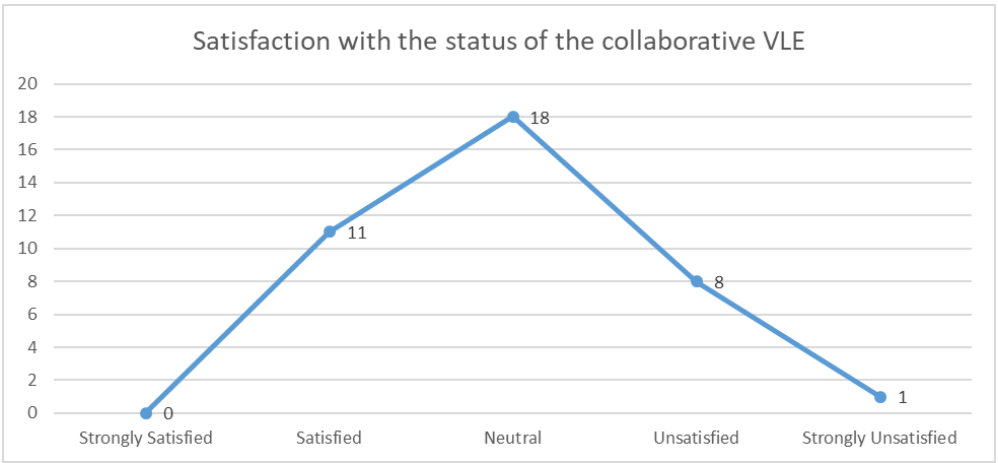


Figure 6.7: Number of participants who are satisfied with the existing collaborative VLE tools in HEIs.

Participant TL10, for example, explained their dissatisfaction with the status of their collaborative VLE tools. The participant mentioned that their current VLE tool is not collaboratively used as well as many features are not even enabled.

User's expectation

Users' expectations of collaborative VLE tools

In order to collect users' expectations, the interviewees were asked:

> "What would you expect a collaborative VLE tool to offer to the Omani Higher Education Institutions?"

The expectations indicated to what extent the users are ambitious and evaluating between their current individual experience and their hopes in regard to their collaborative VLE tools. Table 6.12 presents a list of users' expectations highlighted by the participants as well as their frequencies. "Efficient and effective learning environment" was highlighted by 6 participants followed by "Shared resources either by all HEIs or users", "To offer and save more time", and "Better platform or to interact with people easily" by 4 participants each.

Users' Expectations	Frequency	Participants
Replacing current 3rd party collaborative tools by a comprehensive and all in one system	1	TL1
Unified CBCVLE for all HEIs	3	TL1, TL4, TL7
More utilisation of VLE tools	1	TL2
Available all the time and from any location with any device	1	TL3
More training to the students	1	TL3
Shared resources by either by all HEIs or users	4	TL2, TL4, TL9, TL19
To offer and save more time	4	TL5, TL9, TL12, AT2
Reducing the need for paper-based and traditional methods	1	TL5
Efficient and effective learning environment	6	ST1, TL9, TL16, TL18, TL20, AT3
Enable huge electronic libraries	1	TL6
Each student has their special educational track	1	TL6
Ease of learning and opportunities to find information	3	ST2, ST9, ST11
Help for collaboration	1	TL10
More safer	2	TL10, ST13
Facilitate the work	1	TL11
Better platform or to interact with people easily	4	TL11, TL16, ST6, ST15
Minimize the distance	3	TL11, TL12, AT2
Solve current problems	1	AT1
Sharing resources faster	1	AT1
Open new opportunities in higher education	3	TL15, TL17, TL20
Offer different kinds of learning techniques	1	ST3
Access to information sources at a higher speed	2	AT2, ST6
Lower cost	3	AT2, TL16, ST13
Accommodate a large number of students	1	TL16
Increase academic programs and distance learning	1	ST8
Ease of use	1	ST13

Table 6.12: Users' expectations of collaborative VLE tools.

Many users nowadays are using third party cloud-based services such as Drobox and Google for data storage and sharing. Participant TL1, for example, confirmed this activity and expected to have similar built-in services in their anticipated collaborative VLE tools. Several improvements to the traditional VLE tools were highlighted by the participants. Participant TL2 indicated that their VLE tools are partially utilised to the extent they prefer to use Google Drive instead of depending on their VLE tools for sharing files. Some participants were very optimistic about the CBCVLE tools and they expected that they would eliminate the current drawbacks and provide them with an ultimate experience.

Expected Facilities by Users	**Frequency**	**Participants**
Uploading online pictures	1	TL2
Online conferences	3	TL2, TL5, AT2
High speed of Internet	1	TL3
Sharing resources	4	TL4, TL9, TL13, AT1
Combability with mobile devices	2	ST1, TL6
Complete Wi-Fi coverage in campus	1	TL6
Effective communication with students	1	TL6
Capability to share huge files	1	TL7
Online streaming	1	TL7
High level of privacy of the data	1	TL7
Fast Internet connection	1	TL8
Technical support and training workshops	2	TL8, TL16
Fast and easy use	3	ST2, TL18, ST11
Fast communication with students and faculty members	1	TL9
Ability to get comments and feedback	1	TL9
Security	1	TL10
Chatting	3	TL11, TL12, AT1
Video instant messaging	1	TL11
Increased storage space	3	TL11, ST3, ST13
A technical specialist available in every department	1	TL14
Email alerts	1	AT1
Add notes to courses	1	AT1
Faster performance	1	ST3
Providing up-to-date information sources and accurate professional topics	1	AT2
Participation of all HEIs	1	AT2
Diversity of content	1	TL17
Easy access to academic programs, their documentations and latest publications across Oman.	1	TL19
Specialized institutions in the production of educational materials	1	TL20
Backup	2	ST12, ST13
Considering people with disabilities	1	ST14
Access to cloud-based applications and tools	1	ST15

Table 6.13: Expected facilities in a CBCVLE by the participants.

The interviewees were also asked:

"What facilities would you like to see in a cloud-based collaborative VLE?"

In this context, the participants were very specific to highlight the features they could think for future CBCVLE tools. Table 6.13 shows the list of expected facilities or features that the participants believed could improve their VLEs. "Sharing resources" was highlighted by 4 participants, followed by "online conferences", "fast and easy use", "chatting", and "increased storage space" by 3 participants.

Both participants ST2 and TL13 expressed independently that they hoped the current technical problems can be avoided in their future CBCVLE tools.

Users suggestions for improvements

The wide variety of aspects, elements and features pointed out by the participants to express their willingness to participate in improving the current VLE tools. They aim to avoid any drawback that they have been noticing during the previous and current use. Some participants suggested ways for enhancing future VLE tools with stability, coherence and efficiency.

Outcome Expectancy

The expected outcome as stated, for example, by some participants such as TL2, TL3 and ST1 can be considered as motives to facilitate ways for their utilisation of a CBCVLE.

Future user interface as expected by the participants

The participants highlighted various elements they would like to see in the user interface of future collaborative VLE tools (see Table 6.14).

Element	Frequency	Participants
User's usage statistics	1	TL1
Improved feedback system	1	TL1
Intuitive icons	4	TL2, TL9, ST6, ST11
Colourful and lightweight design	2	TL2, TL5
Statistics about user progress	1	TL3
Simple presentation of content	2	TL4, TL5
Clear navigation path	1	TL5
Easy to use	2	ST1, TL18
Links to communication tools	1	ST1
Intuitive course structure	1	TL6
Avoid complexity	1	TL6
Support for distance learning	1	TL7
Easy access to resources	1	TL8
Easy communications with users	1	ST2
Searching for users	1	TL11

Indication of online users	1	TL12
Vision and mission of the institution	1	TL14
Institution Announcements	1	AT1
Exams Timetable	1	AT1
List of courses	1	AT1
Search bar	1	ST3
Change language	1	AT2
Language spellcheck	2	ST3, AT2
Calendar tools	1	TL16
Links to social networking sites	1	TL16
User friendly	1	TL17
Student absence	1	ST7
Easy navigation	1	ST13
Font size tool	1	ST14

Table 6.14: Anticipated elements that the participants would like to see in the user interface VLE tools.

For example, participant TL3 wanted to have statistics about user's usage while participant TL1 highlighted the need for statistics about user's progress. Furthermore, participant TL1 indicated an improved feedback system would be beneficial.

It was argued that intuitive icons as well as colourful and lightweight design are critical in their future CBCVLE tools. However, some participants such as participant TL11 seem to have some difficulties with their VLE tools, and, therefore they stressed that these issues must be solved in the future software tools. They suggested some improvements for the user interface such as search facility which would help.

Design issues

The interviewees were asked about the aspects that they would like to see in their collaborative VLE tools in terms of the design including their user interfaces. The aspect "Attractive interface with colourful items" was highly pointed out by 10 participants followed by "Simple Design" and "Easy to use" (8 participants each). Many participants also highlighted crucial aspects of design that may be taken into consideration when planning and designing a CBCVLE (see Table 6.15). More details are available in Appendix 6.

Aspect	**Frequency**	**Participants**
All the administrative tasks should be part of this collaborative VLE	1	TL1
The advising system can be integrated	1	TL1
Integration of compilers for IT courses	1	TL1
Video recording for lectures	1	TL1
Attractive interface with colourful items	10	TL2, TL4, TL6, TL7, TL8, ST2, TL9, AT1, TL18, TL20
Easy navigation	2	TL2, TL10

Easy to access	4	TL2, TL3, TL12, TL19
Not time consuming	1	TL2
Simple Design	8	TL3, TL6, TL10, TL12, AT1, ST3, TL19, ST7
Interface must include few options and few buttons (lack of congestion)	6	TL3, TL5, TL6, TL7, ST11, ST13
User friendly	3	TL4, TL10, AT2
Easy to use	8	TL3, TL4, TL6, TL8, TL11, AT2, TL20, ST7
Simple Homepage	3	TL5, TL6, ST13
Clear navigation Path	2	TL5, TL10
Intuitive and self-explanatory icons and symbols	3	ST1, TL9, AT1
Clear headings	1	ST1
Mobile friendly design	1	TL7
Access to all apps and services from one interface	1	TL8
Ability to enlarge text	1	ST2
Immediate help	1	ST2
Effective use of colours	1	TL12
User's customisation of colours	1	TL14
Arabic language as interface	1	TLAT2
3D environment supported	1	TL20

Table 6.15: Expected aspects by participants in their collaborative VLE tools in terms of the design.

Aspect	**Frequency**	**Participants**
Not compatible with mobile device	3	TL1, ST1, TL6
Misuse of applications	1	TL2
Lack of restrictions on the use	1	TL3
Access difficulties	2	TL4, TL17
Unable to upload a folder	1	TL5
Complexity of the design	3	TL6, TL10, TL12
Unable to save old course files as archives	1	TL6
Row column design of the interface	1	TL7
Increased system downtime	1	TL8
Small font size	1	ST2
Small icon size	1	ST2
Overlapping	1	ST2
Disabled features	1	TL9
Lack of communication tools with students	1	TL11
Exaggerated tabs and links	1	AT1
Security	1	TL15
No integration with other systems	1	AT2
Traditional interface	1	TL20
Absence of integration of course materials and applied exercises.	1	TL20
Delayed login	1	ST9
Disorganization	1	ST11

Table 6.16: Drawbacks expressed by participants to be avoided in their VLE tools design.

The interviewees also were asked to identify drawbacks that they would not like to see in their VLE tools design. They provided general as well as specific aspects that they think they can be avoided to improve their VLE tools (see Table 6.16).

It is likely that some participants have some difficulties to browse their VLE tools using mobile devices which made them uncomfortable to use those software tools. Another participant highlighted the difficulties that they face when accessing and navigating their VLE tools.

The lack of uploading a folder at once was stressed out by participant TL5 who clearly described this drawback within their VLE tools. Participant TL8 pointed out some other drawbacks that relate to external and complementary factors that have crucial impact on the use of their VLE tools.

However, the participants highlighted the features that they would you like to be included in their future VLE tools to support collaborative activities. The most concern was about having chat function to communicate with other users followed by the “Ability to share resources”. Furthermore, the participants made some suggestions in this context providing a wide range of features as listed in Table 6.17.

Feature	**Frequency**	**Participants**
Video	1	TL1
Compatibility with mobile devices	3	TL1, TL7, TL14
Automated answering system	1	TL1
Chat	7	TL1, TL6, TL9, TL11, TL12, TL13, ST11
Online lectures	1	TL2
Video conferences	3	TL2, TL3, TL13
Integration of IT helpdesk	1	TL2
Ability to share resources	1	TL3
Assessment	1	TL4
Collaborative editing	1	TL5
Group discussion	3	TL5, TL12, AT1
Integration of all services into one system	1	ST1
Ability to classify students based on criteria	1	TL6
Ability to download and upload different types of files	4	TL6, TL9, TL19, ST13
Online exams	3	TL6, AT1, TL20
Monitoring students’ progress	1	TL6
Instant messaging	1	TL7
Maintaining security and privacy of data	2	TL7, ST12
Ability to share resources	6	TL8, ST2, TL9, TL11, AT1, TL18
Integration of social communication	1	TL8
Ability to share lessons	1	ST2
Access permissions to files and resources	1	TL10
Effective plagiarism detection tool	1	TL11
Email alerts	1	AT1

Search	1	ST3
Interactivity	2	AT2, TL20
Integration with other systems	1	AT2
Calendar	1	TL16
Assignment submission	1	TL19
Easy communication between users	1	TL19
Font size tool	1	ST14

Table 6.17: Features suggested by participants to be included in future VLE tools to support collaborative activities.

6.5.3.1. Overall Summary

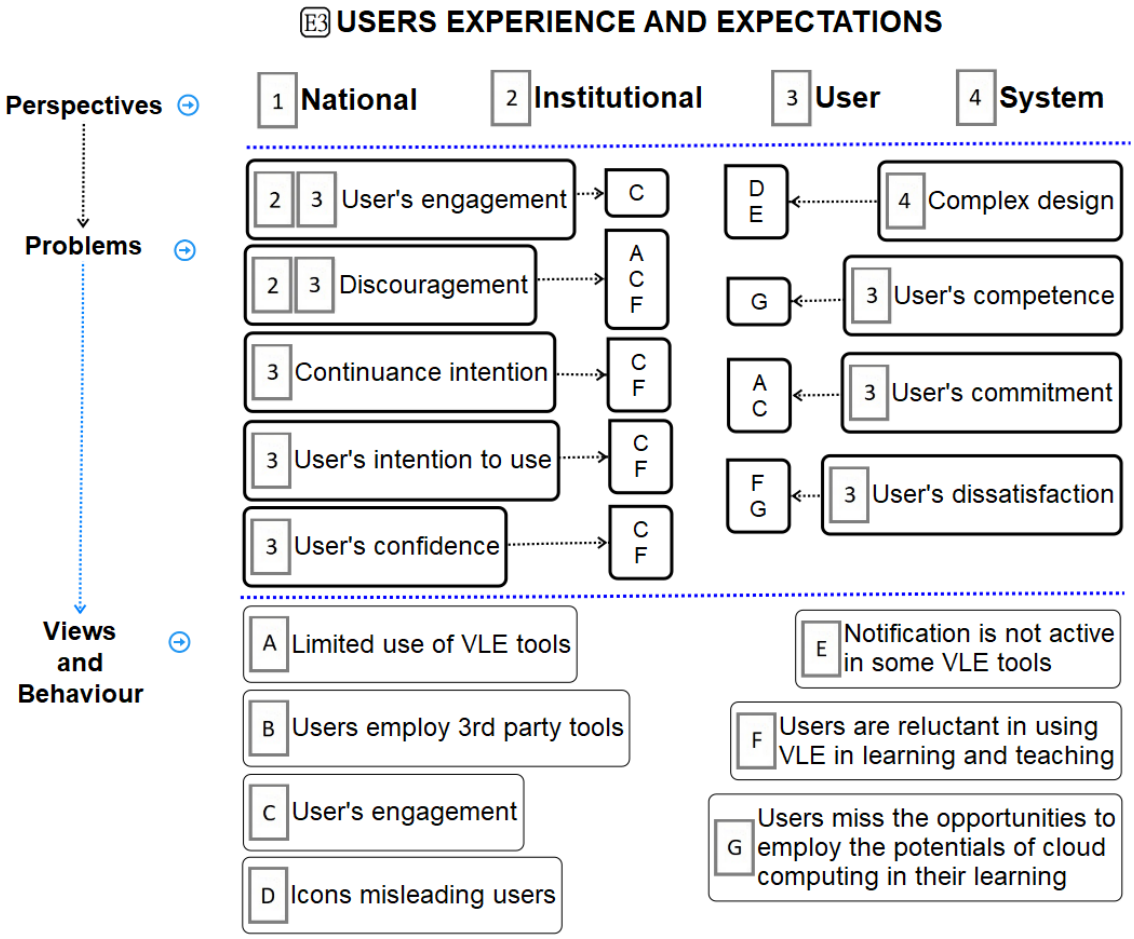


Figure 6.8: User experience and expectations problems/issues.

Figure 6.8 outlines issues and problems from the four perspectives of national, institutional, user and system in respect of user experience and expectations.

6.5.4 FACTORS AFFECTING THE USER'S ACCEPTANCE

Table 6.18 shows the sub-themes and issues that emerged from the interviews for factors affecting the use and acceptance of a CBCVLE. It briefly underlines the motivators and disincentives that the interviewees notably emphasised regarding the factors affecting the use and acceptance of a CBCVLE.

Theme 4	Sub-Themes	Issues
Factors affecting the use and acceptance of a CBCVLE	**Motivators**	▪ User desire to change ▪ User experience ▪ User skills and knowledge ▪ High performance service ▪ Easy course management ▪ Effective course delivery ▪ Enhanced collaborative activities ▪ Clear strategies and policies ▪ User readiness ▪ HEI readiness ▪ User satisfaction ▪ Institutional support ▪ Organisational culture ▪ Individual initiatives ▪ Attractive VLE software design ▪ Peer pressure
	Disincentives	▪ Lack of Internet connectivity ▪ Security and privacy concerns ▪ Bad or complex VLE software design ▪ Lack of knowledge and expertise ▪ Lack of training ▪ Lack of technical support ▪ ICT Knowledge gap ▪ Limited technical knowledge ▪ Digital divide ▪ Resistance to change ▪ Uncertainty with new technology ▪ Lack of devices ▪ Loss of control (Centralisation of ISs including VLE) ▪ Lack of academic or administrative pressure to use VLEs

Table 6.18: Factors affecting the use and acceptance of a CBCVLE.

During the interviews, a wide range of factors affecting the use and acceptance of a CBCVLE were emerged from the interviews. Consequently, these factors were classified under two categories; motivators and disincentives.

Motivators

User desire to change

The participants showed an increasing desire to use the cloud technologies for their collaborative activities supported by their VLE tools.

User experience

It was stated by more than one participant that they are aware and have experience using third party cloud-based collaborative applications. This, however, will facilitate the way for those users to explore and employ their future VLE tools.

User skills and knowledge

As an example of the user skills and knowledge, participant TL12 stated their understanding about the cloud computing technology. The more technical skills and knowledge the users have the more use and acceptance of their anticipating VLE tools.

High performance service

The participants indicated several times through their responses that the high performance of online services would facilitate their education. In contrast, they also described the shortage and low-level services that may affect the overall use of VLE tools negatively.

Easy course management

Wherever is possible, users are seeking an easy to use VLE tools as stated by some participants. Their embracement of such tools depends on the easiness and coherence of these tools to achieve goals and objectives of courses.

Effective course delivery

The users are seeking technologies to improve their education, and consequently the faculty members, for example, would maintain effective delivery for their courses. Designing VLE tools in a minimum of two languages including English and the user's native language would highly support the use and acceptance of such tools by users and reduce the increasing gap.

Enhanced collaborative activities

It was stated by participants that collaborative activities can be enhanced and improved by integrating the latest and ever-changing technology. This was clearly indicated by participants whom confidence of CBCVLE is increasing gradually.

Clear strategies and policies

It was rarely to find the participants in general mentioning the existence or the lack of strategies and policies in their HEIs regarding the use of VLE tools. However, it was indicated by participants TL2 and AT2 the need and importance for strategies and policies to be exist in the institution.

User readiness

As discussed earlier, several indications from responses highlighted the user's readiness to use a CBCVLE. However, various participants added that training, awareness and information should be provided to the users in order to achieve a higher level of use and acceptance of their VLE tools.

HEI readiness

The HEI readiness comprises ICT infrastructure, knowledge, experience, human resources and the budget. The participants judged their HEIs readiness differently, but they almost agreed there are some issues must be resolved and improved. Once an HEI is fully ready to accept and employ a CBCVLE, a crucial factor this will be to push the users to use it.

User satisfaction

Another critical factor consists of the user satisfaction which encourages the user to go further and use the VLE tools extremely. Earlier in this chapter, the user's satisfaction was discussed, and it was stated that a number of participants were dissatisfied with the status of the collaborative VLE tools in HEIs. They, for example, believed that their VLE tools are not ultimately used for collaboration or even lack the collaborative features.

Institutional support

The institutional support plays an important role to facilitate the way for users to use their VLE tools. In regard to VLE tools, the institutional support may include investing on human resources, high quality services, clear policies, dissemination of skills and knowledge between users, promotion for individual initiatives, continuous funding, and much more. An increased and effective institutional support will lead definitely to success in adopting a CBCVLE in HEIs.

Organisational culture

The common culture of an HEI would form the way how the users interact and change ideas and beliefs between themselves. This factor, if managed positively, will popularize the culture

of using a CBCVLE. Participant TL6, for example, described the new culture that can be seen among students in their HEI.

Individual initiatives

Based on their previous experience, the participants to some extents have adopted and integrated several cloud-based collaborative services and applications regardless of the lack of similar ones within their current VLE tools. Participant TL6 mentioned some of these applications such as Classrooms, WhatsApp, Google drive, and Google Docs. Another participant, ST12, also stated that they use Classrooms which is a third-party cloud-based application and sounds easier for them or even has more features than their VLE tools.

Attractive VLE software design

It was clearly highlighted by some participants such as TL4, TL6, TL8, TL9 and TL18 that the design of their future VLE tools should be attractive and user friendly.

Peer pressure

For users in general and for students in particular, being a member of a group of peers would form a critical factor to compete other members and follow their steps. Concerning technology and VLE tools, most of the participants believed that the peer pressure will be critical factor to attract students to use their VLE tools and improve their technical skills.

Disincentives

Lack of Internet connectivity

The frequent interruption of Internet connectivity along with the slow speed provided in HEIs would affect the use of VLE tools negatively. The participants particularly indicated this issue and they recommended an effective strategy and immediate solution for the provision of Internet service in their HEIs. This aspect was found to be the most problematic issue revealed by the participants in regard to the use of VLE tools.

Security and privacy concerns

The participants indicated the security and privacy issues as importantly annoying them to use VLE tools. They believed that these tools still in development and not yet fully improved. Their concern of security and privacy may increase while they have the same initial impression and less information given to them.

Bad or complex VLE software design

Bad design is one of the issues indicated by the participants which they do not like to see in their VLE tools design. The issue of complexity in the design also was mentioned by several participants. A bad or complex design would distract users from employing the VLE tools.

Lack of knowledge and expertise

The participants expressed their views that the technical information provided to them is very limited or even not available. This is can be linked to the trained and qualified human resources in general and IT technicians in particular. It was stated by participant TL10 that they are not aware of collaborative features in their VLE tools. Many participants agreed that the lack of technical knowledge would imply a negative impact on the use of a CBCVLE.

Lack of training

The lack of training was extremely pointed out by participants. For example, TL1 suggested that HEIs should provide a consistent training. Participant TL19 also highlighted the importance of comprehensive training covering the main features and aiming for both teachers and students.

Lack of technical support

The lack of providing technical support will affect the use and acceptance of a CBCVLE tools.

ICT Knowledge gap

The gaps of ICT knowledge and skills among different regions would form a negative factor for those users who live in rural villages and have less or limited knowledge and skills compared to users live in big cities. The proper and adequate knowledge and skills, as stated by participants, are needed in order encourage users to use a CBCVLE tools.

Limited technical knowledge

The participants associated between the lack of or limited technical knowledge and the lower usage of VLE tools. Therefore, the lower limited technical provided by HEI to users, the lower in the extent at which the users use and accept a CBCVLE.

Digital divide

Digital divide which describes the ICT skills and knowledge that differ from one region to another due to various factors including infrastructure, service availability, and the quality of service. Participant TL2 highlighted real example based on their experience which indicate the

huge differences between Muscat (The capital city of Oman) for example and rural areas throughout the country.

Resistance to change

Users' resistance to change would critically slow down the implementation of a CBCVLE. A high number of participants highly agreed that the users' resistance would affect the use and acceptance of such environment and technology. Moving from a traditional VLE to a new featured environment would be a time consuming unless more training and information are provided to users.

Uncertainty with new technology

Like users' resistance, uncertainty with new technology could cause a delay for using and accepting a CBCVLE. The participants extremely believed that there will be uncertainty with new VLE tools and related technologies.

Lack of devices

It was indicated by some participants that users in HEIs may lack the proper devices to access and use VLE tools. Currently, due to issues of compatibility with mobile devices the users must use PCs to access their VLE tools. This raised a problem that not all users specially students possess a PC and consequently being in the campus is the only way for them to access VLE tools and respond to various activities. Another implication is the number of PCs that are available for students in campus is not always adequate.

Loss of control (Centralisation of ISs including VLE)

If managed efficiently, the centralization of an information system to be shared by several HEIs is highly appreciated in terms of the benefits that members can receive from such union. However, some factors may reject this as undesirable experience. Participant TL7 stated that they find difficulties to get timely responses for their queries as well as delay in updating the system. This happens when the control relates to other people outside the HEI. The loss of control was also confirmed by participant AT1.

Lack of academic or administrative pressure to use VLEs

There should be a pressure either from teachers or HEI administration to employ VLE tools in all of the educational activities. It was stated by participant TL6 that the administration of their HEI neither have asked them about the applications they use to enhance their teaching activities nor included it in the annual evaluation of teachers.

6.5.4.1. *Overall Summary*

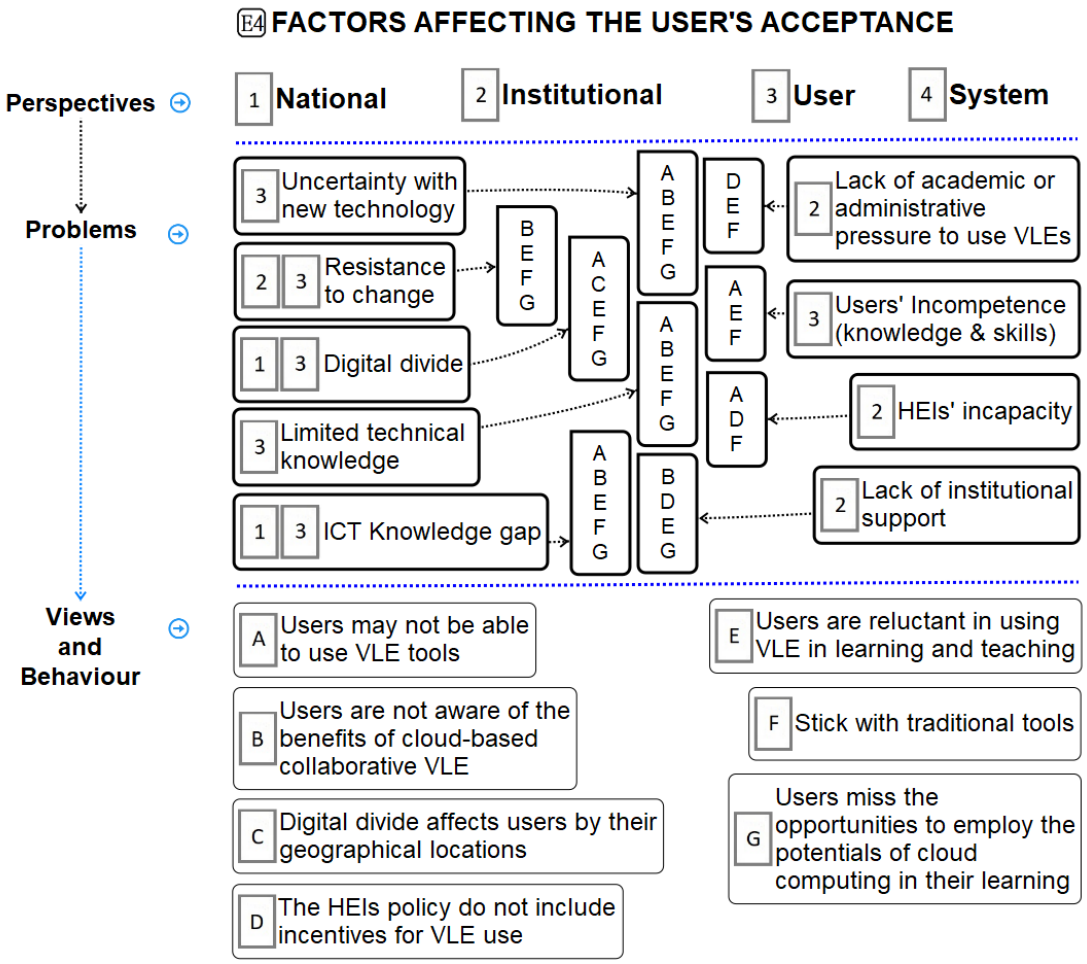


Figure 6.9: Factors affecting the user's acceptance problems/issues.

Figure 6.9 shows issues and problems from the four perspectives of national, institutional, user and system in respect of factors affecting the user's acceptance.

6.6 DISCUSSION

This survey examined issues, factors and challenges with which the collaborative VLE can be affected. It also investigated the associated tools that are not used to their full potential. The analysis and interpretation of the interview responses revealed five main themes (elements). This section offers reflections on four of these themes while the fifth (cultural influences) will be discussed in the next chapter (Chapter 7).

ICT Infrastructure and Services

In respect to the first research question, the study first examined issues related to ICT infrastructure and services that may contribute to a successful implementation and utilisation of a CBCVLE. The results showed that the users ranked desktop computers and laptops as their favourable devices to access VLEs, with mobile devices being the least option. A possible explanation for this might be that most of VLEs in HEIs have compatibility and interoperability issues. Interoperability as identified by Cunsolo et al. (2010), Jin et al. (2010), and Valcheva et al. (2015) to be an essential characteristic of cloud computing, however, it remains problematic in traditional VLEs. The mobility and ease of use were positively reported as motives for some user but in fact it is contradicted with VLE tools' compatibility.

In respect to the second research question, the interview outcome show that some teachers have incorporated several educational mobile applications and social media into their educational activities. This result may be explained by the fact that these represent individual initiatives and not officially supported by HEIs whereas apps like WhatsApp is used for coordination and communication in collaborative activities.

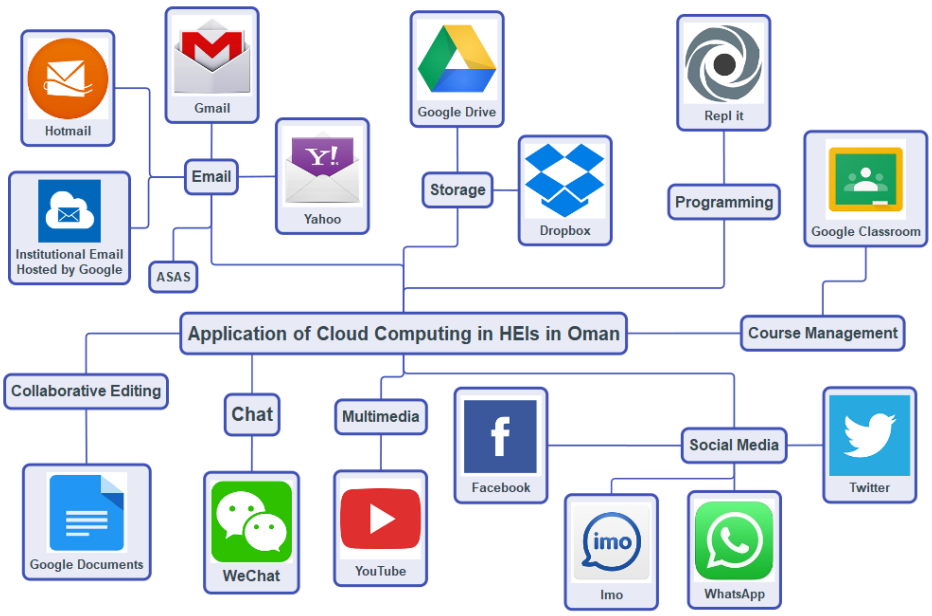


Figure 6.10: Application of cloud computing in HEIs in Oman as perceived by users.

Figure 6.10 illustrates the most common cloud-based applications used by users in HEIs in Oman to support their educational activities. Apart from using cloud-based email applications, users incorporate cloud apps for storage, computer programming, course management, multimedia, chat, collaborative editing, and social media.

Some experienced users indicated further utilisation of external tools that are available globally and free to use. The employment of such apps helps to manage collaboratively courses and communication with students and between colleagues reflecting the situation of their VLE tools which currently is lacking. It seems possible that these issues are due to technical problems that may distract users from using their VLE tools.

Some teachers indicate that they use a 3rd party application like Google Classroom to deliver and manage their courses. This indicates several issues with the existing VLEs. First, they may lack some features for HEIs, or the desired features are disabled. Secondly, they may have access issues to their official VLE forcing them to seek alternatives. Figure 6.11 shows disabled functionalities and features in the current VLEs in HEIs in Oman as indicated by the participants (this is the outcome of this research).

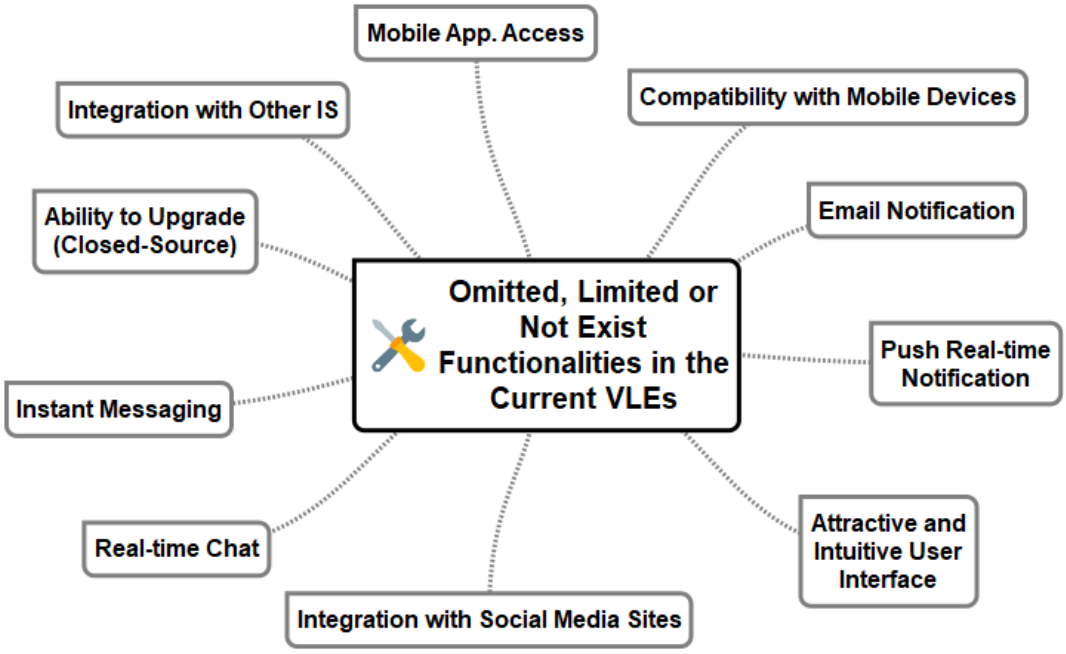


Figure 6.11: Disabled functionalities and features in the current VLEs.

Operational Environment

With regard to the third research question which focuses on concerns and challenges that may have affected on the use and acceptance of a CBCVLE, the survey paid a considerable attention to the related issues. The time consumed by users to complete any task was not up to their expectation, and this reflects that using VLE tools is a time consuming. Consequently, users may stop using these tools or may try to find easier and more efficient ones. This also can

create hesitation by users to avoid employing their VLEs into educational activities as they try to save their time and efforts based on evidences from their own experience.

Technical challenges and concerns were identified by users to include for example: sufficient Internet connectivity, weakness of the Internet connectivity, difficulty of uploading assignments, lack of proper devices, incompatibility with smartphones, and absence of notification system. It can therefore be said that these challenges affect the communication between students themselves and between students and teachers. The slow communication, therefore, results in an extreme delay to assignments and collaborative activities deadlines.

Further concerns were stressed by users such as lack of technical awareness, training, lack of information, lack of experience, lack of knowledge, complexity of VLE tools, data privacy and protection, security, lack of integrating of VLE tools with other information systems. These aspects can be considered vital to collaborative VLE and require more attention by HEIs. It should be noted that all of these issues also relate to the ICT infrastructure and services that are anticipated to be available to users. Users' doubts (e.g. lack of trust) were also expressed by Kirchner and Razmerita (2015) and found to negatively affect the satisfaction of members of collaborative groups.

Organizational challenges and concerns were also highlighted by teachers who were interviewed. They admitted that the teaching load plus administrative duties including teaching, office and consulting hours as well as the lack of pressure from administration to incorporate VLE tools in education. This was also highlighted by Heaton-Shrestha et al. (2005) as a depressing factor that discourages teachers from utilising the VLE. In addition, lack of local HEI's policy would negatively contribute to this situation. Furthermore, central management of VLE tools was raised as a challenge whereas an HEI is being a member among others of a group of institutions that use unified VLE tools. A possible explanation for this might be that this idea of sharing one VLE by several HEIs is not preferred by some of the interviewees based on their experience.

It should be noted that the students, as emphasised by teachers who were interviewed are not confident when using VLE tools. Thus, they lose the confidence with the VLE which implies that they are hesitant to use the respected tools as well as they see no obvious benefit from sticking with it. Participants also complained about the adequacy of technical support. Absence of great features such as assignment online grading was highlighted by participants. All these issues contribute badly to users' confidence towards using collaborative VLEs. It was asserted by Vitkar (2012) that the lack of confidence would make users reluctant to use their

VLE tools. On the other hand, the provision of sufficient training and proper knowledge, for example, may result in a stable utilisation and performance (Dennis et al. 2008).

It was stated by some participants the lack for policies, manuals or even published guidelines for the utilisation of their VLE. These, if provided, will establish a stable environment for implementing and utilising VLE tools which will consequently motivate users as well. The lack for a specific department in HEIs to produce scientific or educational materials that support the VLE was also emphasised. This will give a collaborative VLE an extended importance to bypass its current and limited role as a storage space for course materials to be a platform of learning and collaboration. Google Drive, for example, is a cloud-based collaborative tool which is as stated by Erturk (2016) can change the work of group members from just a storage to an enhanced environment of peer teaching, learning activities, and collaboration is facilitated.

The findings showed that some users were not fully aware of issues concerning collaborative VLE and cloud computing applications and services. In addition, they even did not know whether a specific feature is available in their VLE tools. The possible explanation for this is the lack of awareness and the lack of the dissemination of information, knowledge, and training among the users in HEIs.

The findings also suggest that many users will be resisting the use of cloud-based services for a collaborative VLE if their HEI employs it. Some users agreed with the fact that adequate training provided along-side the implementation of VLE would laminate such resistance. The implementation of a CBCVLE with less knowledge and awareness of its capabilities among practitioners, as stressed by the participants may result in an increased hesitance to become active in the new environment. Darwaish and Wang (2012) indicated the lack of interviewees' knowledge on the existing features in VLE tools. Dillenbourg (2002) emphasised knowledge as a critical factor within collaborative environment in which Weinberger et al. (2007) asserted that knowledge helps users when learning and interacting collaboratively.

Similarly, the lack of sufficient technical knowledge was pointed out by participants as a crucial factor for the utilisation of a CBCVLE. It can be argued that there is a strong relationship between the provision of technical information and training and the users' acceptance of a system or technology. The establishment of a CBCVLE that is compatible with mobile devices would require less efforts in this regard as the majority of users are anticipated to own and have a good experience of such devices. Some participants indicated that they need less knowledge and experience to work on cloud-based applications compared to those traditional

ones. This is supported by White et al. (2009) who argued that cloud-based collaborative environment requires less efforts from users.

The findings also revealed users considered uncertainty with new technology as a challenge to accept and use a CBCVLE. This finding is consistent with Isaila (2014) who identified uncertainty as a challenge of adopting a cloud computing technology. Moreover, Olaniran et al. (2010) found that local customs and traditions could increase the user's uncertainty within VLE. However, and concerning the age of users, the new generations could have less hesitation and uncertainty in regard to adopting technologies. This is supported by Cox (1994) cited by Oetzel (2001) who identified age as a cultural issue that represents a personal characteristic within the community.

Overall, participants indicated various examples that represent the current situation of their VLEs. They are obliged to use several login accounts for different systems in their HEIs as well for those external applications and services. Due to the problems they face, participants became reluctant to use their official VLE tools or they may search for alternatives. This is regardless of the fact that the difficulties face some teachers which make them likely to be reluctant to use online tools (Chawdhry et al. 2012). This reluctance was addressed by Wang and Huang (2016) who asserted that users who are not well trained are more likely to be reluctant to use a new technology. Further, some participants lack the proper knowledge and experience to employ the advancement of cloud computing in their education. Similarly, they may resist any newcomer of technology and even create a hesitation barrier towards the utilisation of VLE tools for which participants seem sometimes have no motivation to embrace and continue using their respective VLE. The users' hesitation to use VLEs can be eliminated by widening their knowledge and understanding of the technology (Anuar et al. 2016).

User Experience and Expectations

With regard to user experience and expectations, the finding highlighted issues concerning user intention to use, application of cloud computing in education, perceived benefits, user satisfaction, and user expectations. The findings articulated the extent to which participants are confident of the importance of VLE tools and cloud computing applications. This is as argued by Dennis et al. (2008) will have a positive impact on the users' performance. Also, the dissemination of information and training would increase the users' confidence (Rossing et al. 2012). The results identified a relationship between having knowledge and being aware of the importance of the technology. However, some interviewees argued that the absence of implementing and the use of cloud-based tools and applications into the annual evaluation of

teachers, would make them gradually abandoning such tools as they are not promoted by the HEI. Another indication was pointed out by a teacher who highlighted that officials are not aware of the importance of VLE.

In regard to collaborative work, students interviewees expressed their views that they are not engaged in such projects due the lack of organisational culture which is anticipated to promote these activities. Yeboah-Boateng and Essandoh (2014) addressed conformity with work culture and style as a critical factor for implementing a technology. Milne (2007, p.28) states that "*the challenge now is to develop an organisational culture where sharing knowledge is the norm*". Therefore, the dissemination of the proper knowledge among users in HEIs would enhance the culture of collaborative VLE and any application of cloud computing.

The users in HEIs are willing to use a CBCVLE tools. Their intention to use such tools can be envisaged throughout the interviewees' responses. The participants broadly indicated the use and implementation of more than 15 cloud-based applications in their learning and teaching activities. Therefore, the users are eager to obtain free cloud-based applications for use in their educational and collaborative activities. Another indication is that the participants highlighted and expected various features and elements they are missing in their current VLE tools. An implication of this is the possibility that their suggestions indicate their desire to have those features in their future VLE tools. Hew and Kadir (2016a) assert that when teachers observe an appropriate and coherent content design their intention to use VLE will be increased.

One of the issues that emerges from these findings is users' continuance intention to use a CBCVLE. It was enclosed in some participants' responses that the great and effective features of cloud computing are anticipated to be included in their VLE tools. Moreover, some participants indicated their continuance to use cloud-based applications regardless that the HEI regulations do not take this aspect as measure in the annual evaluation of faculty members teaching approaches. However, some teachers were not sure of students' willingness to use a CBCVLE as their preference expected to be traditional paper-based tools in learning. However, Mouakket (2015) addresses the obvious effect of satisfaction on continuance intention and the effect of habits and enjoyment to increase the users' continuance intention.

The users in general indicated various examples of cloud-based applications and sites that they use either in their HEIs for educational activities or for personal use. Google Drive, Dropbox, and Google Documents which are mostly cloud-based were the applications and sites highlighted by the participants. Furthermore, participants highlighted cloud computing

tools for: sharing files and documents, files storage, email, communicating with other users, collaborative editing, supporting educational activities, enhancing teaching and learning, providing alternatives for PC software, collaborative projects and assignments, assisting course management and delivery, course assessment, and scheduling tasks. The diversity and the wide range of cloud-based applications and tools that users in HEIs are familiar with can help them to accomplish their educational or personal tasks. Although this cannot be generalised as there will be a proportion of users who would struggle with newcomer of technology, however, intensive training programs would eliminate any associated effect.

Some of the issues emerging from the findings relate specifically to motives which were also stressed to be important to push users to utilise collaborative VLEs. Motivation can be created through rewards for students such as extra marks or for teachers such as points in their annual evaluation/appraisal. This is consistent with Milne (2007, p.1) who stated, "*reward and recognition programmes can positively affect motivation*". Similarly, peers who are trained and are capable of using VLE tools would motive other students due to peer pressure. Rossing (2012) found that peer-assistance helps students understanding related to functionality and improves their "perception of convenience".

Regardless the motivation, users must not be left discouraged to the extent that they may abandon the use of a CBCVLE. Discouragement may occur as a result for an HEI procrastination towards solving and eliminating obstacles that may face the users. The variety of related challenges and concerns may also be considered as a rich source for discouragement. The findings revealed several examples of causes of discouragement such as low speed and less availability of Internet connection, low technical knowledge, frustration and doubts about cloud computing. Moreover, some teachers seem to be discouraged as they get a high teaching load. This finding is consistent with Heaton-Shrestha et al. (2005) who indicate that the higher workload of teachers, the higher discouragement they have regarding the use of VLE.

In terms of users' engagement, some teachers managed to engage their students to use VLE tools while others were the cause for not utilising VLE. This indicates that the role of teachers in this regard is crucial to keep their students engaged with online and collaborative activities using VLE tools. Users also can be engaged as teachers allocate VLE tools as the main medium for communication with which users find themselves limited to. However, it was asserted by some teachers interviewed that students may lack the proper communication channels within VLE tools to the extent that they cannot proceed further in collaborative group projects. This situation discourages students from working collaboratively, and instead they prefer to work

individually. Valcheva et al. (2015) argue that the implementation of cloud computing into learning process would enhance student engagement with opportunities to have access to real world learning. However, students show different levels of engagement in their learning through collaborative online courses (Håklev and Slotta 2017). Similarly, Vitkar (2012) asserts that the implementation of cloud computing in HEIs supports and enhance users' engagement.

Regarding the users' competence, a number of interviewees stressed that students are not fully ready to use of a CBCVLE. Another group of the interviewees stated that students are not competent, and they indicated that some require more awareness and also they need to improve their knowledge. Further, some users also addressed other actions to improve students' competence, these are: enough training to students, guidance on how to use the VLE, adequate information and knowledge, teachers' insistence that students must use VLE tools, and HEI's support and encouragement. On the other hand, teachers were highly considered as partially competent and moderately competent. These actions include: more training, motivation and time assigned to their timetables, training and workshops, further training sessions, incentives must be present, and presence of technical staff in academic departments. Overall, most of students who were interviewed see themselves as partially competent, and also the majority of teachers categorise themselves as partially competent to use a CBCVLE. Perceived competence is discussed by Hew et al. (2016b) who claim that it has a great and positive impact on users' intention to use. Zhu et al. (2009) highlight aspects that affect users' competence such as easier access to computers, software and the Internet, as well as their familiarity with computers.

Concerning users' experience in sharing resources, from their responses, the participants highlighted various applications and services such as Google drive, Dropbox, Gmail, Google Forms, Google Docs, WhatsApp, E-mail, Google Classrooms, Blackboard, FTP, HEI portal, and ASAS program for correspondence. Moreover, the participants stated that they have experience in sharing versatile types of materials including course materials, questions papers, assessment samples, scheduling the exams, scheduling the meetings, documents, PDF files, videos, images, learning materials, PowerPoint presentations, Views, and scheduling tasks. In this regard, Erturk (2016) points out that the better the users' skills are, the more commitment and satisfaction they will have in their collaborative VLE.

With regard to users' commitment, different views were revealed about the users in HEIs by the interviewees. Some users tend to focus ordinary methods of learning and teaching while others are in favour of new ways that is supported by technologies. On the other hand, some

users have been devoting themselves to the changing technology including mobile phones and their dramatic developed applications. Therefore, this makes it easier for them to accept and use any anticipated technology. Young users especially students are particularly attached to their mobile devices and prefer to view their learning materials through them. They look for mobility and quick transactions and progress as they are described with “IT generation”. This is consistent with Erturk (2016) who expresses that the greater commitment to the technology; the more satisfaction is expected.

The findings proved that participants are aware of the benefits of utilising the CBCVLE tools as they perceived them. The benefits of a CBCVLE are: wider usability and utilisation, easier to use, easier to collaborate, efficient assignment publishing and management, real-time notification, access to resources, lower cost, shared hardware resources, fast and easy access, fast communication, self-assessment evaluation, chat and instant messaging, save time and efforts, effective education, collaborative editing, reliable IT resources, better user support, interactive environment, and more efficient academic environment. “Fast and easy access” was highly rated by users followed by “Easier to use”, “Access to resources”, and “Efficient storage”. The perceived usefulness of this environment would positively enhance the use of a CBCVLE. This, as argued by Mouakket (2015), will have also a great impact on the users’ continuance intention.

Conversely, the findings highlighted drawbacks and challenges of utilising CBCVLE tools as perceived by the interviewees. They include: security and privacy, Internet connection, network problem, lack of knowledge, loss of information, lack of hardware, not compatible with mobile devices, misuse of applications, lack of restrictions on the use, access difficulties, unable to upload a folder, complexity of the design, unable to save old course files as archives. row column design of the interface, increased system downtime, small font size, small icon size, overlapping, disabled features, lack of communication tools with students, exaggerated tabs and links, security, no integration with other systems, traditional interface, absence of integration of course materials and applied exercises, delayed login, and disorganization. “Security and privacy” and “Internet connection” were particularly stressed by the interviewees, followed by “Network problems”. Although users’ awareness of drawbacks and concurrent challenges may distract them from accepting collaborative VLE, these issues can be best managed by HEIs and convert the most of them to drivers for increased utilisation of CBCVLE.

The findings identified users’ satisfaction of the current status of collaborative VLE. Some of the participants revealed their satisfaction while a similar number of them were mainly

dissatisfied. One of the causes of this dissatisfaction was that current VLE tool is not collaboratively used and many of the features are not even enabled. Satisfaction was identified by researchers (Joo et al. 2017; Lee 2010) as the primary cause for perceived usefulness and a consequently continuance intention to use. These findings are consistent with White et al. (2009) who identify a relationship between users' satisfactions and perceived usefulness with which users are more in favour with cloud-based collaborative tasks than with traditional methods. Mouakket (2015) confirms that satisfaction has a positive impact on users' continuance intention.

Turning to the fifth research question, namely "What are the features of this CBCVLE that make it suitable for the HEIs in Oman?", the interviewees revealed their expectations (26 features) of collaborative VLE tools. "Efficient and effective learning environment" was particularly identified by participants followed by "Shared resources either by all HEIs or users", "To offer and save more time", and "Better platform or to interact with people easily". Users went further to expect features available within third-party applications such as Drobox and Google Drive to be built-in within their VLE tools. Users also revealed their expected facilities to be incorporated in their VLE tools. There were 31 facilities mentioned by users whereas "sharing resources" was mostly pointed followed by "online conferences", "fast and easy use", "chatting", and "Increased storage space". Moreover, a number of participants provided some suggestions to overcome the current issues within their VLE tools. The features and tools listed above which are expected by participants in HEIs far exceeded the list mentioned by Bouras et al. (2001) (see section 3.5).

Additionally, the findings highlighted 29 anticipated elements that the participants would like to see in the user interface of future collaborative VLE tools. "Intuitive icons" and "lightweight design" were among other elements suggested by the participants. Although the design aspects are not within the scope of this research, these issues remain annoying to users. Furthermore, users emphasised 24 design aspects that may be taken into consideration when planning and designing a CBCVLE. "Attractive interface with colourful items" was specifically pointed out, followed by "simple design" and "easy to use". The participants also identified 21 drawbacks that they would not like to see in their VLE tools design. They include: "not compatible with mobile device" and "complexity of the design". Further, participants highlighted 31 features to be included in future VLE tools to support collaborative activities. Two of them which were indicated by most of the users are: "ability to share resources" and "chat". Darwaish and Wang (2012) addressed the issue of complicated design as the reason

that caused the participants in their study to expect future features that are already available in their VLE tools.

With regard to outcome expectancy, the users showed realistic examples of confidence to use cloud computing to support and improve their collaborative VLE. They proved their desire and ability to employ third-party cloud-based applications and services to support their learning and teaching activities.

Factors Affecting the Use and Acceptance

Turning back to the third research question, a set of factors have emerged from the survey. These factors were divided into two categories; motivators and disincentives. The first category includes aspects with which the use and acceptance of a CBCVLE would increase while the second deters utilisation.

With regard to motivators, the findings revealed various aspects including: user desire to change, user experience, user skills and knowledge, high performance service, easy course management, effective course delivery, enhanced collaborative activities, clear policies, user readiness, HEI readiness, user satisfaction, institutional support, organisational culture, individual initiatives, attractive VLE software design, and peer pressure. Collaborative group-based incentives were highlighted by Milne (2007) to enhance the outcomes of groupwork if designed appropriately.

Regarding the disincentives, the results presented various issues that may affect the use and acceptance of a CBCVLE. These disincentives are: lack of Internet connectivity, security and privacy concerns, bad or complex VLE software design, lack of knowledge and expertise, lack of training, lack of technical support, ICT Knowledge gap, limited technical knowledge, digital divide, resistance to change, uncertainty with new technology, lack of devices, loss of control (centralisation of ISS including VLE), and lack of academic or administrative pressure to use VLEs. Bandura (2006) concludes that disincentives represent the negative forms and expectations of outcomes in any context. This implies that these disincentives can be extremely controlled and dramatically converted to serve as incentives.

The following is proposed which can increase the level of acceptance of a CBCVLE:

- Training and Dissemination of Knowledge
- Technical knowledge
- Narrowing digital divide
- Confidence for change
- Promotion of certainty with new technology

- Academic or administrative pressure to use VLEs
- Users' competence
- HEIs' capacity
- Institutional support

6.7 CHAPTER SUMMARY

The chapter presented the process and characteristics of survey 2. The results were analysed and significant issues that relate to CBCVLE were identified. The results were categorised into five themes as follows: (1) ICT infrastructure and services in HEIs in Oman, (2) operational environment, (3) user experience and expectations, (4) factors affecting the user's acceptance, (5) cultural influences.

The purpose of the interviews was to explore the factors affecting the use and acceptance of a CBCVLE by users in HEIs in Oman and then to identify the areas that need consideration when employing such system. Five themes were identified to classify issues emerged within the analysis. The findings indicate a lack of sufficient ICT infrastructure and services. Collaborative VLE in HEIs in Oman was examined and stated while factors that relate to HEIs were identified. Moreover, user's favourable devices for accessing VLE were highlighted. In regard to operational environment, a wide range of concerns and challenges were identified by participants. Various issues were found to have an impact on the use of VLE tools and collaborative environment.

In regard to user experience and expectations, participants highlighted issues that relating to user's intention to use, application of cloud computing in education, perceived benefits, user satisfaction, and user expectations. Factors affecting the use and acceptance of a CBCVLE were also highlighted and classified as motivators and disincentives. Both categories were explained and supported by examples from the participants points of views. Finally, cultural influences will be discussed and presented to highlight their possible effects on the use and acceptance of a CBCVLE (see Chapter 7). Interpretations and discussion of the results will also be provided.

CHAPTER 7: SURVEY 2 ANALYSIS – PART 2

This chapter discusses the analysis of the cultural influences revealed in the participant responses to survey 2. Cultural issues that may have an impact on the use and acceptance of collaborative VLE are identified and discussed. Similar to Chapter 6, this chapter contributes to the framework which represents a draft version of the final framework that will be discussed in Chapter 8.

7.1 INTRODUCTION

Cultural influences, as discussed in section 2.5, are reflected in various issues with which users of VLE are prevented, partially or ultimately from using related apps and tools and even from participating in collaborative activities. Gender, for example, would barely have an effect in some western countries, however, it could constitute a barrier in some eastern countries such as Oman concerning collaborative work. Chapter 6 provided information about the process of data/information gathering in survey 2 and participants' characteristics. A representative selection of quotes of responses are provided in Appendix 7.

7.2 CULTURAL INFLUENCES

Table 7.1 shows the sub-themes and issues that emerged from the interviews in respect of cultural influences on the use and acceptance of a CBCVLE. It briefly lists the aspects that the interviewees considered important regarding the use and acceptance of a CBCVLE in terms of the local culture in Oman.

Theme 5	Sub-Themes	Issues
Cultural influences on the use of a CBCVLE	**Family**	▪ Members obligations and commitments ▪ Restrictions on girls ▪ Level of education ▪ Level of IT skills ▪ Family Characteristics
	Religious influences	▪ Beliefs and religious practices ▪ Collision with religious instructions ▪ Indirect effects of religion
	Language	▪ User interface ▪ Use of native language (Bilingual Interface)

		▪ Use of multiple language (Multilingual Interface) ▪ Use of English language only ▪ Lack of adequate English language skills ▪ Users practice for translations ▪ Integrated translation ▪ HEI official language ▪ Language of delivering educational materials and applications ▪ Users preference of languages for delivering educational materials ▪ Quality of the language used in the communications
	Customs and traditions	▪ Flexibility of customs and traditions ▪ Openness to other cultures ▪ People commitment to local customs and traditions ▪ Big cities vs remote areas ▪ Restricted communication between male or female ▪ Recognizing the purpose of communication
	Lifestyle	▪ Characteristics ▪ Anticipated benefits ▪ Negative effects on lifestyle
	Gender	▪ Gender differences ▪ Negative effects of gender ▪ Female privacy vs recording lectures ▪ Interaction between different genders ▪ Family restrictions ▪ Conservative society ▪ Unexpected behaviour ▪ Misuse of technology ▪ VLE software design considerations ▪ Masculinity vs femininity ▪ Current state of genders in HEIs ▪ Appropriateness of materials and applications for genders ▪ Capability of females to use the technology ▪ Role of the educational environment ▪ User's occupation and impression of local community ▪ Females criticism

		▪ Hesitation to participate with the opposite gender ▪ Geographically affected areas ▪ Community awareness of the benefits ▪ Nature of the communication between different genders ▪ Modern needs vs the contact and collaboration between genders
	Age	▪ Age effects in embracing technology
	Local culture and technology in Oman	▪ Social media ▪ Internet ▪ Mobile applications ▪ ICT ▪ Customizing a cloud-based global service, application, or innovation to local culture ▪ Annoyance of adverts ▪ Fear of openness to other cultures

Table 7.1: Cultural influences on the use of a CBCVLE.

The participants were asked to select which of the following would have the most influence on the use of a CBCVLE (dress, religious practices, customs and traditions, gender, age, social values, family obligations and pressure, and non-verbal behaviour).

Table 7.2 shows the frequency of the eight factors (shown on the table) as specified by the participants.

Theme	**Frequency**	**Positive Impact**	**Negative Impact**	**Neither Specified**	**No Impact**
Dress	3	-	-	-	3
Religious practices	8	2	4	1	1
Customs and traditions	9	2	2	4	1
Gender	6	-	2	2	3
Age	5	4		2	-
Social values	7	-	3	4	-
Family obligations and pressure	11	5	3	3	-
Non-verbal behaviour	6	1	3	2	-

Table 7.2: Users rating factors that would influence the use of a CBCVLE.

The factor “Family obligations and pressure” was frequently identified by the participants (N=11) as the most influencing factors on the use of a CBCVLE. Among 11 concurrencies of the same factor, 5 participants stated that this factor has a positive impact while 3 participants assigned a negative impact to it and another 3 participants have not specified any type of

effects associated with their rating. This factor was followed by "Customs and traditions" (N=9) and "Religious practices" (N=8).

The top two factors rated by the participants as positive impact were "Family obligations and pressure" (N=5) and "Age" (N=4). On the other hand, the participants rated "Religious practices" (N=4) as the most important factor with a negative impact followed by "Social values", "Family obligations and pressure", and "Non-verbal behaviour" (N=3). The "Dress" factor was identified by 3 participants who stated that it has no impact on the use of a CBCVLE. The next few sections will highlight these findings with regard to the types of responses of the participants with links to evidences.

7.2.1 Family Influences

In respect to family influences, the participants were asked whether the family in Oman can influence the extent of utilisation of a CBCVLE. The clear majority of participants in general positively agreed with the statement. Participant TL2 highlighted some concerns that parents may have towards their daughters when using such technologies.

Some interviewees such as TL4 highlighted the level of education of a family which can play a critical role in supporting or opposing the use and acceptance of cloud-based applications and services.

Participant TL5 was confident that not all families would accept the new environment, especially with the presence of some fears in regard to privacy.

Table 7.3 shows a summary of the responses in respect to family influences. It describes the extent to which every type of family identified by the participants, would affect the use and acceptance of a CBCVLE either positively or negatively.

Family Characteristics	Influence	Representative Responses
Well educated family	Positively	"*It is depending upon the educational level of the family, … So, in that case definitely difference will be there. … it is their knowledge level.*" TL4
Technology-friendly family	Positively	"*… surely the knowledge and a good experience in ICT will surely increase the utilisation of cloud-based [VLE].*" TL1
Open-minded family	Positively	"*open-minded families that love knowledge love to know that you love to be open to many things to know them*" ST1
Young parents	Positively	"*…families of young mother and father in the stage of youth … for the youth stage will have*

		more knowledge and can enter the system and make sure the system is educational" TL12
Mature parents	Negatively	"*…and there are mother and father families in the stage of aging, … will have a negative impact will be preventing the student from the use …*" TL12
Restrictive family	Negatively	"*Not every family will accept that my boy or my girl is having a collaborative work in VLE*" TL5
Culturally sensitive family	Negatively	"*Yes, sometimes some parents refuse to share their sons with a female student.*" TL6
Family living in modern cities	Positively	"*In the villages there is no awareness about all the techniques and therefore will have a positive impact in cities and negative in the villages.*" AT1
Family living in rural villages	Negatively	"*To some extent have an effect … the difference of cultures, customs and traditions between families, towns, countryside and mountains.*" TL16
Socio-technology family	Positively	"*… now families compete in community development.*" ST5

Table 7.3: Summary of responses in respect to family influences.

Participants were asked whether they agree family upbringing with good experience and knowledge in ICT would encourage the use of a CBCVLE. Almost all the participants agreed that this would play a crucial role in facilitating the way for children to accept and use a CBCVLE. As stated by the participants, families with adequate ICT knowledge and experience will be more aware of the potentials of the technology and therefore they will support their children using it.

On the other hand, some families with less knowledge of ICT, may ultimately concentrate more on the concerns and issues than the benefits. In this way, a family will become a barrier for the use of the technology by their children.

7.2.2 Religious Influences

In a Muslim country like Oman, normally people have beliefs and religious practices that are different from western countries, where Islam is a minority religion. Therefore, the views of the users were explored to ascertain whether religious practices would have any influence on the use of a CBCVLE.

Participant TL6 raised an issue of difficulty in collaborating with a research partner from a different religion. The participant stated that this will affect the collaboration negatively but in the long term a "better cooperation among people" is anticipated. Other than that, the

same participant raised other issue regarding religiously unacceptable online communication between people with opposite gender and the nature of the language phrases used by young users facilitated by VLE software tools.

It was stated by TL6 that blocking social sites by some countries in the region is not the proper solution to overcome the challenges raised in regard to religion instructions. It was argued by the participant that youth should be educated and given awareness of pros and cons in order to achieve a good use of these sites in the way that it does not contradict with the religious beliefs and expectation. Therefore, incorporating these social sites with CBCVLEs will enhance them as well as limiting the negative effects that can arise from such use.

Participant ST1 believed there would be great impact on social values which ultimately come from religious roots. The participant stated that there will be objections in aspects that relate to religion and consequently this will somehow affect the use of a CBCVLEs. As described by the participants, there is an indirect impact of religion on related issues which will consequently affect the use of CBCVLEs.

7.2.3 Language

It is ultimately a natural feeling and it is more comfortable when someone is using their native language. This is being stated by TL3 who stressed using a technology that utilises the user's native language will guarantee more use and acceptance than if it was provided in a different language.

Moreover, TL4 asserted that producing any educational material in a user's native language will assure speedy acceptance by the user compared to presenting it in another language. Using only the English language for VLE tools will negatively affect their utilisation. TL5 indicated that not all users are capable of using the English language, and therefore, some users may get lost if no alternatives are available.

Similarly, participant TL5 argued that some social media sites such as Facebook have bilingual interfaces. Additionally, the effective use of icons in these sites make the user intuitively understand the icons even if the site is presented in another language.

Another participant confirmed the need for provision of an Arabic interface along with the initial English version, especially for the foundation year students who come to HEIs with lower levels of English language. Participant TL1 whom first language is neither Arabic nor English also indicated that they alternatively use Google Translate to understand correspondence sent to them within their HEI.

Participant TL1 suggested that the proposed CBCVLE should integrate a translation service to provide users with options to use an interface with their respective native language. For example, a student could be able to get a forwarded document translated to their mother language. A common example of a web-based application was mentioned by participant TL2. Chrome, a popular web browser for either PCs or mobile devices provides online translation for almost any page to the user's native language.

Another participant, TL10, highlighted the same issue and suggested that also to have a multilingual interface to include one international language and one local language. In terms of communication between users, one participant indicated that it may be affected when a user lacks the proper level of English language skills. TL16 considered the lack of adequate English language as the biggest drawback in the learning environment where the required language skills are not possessed. It was stated by TL19 that students' weakness in English is a common problem which may affect different aspects including the use of VLE tools. Also, the lack of adequate English language was highlighted by ST9 and ST14 who were students. They stated that with a lower level in English, students will not be capable to use such VLE tools.

7.2.4 Language of Delivering Educational Materials and Applications

The participants were asked whether they prefer delivering educational materials and applications in their native language or in English. Table 7.4 provides a summary of the users' preferences of the language for delivering educational materials.

Native Language	English Language	Either/Both
14	13	8

Note: No response was recorded from 3 participants.

Table 7.4: Users' responses regarding the language for delivering educational materials.

The participants (N=14) preferred their native language be used for delivering educational materials while nearly a similar number of them preferred English language. The remaining participants chose either option based on some conditions and circumstances.

One of the faculty members, TL20, argued that producing educational materials in the local languages will partially eliminate the difficulties faced by students whom English language is lower than the minimum standard to pursue their studies and any related educational activities as well as using VLE tools.

As presented in Table 7.5, the participants who preferred native language highlighted the reasons for their preferences for delivering educational materials. Nearly half of those who preferred native language stated that it is easy to understand the content delivered in the native language.

Reasons to prefer native language	**Frequency**	**Representative Responses**
Easy to understand.	7	"*I prefer my native Arabic language because I can understand and benefit as much as possible from this system.*" ST1
Speed of reaching information.	1	"*…It will reach the students very fast. I prefer mother tongue because it will reach fast …*" TL4
Less effort from the student and the teacher in translation.	3	"*The best language in the mother tongue and the reason it does not require effort from the student and the teacher in the translation …*" TL14
Easier to explain and give examples.	1	"*… explaining the educational materials requires a lot of giving examples and the more examples related to the environment and culture, the clearer and better and easier on both ends of the educational process …*" TL20
NO REASON SPECIFIED.	2	"*Yes, personally, I prefer to present it in the mother tongue.*" TL6

Table 7.5: Participants' reasons to prefer native language.

The participants, who preferred English to be the language for delivering courses and educational materials, indicated their choice as being the current state in their HEIs where English is used officially as an academic language. Some of the participants indicated their experience and proficiency of English as the reason behind their choice (see Table 7.6).

Reasons to prefer English language	**Frequency**	**Representative Responses**
It is the language of science.	1	"*…they go to the work they should work in English for like as a configuration, as submitted their papers and other stuff …*" TL2
The official and academic language of the institution.	4	"*…we are still using in English as the main language of education here in the College …*" TL5
User's experience and proficiency in English.	3	"*… I did study in English and now I need to teach in English. If the work asked me to do that then I will prefer to do in the English language.*" TL5
Language support of scientific terms.	1	"*In English because the names and terms used are different from those in my mother tongue.*" ST2

Reduced risk of translation.	1	"*In English, there is no real problem with the language, and perhaps the difference in translation has changed the meaning.*" AT1
Popularity of the language.	1	"*…Better in English because the whole world is using this language to communicate and others.*" ST9
NO REASON SPECIFIED.	2	"*Best to be in English.*" TL16

Table 7.6: Participants' reasons to prefer English language.

In regard to the remaining choice, which is about using either language for delivering educational materials, the participants specified five reasons for their choice as listed in Table 7.7.

Reasons to prefer either language	**Frequency**	**Representative Responses**
Use both languages.	1	"*I have a 50/50 idea about this, because if I said that yes I will prefer native language because people feel comfortable but my idea is that we should use English also because sense for higher education and for so many other things we need English …*" TL3
The context of the course.	1	"*It depends on what is the mode of the learning like if you are using English as the language for learning then we have to have it in English, it depends on what subject we are learning and what is the mode of learning.*" TL7
The level of difficulty of the content.	1	"*Depending on the difficulty of the article, its plainness, if the article is easy or simple, it is best to use the English language. If the material contains large terms on the student, I will use only the Arabic language.*" TL12
The language of other members of a project.	1	"*It depends on the members of the project, but I consider using my own language too.*" TL13
The official language of education system.	1	"*…Of course, this depends on the language of teaching or the language of education. The Arabic language was better because the student when he learns in his language, he makes one effort to the content of the article so that the content can be understood and expressed in his style while if he learns without his language here he needs to make a double effort one language and the other content Subject.*" TL8
No reason specified.	3	"*I would love to have it in my own language, but I don't mind the English anyway.*" ST3 "*Both languages.*" ST7

Table 7.7: Participants' reasons to prefer either language.

In general, the delivery of courses and educational materials in a non-native language would force the user (especially students) to make multiple efforts in translating, reviewing, understanding materials, and expressing themselves.

7.2.5 Customs and Traditions

Customs and traditions play a crucial role in distinguishing one nation's culture from another. Therefore, this section discusses whether this aspect has an effect on a CBCVLE from the users' perspective.

Nearly half of the interviewees responded by expressing that customs and traditions can affect the use of a CBCVLE. Some of the participants such as TL5, highlighted a positive impact while others indicated negative effects. The participant indicated that the local customs and traditions in Oman do not strictly disallow the use of a new technology. Participant TL10 described the Omani society as an open place which would not deny the use of a CBCVLE. TL13 expressed the view that there would be no effect, except for privacy which will be the main concern in terms of customs and traditions.

In regard to students and young users, participant TL20 clearly stated that they are not strictly influenced by the customs and traditions in respect of using new technologies. On the other hand, a similar number of participants expressed their views that the customs and traditions would have an impact on the use of a CBCVLE. Some participants such as TL2 and TL3 stressed that it may have an effect on people living in remote areas of Oman, but not others as these people are enormously attached to the local customs and traditions.

Participants such as TL6, ST2, TL9, TL11, TL12 and ST12 identified the causes of the effects which have impacts on the communication between genders. Thus, for overcoming possible effects of customs and traditions, TL2 and TL3 suggested that educating the users and keeping them aware of the benefits of the new technology including applications and services would eliminate these effects.

7.2.6 Gender

The gender in general or liaising, communicating, working and collaborating with the opposite sex in particular are culturally different from one region to another. This section discusses the participants' responses in this regard and provides their views and insights whether these aspects have an impact on the use of a CBCVLE.

Table 7.8 indicates the three statements discussed in this section to gather the participants' views. The table shows the number of participants from every gender who responded to the different cases of the statements.

Statement	Case	No. of Responses	Males	Females
The gender would be an issue when using a CBCVLE.	With	10	3	7
	Against	18	13	5
The male would have more power and freedom to use a CBCVLE than female	With	8	2	6
	Against	24	17	7
The female would be criticised for collaborating online with males in educational activities.	With	20	11	9
	Against	11	7	4

Table 7.8: Participants' responses to the statements in respect of gender.

From the females' perspective, there were 7 female participants who agreed with the first statement compared to 5 female participants who disagreed. However, only 3 male participants agreed with the statement.

Participants were asked whether gender would be an issue when using a CBCVLE. Even though some participants agreed with the statement, nearly half of the participants (18) expressed that there would be no impact of gender on the use of a CBCVLE. On the other hand, some participants (10) indicated that gender would have an effect on the use of a CBCVLE.

Participants TL2 and TL5 gave a realistic example from their learning environment where gender had an impact on the use of a cloud-based social applications. They have experienced issues by joining a mix of genders in WhatsApp groups which initial purpose has change to offer their members a place for making relationships or further behaviour that are culturally and religiously not accepted. Participant TL5 also mentioned video call or video conference in which a female student is restricted from participation by their parents or families.

Other participant (TL3) stressed that the aspect of gender would go to the advantage of female users who, as described by the participant, are more devoted to technology and learning than males. Another participant, TL2, suggested that gender should be taken into consideration in the design of applications and any relative interfaces.

The participants also were asked whether the male would have more power and freedom to use a CBCVLE than female. The majority of participants (24) did not agree with the statement in comparison with 8 participants who showed their clear agreement.

The participants who were against the statement declared that both genders have equal opportunities dealing with the technology. TL4 indicated the high and noticeable number of female students in their respective Colleges.

Participant ST3 went further and indicated that females would accept and use a CBCVLE more than males due to their long stay at homes, compared to male users. Participant TL6 also had a similar view. The participant stressed that males have more chance to be busy with other things than education. Thus, females are more available and have more free time than males, and therefore they have more opportunities to use the VLE.

On the other hand, the participants who agreed with the statement expressed their views. TL5 stated that except for those open families and those who have lived abroad, a large number of families still see males using these technologies more than females. The participant pointed out that posting personal videos or photographs by males are done without any restriction, but if these materials relate to females then more restrictions are applied where culture and religion have an impact over the use of such a technology.

Participant TL11 indicated the effect of culture on females who cannot interact easily with males within a VLE. The participant was convinced that this aspect gives males more opportunities than females to use a VLE. Participant ST6 described Oman as masculine country which gives advantage to males to use VLEs and the related technologies.

However, participant TL1 opposed the statement and identified the strengths which support the idea that females became more capable to use the technology. From their observation, the participant indicated that the number of females compared to males if it is not more it will be approximately equal.

The educational environment including the applications of VLE tools as stated by TL8 would play a critical role to support the power and freedom of one gender over the other. The participant indicated that this issue is affected by the majority of HEI's population whether they are males or females. This includes students, administrators and academics.

The participants were asked whether female would be criticised for collaborating online with males in educational activities. In total, 20 participants supported the statement while 11 participants were against it. Participant TL5 differentiated between female teachers and female students, whereas the first will not face a criticism especially from their families as they are doing their jobs since they are aware of the nature of such jobs. However, the participant indicated that female teachers may be criticized by the community excluding their family members. The participant stressed that both male and female students are found to have a hesitation to participate with the opposite gender. The participant associated this hesitation to the local culture and the region itself. As stated by the participant, the gender differences affect more those students who came from rural areas in comparison to those who live in big cities.

The participant TL6 stressed out their experience to setup discussions among students by creating a WhatsApp group including mixed genders. As mentioned by the participant, female members asked to have a special group for females to avoid any criticism. Other participants; TL14, AT1 and ST2 referred this situation to the culture of Omani society in which contacting the opposite sex is not accepted. Participant ST13 outlined some solutions to mitigate the effects of this situation. It includes: (1) collaboration must be for the purpose of education only, (2) close supervision from HEIs, and (3) family awareness and knowledge.

On the other hand, some participants such as TL3, TL12 and TL19 expressed their disagreement with the third statement (see Table 7.8). Participant TL12 believed that the society has already started developing knowledge and once the community becomes aware of the benefits and the nature of communication between different genders, definitely it will be accepted. Participant TL19 highlighted that the Omani society recognizes its modern needs including contacts and collaboration between males and females in different aspects of daily life. More than one participant agreed that when contacting the opposite sex for the purpose of education then the society will accept it and therefore females will not be criticized for such communication.

7.2.7 Lifestyle

This section investigates whether the use of a CBCVLE will fit with the users' lifestyle. It was noticeable from the responses that the vast majority of the participants asserted that the use of the proposed environment and technology will have no negative impact on their lifestyle.

The users nowadays have intuitively integrated social media and mobile phones into their daily lifestyle. Hence, this will help in the use and acceptance of a CBCVLE by an enormous number of users who are indirectly being trained and are also familiar with such an environment.

7.2.8 Influence of Local Culture in Oman on Application of Technology

The participants were asked:

> "In respect to local culture in Oman, what parts of the technology (ICT, Internet, mobile applications, social media, etc.) can mostly improve the utilisation of a cloud-based collaborative VLE?"

Table 7.9 presents the participants' responses of the most effective part of technology that would affect the utilisation of a CBCVLE. Social media was selected by 18 participants as the

part of the technology that has the most impact on the utilisation of a CBCVLE. This is followed by the Internet (N=15), Mobile applications (N=10), and ICT (N=2) respectively.

Technology	Frequency	Representative Responses
ICT	2	"*I find that all that is said to be useful in improving this technical aspect whenever mentioning whether the aspects of communication or the Internet or social networks.*" ST1
Internet	15	"*... Internet is one of the important things which I can say which will improve the utilisation of a cloud-based infrastructure other than social media and other aspects.*" TL1
Mobile Applications	10	"*... now people they are much into the Internet and mobile applications as I told you we can see the young generation of people here especially youth aging from 18 to 25 they use their phones in like every single minute …*" TL11
Social Media	18	"*In my personal point of view social media like WhatsApp and Facebook we find that everyone is using here, so it definitely is going to provide the most impact if we want to utilise the cloud-based VLE.*" TL3

Table 7.9: Participants' responses of the most effective part of technology in respect of utilisation of a CBCVLE.

The participants also were asked whether customizing a cloud-based global service or application to their local culture would fit to their needs. Nearly all the participants responded by expressing their agreement to the statement.

Most of the participants were convinced that customisation of a CBCVLE to the local culture will help in the adoption by the users as well as them being more comfortable with the environment. This also will give opportunities to users who have less skills in English to use it. Participants TL2 highlighted some aspects that can be customised such as colours, icons and the language. The participant expressed that the Omani users will find an Arabic user interface more acceptable and understandable.

Another participant indicated the annoyance of adverts in some mobile applications which contradict with their culture. The participant believed that inappropriate adverts should be eliminated if such applications are customised to their local culture. Another participant added that such customisation to meet the local norms and traditions would attract more users and it will be more likely that their families support the use of VLEs. Another participant expressed that once a customised system or application is culturally accepted then there will be no hesitance or resistance from the local community to use them.

For those very few participants such as ST2 and AT1 who were against the idea, they highlighted their concerns and fears which include (1) inappropriate adverts, (2) delivery language in English, (3) lack of privacy, and (4) fear of openness.

7.2.9 Other Cultural Issues

The participants were asked to identify any other cultural issues they think that may affect the utilisation of a CBCVLE. The vast majority of the participants had nothing to add while some participants stated that the culture has no negative impact on the use of VLEs.

However, some participants such as TL6 indicated the inappropriate use of the language used in the communications between the two genders of young people is not culturally acceptable. Another participant highlighted the danger of the possible use of a VLE to share culturally unacceptable materials such as pictures and websites. The participants also highlighted the advantage for young users to use and accept a new technology more than elderly users.

7.2.10 Overall Summary

Figure 7.1 shows issues and problems from four perspectives (national, institutional, user and system) in respect of cultural influences. In this figure, issues and problems are further highlighted by giving examples based on users' views and behaviours. Some issues deal solely with one entity while others have two different relations. The National perspective is concerned with national ICT infrastructure while the Institutional perspective deals with laws, policies and logistics inside HEIs. The Users' perspective relates to daily aspects and issues that users may conduct or face within collaborative VLEs. Finally, the System's perspective reflects aspects concerning collaborative VLE tools.

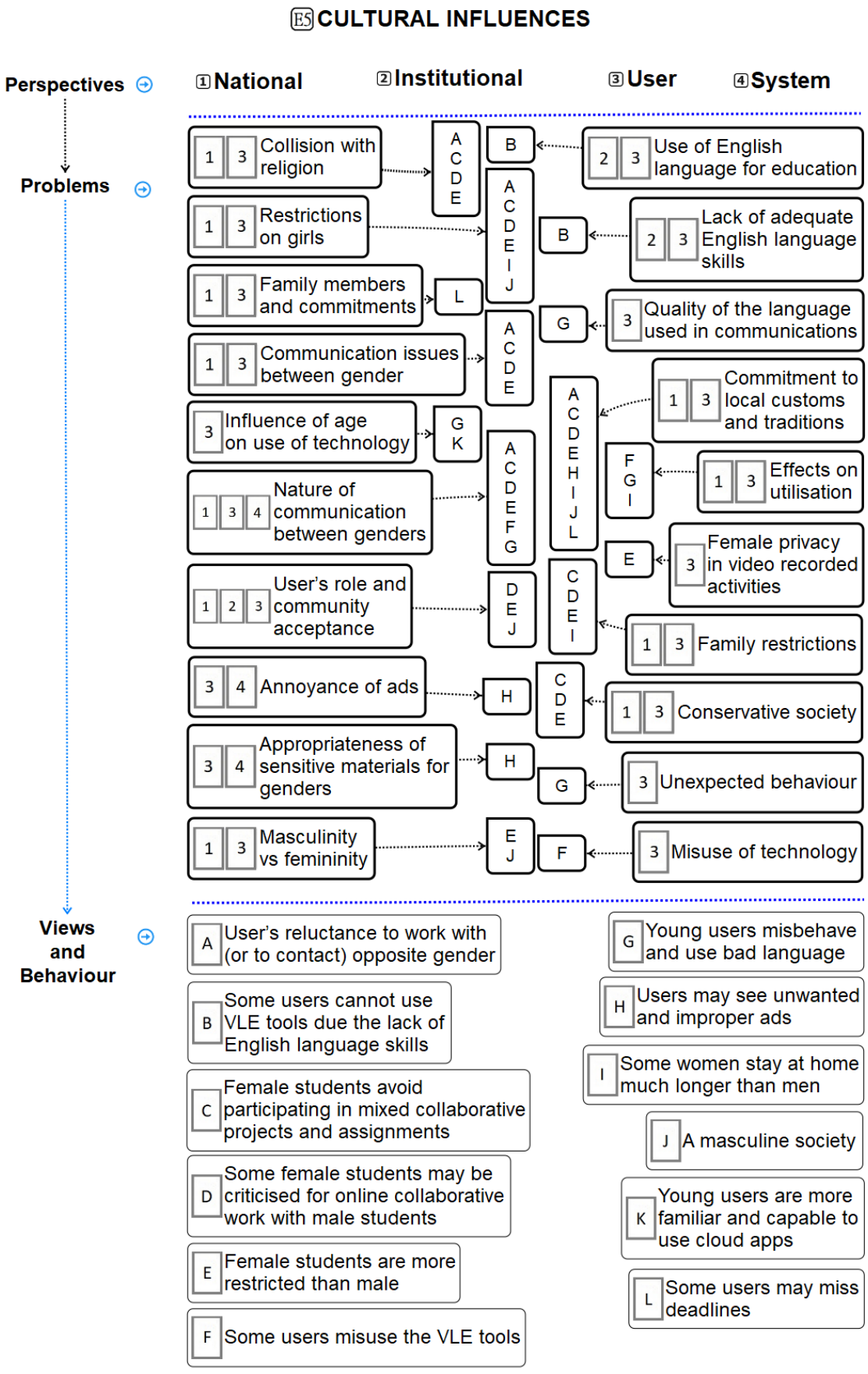


Figure 7.1: Cultural influences problems/issues.

7.3 DISCUSSION

This section provides reflections on the fifth theme "cultural influences" that emerged from the analysis of survey 2. Cultural influences and the application of VLEs in particular and technology in general have already been discussed in Chapter 2, section 2.5.

In respect to the sixth research question (see section 1.5), the survey focuses on the effect of culture which may influence the use of a CBCVLE in Oman. The cultural influences include family, religion, language, gender, and customs and traditions.

The survey findings extensively highlighted the effect of culture in HEIs in Oman. Some common practices were identified which are compatible with local culture. On the other hand, the findings showed other practices exist (e.g. some Universities and Colleges have mixed groups where the policy is single gender groups).

With regard to family influences, the findings indicated a high level of agreement between the participants with the fact that the family in Oman have an influence on the extent of the utilisation of a CBCVLE. Some factors that may eliminate the negative impact of families towards using a CBCVLE were pointed out. They are: (1) level of education of a family, (2) the socio-economic class of a family, (3) knowledge and experience in ICT, (4) experience of living abroad, (5) age of parents, (6) geographical area, and (7) the level of commitment to local culture. Each one of these factors can either positively or negatively affect the use of a CBCVLE. For example, a family who had the experience of living abroad may be more open to technologies, and therefore, is expected to help promoting collaborative activities. In contrast, a very conservative family that is more committed to local customs and traditions would not allow their daughters, for example, to collaborate and communicate with males even for educational purposes. The participants were confident that being brought up in a family with a good experience and knowledge in ICT would encourage a user to use a CBCVLE. It is not a wrong assumption to expect that when parents are aware of a technology, they will facilitate and support utilising it by their children. On the other hand, families with less knowledge, training, skills, and experience in ICT, are expected to create a barrier for such utilisation and acceptance. These findings may indicate that Oman is a feminine society where, as asserted by Hofstede (2014), the people try to achieve a balance between their families' commitment and work duties. This may not be achieved as desirable as possible and accordingly the use of a CBCVLE is affected.

With regard to religious influences, Sun (2016) states that a religion is the lead and the root of a culture. It was asserted by Culture Trip (2019), Worrall (2012) and McColl (2014) that Omani society is conservative, and it is entirely inspired by Islam as a religion. In this regard,

the results indicated the participants' concerns regarding religiously unacceptable behaviours as well as the inappropriate use of the language by young users (mostly students) online. Moreover, an example was highlighted where a government in a neighbouring country has banned social websites to avoid contradicting with religious instructions. Even though some participants were aware that there will be some hesitation or even objection to some practical aspects within a CBCVLE concerning culture. However, participants were confident regarding the role of training and awareness in terms of the benefits and the features which should be recognised by users and consequently remove any ambiguity in terms of religious beliefs.

The findings highlight the vital role of language in the design and utilisation of a CBCVLE. It is found that language is crucial to users' acceptance of a CBCVLE. Translation is considered by this study as a part of the localisation process that can be found and implemented by several websites. It can be seen as a built-in feature in some web browsers such as Google Chrome. Equally important, localisation incorporates various aspects including but not limited to time zone, measurement units, local expression, and custom content, images and videos that correspond to local culture. The aim of proposing localisation in this study is consistent with the view of GALA (2018) to customise the whole CBCVLE for local users to the extent that they feel it is entirely designed for them. Therefore, this proposed localisation goes further to what ordinary translation covers in terms of user interfaces and content. However, it was stated by Courage and Baxter (2005) that localisation may preserves misrepresentation of information. Therefore, hiring experts among locals may mitigate any related effect.

Similarly, participants highlighted that the local language must be considered officially by HEIs in the education system as well as in course materials. This is as stated by participants would ensure fast acceptance from users to the CBCVLE. This is consistent with the finding of Nthiga and Fender (2015) who state that the use of local language in an African government project have attracted a great response from the local community.

The results also showed that the use of English language only by non-English native users will negatively affect users in less utilisation of a CBCVLE. This is consistent with those of Castro (2016) who indicates that the participants identified language as one of the most important cultural issues in collaboration. It cannot be assumed that all users are capable of using the English language effectively. Consequently, users with lower English skills may not use the system, and therefore should be provided with alternative language to enable improved utilisation of a CBCVLE. In addition to local language being used in a CBCVLE, appropriate use of icons and graphics was stated to intuitively reflect the local language. It was also indicated by the results that some users have been using online translation services to understand any

correspondence content such as official emails from administrators. Similarly, it was suggested that the proposed CBCVLE should serve the users with multiple languages to accommodate their diversity. The reasons specified by participants were mainly related to their weakness with English language skills which led to the difficulties in using a CBCVLE.

The findings also articulated the reasons for which participants prefer their native language for the delivery of educational materials and applications. These are: (1) it is easy to understand, (2) it will reach the students very fast, (3) less effort from the student and the teacher in translation, and (4) easier to explain and give examples. On the other hand, other participants indicated they favour with English for the following reasons: (1) it is the language of science, (2) the official and academic language of the institution, (3) user's experience and proficiency in English, (4) language support of scientific terms, (5) reduced risk of translation, and (6) popularity of the language. A number of participants stated their desire to have either or both English and Arabic languages for the reasons following: (1) the use of Arabic language for courses that relate to cultural related subjects, (2) the difficulty level of understanding of the course content, (3) the language of other members of a project, and (4) the official language of the education system. However, the delivery of courses and educational materials in a non-native language may require more efforts by some students in translating and reviewing in order to understand and express themselves.

Regarding local customs and traditions, the results highlighted two different views of participants. While some participants indicated that customs and tradition will not restrict the use of a CBCVLE, a high number of participants believed that there will be an impact on such utilisation. Privacy was highlighted to be an issue in terms of local customs and traditions. Participants indicated that younger users (such as students) are not as strongly attached to the local customs and traditions. This means that mature users would be more attached to the local customs and traditions, and consequently, their utilisation of a CBCVLE can be negatively affected. Another finding indicated that users from rural areas are more attached to the local customs and traditions than those living in big cities. The customs and traditions as a cultural factor were pointed out by Olaniran et al. (2010) which may affect the users' uncertainty in utilisation of VLEs. It was suggested by participants that educating users would minimise or maybe eliminate the effects on utilisation of a CBCVLE.

Other studies (see section 2.5) have noted the importance of gender in utilisation of VLEs. Similarly, gender was found by this study to have a great influence on the use of a CBCVLE. This research found two different views from participants regarding the impact of gender with regards to utilisation of a CBCVLE. However, some participants highlighted negative effects of

gender on a CBCVLE. For instance, some participants indicated that some users may refuse to participate in mixed gender collaborative groups. This type of interaction is considered culturally and religiously unacceptable. Collaborative VLE also implies that users may communicate with other members of a collaborative group either by audio or video calls as well as instant messages. Therefore, it is anticipated that, for example, many female students may not participate in communicating with male students and vice versa due to cultural/religious restrictions. The restrictions may differ from one city to another, which consequently can affect the utilisation of a CBCVLE. This research is in line with those by Gabrenya et al. (1985) who identify a link between gender and members' behaviour within a collaborative group. It is also asserted by Collis (1985) cited by Ahuja and Thatcher (2005) who argues that technologies may influence the views of an attitude of different genders among young people.

The findings also reveal more issues related to gender. Many participants were against the concept that males would have more power and freedom to use a CBCVLE than females. However, some participants agreed with the concept that female users who stay more at home, have more opportunities to use a CBCVLE. Some participants highlighted the impact that culture and religion have on how personal photographs and videos posted by different genders are viewed. There are restrictions for females posting personal materials as perceived as unacceptable by the local community. However, it can be concluded that that there are less cultural restrictions on males using a CBCVLE. In addition, it was pointed by one of the participants that the high proportion of a gender in a study group may encourage utilisation of a CBCVLE by members of that gender.

A further point to emerge in relation to the effects of gender is the public criticism of females for communicating with males online. Nearly two thirds of participants indicated that a female would be criticised for collaborating online with males even in educational activities. This finding can be linked to the conservative societies where such actions are religiously discouraged and considered unacceptable in terms of local customs and traditions. However, in case of female teachers it is acceptable by the local tradition/religion to contact male students for educational purposes. Participants gave examples of how gender affect students within their HEIs. Female students, for instance, acquired single gender WhatsApp group which is initially created for collaborative activities. This is can be also referred to the local culture including religious influences and customs and traditions whereas contacting the opposite gender is unacceptable. In this regard, Chatty (2000) indicates that women in Oman are under the influence of their husbands and fathers in terms of communicating with people

who are not related. On the other hand, it was declared by some participants that the Omani society has already recognised the need for collaboration between males and females in different aspects. This fact can be explained where certain professions such as the banking sector which have developed this type of communication between different genders over the years. However, communicating with the opposite gender would be acceptable as suggested by participants for using a CBCVLE for educational purposes under a close and continuous supervision by officials. Additionally, dissemination of awareness and information about a CBCVLE among families would contribute positively to its utilisation.

The results indicated that the lifestyle of users, as asserted by participants, will not be affected by the use of a CBCVLE as it is anticipated that there will be no conflict between them. This can further be linked to the use of social media sites and applications that are being used by a high number of users nowadays. Similarly, and irrespective of some cultural concerns, the use of a CBCVLE may imply the facilitation of education that would stand side by side with users' modern lifestyle. For example, users may not need an extra device to use a CBCVLE, instead they can use their mobile phones for several tasks and purposes including education. This is consistent with Bosomworth (2015) who argues that 80% of the Internet users have their own smartphones. Furthermore, Sarrab et al. (2016) claim that 47.4% of students surveyed in HEIs in Oman use their smart phones for accessing the Internet. Hence, mobile devices in general have become the easy way for people to communicate and get information whenever required.

In respect of local culture in Oman, the participants identified the most effective part of the technology (ICT, Internet, mobile applications, social media, etc.) that can mostly improve the utilisation of a CBCVLE. Social media was highly identified by participants, followed by Internet and mobile applications respectively. This finding can be explained by the wide use of social media applications and sites by diverse users including teachers and students. It is anticipated that users who are familiar with social media will be more capable of using collaborative VLEs. Therefore, it can be concluded that the user experience in social media increases activities within a CBCVLE and may consequently enhance the individual PLE (Al-Zoube et al. 2010). In addition, AlCattan (2014) highlights the integration of social media into collaborative VLEs.

Overall, the participants were clearly convinced that the localisation of a CBCVLE will ensure more utilisation and acceptance. It should be noted that there is a relationship between cultural influences and users' experience which can be affected. It was asserted by Sarrab et al. (2016) that cultural factors have an impact on "ease of use" and "perceived usefulness" which determine the actual system use. This localisation, as indicated by participants, includes

using real Arabic language, removing improper advertisement, customising to local culture, and also icons. These suggestions among others will attract local users to use a CBCVLE since the aspects of local culture are incorporated into its design.

7.4 CHAPTER SUMMARY

The Cultural influences were given more attention in this study as they form the extended scope of the thesis with which a prototyped VLE is used for demonstrating aspects of the proposed framework (see chapters 8 and 9). Cultural issues concerning family, religion, language, customs and traditions, and gender were highlighted based on the participants views and responses. The findings were discussed and linked to literature.

The survey has uncovered many issues that can influence utilisation and acceptance of a CBCVLE. Cultural influences were found to be critical and vital to users, whereas local culture affect their thinking, attitude, and behaviour. It was clear from the findings that family, religion, language, customs and traditions, and gender can have a critical effect on the users' participation in collaborative projects. The entire collaborative environment depends mostly in communication between members to coordinate tasks. However, local culture may restrict such communication with the opposite gender as customs and traditions disallow it as well the interpretation of the local religion. The survey brought to light the role of the local language for the use and acceptance of a CBCVLE. It was found that the use of the local language in the CBCVLE can improve the rate of its acceptance. Overall, cultural influences are considered by this study as being the most important challenges contributing to the use and acceptance of a CBCVLE.

CHAPTER 8: A FRAMEWORK FOR A CBCVLE IN HEIs IN OMAN

This chapter discusses the development of a proposed CBCVLE framework to improve VLE utilisation and collaborative activities between potential users. Recommendations are provided to HEIs to help to mitigate the possible effects that may prevent or even reduce the use of a CBCVLE. Potential issues are categorised into five main elements which form the structure of the framework. Each main element is divided into several sub-elements to articulate issues that relate to the "parent" element. Entities and associated relationships between sub-elements are illustrated and explained. Further, the characteristics of the CBCVLE are specified in comparison with traditional VLEs.

8.1 INTRODUCTION

The framework incorporates five elements that represent an accumulation of syntheses and issues derived from the experience and perspectives of a range of different types of user. It discusses issues which affect users' experience in respect of VLEs, reflecting the technological problems such as speed of Internet. As discussed in Chapter 7, cultural influences are expected to affect the user's acceptance and use of the collaborative environment. Individual differences such as age, gender and experience must also be taken into consideration when designing and implementing a CBCVLE.

This chapter concludes with suggestions drawn from the research results as well as literature, and it is anticipated that these guidelines may help promote the further development and application of a CBCVLE in HEIs in Oman.

8.2 FRAMEWORK DEVELOPMENT

The framework was developed based on the outcome of the literature review as well as survey 1 and survey 2, which revealed the users' views. The framework is illustrated by a sequence of diagrams which outline various issues identified by the research.

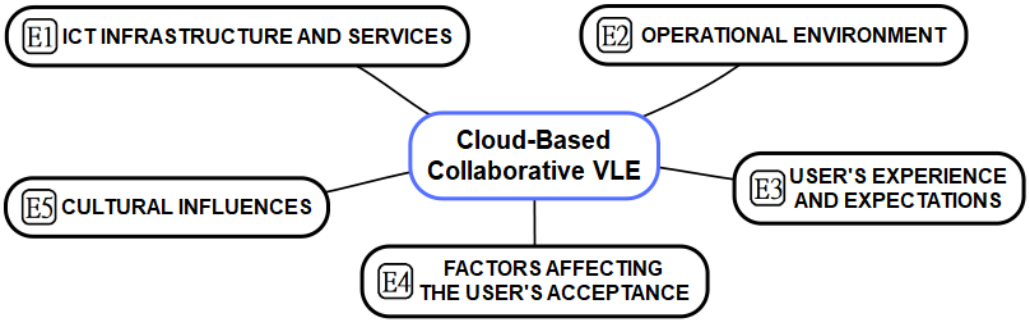


Figure 8.1: Top level structure of the framework (level 1).

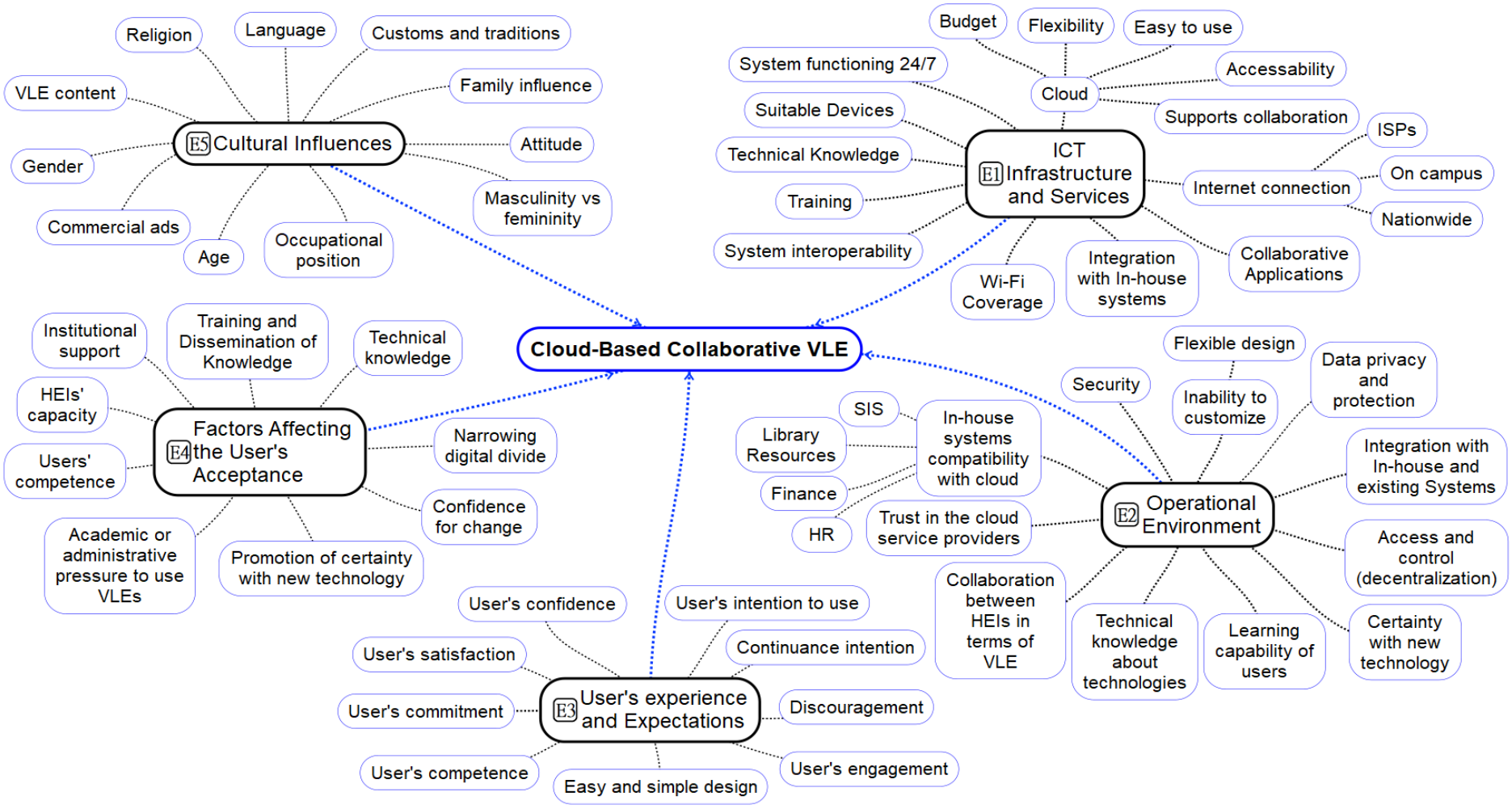


Figure 8.2: Structure of the overall framework illustrating the issues and relationships between the elements and sub-elements (level 2).

The framework consists of five main elements (level 1) as illustrated in Figure 8.1. These elements are: ICT infrastructure and services (E1), operational environment (E2), user experience and expectations (E3), factors affecting user's acceptance (E4), and cultural influences (E5). Every element incorporates some associated issues which are classified accordingly. Figure 8.2 presents the structure of the overall framework illustrating the issues and relationships between the elements and sub-elements. This is categorised as level 2. The main and sub-elements will be further discussed below in this chapter.

The structure of the framework, as shown in Figure 8.2, is defined by five main elements which contribute to overall focus of the research. Alternatively, each element is expanded to elaborate the related issues. However, the following areas were outside the scope of this framework, and therefore, are not discussed in details:

- Quality and efficiency in e-learning.
- Technical details about cloud computing.
- Cloud computing adoption and implementation.
- HEIs budgets and financial issues.

8.2.1 ENTITIES AND ASSOCIATED RELATIONSHIPS

The framework identifies four entities that correspond with each other within a CBCVLE. These proposed entities are national, institution, user, and system. Table 8.1 summarises the anticipated relationships between entities within a CBCVLE.

Entity	National	Institution	User	System
Nation		✓	✓	✓
Institution	✓		✓	✓
User	✓	✓		✓
System	✓	✓	✓	

Table 8.1: Entity-Relationship Matrix.

The relationships between entities are mostly directional in either way. HEIs are responsible for the provision of ICT infrastructure and services to run VLE system and tools. Users are affected by the provision of technical requirements and the chosen system by HEI. The VLE

system is anticipated to help an HEI to achieve their academic aims and to aid users to enhance their educational activities.

All the above entities are anticipated to comply with National Strategy of Education in the Sultanate of Oman 2040 (Education Council 2019b). The Education Council in Oman has defined its vision as "*Creating a high quality educational system coping with the latest developments, meeting requirements of sustainable development and boosting the national identity*" (Education Council 2019a).

Having implemented an entity relationship (ER) model (Beal 2019), Figure 8.3 illustrates Many-to-Many relationships between all entities.

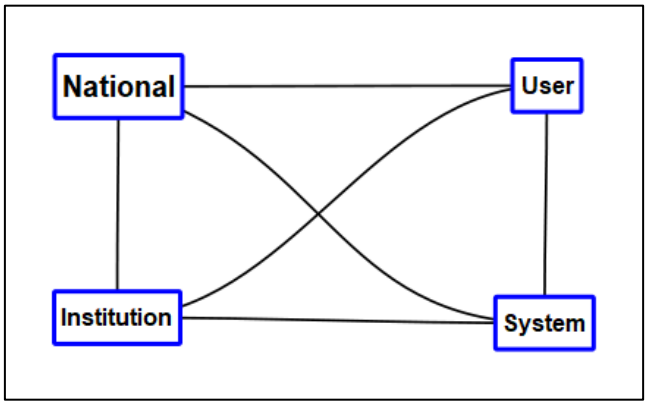


Figure 8.3: Relationships between entities using the ER Model.

8.2.2 DEPENDENCY BETWEEN MAIN ELEMENTS

A dependency relationship can be found between two elements whereas a change in one end affects the dependent element (Fridenthal et al. 2008). Therefore, relationships between the elements of the framework are presented in Table 8.2. The table demonstrates how one element corresponds and correlates with other elements in the framework. Although some of the relationships cannot be seen easily between some of the main elements, a sort of relationship exists and can be identified between two or more sub-elements across main elements.

Source Element	Relation	Destination Element	Discussion
E3	Depends on	E1	The provision of sufficient and reliable ICT infrastructure and services in HEIs would improve the user's experience and expectation. For example, unreliable Internet connection and low Wi-Fi coverage in HEIs results in a low level of user's confidence to use a CBCVLE.

E3	Depends on	E2	Users may lose their confidence with a system in which security and data privacy are compromised or even is vulnerable.
E2	Affects	E3	A set of operational issues if best managed, will have a positive impact on the user's experience, and vice versa.
E3	Affects	E5	It is anticipated that users with a high level of confidence, satisfaction, commitment, readiness, engagement and intention to use, would be more able to mitigate cultural influences that may come across.
E1	Affects	E2	Less efforts in ICT infrastructure and services could make it worst for an HEI to manage the operational environment.
E1	Affects	E3	The provision of a high-speed Internet connectivity within HEIs or nationally could preserve a high level of user's intention to use a CBCVLE.
E1	Affects	E4	In parallel, efforts must be given to both; ICT infrastructure and services and maintaining various incentives to attract users to use a CBCVLE.
E1	Affects	E5	The spread of collaborative applications, especially those intended for education, could enhance the user's experience and consequently contribute to mitigation of cultural influences.
E5	Affects	E3	Some cultural influences could affect user's experience negatively. Gender, for example, could be a barrier for some users for collaborating effectively or even employing some features of a CBCVLE.
E2		E4	Many sub-elements in one end have an impact over the other sub-elements. For example, when users are certain about new technology, they may be positively confident for any coming change.
E2	Affects	E5	Certainty with new technology as well as technical knowledge about technologies, for example, could positively eliminate the effect of some cultural influences such as age, attitude and family influence.
E4	Affects	E5	Narrowing digital divide could help some users to be aware of new advances in technology and eliminate any effect may rise from local customs and traditions.
E5	Affects	E4	Localising VLE tools, applications, and resources would help to make users more confident for change.

Table 8.2: List of dependencies between main elements.

From an HEI perspective, facilitating an efficient Intranet as well as a reliable Internet connection will maintain and improve user's experience. Similarly, the presence and diversity of collaborative applications in HEIs will provide users with opportunities and also alternatives to pursue their collaborative learning and complete related tasks with ease and passion.

The users on the other hand would be more satisfied and confident when they preserve a stable provision of ICT infrastructure and services accompanied by sufficient training and knowledge to cope with different tasks and responsibilities. The negative effects of cultural influences may be mitigated by extending and enhancing user's experience and expectations.

8.2.3 ICT INFRASTRUCTURE AND SERVICES (E1)

This element (see Figure 8.4) combines issues related to ICT infrastructure and services such as Internet connectivity, devices, training, skills, knowledge, and the availability of collaborative tools. This element also indicates the level of infrastructure HEIs have to achieve and maintain to provide a service for CBCVLEs.

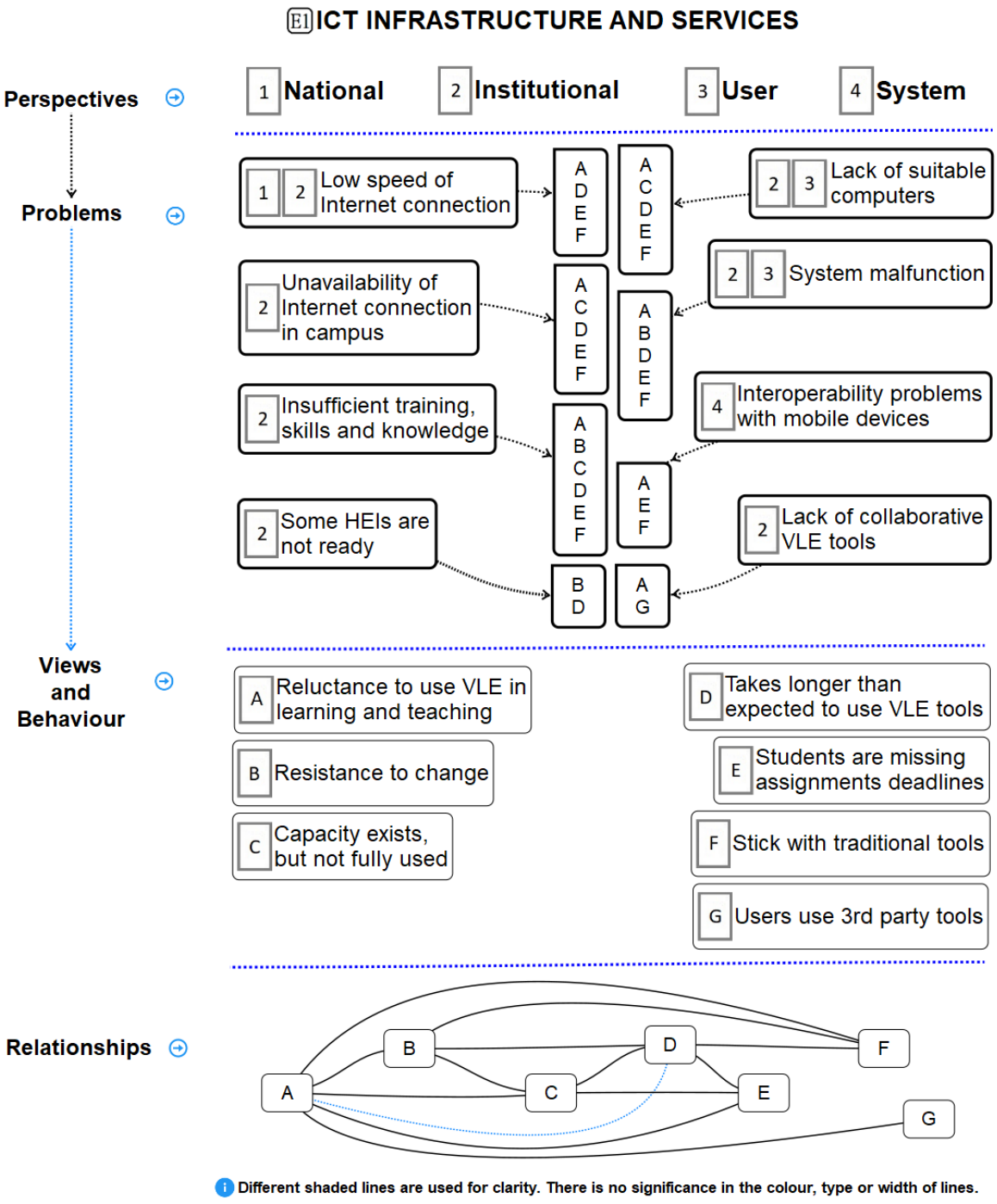


Figure 8.4: (E1) ICT infrastructure and services, issues and relationships.

Figure 8.4 is made up of four parts as follows: (1) perspectives from national, institutional, user and system levels, (2) problems, (3) views and behaviours, and (4) relationships. The four perspectives are incorporated from the four entities explained earlier in section 8.2.1.

Review of the literature and the findings of survey 1 and survey 2 have illustrated the importance of the provision of ICT infrastructure and services in HEIs concerning the utilisation of a CBCVLE. Karim and Goodwin (2013) emphasise the need for proper ICT infrastructure in

educational institutions in order to provide E-learning through cloud computing. The ICT infrastructure and services can be classified into three categories as follows:

1. Internal, which includes for example, networks, computers, software, Wi-Fi and Internet access. This also concerns systems used in an HEI including VLE tools and any associated training and technical support. Not all HEIs can afford to maintain a minimum standard of ICT infrastructure, and therefore, a consortium would be a promising solution. OMREN (Al Kharusi 2016; The Research Council 2019) would partially provide a shared platform that HEIs can benefit from in regard to ICT infrastructure and systems including VLE tools if supported.
2. External, which represents the national ICT infrastructure and services across the country. This category incorporates issues regarding the dissemination of the Internet throughout the country and any national effort to decrease the knowledge gap among people and cities. In this regard, the government is anticipated to play an important role to assure that access to the Internet is available across the country. ISPs also are expected to coordinate with the Telecommunications Regulatory Authority (TRA) (TRA 2019) to provide a range of Internet services at affordable prices and with special attention to students in HEIs.
3. Users' personal devices and related services which are anticipated to be crucial and supportive part of the institutional and national policies regarding the use of information systems. It is the responsibility of the government to initiate a national project to promote the availability and dissemination of users' personal devices and Internet access outside campuses. For example, personal loans can be supported by the government at zero profit to help students in HEIs to own a personal device that is capable to use a CBCVLE.

The need for adequate and sufficient training was identified by participants and highlighted by literature as highly important. For example, Salas et al. (2004, p.320) assert that "*a need for training programs to go beyond cultural awareness to theoretically based training programs that impart skills along with knowledge*". The type of training required by users may be related to their age, and therefore giving more training to older users can overcome some barriers related to their acceptance of VLE and related tools (Morris and Venkatesh 2000).
HEIs should not assume that users are competent and ready to use new technologies (Rossing 2012). Therefore, HEIs should consider their efforts in training their users and keeping them aware of any new technology as well as disseminating technical knowledge among users.

Further, an LMS should be able to combine training initiatives into a consolidated and accessible web-based platform (Subramanian et al. 2014).

As identified by a large number of studies (Chang and Wills 2013; CISCO 2012; Educause and Nacubo 2010; Gagliardi and Muscella 2010; González-Martínez et al. 2015; Isaila 2014; Jalgaonkar and Kanojia 2013; Karim and Goodwin 2013; Leadbeater 2010; Logofatu et al. 2017; Rimal et al. 2010; Talukder et al. 2010; Vance 2011; Williams 2010; Yadegaridehkordi et al. 2015; Zhang et al. 2010), the most popular benefit of optimising a unified collaborative VLE among several HEIs is cost sharing. Having joined OMREN, HEIs will benefit from sharing and minimising the costs of Internet access and any other related hardware and software (Al Kharusi 2016). These benefits will be extended to include purchasing standalone VLE tools, licences, annual maintenance, and any integration or incorporation of global cloud system/service.

Main Element	ICT INFRASTRUCTURE AND SERVICES IN HEIs IN OMAN	
Dimension:	ICT infrastructure and services	
Overview of the problems:	Limited or lack of requirements in regard to ICT in HEIs to run a CBCVLE.	
Desired Purpose:	Dissemination of proper ICT infrastructure to utilise collaborative VLE.	
Sub-Element	**Discussion**	**Recommendations**
Devices availability	Lack of personal computers (Desktop/Laptop) with users. VLE tools are mostly compatible with PCs. A delay by students in responding to courses assignments.	An HEI should get a reasonable number of desktop PCs available to their users. The proper numbers could be judged based on the statistics of daily usage.
Internet connectivity in campuses	Heavy traffic over the Internet connection. Rolling out email messages including attachments to the local users using an external email host such as Google or Microsoft. Submitting (and download) files and documents to/from VLE tools that are hosted externally.	Enhancing the Internet connections by employing more reliable lines from different ISPs. Hosting HEI's email locally to free a huge load from the core connectivity. Hosting VLE tools locally in case the Internet connectivity remains slow and unreliable.
Wi-Fi coverage	It does not match user expectations or is not reliable. It has a low capacity to serve a large number of users on the campus.	Renovation of current Networking infrastructure and employing recent and efficient advancements of Wi-Fi technologies.

Internet service outside campus	Lack of mobile Internet coverage with users. Low speed or low coverage of mobile Internet.	National ICT strategy should encourage extending the coverage throughout the country. ISPs should consider HEIs' users in their offers and promotions.
Bandwidth and speed of mobile data subscriptions	Mobile Internet speed is not reliable.	A national initiative should be established to expand mobile data coverage all over the country.
Interpretability	VLE tools are not fully or partially compatible with mobile devices or web browsers. Users have a frustrating experience of using their VLEs via mobile devices.	HEIs must adopt the most compatible VLE tools with mobile devices. Working out the current packages of VLE tools to meet the Interpretability standards.
Technical support	Users complain about the technical support provided to them. Personal devices are not covered by HEIs' technical support.	Providing a continuous and efficient technical support for both HEIs' and users' personal devices.
Storage	Users mainly use flash disk drives as a primary storage. Cloud storage are not provided.	HEIs should provide users with efficient cloud storage either in local infrastructure or with external cloud provider.

Table 8.3: ICT infrastructure and services.

Fisher (2019) claims that "*Not all college campuses have the most reliable Wi-Fi connections*". Lung and Shih (2015) highlights the security measures that Wi-Fi in Universities go through mainly represented in several firewalls that perform handshakes to the connections. As a result, these security procedures may cause annoying delays to users. According to Veroniiiica (2018), range extenders are useless and not recommended to be used in campuses as they may slow the Internet down.

However, this issue can be taken into consideration and may be included in their annual upgrade of ICT infrastructure. Moreover, Wi-Fi coverage can be extended to include most of the public and popular places such as commercial complexes, tourism attractions, and transport stations and means. This can be financially and continuously supported both by the government and the private sectors. Further, HEIs need to employ a mechanism which as described by Lung and Shih (2015) to allow a device to move smoothly from one access point to another as the user move within the campus. Further, "*Continual Service Improvement*" as stated by Lung and Shih (2015) is one of the core missions of Information Technology Services (ITS) which will increase the number of Wi-Fi access points periodically.

On the other hand, IT departments in HEIs do not provide users with technical support if the issue relates to the user's private device (Fisher 2019). The users in HEIs reported their lack for proper PCs to use on campus. In the same time, they may have issues with their mobile devices that receive no response from their HEIs in regard to technical support. However, this issue can be tackled through two ways: first, HEIs should enhance the technical support to include the users' personal devices. Second, HEIs pay more attention to assure that every user can find a proper PC to use on campus. Both solutions still have an impact if a single one is planned individually and not accompanied with the other option. HEIs may need to promote the use of personal mobile devices which remain a user's property that can be used 24/7 whenever needed. Thus, supporting the second option will not assure a continuous use of VLE tools as the students, for example, will take more time responding to their teachers due to the lack of proper devices to use, and, subsequently, some deadlines may be missed.

In regard to security and storage, users in HEIs may be provided with sufficient cloud storage to replace the ordinary removable drives which may imply threats to computers and data. Users' confidence will be affected if there is insufficient flexible and efficient cloud storage within the HEI. However, the provision of cloud storage will improve user's experience and eliminate threats of viruses distributed unintentionally by users through using removable storage devices. Users are expected to be more familiar with cloud storage and its potentials benefits and features that can contribute to their education.

In regard to accessing VLE tools, it was indicated that there are some difficulties the users in HEIs are experiencing when accessing their VLEs. These obstacles refer to the lack of appropriate devices needed for access. They are also referred to compatibility issues of those tools and applications with users' devices and the diverse web browsers. The ease and wide accessibility of VLE tools should be taken into consideration by HEIs as this issue can affect the utilisation of a CBCVLE. The participants indicated their preference to use their mobile devices to access VLE tools, but they raised issues regarding the interoperability of their VLEs. Such issues can be mitigated by implementing VLE tools through cloud computing technologies which perceive the feature of interoperability as asserted by several researchers (Cunsolo et al. 2010; Jin et al. 2010; Valcheva et al. 2015).

8.2.4 OPERATIONAL ENVIRONMENT (E2)

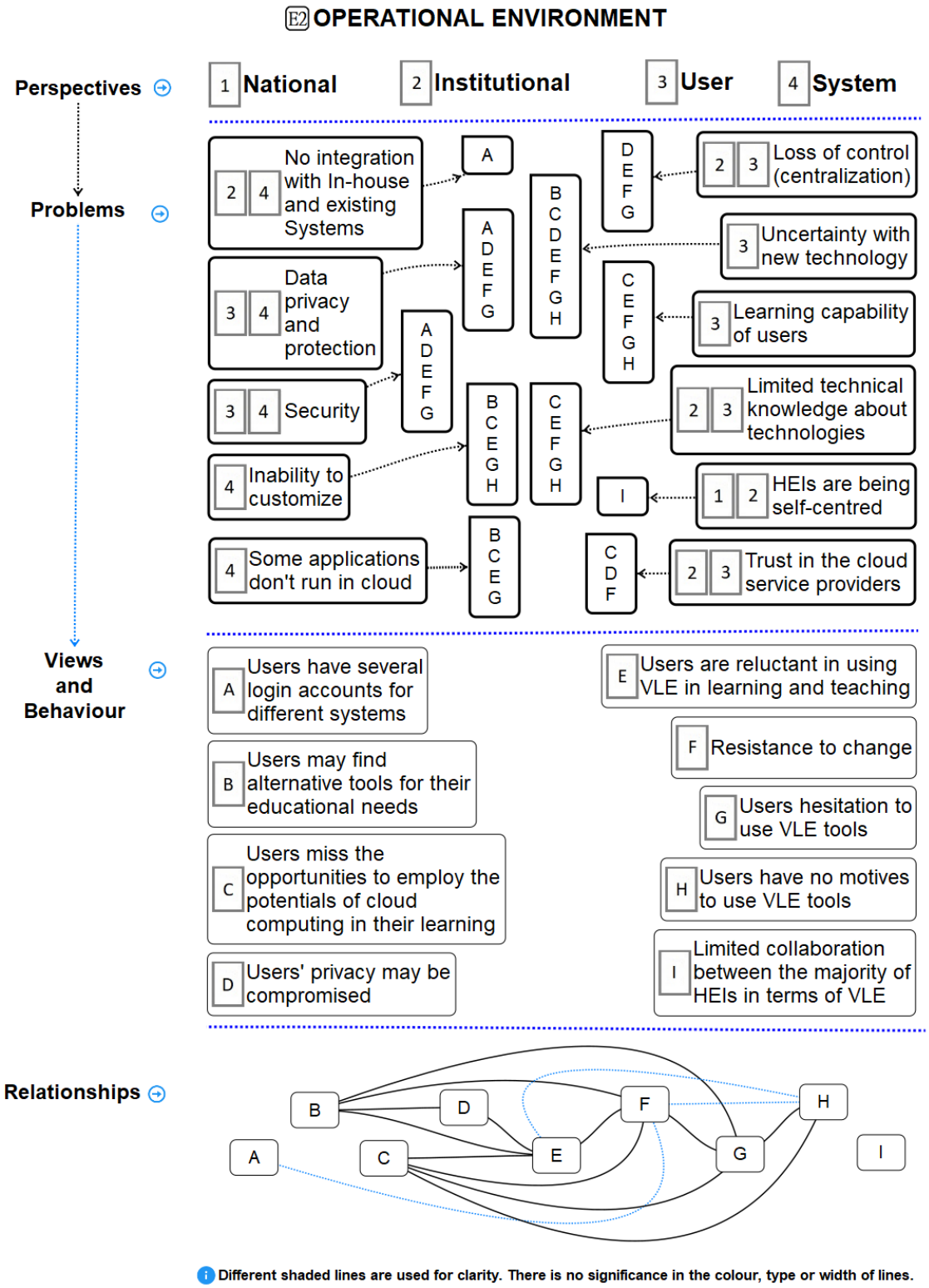


Figure 8.5: (E2) Operational environment, issues and relationships.

The analysis of data collected in this research (see chapters 5, 6 and 7) indicated challenges and concerns that may affect the utilisation of a CBCVLE. The issues in respect of the operational environment mainly relate to: VLE tools, HEIs, users and ICT across the country.

Figure 8.5 which consists of four parts illustrate this. In this figure, (1) perspectives from national, institutional, user and system levels, (2) problems, (3) views and behaviours, and (4) relationships. The four perspectives are incorporated from the four entities explained earlier in section 8.2.1.

In regard to VLE tools, the current ICT infrastructure, especially the instability of Internet connection has negatively affected the users' views about employing VLE tools in their education. Users are spending more time than expected to complete online tasks. Moreover, the VLE tools are not integrated with other information systems in the institution. This may require more efforts and time consumed by users dealing with multiple user accounts and systems. As mentioned in the previous section, HEIs would be able to overcome the issue of slow of Internet connectivity either individually or in a consortium (such as joining OMREN). Additionally, by adopting cloud computing, HEIs would be facilitating the integration of a CBCVLE and other information systems. This can be achieved by customising the new tools and applications to be much easier and accessible to communicate with other systems and apps inside an HEI. Other issues such as data privacy and security can be resolved by employing more efficient security measures to minimise any related risks to a minimum. Also, hiring expert cloud providers would help in this regard. In addition, more training and information given to users may decrease their concerns about these issues. The participants indicated that they are not aware of regulations, manuals or even published guidelines for the utilisation of their VLEs. This brings the importance of establishing such regulations and guidelines and offer them online to users as Wang and Huang (2016, p.637) confirm that "*strategies for students engaging in the multi-user mode should be considered*". In addition, the implementation of a CBCVLE through cloud computing will resolve issues highlighted by the participants. These are: lack of accessibility, slowness, interruption, complexity of design and integration, and the incompatibility with devices and web browsers.

Regarding HEIs, it was revealed that many HEIs are self-centred in terms of employing or hosting VLE tools and collaborative education. This indicates that some HEIs have their own individual VLE tools or some may not have such system. Collaboration between HEIs would be the promising solution that will bring the potential benefits to all members. Hence, a CBCVLE can enhance the collaborative environment between HEIs by facilitating unified VLE tools that can be shared. Also, it was revealed that some HEIs have lost control over their shared VLE tools to the extent that their utilisation is affected. However, establishing a consortium by a group of HEIs should be managed appropriately and equipped with professional experts and management to maintain a stable environment. It was also mentioned that there are no

demands or pressure from upper administration in HEIs to employ VLE tools. Additionally, the high load in timetables for both teachers and students may perform a barrier to use such tools. There is the perception that there is a steep learning curve for learning how to use the tools and there is not enough time available due to the high load in timetable. However, HEIs may introduce the utilisation of VLE tools by teachers into the annual evaluation. Therefore, the study recommended that HEIs allocate free times in the timetables enabling them to use VLE tools during the day.

In regard to users, this research highlights the increasing demand for training programs for users as well as the technical knowledge about new technologies. It should be noted that the more knowledgeable and aware of technologies the users are, the more confident they are to use them in their education. It is important to note that providing an effective training in the beginning of the implementation of a CBCVLE is essential. This is asserted by Krechowiecka (2003) who states that training is an essential aspect for an institution to consider when procuring a VLE.

It was also indicated that the number of computers in campuses are not sufficient, while a large number of users (mostly students) lack such devices at homes. The government in cooperation with private corporations can establish a national program for subsidising students in HEIs to have their own computers. However, the adoption of cloud computing into a CBCVLE would assure its compatibility with mobile devices to the extent that students may not need computers to use it. This also necessitates the provision of mobile applications that facilitate the access and use of VLE tools.

In regard to ICT, it was pointed by the participants the lack of Internet connectivity remains problematic to users. They relate this issue with the abandonment of using VLE tools as their confidence of local ISPs is low, and therefore they cannot depend fully on their services. The government should deal mainly with the issue of coordinating with the ISPs. It was mentioned by cable.co.uk (Cable 2019) (see Chapter 3) that Oman was ranked 173rd for the prices of mobile data. Thus, TRA should be involved to reduce the prices of Internet plans for homes, HEIs and individuals (users in HEIs). This should be considered a national project which aims to disseminate Internet access across the country at affordable tariffs and reasonable speeds. The research findings highlighted the effects of users' resistance, limited technical knowledge of users, and uncertainty with new technology. Therefore, it should be noted that the more training and information is provided to users, the less resistant for using a CBCVLE. Figure 8.6 illustrates users' views about uncertainty with a CBCVLE.

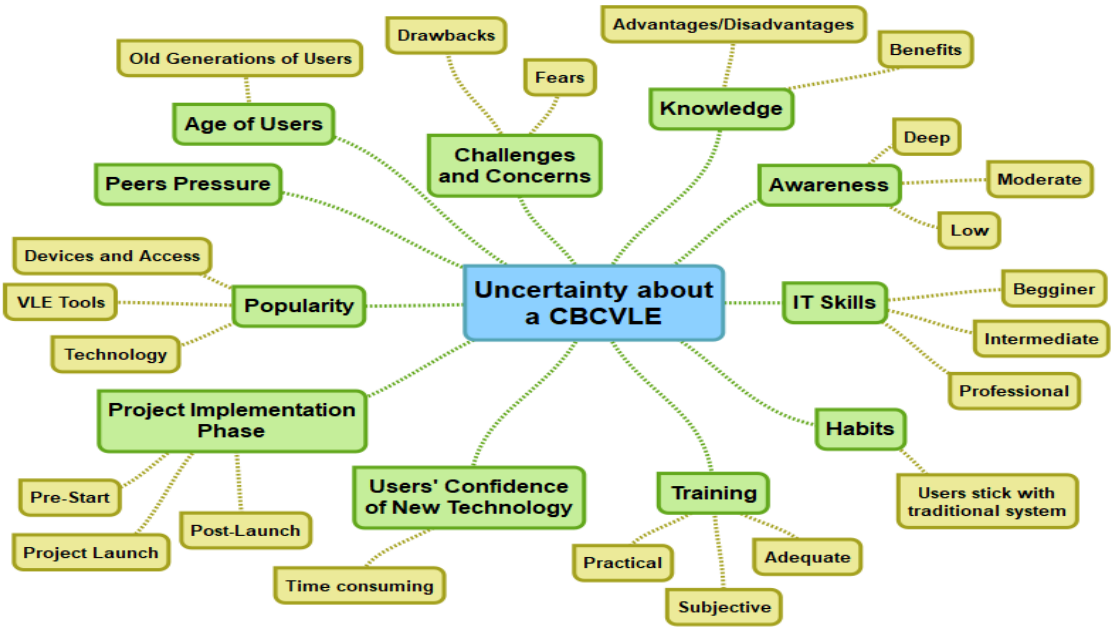


Figure 8.6: Users' views and their uncertainty about a CBCVLE.

8.2.5 USER EXPERIENCE AND EXPECTATIONS (E3)

The findings (see chapters 5, 6 and 7) highlighted the issues that relate to user's intention to use, application of cloud computing in education, perceived benefits, user satisfaction, and user's expectations. Several issues were found to have effects on the use of a CBCVLE as shown in Figure 8.7. The figure is made up of four parts as follows: (1) perspectives from national, institutional, user and system levels, (2) problems, (3) views and behaviours, and (4) relationships. The four perspectives are incorporated from the four entities explained earlier in section 8.2.1.

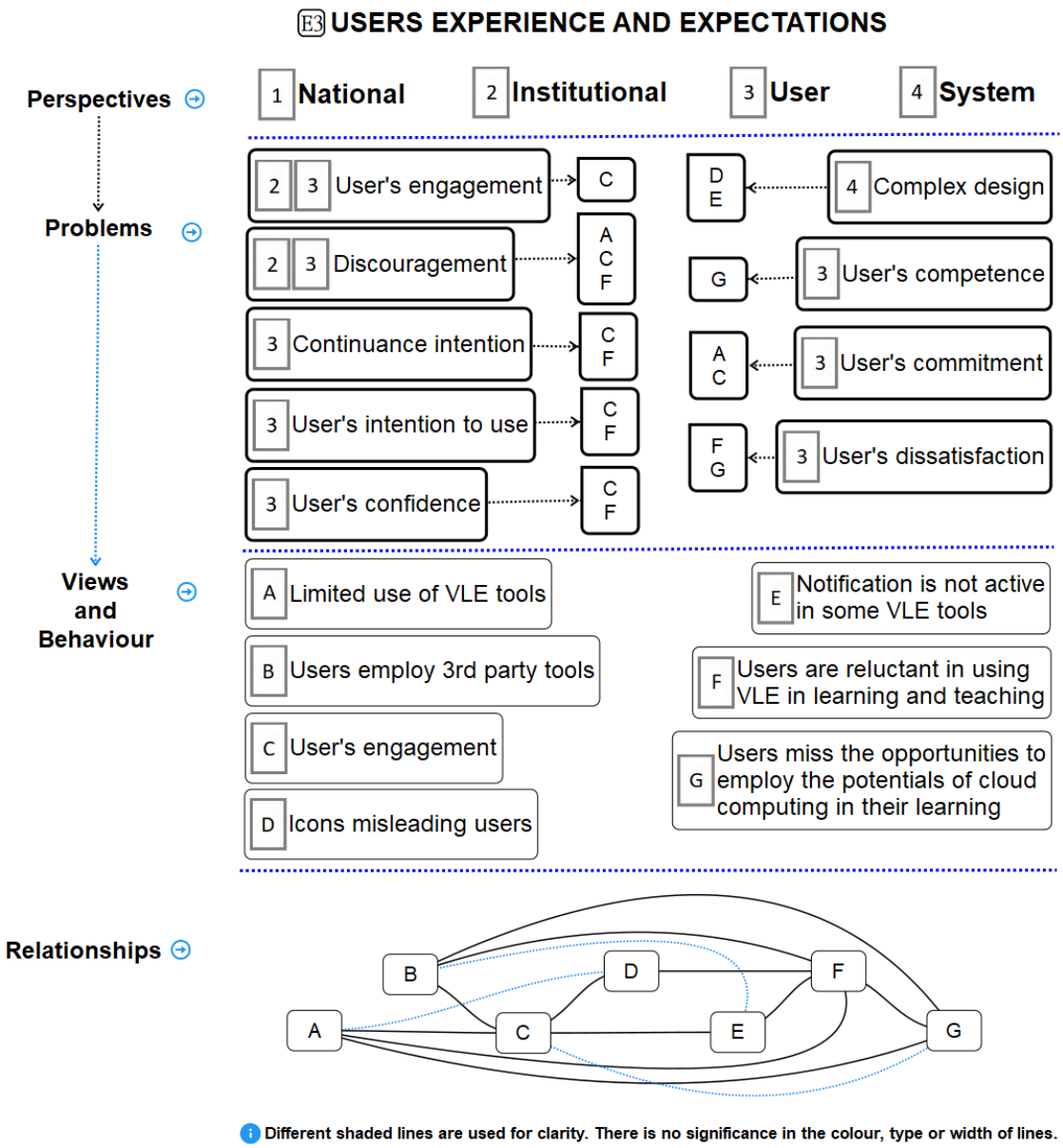


Figure 8.7: (E3) User experience and expectations, issues and relationships.

The lack of collaborative culture among students was revealed by the research to have an effect on the use of a CBCVLE. Users' engagement in collaborative activities should be considered by HEIs either locally or between HEIs in Oman. Wang and Huang (2016, p.637) state that "*training and problem-solving assistance are helpful to familiarise students*" with computer-supported collaborative learning. However, some HEIs were found to have a sort of collaborative activities that can be categorised as the distribution of course materials and exams preparation between teachers delivering the same course.

The research also articulated issues related to users' confidence, intention to use, continuance intention, encouragement, engagement, competence, commitment, and satisfaction. The use

of VLE tools was found limited, and users sought alternatives and employed 3rd party tools. This reveals their hopeless experience with official VLE tools.

Users' intention to use was discussed in Chapter 3 and found to be crucial for users to accept and use a technology. Further, continuance intention was also revealed to have a similar influence. Thus, the research highlights students' willingness to use new technologies in their learning very positive. However, at the same time, there are some students who stick themselves to traditional paper-based tools. This can be explained by that they face some challenges and concerns which deter them from employing such tools. Also, limited technical knowledge could lead to the same result. HEIs should recognise these causes and consequently enhance the users' intention and continuance intention to use a CBCVLE by encouraging users to become more engaged. It was asserted by White et al. (2009) that the users' perception of the usefulness of VLE tools will continuously enhance their intention to use. In addition, Hew et al. (2016a) state that users' intention to use will increase when users trust a VLE including perception of security, reliability and trustworthy.

In regard to user's confidence in respect of cloud computing and collaborative VLE, the findings pointed out that the users' confidence will enrich their experience in terms of a CBCVLE. Lampe et al. (2001, p. 344) state that "*decreases likelihood of collaborating negatively, suggesting that confidence in more information-seeking skills could reduce the propensity of negative collaboration*".

As a CBCVLE depends on cloud computing, HEIs can maintain a good user experience whereas users would be more familiar with such technologies and applications. It was asserted by White et al. (2009, p.29) that "*teams using the cloud computing tool should express higher satisfaction and more intentions to continue use of this new tool*". It should be noted that if more training and information are given to users, they will enhance the users' competencies as stated by Hew et al. (2016a): *"Organising seminars, symposiums, conferences, workshops, talks, demonstrations and etc."*. In addition, Rossing (2012) asserts that involving students to help and guide their peers will allow dissemination of knowledge among them and assures higher engagement and confidence.

As discussed in Chapter 2, several authors (Bhattacherjee 2001; Dağhan and Akkoyunlu 2016; Davis 1989; Dennis et al. 2008; Denton 2012; Erturk 2016; Hew and Kadir 2016a; Hew et al. 2016a; Hew et al. 2016b; Hewagamage et al. 2012; Hossain and Quaddus 2012; Jiang and Klein 2009; Jiang et al. 2012; Joo et al. 2017; Kirchner and Razmerita 2015; Lee 2010; Morris and Venkatesh 2000; Mouakket 2015; Oetzel 2001; Rossing et al. 2012; Sarrab et al. 2016; So and Brush 2008; Unal and Unal 2011; Venkatesh et al. 2012; Vitkar 2012; Wang and Huang 2016;

White et al. 2009; Yadegaridehkordi et al. 2014; Yadegaridehkordi et al. 2015) highlighted "users' experience" from different perspectives. Therefore, Figure 8.8 concludes the findings and theories applied in different studies and elaborate the related aspects that may affect the whole experience of users. As illustrated in Figure 8.8, 18 aspects have great effects on individual user's satisfaction which consequently contributes to the overall collaborative group satisfaction. Both individual and group satisfactions have an influence on users' intention to use. The latter also greatly affects users' continuous intention which results in accepting and using a CBCVLE. Lee (2010) asserts that satisfaction has the most vital effect on users' continuance intention.

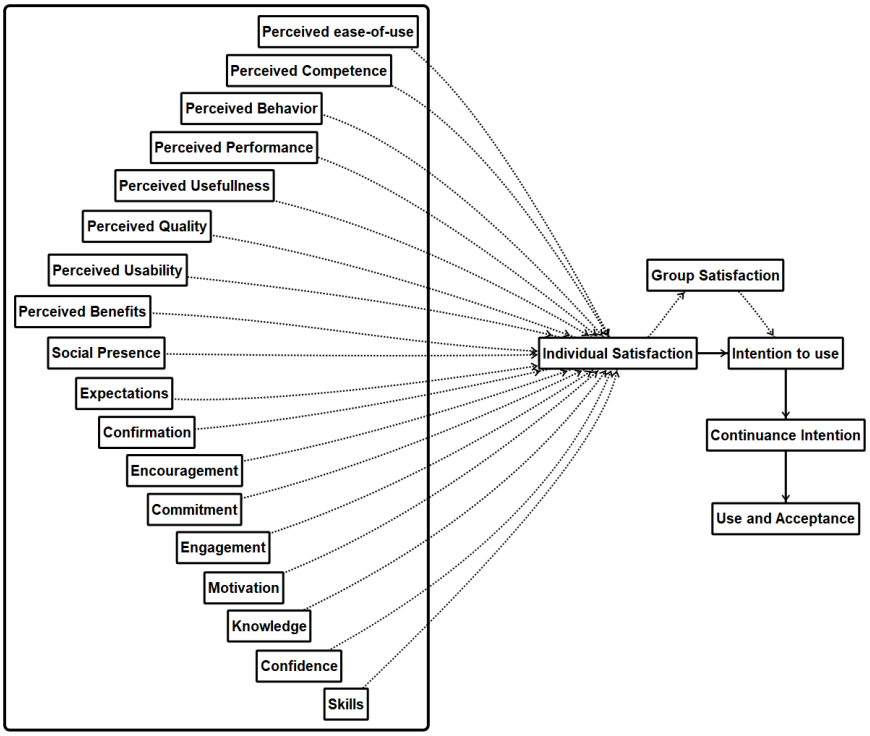


Figure 8.8: User experience and expectations within a CBCVLE.

8.2.6 FACTORS AFFECTING USER'S ACCEPTANCE (E4)

The fourth key element proposed in this research highlights factors (motivators and disincentives) that found to be affecting the use of a CBCVLE. HEIs would benefit from considering motivators in the implementation of a CBCVLE while paying more attention to eliminate effects of those disincentives. Figure 8.9 consists of four parts as follows: (1) perspectives from national, institutional, user and system levels, (2) problems, (3) views and behaviours, and (4) relationships. The four perspectives are incorporated from the four entities explained earlier in section 8.2.1.

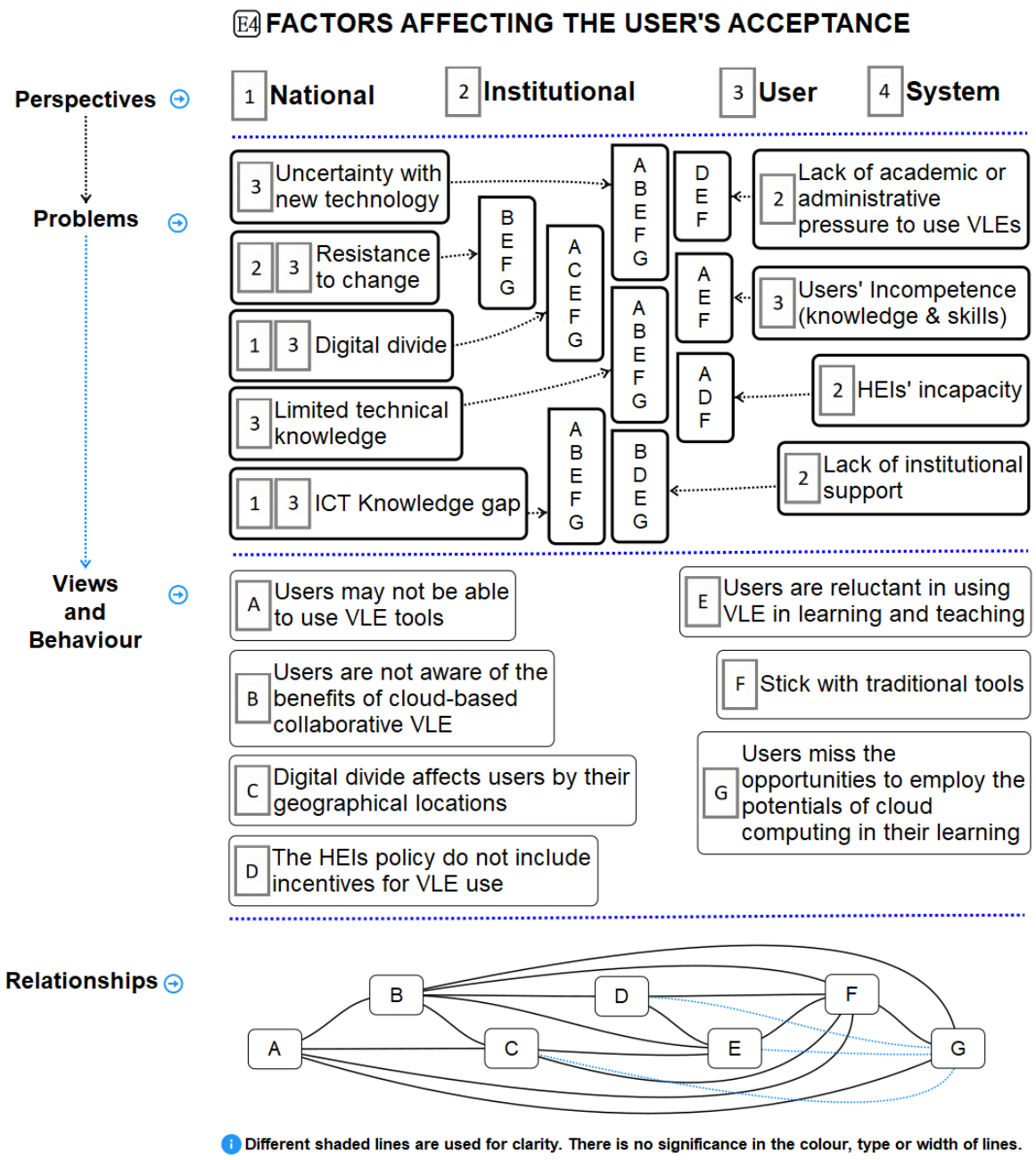


Figure 8.9: (E4) Factors affecting user's acceptance, issues and relationships.

The analysis of data collected for this research identified an impact of issues such as ICT knowledge gap, limited technical knowledge, and digital divide. These factors can be treated by the Omani government as guidelines for the establishment of national programs for disseminating technical knowledge and sufficient ICT infrastructure and services. By bridging the ICT gap between different cities and villages across the country, we can assure equal opportunities for users of a CBCVLE. HEIs are may pass their primitive roles to provide the local community with adequate and continuous education. These also can bridge the ICT knowledge gap by getting people to be continuously aware of new technologies and related

applications. Very recently, Sultan Qaboos University has introduced a Massive Open Online Course (MOOC) for the public starting with a single course (SQU MOOC 2019). This initiative of MOOC clearly presented how HEIs can fly beyond their boundaries using the latest technologies to deliver education nationwide.

Resistance to change and uncertainty with new technology were also identified by this research to be vital to the use of a CBCVLE. Therefore, HEIs are anticipated to extend the users' technical knowledge about ever changing technologies and applications. Moreover, users' competence including knowledge and skills are also required to be enhanced in relation to a CBCVLE.

HEIs' incapacity as well as the lack of institutional support were identified as critical factors that may affect the utilisation of a CBCVLE. These issues vary from one HEI to another. However, this requires HEIs to invest in human resources as the first demand. In addition, HEIs need to offer any related ICT infrastructures including tools, applications, and services. Users' knowledge, skills and abilities should be targeted to facilitate the way for using a CBCVLE.

In regard to HEIs' policies and regulations that may not support the utilisation of VLE tools as reported by the findings, both teachers and students feel there is no encouragement to use such tools. Hence, HEIs should consider including such utilisation into the evaluation of their courses' and the annual appraisal of teachers. In addition, HEIs can establish a rewarding scheme that can be used to promote collaborative activities through the use of a CBCVLE. Several ways and methods can be implemented. "*A 5-star rating system, certificates of recognition, free storage space and other rewards may also be given to teachers …*" (Hew et al. 2016a, p.17).

8.2.7 CULTURAL INFLUENCES (E5)

The findings of survey 2 (see Chapter 7) highlighted key cultural issues that may critically affect the utilisation of a CBCVLE. These issues are: family, religion, language, customs and traditions, and gender. Figure 8.10 illustrate these issues and it is made up of four parts as follows: (1) perspectives from national, institutional, user and system levels, (2) problems, (3) views and behaviours, and (4) relationships. The four perspectives are incorporated into the four entities as explained in section 8.2.1. The diagram also shows the relationships between the issues and also between the views and behaviours.

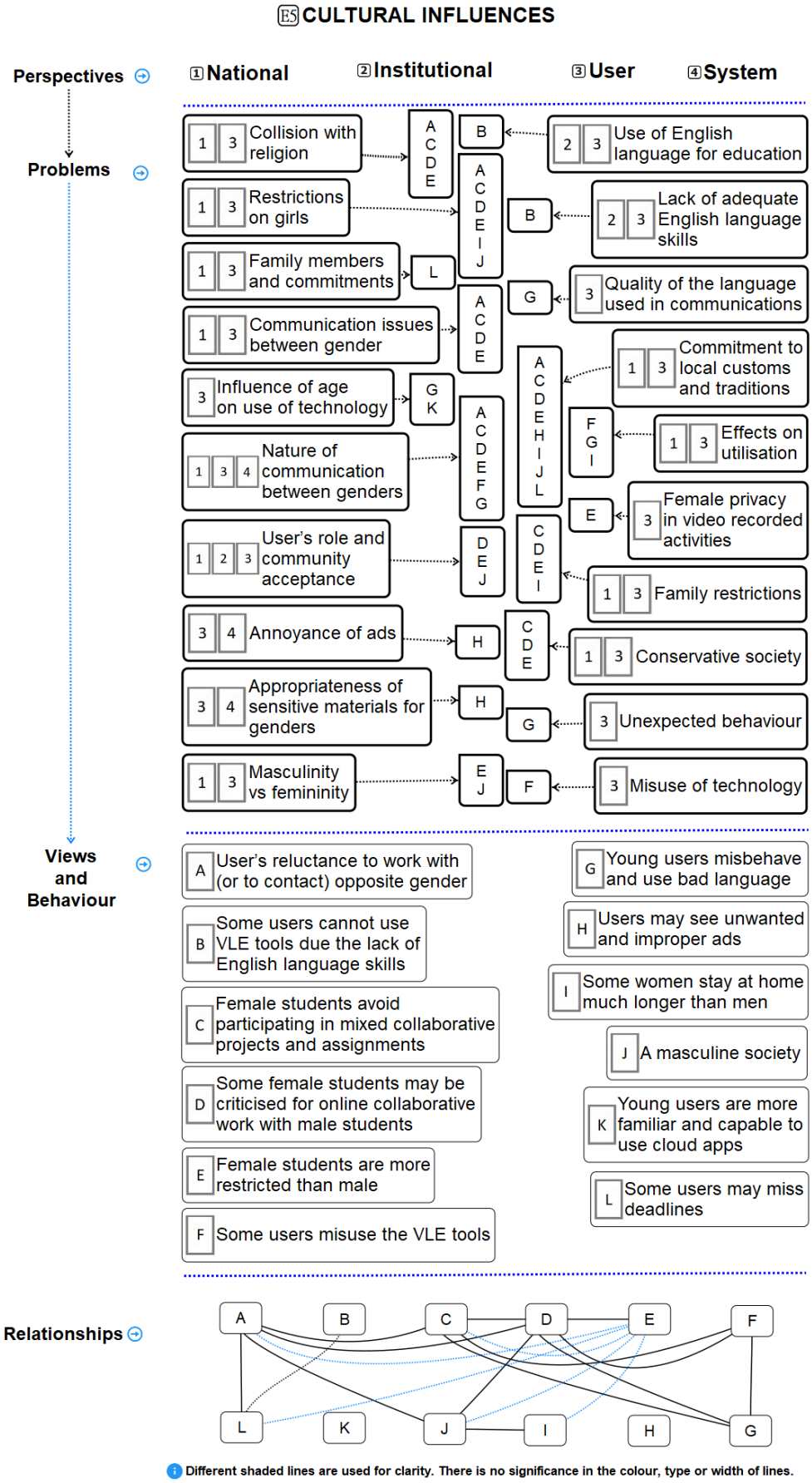


Figure 8.10: (E5) Cultural influences, issues and relationships.

The framework covers many areas. However, the focus of this research is on culture and cultural influences which can affect the use of the CBCVLE. Figure 8.11 highlights the cultural issues which can influence the utilisation of the proposed CBCVLE. Figure 8.12 provides the details at the granular level.

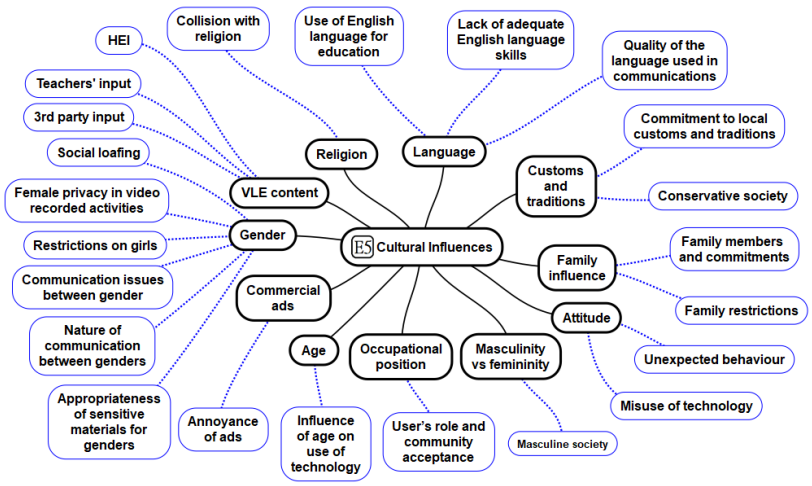


Figure 8.11: Issues which can affect cultural influences (level 3).

The cultural influences are further expanded to a more detailed level in Figure 8.12.

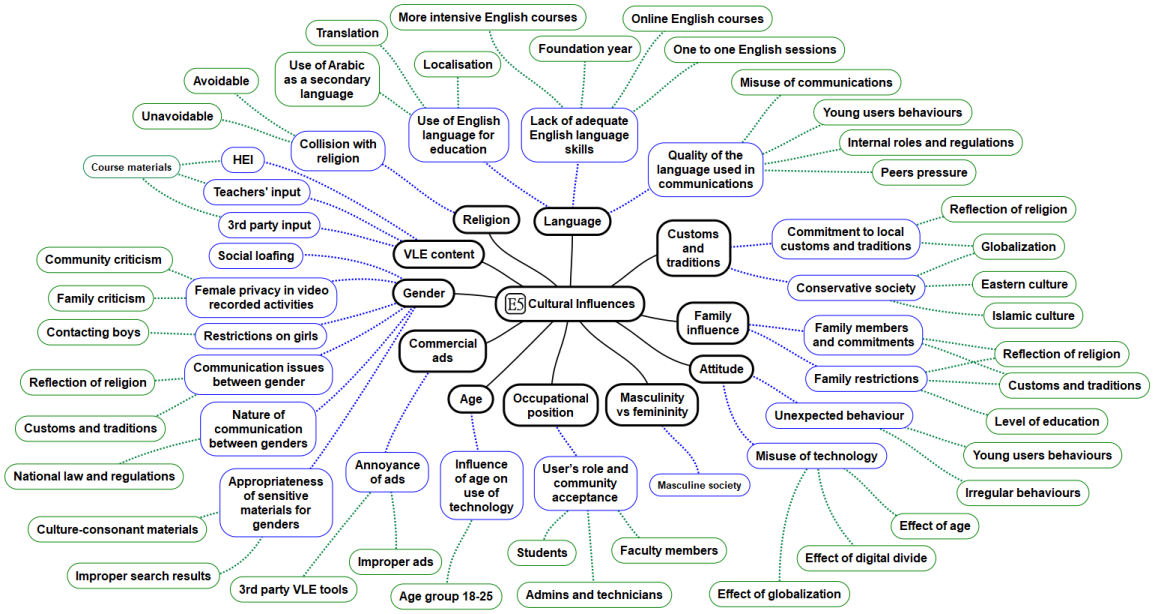


Figure 8.12: The cultural influences at granular level (level 4).

In regard to family influences, it was identified by the research (see Chapter 7) that family members that do not have knowledge and experience of ICT may have negative attitudes towards CBCVLEs which could become a barrier for their acceptance and use. The research identified several types of families (see section 7.2.1) that either promote the use of a CBCVLE

or discourage it which may reinforce or reduce the user's hesitation and resistance to change. It should be noted that the role of a family in this regard is crucial, and therefore, the efforts in disseminating ICT knowledge and skills are required. Overall, it can be said that the more educated a family is, the more open and able to embrace new technologies. This is regardless the effects of cultural influences such as religion and customs and traditions which should be treated carefully both by HEIs and the government in a long-term plan.

Misuse of technology and unexpected behaviour were reported by some participants to be initiated by young users (mostly students). The establishment of policies and regulations in HEIs, which currently do not exist, would help to reduce and possibly to eliminate the effects of these issues and would identify the boundaries within which users should use a CBCVLE.

Regarding the religious influences and gender, the research identified a number of that have an effect on the use of a CBCVLE. For example, some Islamic instructions do not allow females to be contacted by males who have no close relationships with them. This issue may limit the use of a CBCVLE as some female users would be hesitant to be involved in collaborative groups especially with the presence of male members in the same group. It should be noted that the social values and customs and traditions of Omani society has been formed by the religious beliefs and instructions (see Figure 8.13). Therefore, this issue should be taken into consideration by HEIs to offer alternatives for both male and female users in terms of online collaboration. The composition of a group as stated by Dillenbourg (2002) would affect the overall collaborative tasks. This may imply issues related to cultural factors such as gender and local culture. In this regard, the research proposes the customisation of user's profile to include the cultural preferences for users that suit their cultural needs (see section 8.2.9.1 and Chapter 9 for more details).

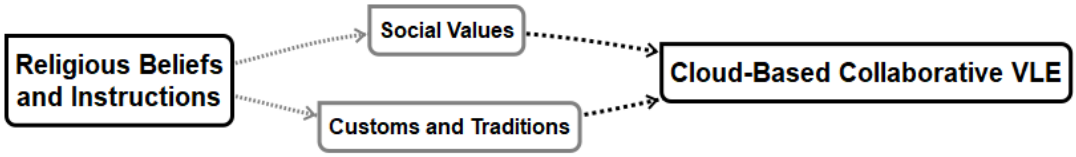


Figure 8.13: Indirect impact of religion on a CBCVLE.

There is a strong relationship between religion and the local customs and traditions. This can be seen in the regulation of communication between people of the opposite gender which is restricted and even prohibited except for those who relate to the same family. However, this cannot be generalised to all users as some are more open to western culture, especially those who are internationally educated. Young users, as reported by the findings, are less restricted by local customs and traditions. Educating users would have a positive impact to recognise

the benefits of a CBCVLE and become aware of all related aspects which may remove any hesitation towards the use of VLE tools.

In the same context, currently, users can see unwanted adverts as they use third-party applications and websites while they seek alternatives to enhance their education. In this regard, HEIs would eliminate and stop such adverts by providing their users with custom applications and tools that meet their needs and expectations. Users, then, will not need to acquire any external applications for collaborative activities other than official VLE tools.

Most teachers in HEIs in Oman are non-Omani citizens (72.3% based on the only available and recent statistics produced by HEAC 2017) and they have different cultural backgrounds. Some participants (mostly teachers) in survey 2 clearly indicated that they are not aware of the local culture of Oman. This indicates that such teachers may indirectly influence their students for the use and acceptance of a CBCVLE. Hence, HEIs should make these teachers aware of aspects of the local culture in order to understand their students thinking and beliefs. Consequently, teachers would have more cultural awareness, for example, when assigning their students to collaborative groups and projects in a proper manner.

Regarding the language, it was identified by this research that it would perform a barrier to the use of VLE tools if the local language is not considered extensively. Therefore, HEIs should cater for this issue in their VLE tools and course materials. Arabic language should be initially available and supported by VLE tools and additionally any other languages spoken by some groups of users such as foreign teachers. Further, the literal translation is not the target of this research, but instead, localisation of VLE tools and courses materials should be implemented. This research proposes “localisation” as an effective incentive for users to continue using a CBCVLE. Section 8.2.9.2 provides more details about localisation as well section 9.2.4.6.

Overall, the research proposes parent monitoring (see section 8.2.9.3 and Chapter 9) to overcome and mitigate the effects of cultural influences and to promote the utilisation of a CBCVLE within a preferred and favoured environment. This monitoring, which should be consented to by users, as is considered vital to have the support from the society in general and from parents in particular. Parents are anticipated to assure and to be aware of the nature of online transactions and communications of their son/daughter over a CBCVLE. Regardless of parents’ educational backgrounds, knowledge, skills, experience, and customs and traditions, they will be timely aware and confident of their son/daughter activities. Therefore, the effect of local culture on the use of a CBCVLE will be mitigated.

8.2.8 OVERALL IMPLICATIONS/OUTCOME/SUMMARY

To sum up, the research identified issues that may affect the utilisation of a CBCVLE. The framework highlights these issues and articulates steps and guidelines that HEIs can follow to maintain a continuous use of the environment and related technologies. Figure 8.14 depicts the factors which can influence the utilisation of the proposed CBCVLE. The figure shows the extent to which HEIs gain when paying attention to every category in terms of utilising a CBCVLE. The figure also illustrates that the more HEIs consider these factors in the design and implementation of a CBCVLE, the higher the utilisation of the environment including related technologies, tools and applications.

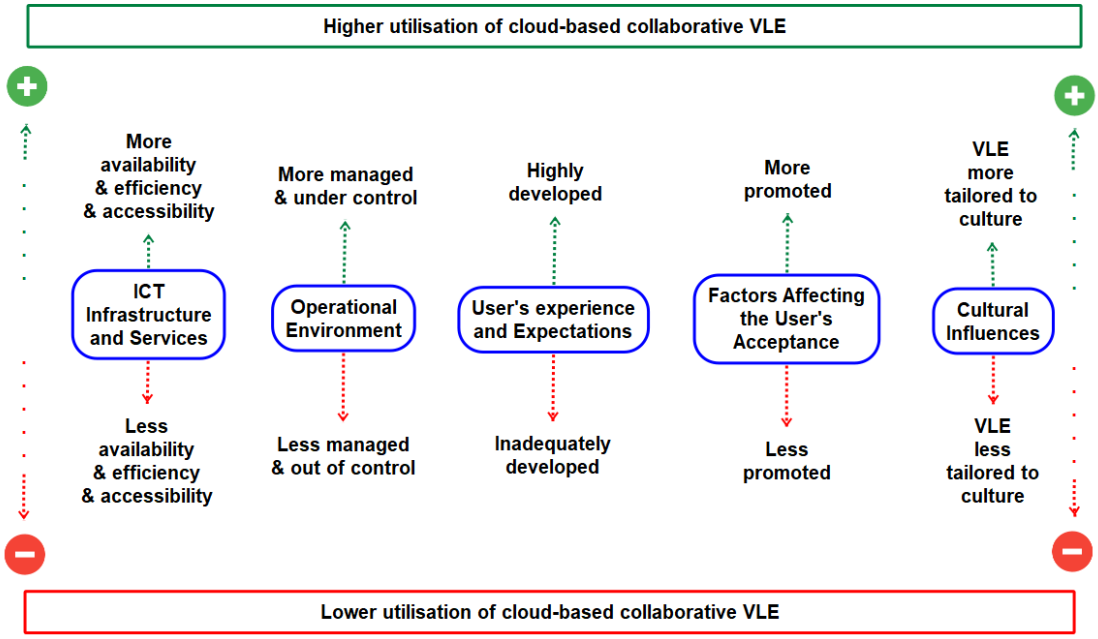


Figure 8.14: Factors influencing utilisation of a CBCVLE.

Table 8.4 concludes the anticipated characteristics of the proposed CBCVLE compared to traditional VLEs.

Aspect	Traditional VLEs	Proposed CBCVLE	Discussion
Language	Literal translation.	Localisation.	Thorough translation accompanied with localisation of VLE content, images, video, audio, adverts, communications in regard to the local culture.

Language	Bilingual user selection.	List of languages including English, Arabic, … etc.	To accommodate the diversity of users coming from different cultures and countries.
Cultural influences in general	Not or rarely targeted.	Extensively targeted.	Incorporating and considering cultural influences in implementing a CBCVLE would positively make a difference in using and accepting the VLE and associated services and applications by users.
Local customs and traditions	Affect the use.	It has no effect on the use.	Specific issues can be resolved where the users have more preferences and choices in regard to gender and communication for example.
Commercial Advertising	Can be expected specially in 3rd party tools.	Can be directed and even eliminated.	Improper content displayed within adverts can be eliminated. Moreover, content that complies with local culture would be used instead.
Training	Inadequate.	Adequate training focusing on the user needs and requirements.	Training is considered essential to CBCVLE. Training makes users capable to complete collaborative tasks effectively.
Awareness	Users are partially aware of benefits, capabilities, features and ways to use VLE.	Current awareness is essential.	Full awareness of benefits of cloud computing in education and the potential features and capabilities of CBCVLE are continuously provided.
Institutional support	Insufficient support.	Continuous and enhanced support.	Institutional support broadly include supply, maintain and continuously improve issues related to CBCVLE.
HEI logistics	Lack of a high-speed Internet connection in several HEIs.	Adequate high-speed Internet connectivity in campus, and nationally as well.	In order to get the potentials from a CBCVLE. HEIs are required to provide their users with sufficient Internet connection as a minimum requirement.
Peer pressure	Rarely implemented.	Highly dependent on.	This is essential to CBCVLE where peers have a better opportunity to learn and compete within VLE.
User Experience	Not or partially targeted	Fully targeted	A CBCVLE targets the potential users to be more satisfied, engaged, competent, confident, committed and to continuously have intention to accept and to use the environment.

User expectations	Not or partially targeted	Fully targeted	Users would be distracted by using various 3rd party tools in their education. Instead, the provision of features suggested by users would be more motivated to use tools and features that they have previously recommended.
Collaboration tools	User depends on multiple global collaborative tools (3rd party)	Collaborative tools are built in the system. Third party tools are rarely used.	The annoyance of moving between tools and applications to do a single task, for example, will be eliminated. Users will become certain that they can complete their educational tasks in one platform.
Collaborative activities between HEIs	Rarely to find such activities supported comprehensively by VLE tools.	Collaborative tasks are targeted to a high degree by a CBCVLE.	The variety of tools and applications are mainly intended to increasingly support the collaborative groups either inside or outside HEIs.
Complexity of user interface	Current user interfaces in VLEs are equipped by a large number of icons, links and content.	User interface has far less complexity with proper use of icons and typography.	Users should not by distracted and annoyed by a complicated user interface. Users should be able to customise their interfaces to the extent that this make them adhered to VLE.
Full functionality	Some features and functions are currently disabled.	Fully functioning as well as extra features added.	All built-in and external features are considered integrated with VLE system as well as those expected by the users.
Hosting server	In-House	Cloud-based	To be more capable to run any application regardless the extent of computing resources needed.
Availability	Frequent downtime.	100% Up-time.	Not just to minimise the downtime but to eliminate any interruption that may cause delay for users to submit their tasks.
Cost	Unaffordable.	Affordable with an option of shared cost by HEIs.	Especially with local ICT infrastructure and survives including computers, networks, …etc. HEIs can invest their capitals by hosting other institutions or using a unified VLE tools.

Notifications	Via Email and almost always disabled.	Email, SMS enabled, Mobile app push notification.	To activate the currently disabled/inactive notifications and to provide users with options to suit the user's needs and time.
Compatibility	Not or partially compatible.	Fully compatible with almost all mobile devices.	To give the users full access with mobility.
Incentives	Lack of incentives.	HEIs seek the promotion of incentives among users in collaborative VLEs.	Incentives have a great impact to attract users and preserve a stable and continuous utilisation.

Table 8.4: Characteristics of the proposed CBCVLE compared to traditional VLEs.

8.2.9 RECOMMENDATIONS FOR MORE UTILISATION OF A CBCVLE

This section briefly provides insights in the practical contribution of this thesis that would help HEIs to mitigate the effects of some of the issues concerning the use and acceptance of a CBCVLE. These proposed recommendations are discussed further in Chapter 9.

8.2.9.1. User Profile

User profile is defined by Courage and Baxter (2005, p.41) as "*a detailed description of your users' attributes*". Courage and Baxter (2005) also state that a user profile helps institutions to understand their potential users and for any usability activities. In the context of this research, user profile is considered as a key aspect to define users' preferences that would help to customise VLE tools to their needs and expectations.

User profile is proposed by this study as a vital feature that can be customised to adopt and acquire users' needs and desires within a CBCVLE. This feature would also help to eliminate gaps between users and the collaborative VLE as the local culture is significantly considered. Figure 8.15 illustrates the existing fields in most VLE tools as well as those proposed fields (highlighted in green) that can be used to customise a CBCVLE to the users' needs in terms of local culture. More details about user profile are provided in Chapter 9.

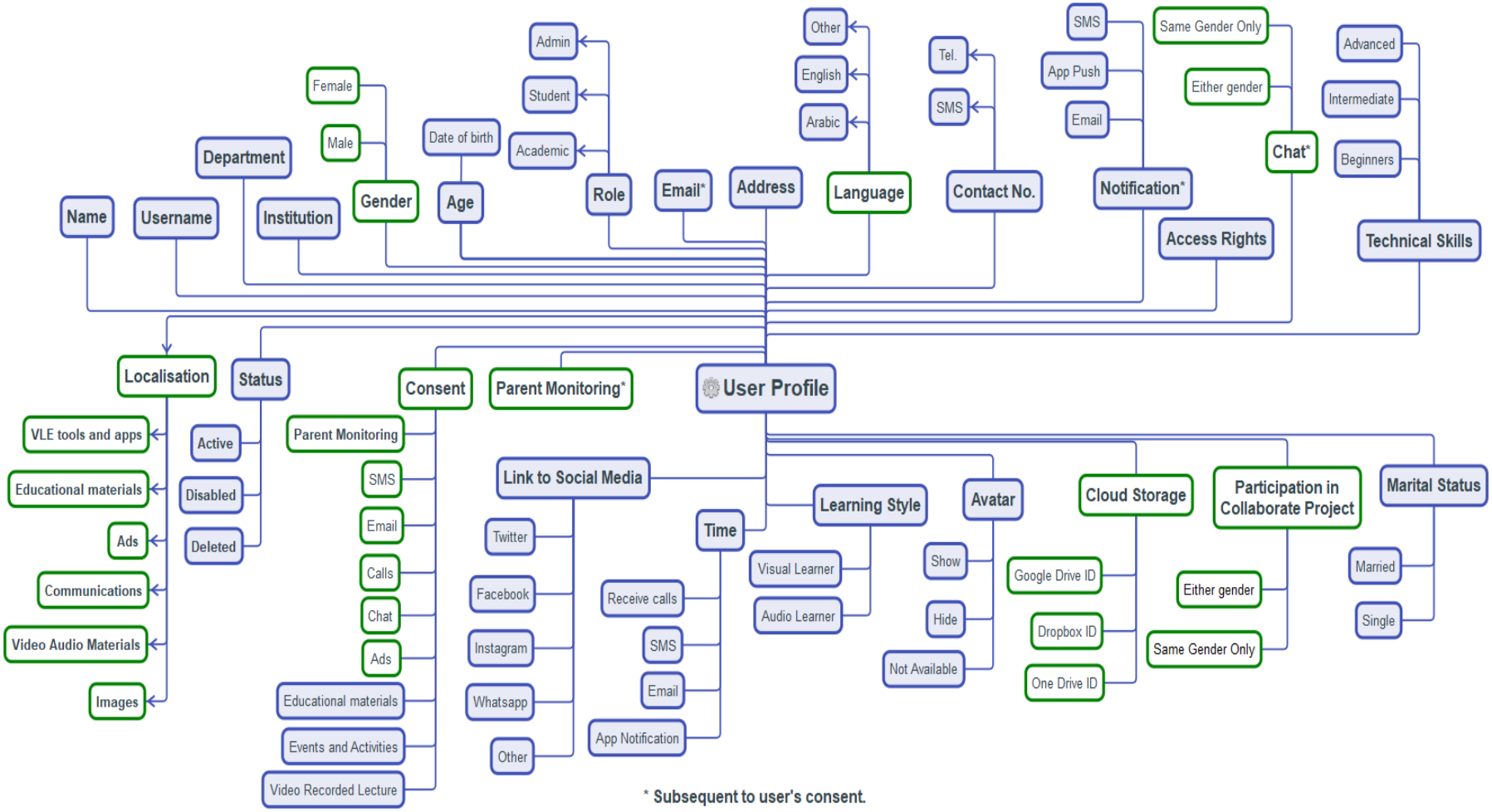


Figure 8.15: Application of user profiles in VLE tools to mitigate effects of cultural influences.

8.2.9.2. Localisation

Localisation extends its coherence to include many aspects other than translation. Sandrini (2005) states that localisation is used relatively with the terms “internationalization” and “globalization”. Keniston (1997) considers translation to be an important aspect of localization. In addition, localisation makes websites and applications more accessible (Leiva and Alabau 2015). However, a website or VLE tools may include a variety of digital assets such as texts, pictures, multimedia, audio and video streaming, dynamic contents, applications, as well as transactional assets (Sandrini 2005) and many others. Therefore, the localisation activity would involve huge efforts that exceed merely the translation of text.

The popularity of implementing two languages can be noticed in most websites nowadays (Alabau and Leiva 2014) especially considering the cultural differences (Hsieh et al. 2008). Moreover, Keniston (1997) used the term “cultural localization” to describe the process of adopting a computer program written for one culture to another culture considering aspects such as language, assumptions, values, and outlooks of the latter. Hsieh et al. (2008) assert that “*software localization focuses on reflecting the conventions of said target audience*”. Similarly, Keniston (1997) used "technical localization" to describe the translation of computer programs from one language to another taking into consideration aspects such as local character sets, numbers, scrolling patterns, dates, colours, etc. Sarrab et al. (2016) indicates that the local contexts should be taken into consideration by policy makers whereas policies are localised either being created or adopted. However, Sandrini (2005) asserts that the process of localisation would be extremely costly if it is done independently, however, it should be considered an integrated component of VLE development.

In this regard, Leiva and Alabau (2015) propose Just In Time Localization (JITL) which is a collaborative localisation post-hoc method that contributes a timely internationalisation of web-based applications while the source code remains intact of modification.

Figure 8.16 shows the proposed aspects of localising a CBCVLE as viewed by this research.

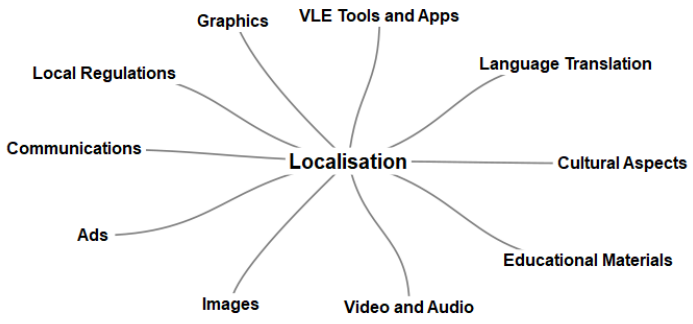


Figure 8.16: The broad view of localisation.

As shown in Figure 8.16, this research considers cultural aspects into the localisation process among other aspects due to the importance of culture . HEIs can benefit from translating the current content of courses as well as producing new materials that comply with local culture and regulations. This is asserted by Roturier (2015, p.10) who states that "*it is sometimes necessary to create some parts from scratch to supplement or replace existing translated sections, in order to meet local expectations or comply with local laws and regulations*".

8.2.9.3. Parent Monitoring

Parent monitoring is defined by Dishion and McMahon (1998, p.61) as "*a set of correlated parenting behaviors involving attention to and tracking of the child's whereabouts, activities, and adaptations*".

Parent monitoring as proposed by this study aims to ensure that parents are confident of a CBCVLE and any communication in such an environment. Moreover, parents will be aware of the safety measures incorporated in the system to protect their sons/daughters. Therefore, parents will play a critical role pushing and supporting their sons/daughters to use a CBCVLE or vice versa.

Figure 8.17 illustrates the expansion of the proposed CBCVLE in terms of incorporating more aspects and features for parent monitoring compared to the existing VLE tools such as Moodle. Parents are anticipated to be able to monitor every single collaborative activity including any type of communication used that their respected sons/daughters are involved in. Moreover, all materials distributed within an activity would also be available for monitoring as well as deleted messages and materials. Parent monitoring will be further explained in Chapter 9.

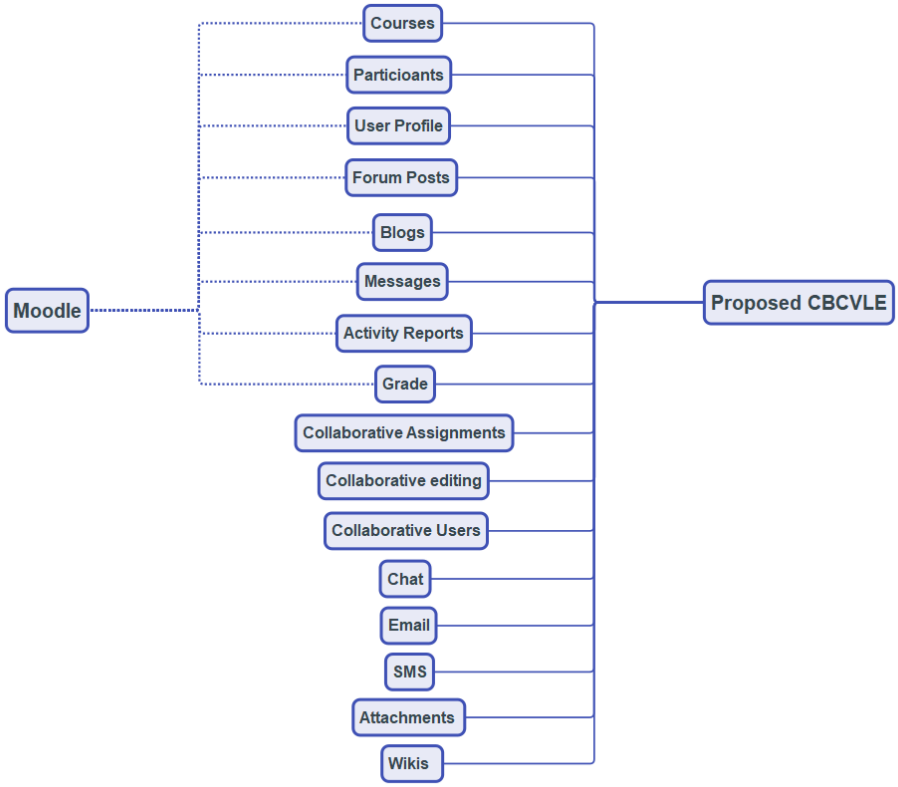


Figure 8.17: Parent monitoring (Moodle vs proposed CBCVLE).

Regarding legal issues and concerns in terms of giving parents the ability to view and browse their sons/daughters' data, in accordance to Article 43 of the Omani Electronic Transactions Law (ETL) which states: "*Any government body or authentication service provider may collect personal data directly from the concerned person or from others after his explicit approval, only for the purpose of issuing a certificate or keeping it or facilitating such issuing or keeping. It is not permitted to collect or process or use such data for any other purpose without the explicit consent of the person from whom such data is collected.*" (Oman Government 2008, p. 14). Therefore, the organisation body (keeper of data) is responsible to obtain the explicit consent from the user whom data will be used accordingly (Oman Government 2008, p. 14). Hence, consent may be given by a student to a single parent account to specifically allow them viewing their online activities. A student should also be able to opt out their previous consent at any time. On the other hand, parents are required to initiate a one-time request to have their sons/daughters' consent and the request may be either accepted or rejected.

The other issue is the legitimacy of monitoring other users whom communication involved in parents' son/daughter. However, this issue can be resolved by making it clear to users that the contents of their communication with any user participated in that communication can be viewed by parents. By signing an agreement of using a CBCVLE, users should be aware that the whole use is for educational purposes only.

8.3 COLLABORATIVE ENVIRONMENT

The research identified that level of collaboration between HEIs is notably low. Very few examples of collaborations were indicated by the findings (see Chapter 6) which mainly relate to the preparation for exams' questions between certain colleges that are affiliated by the same ministry (e.g. CAS). The research findings also highlighted that the VLE tools are often used for uploading and downloading courses materials and are not even used for exchanging exams' questions. Email services were used instead as a collaboration tool to fulfil the tasks between members. Moreover, technical issues such as unavailability or a slow Internet connection, and regular interruption of VLE tool were considered barriers to go further in the use of VLE tools. In addition, collaboration is not supported by local policies and academic regulations in HEIs. Apart from that, collaborative activities that relate to courses inside an HEI are also limited or even not exist.

A collaborative VLE which is shared by several HEIs would be a promising and a good solution especially for private HEIs in Oman. Al Kharusi (2016) points out that many private HEIs are continuously facing funding problems to maintain the required Internet services and access to library resources compared to public HEIs. OMREN is anticipated to provide users and HEIs with tools for collaboration and sharing resources (Al Kharusi 2016).

HEIs are required to invest in a shared ICT infrastructure that help to facilitate educational resources and improved communications channels between users. Moreover, policies in HEIs, as well as the academic regulations should be updated to accommodate the new environment. Users should feel the differences as well as the importance of the employment of a CBCVLE and behave accordingly. These policies and regulations would outline the users' rights and obligations and bridge the gap between them and the new technologies. Also, these policies and regulations can create an environment for improving user's experience towards accepting and using a CBCVLE.

8.3.1 COLLABORATION TYPES

Types of collaboration vary based on where it takes place, for instance, collaboration would be obviously seen between individuals or even institutions. Furthermore, collaborative activities could also be found within the local community and with external individuals and entities. Erturk (2016) highlights three types of collaboration and sharing:

- "*Seeing and learning from other students' work.*
- *Receiving direct suggestions from others.*

- *Allowing others to edit documents that belong to them*".

Erturk's view of collaboration types seems very limited to include the above three types. However, and in the context of a CBCVLE, collaboration could include a wide range of types as listed below (also see Figure 8.18):

1. Student to Student Collaboration
2. Student to Group Collaboration
3. Student to Teacher Collaboration
4. Student to Local Community Collaboration
5. Student to External Scholar Collaboration
6. Student to Anonymous Collaboration
7. Teacher to Teacher Collaboration
8. Teacher to Group Collaboration
9. Teacher to Student Collaboration
10. Teacher to Local Community Collaboration
11. Teacher to External Scholars Collaboration
12. Teacher to Anonymous Collaboration
13. Institution to institution Collaboration.

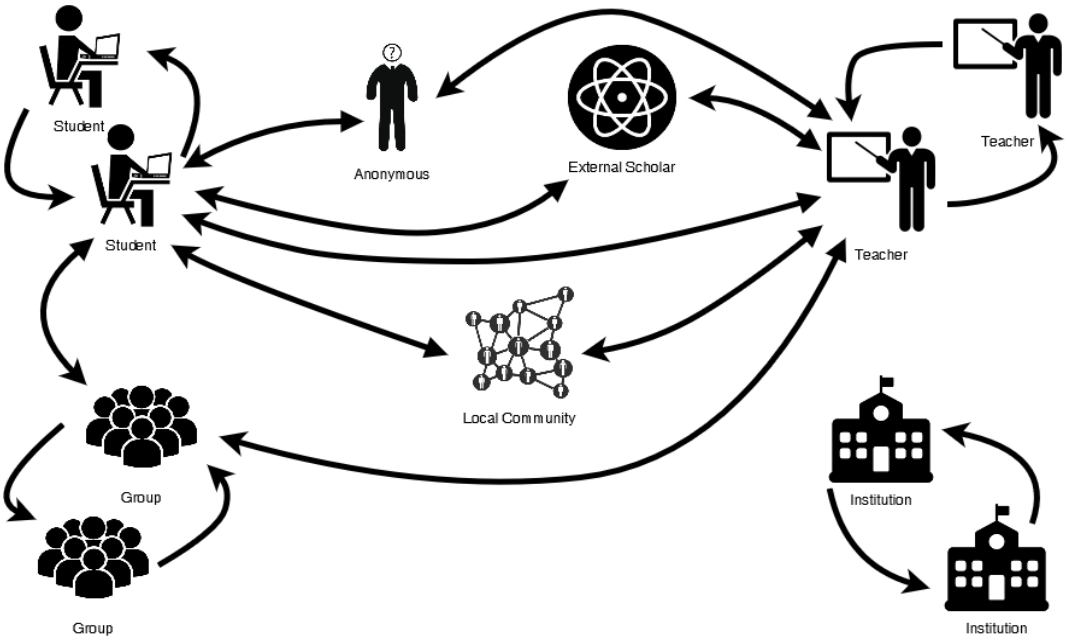


Figure 8.18: Collaboration types in a CBCVLE.

8.3.2 APPLICATION OF CLOUD COMPUTING

Based on the literature and the users' expectations, it can be argued that implementing cloud computing in the collaborative VLE is essential. Its characteristics and potential benefits point out the necessity that such technologies must be adopted to enhance the collaborative VLE. Most HEIs in Oman are individual colleges and most of them are private which indicates the need for a unified solution for a CBCVLE. The current situation indicates that very few HEIs have their own private cloud due to the high cost and lack for human resources. Therefore, the tendency for sharing one CBCVLE may be favourable. This is regardless of some concerns such as ownership, control, and security that may be raised by members. However, such concerns may be dominant and consequently ban some members from joining the consortium. IaaS would be more in favour by those HEIs employing their own cloud while it is also available for them as well as others through a provision of an external cloud provider (pay as you go model). A hybrid cloud, on the other hand, would be a reliable solution for some HEIs which are capable of establishing their private cloud and, at the same time, do not miss the opportunity to employ more cloud features and functionalities. The potentials of cloud computing (e.g. cost saving and sharing, elasticity, less management overhead, scalability, mobility, ease of access, … etc) can greatly convince HEIs to employ a CBCVLE. Users as well have started using cloud-based mobile applications (e.g. email) either for personal or educational purposes. Their experience in using 3rd party cloud-based applications would facilitate the way for the implementation of a CBCVLE. However, HEIs in cooperation with the government could make a plan to educate the local people including families to accept new technologies. Awareness of benefits should be passed to parents while the new applications can be localised to meet the local culture and enrich user experience.

8.4 CHAPTER SUMMARY

The chapter discussed the proposed CBCVLE framework which consists of five main elements. These elements are: ICT infrastructure and services, operational environment, user experience and expectations, factors affecting user's acceptance, and cultural influences. Each element was discussed and illustrated by informative diagrams. Recommendations and guidelines were outlined to HEIs to help to mitigate the possible effects that may prevent or even limit the use of a CBCVLE. In the next chapter a partial prototype of the framework is discussed (see Chapter 9) and evaluated (see Chapter 10).

CHAPTER 9: A PROTOTYPE FOR A CBCVLE

This chapter discusses the prototyping of some aspects of the framework where some features are selected and implemented to demonstrate how the issues can be tackled within VLE tools. User profile is selected and extended incorporating more options than ordinarily available in traditional VLE tools. Cultural aspects such as gender and localisation are selected for inclusion in the prototype. The prototype is evaluated alongside with the framework which are discussed in Chapter 10.

9.1 INTRODUCTION

As discussed in Chapter 8, the framework incorporates five main elements which broadly articulate various challenges, concerns, and issues that are considered important within a CBCVLE.

9.2 PROTOTYPE DEVELOPMENT

The aim of the prototype is to implement some of the features proposed in the CBCVLE framework for the purpose of illustration and the proof of concept. The prototype incorporates two cultural influences; gender and language, and therefore, four aspects/features are applied accordingly as presented in Table 9.1.

N.	Aspect/Feature
1.	Considering the user's preference relating to interaction with different **genders** when initiating a request to **communicate** with other users within VLE tools.
2.	Considering the user's preference relating to **interaction with different genders** when **assigning a student** to a collaborative project **group** within VLE tools.
3.	Allowing **parents** to **monitor** the activities of their son/daughter over VLE tools with a consent given to parents.
4.	Giving users the right to view either a **localised or native version** of educational materials, video audio materials, images, adverts, and communications in VLE tools and apps.

Table 9.1: Features implemented in the prototype.

It is anticipated that the gender preference would contribute positively to meet the user's needs in terms of the local culture. The user would culturally customise their ways of communication within VLE accordingly. Moreover, this also provides a flexible and

customisable collaborative space where users are anticipated to participate and work effectively.

Moodle (Moodle 2019), an open source VLE, was employed to run the prototype. Moodle was chosen among the other VLE packages (see Chapter 2) for the prototype due to:

- Free open source VLE tools.
- Easy modification and customisation.
- Flexibility to add and modify extra fields in the user profile.
- Widely used among HEIs in Oman.

The latest version (3.7) of Moodle was downloaded and installed as a local web server which is run by Apache HTTP Server (Apache 2019) and MySQL (MySQL 2019) database within Windows Operating System. Figure 9.1 shows the screenshot of the enhanced view of the homepage of the prototype.

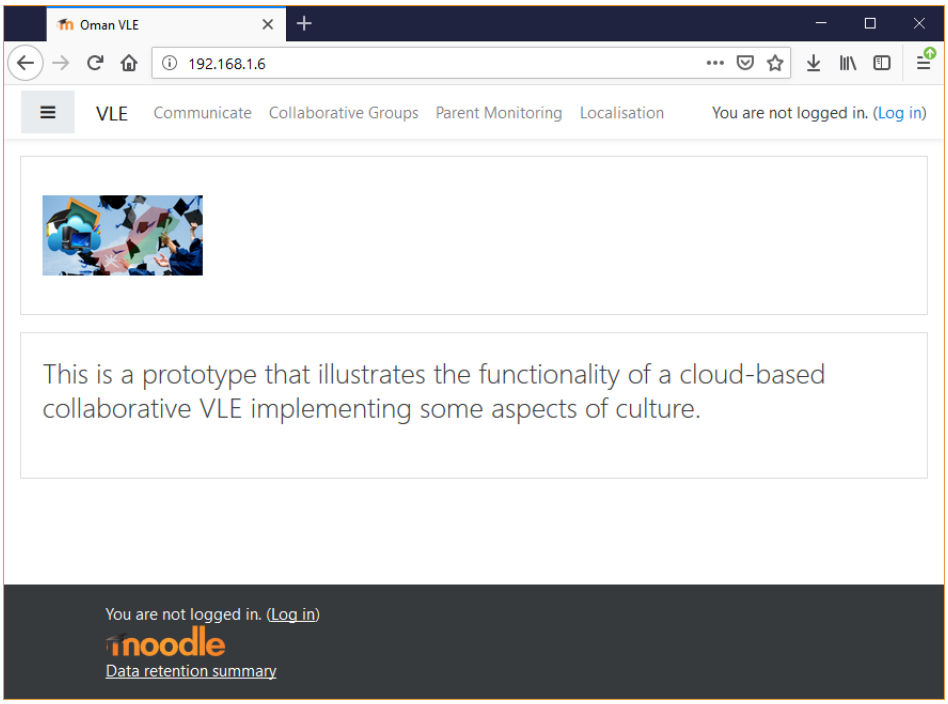


Figure 9.1: Homepage of the prototype.

Table 9.2 present a list of users' accounts used as examples in the prototype (gender preferences). Every user is able to customise their preferences by setting the gender attribute of their user profile. The proposed options for gender for a user include "Either Gender", "Same Gender Only" and "N/A" assigned for parents to indicate it is not applicable (for some parts of prototype parent accounts are not involved). The gender setting affects the following attributes: participation in collaborative project, app messages, Email, SMS, and chat.

ID	Username	Role	Gender	Participation in Collaborative Project	Parent Monitoring	App Messages	Email	SMS	Chat
3	teacher1	Teacher	Male	Either Gender	N/A	Either Gender	Either Gender	Either Gender	Either Gender
4	teacher2	Teacher	Female	Either Gender	N/A	Either Gender	Either Gender	Either Gender	Either Gender
5	student1	Student	Male	Either Gender	Yes	Either Gender	Either Gender	Same Gender Only	Same Gender Only
6	student2	Student	Male	Same Gender Only	Yes	Either Gender	Same Gender Only	Same Gender Only	Either Gender
7	student3	Student	Female	Same Gender Only	Yes	Same Gender Only	Either Gender	Same Gender Only	Same Gender Only
8	student4	Student	Female	Either Gender	No	Either Gender	Same Gender Only	Same Gender Only	Either Gender
9	parent1	Parent	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	parent2	Parent	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 9.2: List of user's accounts used in the prototype (Gender attribute).

Table 9.3 provides a list of users' accounts used in the prototype (preferences relating to consent) whereas users are able to customise. These preferences are also anticipated to provide the user with a custom space either working individually or in a collaborative group. The permission to receive any type of communication or involving in a collaborative project group are both tailored by the user. The proposed settings related to consent for a user include "Yes", "No" and "N/A" which is assigned for parents to indicate it is not applicable (for some parts of prototype parent accounts are not involved). The consent preferences are available for the following aspects: participation in collaborative project, app messages, Email, SMS, and chat.

ID	Username	Role	Gender	Consent Participation in Collaborative Project	Consent Parent Monitoring	Consent App Messages	Consent Email	Consent SMS	Consent Chat
3	teacher1	Teacher	Male	N/A	N/A	Yes	Yes	Yes	Yes
4	teacher2	Teacher	Female	N/A	N/A	Yes	Yes	Yes	Yes
5	student1	Student	Male	Yes	Yes	No	Yes	Yes	Yes
6	student2	Student	Male	Yes	Yes	Yes	Yes	No	Yes
7	student3	Student	Female	Yes	Yes	Yes	No	No	No
8	student4	Student	Female	No	No	Yes	Yes	No	No
9	parent1	Parent	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	parent2	Parent	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 9.3: List of user's accounts used in the prototype (Preferences relating to consent).

Table 9.3 also presents a list of fields added to user's profile within the prototype. The user has the right to enable, disable or customise any of the following: participation in a collaborative project, parent monitoring, app messages, Email, SMS, and chat. The available options for each are "Yes" and "No" and they are only applicable to students.

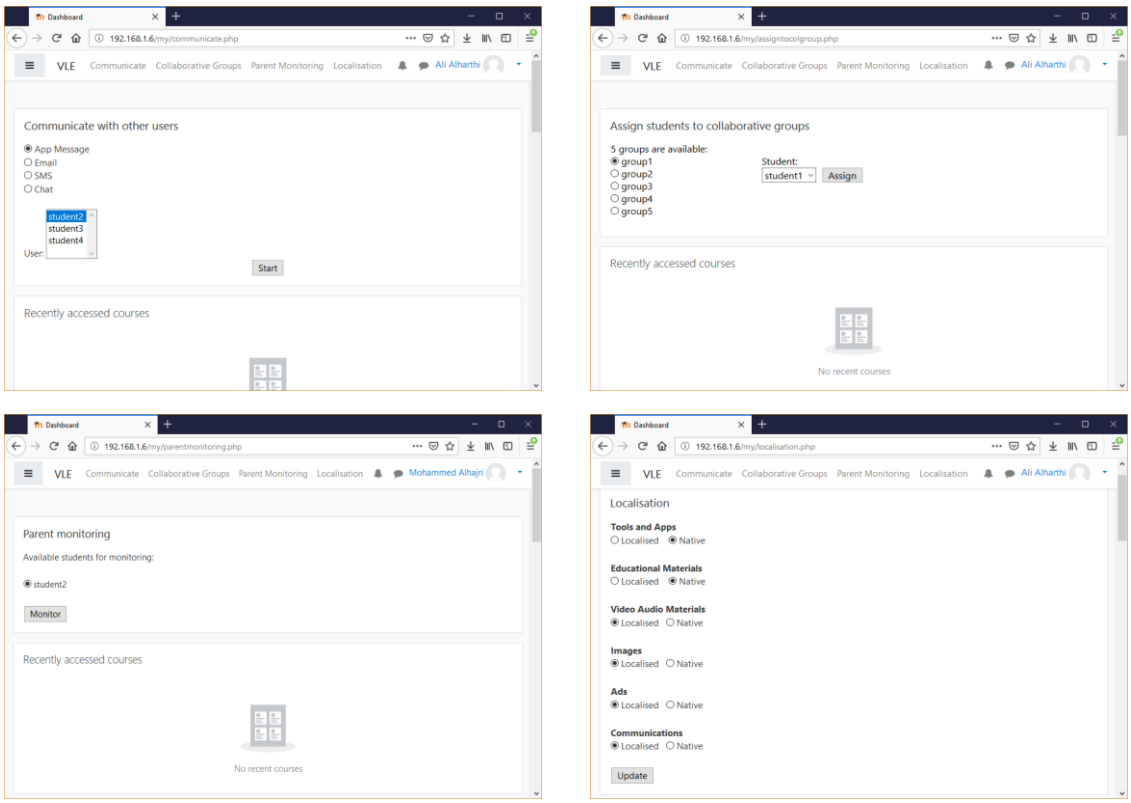


Figure 9.2: Homepages of aspects/features implemented in the prototype.

Figure 9.2 illustrates various homepages of the aspects/features implemented in the prototype. These are further explained in the next sections.

9.2.1 USER PROFILE

The default user profile fields of typical software tools "Moodle" and associated features are extended to enhance the way the system responds to cultural factors. This gives users the opportunity to customise preferences and presentation of content. Figure 9.3 shows the new categories (Cultural Factors, Localisation, Communication and Notification, Consent, Time Preferences, and Cloud Storage) which are added to Moodle's user profile as well as those existing categories.

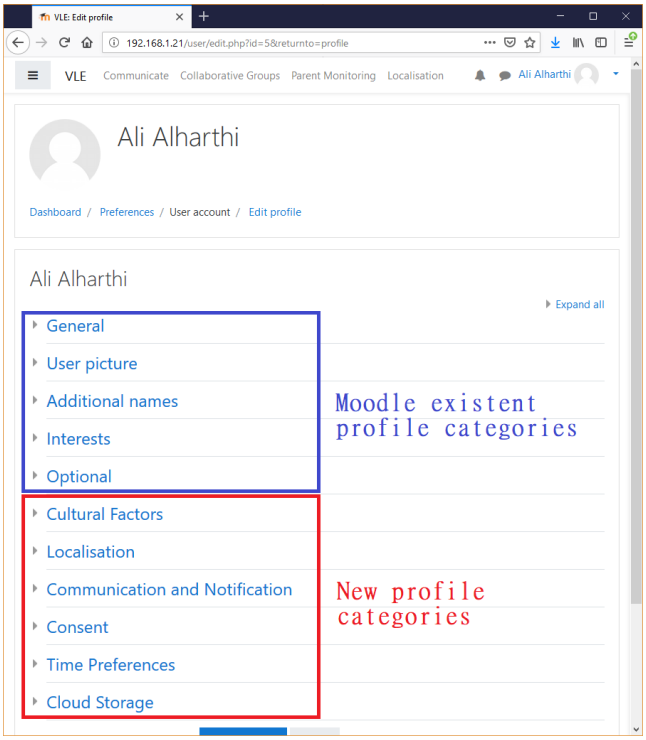


Figure 9.3: Extended user profile categories.

Figure 9.4 gives a broad and typical view of categories used in the user profile including those which are proposed in this prototype. Each category includes one or more of related fields. The contribution of this prototype relates on three categories (Preferences relating to Language, Culture and Collaboration) to extend VLEs capabilities concerning cultural influences. However, this does not neglect the importance of other categories and associated fields.

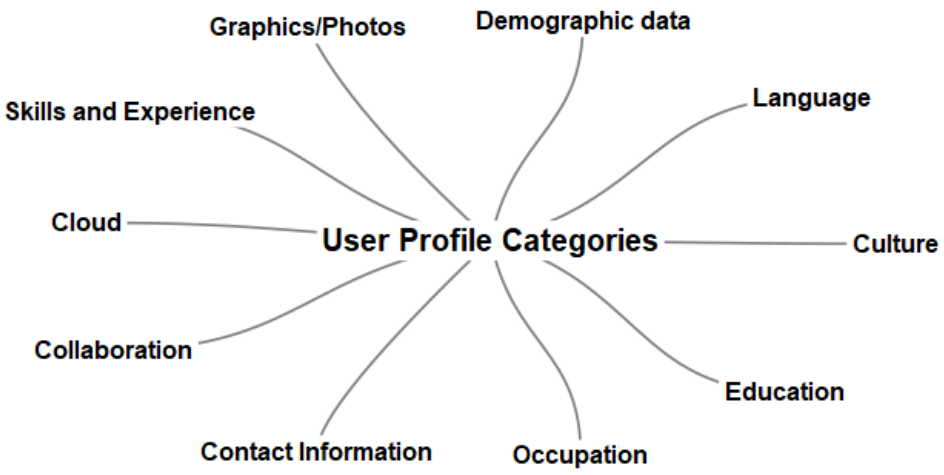


Figure 9.4: Categories of user profile fields.

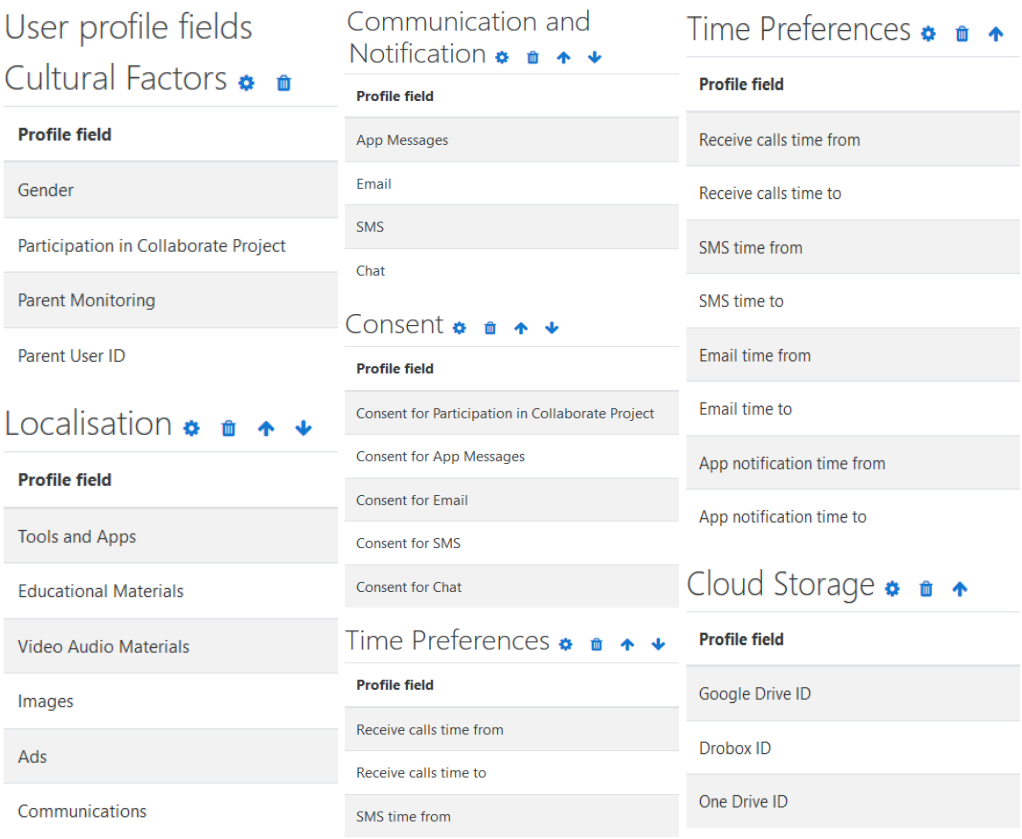


Figure 9.5: Extended user profile fields.

Figure 9.5 presents various extended user profile fields under each category. These fields represent the containers of users' preferences to customise associated features to their needs.

Additionally, Table 9.4 presents a list of fields added to user's profile within the prototype. These fields are proposed to extend the functionality of the original package of Moodle or any similar VLE tools.

Field	Options	Explanation/Justification
Gender	Male, Female	Based on these criteria, the system will behave in responding to a user's request to communicate with another user with accordance with other criteria such as participation in collaborative project.
Participation in Collaborative Projects	Either gender, Same Gender Only	Based on these criteria, the system will behave in responding to a user's request to communicate with another user with accordance with other criteria such as gender.

App Messages	Either gender, Same Gender Only	The users would select the most desired preference for application messages to suite their cultural background.
Email	Either gender, Same Gender Only	The users would select the most desired preference for Email to suite their cultural background.
SMS	Either gender, Same Gender Only	The users would select the most desired preference for SMS to suite their cultural background.
Chat	Either gender, Same Gender Only	Similar to the above field, the users would pick the most desired option for chatting, for example, with other users to meet their cultural background.
Parent Monitoring	Yes, No	Users (son/daughter) give their consent to allow their parents to monitor their online and collaborative activities.
Consent for Participation in Collaborative Projects	Yes, No	Users give their consent to whether allow them being assigned to collaborative project groups or disallow.
Consent for App Messages	Yes, No	Users give their consent to whether other users are allowed to send them app messages or disallowed.
Consent for Email	Yes, No	Users give their consent to whether other users are allowed to send them Emails or disallowed.
Consent for SMS	Yes, No	Users give their consent to whether other users are allowed to send them SMS or disallowed.
Consent for Chat	Yes, No	Users give their consent to whether other users are allowed to chat with them or disallowed.
Time Preferences	Receive calls, SMS, Email, App Notification	The time set by users to meet with their lifestyle and achieve a high extent of comfortability while committing to communicate with other users or responding to the system's notifications.
Cloud Storage	Google Drive ID, Drobox ID, One Drive ID	To extend the local storage provided via an HEI by linking an external cloud storage that relates to a user.
Notification	SMS, Email, App Notification	Users will select their comfortable way for receiving notifications from their CBCVLE.

Table 9.4: List of the fields added to user's profile within the prototype.

9.2.2 ASSIGNING STUDENTS TO COLLABORATIVE GROUP

Apart from the user profile preferences of gender, a database table was created (as seen in Figure 9.6). This table is used for storing data related to assigning students either by themselves or by their teachers to collaborative groups of courses enrolled. The column "id"

represents the ID of collaborative groups in a course. The first column “id” represents the group id.

id	courseid	userid	gender
1	1	10	Male
1	1	11	Male
2	1	12	Female
2	1	13	Male
3	1	14	Female
4	1	15	Female
4	1	16	Female
4	1	17	Male
5	1	18	Male
5	1	19	Male
5	1	5	Male

Figure 9.6: MySQL table for assigning students to collaborative groups.

9.2.3 PARENT MONITORING

As was discussed in the previous chapter, parents monitoring which depends on a robust logging system (see section 9.2.4.4) would provide them with detailed information on transactions. Table 9.5 shows an example of an event tracked by Moodle logging system.

Field	Data	Field	Data
username	user8540069828419911681	**contextlevel**	50
id	25017	**contextinstanceid**	5282
eventname	\core\event\course_viewed	**courseid**	5282
component	core	**anonymous**	0
action	viewed	**other**	N;
target	course	**timecreated**	1417771086
objecttable	-	**origin**	web
objectid	-	**ip**	0.0.0.0
crud	r	**relatedusername**	-
edulevel	2	**realusername**	-
contextid	107483		

Table 9.5: Example of Moodle log store (Moodle Research 2019).

Field	Description
username	The anonymised username, imported from the mdl_user file to allow links to user records
id	The unique id of this log entry record
eventname	The event class name in path format, delimited by \ e.g. '\core\event\course_viewed'
component	The component that generated the log entry, e.g. core or mod_(modulename), using frankensytle
action	What action was taken, e.g. viewed, searched, deleted, etc.
target	The type of object the action was directed toward
objecttable	The suffix of the database table the object is stored in
objectid	The id of the object within its own table
crud	Create/Read/Update/Delete, a simple way of categorizing actions
edulevel	1 = Teaching - actions performed by a teacher, e.g. updating a resource; 2 = Participating - actions performed by a student, e.g. posting in a forum (including a teacher posting in a forum); 3 (or 0) = Other - actions performed by a user with a role other than teacher or student, or performing an action not directly related to learning, e.g. viewing or updating a profile.
contextid	The ID of the context in which the event occurs
contextlevel	The level of the context in which the event occurs. This tells you if it was a course, activity, course category, etc.
contextinstanceid	Based on context level this may be course id, course module id, course category, etc. (event->contextinstanceid)
courseid	This is used only for contexts at and below course level - this can be used to filter events by course (includes all course activities)
relatedusername	Used when the event can act on someone other than the person who triggered it, i.e. an unenroll event would likely contain the id of the user being unenrolled. (Set to anonymized username of relevant user in this data set.)
anonymous	Was this event anonymous at the time of triggering?
other	Any other fields needed for event description - scalars or arrays, must be serialisable using json_encode(). Floating point numbers cannot be used.
timecreated	Time when the event was triggered.
origin	How the event was triggered, e.g. web, cli (command-line interface), cron, ws (web services), etc.
ip	IP address of the user who triggered the event (anonymised in this data set)
realusername	Anonymized username of the user when using logged-in-as feature

Table 9.6: Moodle log store fields (Moodle Research 2019).

Moreover, Moodle log store fields as shown on Table 9.6, represents the fields that are used for log store and consequently to provide more details about user's transactions and activities. However, these fields are required to be extended in the proposed CBCVLE, and therefore, can be used for parents monitoring.

Apart from the user profile preferences of parents monitoring, another database table was created (as seen in Figure 9.7). This table is used for storing data related to parents monitoring requests sent by parents and students' responses. The first column "id" represents the request id.

id	parentid	parentusername	studentid	studentusername	status
1	9	parent1	7	student3	Reject
6	9	parent1	6	student2	Accept
8	10	parent2	8	student4	Pending

Figure 9.7: MySQL table for parents monitoring.

Logging activities and transaction of users (see section 9.2.4.4) will be used for parents monitoring. All transactions and VLE online activities will be clearly and transparently disclosed to parents based on user's prior consent. Table 9.7 describes the modified log store (which includes additional fields) and detailed list of activities of users (son/daughter) within VLE tools which can be seen by relevant parents.

Field	Description
Transaction type	The type of the activity or event whether it is a chat, forum posts, SMS, email, instant message, … etc.
Date	The date of activity or event.
Time start	The time that an activity or event is initiated.
Time end	The time that an activity or event is ended.
Duration	The time spent in the entire activity or event.
Description	This includes the full text of SMS, messages, emails, forum post, … etc
Collaborative users	The real names of collaborative users who were involved in an activity or event
Attachments	Any files including video, audio, images, screenshots, … etc which are being exchanged within an activity or event.
Correspondents	The real names of communicators if they are different than collaborative users.

Table 9.7: Modified log store (additional fields).

9.2.4 SCENARIOS

A set of six scenarios (see Figure 9.8, Figure 9.10, Figure 9.12, Figure 9.14, Figure 9.15, and Figure 9.17) have been created to illustrate the functionality of the prototype. Each scenario demonstrates the step by step processes and anticipated conditions (decisions) and the system responses.

9.2.4.1. Communicating with Other Gender

A VLE user, presumably a student, is given an opportunity to pre-set their preferences for communication with other students (Either gender, Same Gender Only). This is for any type of communication medium such as app messages, Email, SMS, and chat. Figure 9.8 illustrates the scenario of a student initiating a request for communication (chat) with another student. The system will perform a parallel check of the preferences for both sender and receiver. Based on the preferences, the system will either proceed or display a message to the user. Then, if both users permit the chat, the system will match their gender first, and once both have a same gender, the system will notify the receiver. If the request is accepted by the receiver, the communication will be established. On the other hand, if the gender of the initiator does not match the receiver, the system will perform another check. In this check, both preferences are confirmed whether to allow chat with opposite gender. If found positive, the system will proceed further to invite the receiver with whom the acceptance is required to start the communication. However, if the receiver does not allow the chat with opposite gender, the system will select another type of communication (e.g. email, messages or SMS) that may be alternatively preferred by the receiver. If an alternative is found, the communication will be commenced. Overall, messages are displayed to the initiator throughout the transaction whether it proceeds further or not.

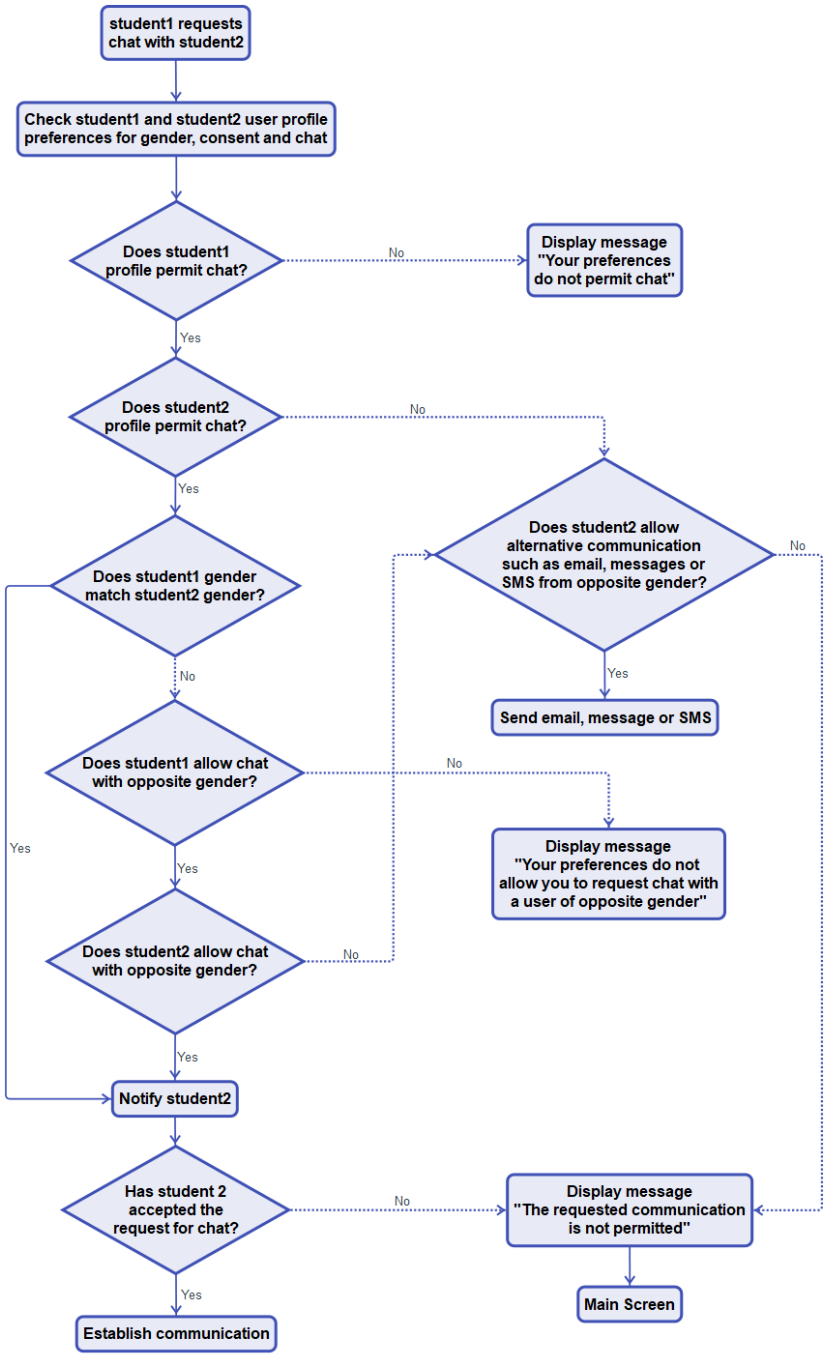


Figure 9.8: Scenario 1 - sequences of requesting chat from opposite gender.

Figure 9.9 shows some screenshots that illustrate the functionality of scenario 1 as well as some system's responses and messages displayed to the user.

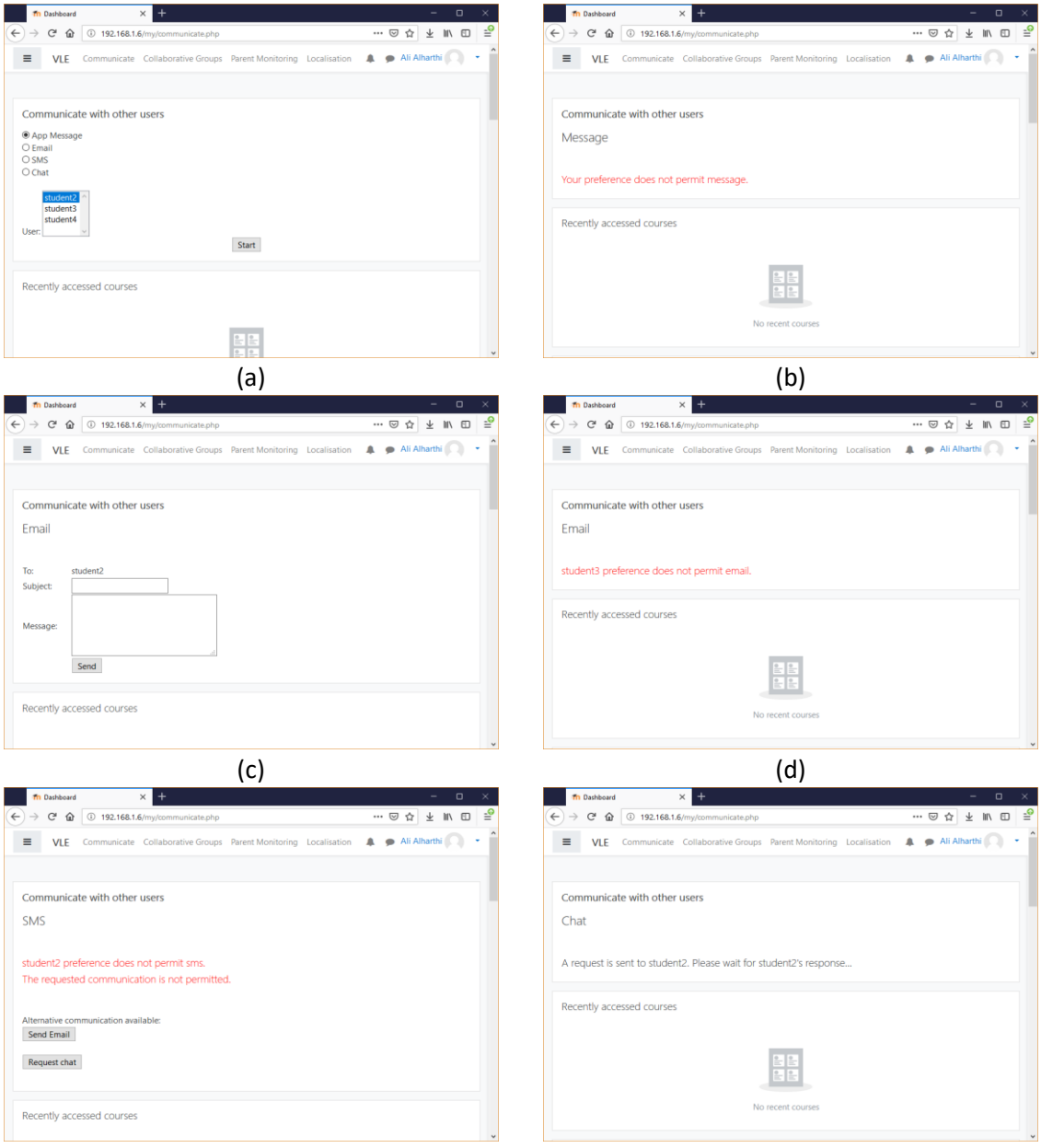


Figure 9.9: Screenshots of implementing scenario 1, “communicating with other gender”.

9.2.4.2. Collaborative Group Gender Composition (Teacher Role)

In their courses, teachers assign their students to various collaborative groups based on the students’ preference relating to gender. The students are assumed to pre-select their preferences (Either gender, Same Gender Only) of the their prefered gender composition for collaborative groups. Assuming that a teacher assigns students to a collaborative project group, the system will check the student’s preference in this regard. If the preference relating to gender allows assigning the student to a group of either gender, then the student will be assigned to an available group. On the other hand, if the student’s preference is “Same Gender

Only", the system will check the composition of the existing groups and select a group which matches it with the student's gender. If both match each other, then the student will be assigned to the group, otherwise another group will be considered (as illustrated in Figure 9.10).

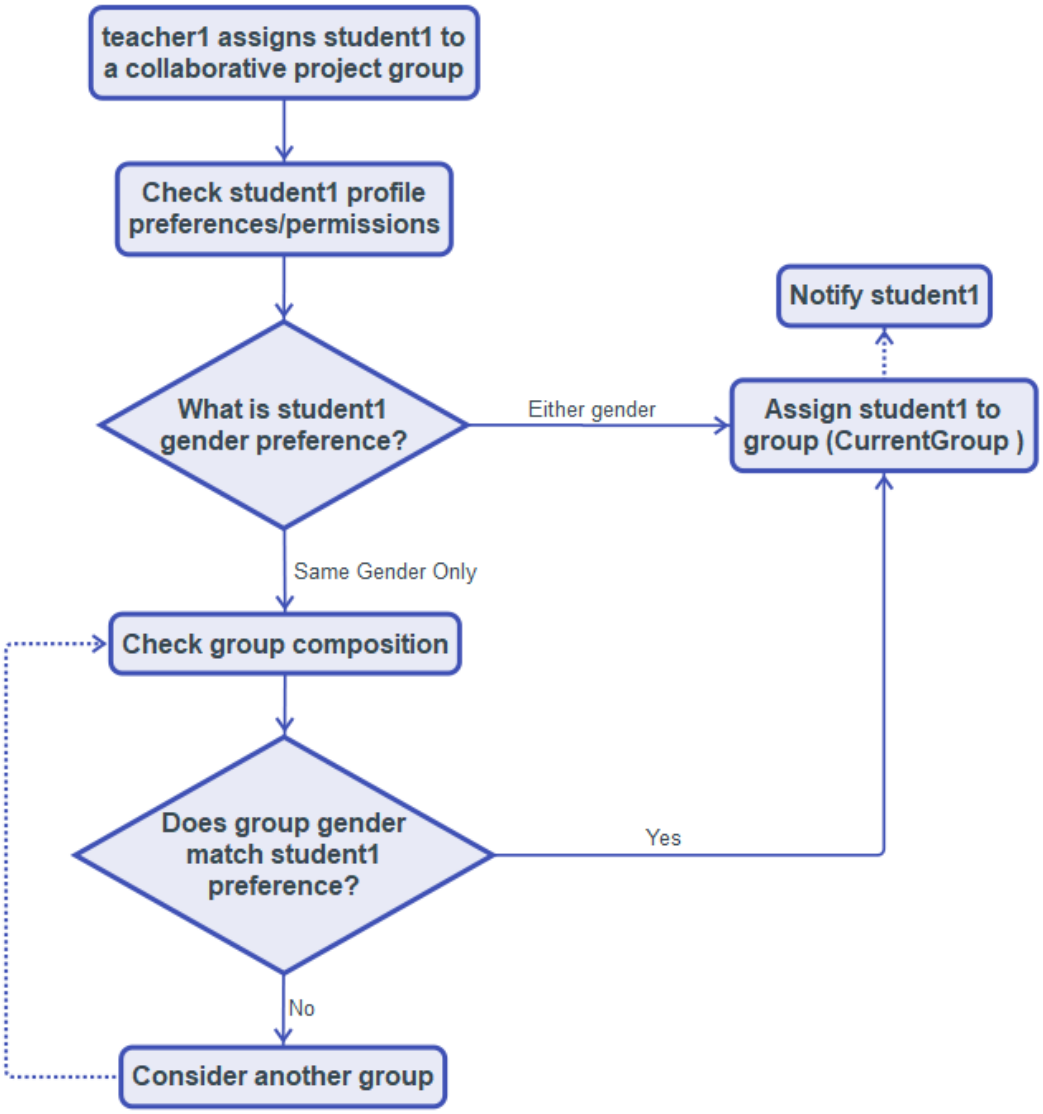
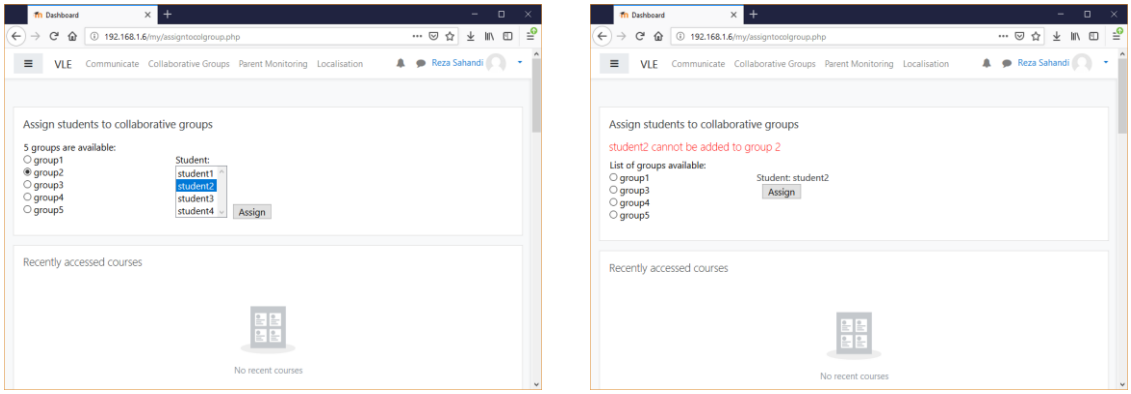


Figure 9.10: Scenario 2 - teacher assigns a student to a collaborative project group containing the appropriate gender composition.

Figure 9.11 shows some screenshots that illustrate the functionality of the prototype in respect of scenario 2. It also shows some of the system's responses and the messages displayed to the user.



(a) (b)

Figure 9.11: Screenshots of implementing scenario 2, "collaborative group gender composition (teacher role)".

9.2.4.3. Collaborative Group Gender Composition (Student Role)

Students who intend to assign themselves to a collaborative group based on the their preferences can select their options. The students are assumed to pre-set their preferences (Either gender, Same Gender Only) of their prefered gender composition of collaborative groups. The process is almost similar to the previous scenario (see section 9.2.4.2), but with the difference is that students can perform this task by themselves (see Figure 9.12).

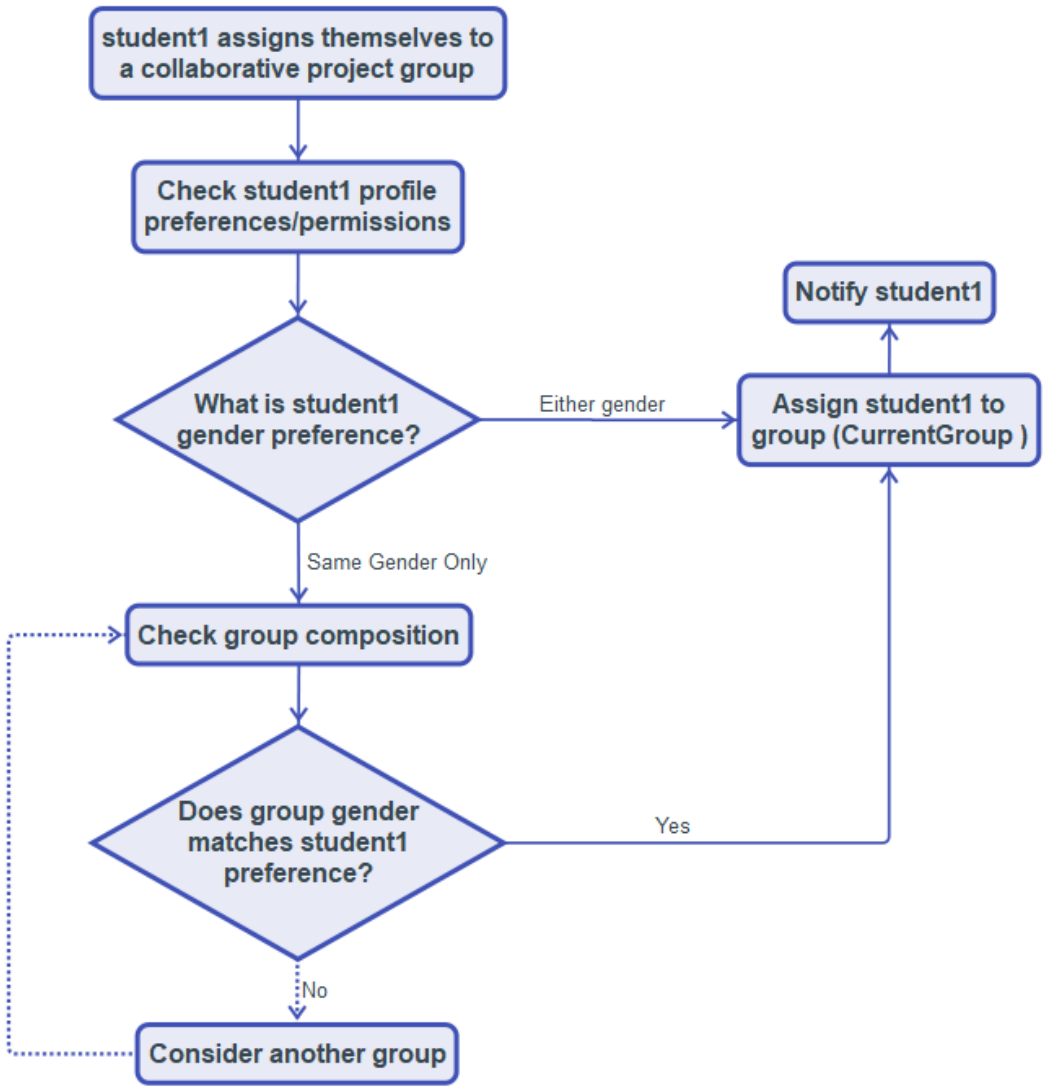


Figure 9.12: Scenario 3 - students assign themselves to a collaborative group containing the gender composition of their choice.

Figure 9.13 shows some screenshots that illustrate the functionality of scenario 3, including some system's responses and messages which are displayed to the user.

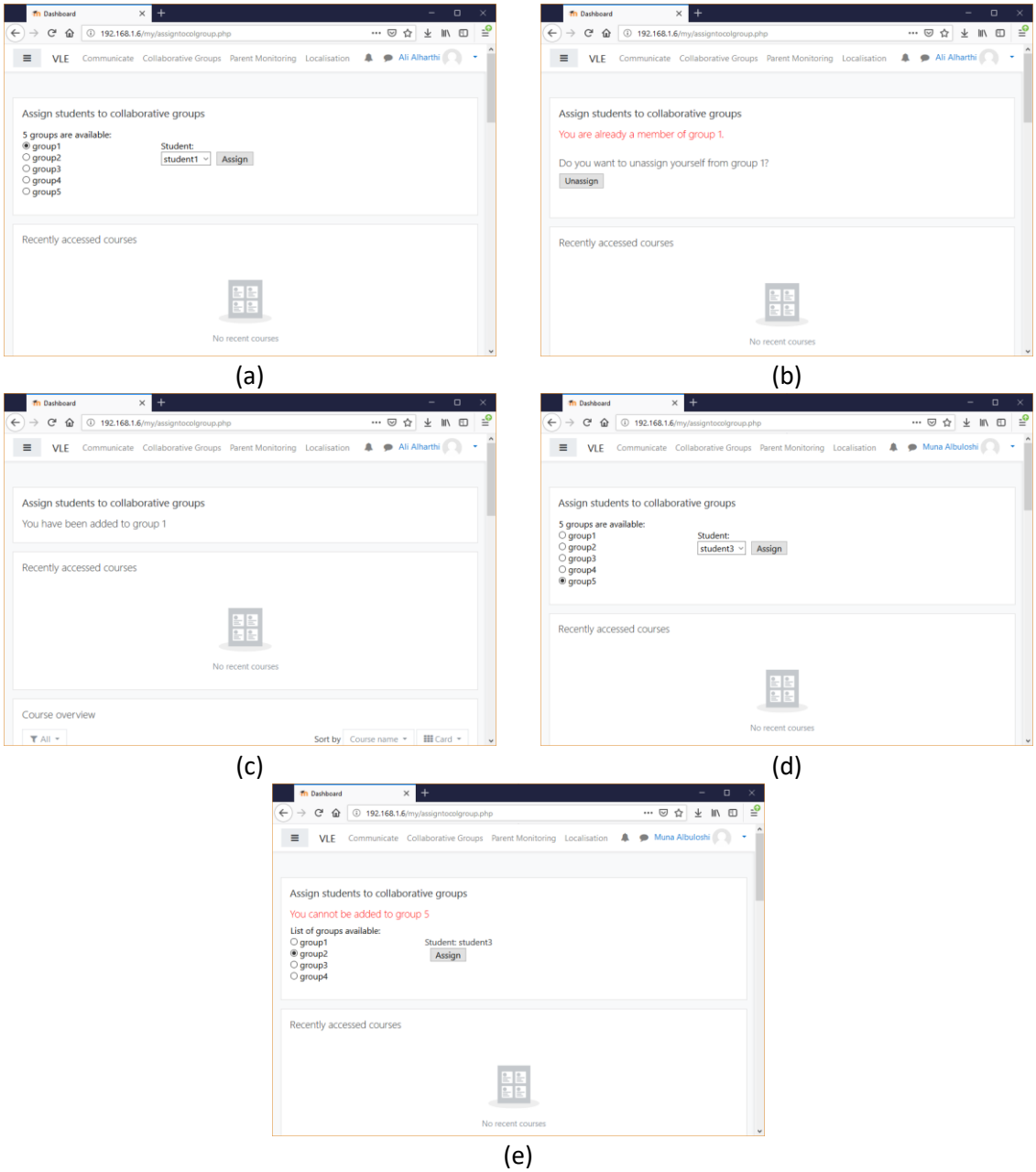


Figure 9.13: Screenshots of implementing scenario 3, "collaborative group gender composition (student role)".

9.2.4.4. Logging User's Transactions

It is intended for the proposed CBCVLE that all transactions and activities of users are strictly saved into a database for future use for parents monitoring. Figure 9.14 demonstrates how detailed transactions of users and activities are stored and retrieved from a database.

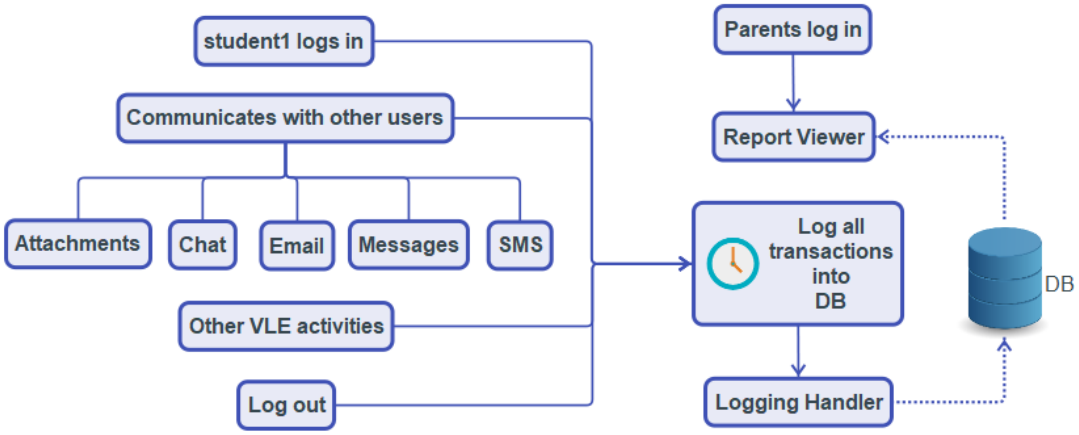


Figure 9.14: Scenario 4 - enabling logging user's detailed transactions and activities for parents monitoring.

9.2.4.5. Parents Monitoring

This scenario as displayed in Figure 9.15 shows an option for parents to monitor their son's/daughter's transactions and activities over the VLE tools. If a parent had not obtained prior consent, they can request it. The intended student has a choice of either to accepting or to rejecting it. Once a consent is given to parents, they can have access to view all the previously logged records stored into the database. If the student does not provide the consent, parents are informed about their rejected requests for monitoring.

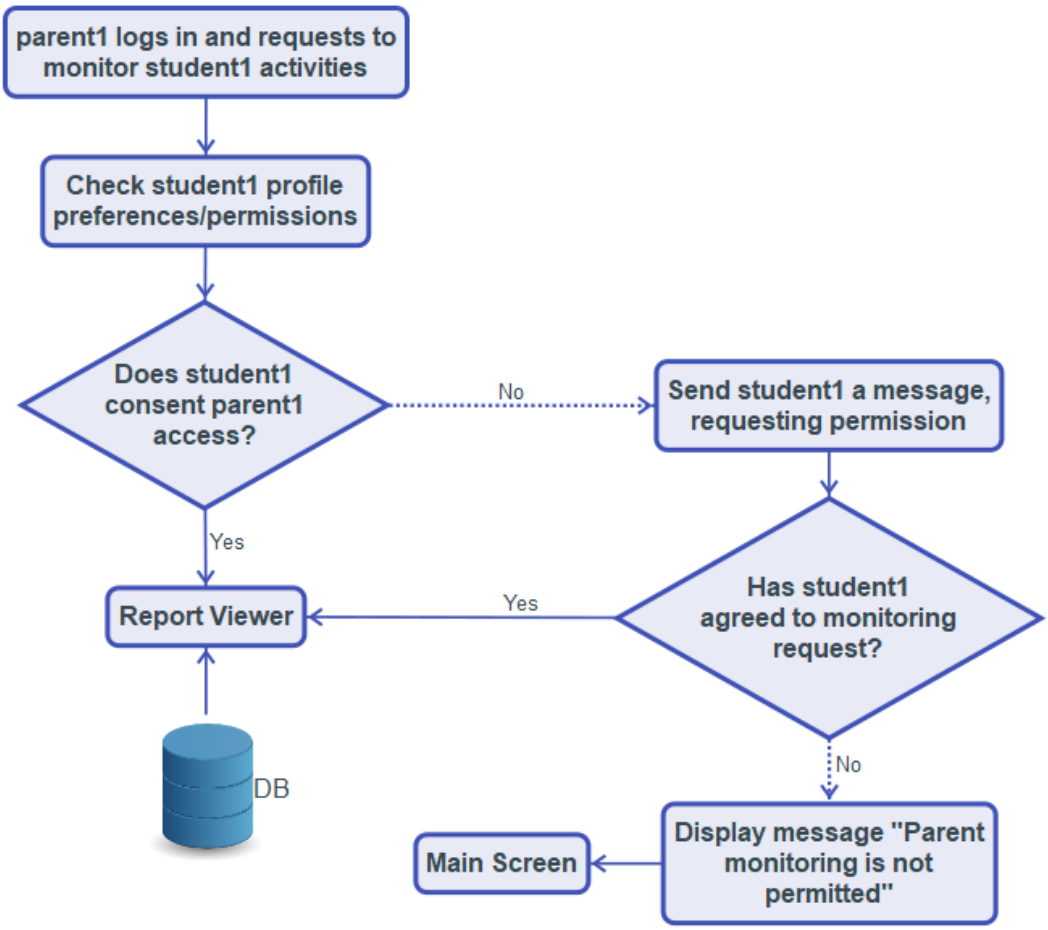


Figure 9.15: Scenario 5 - parents monitoring of student's activities and events.

Figure 9.16 shows some screenshots that illustrate the functionality of scenario 5 including some system's responses and messages which are displayed to the user.

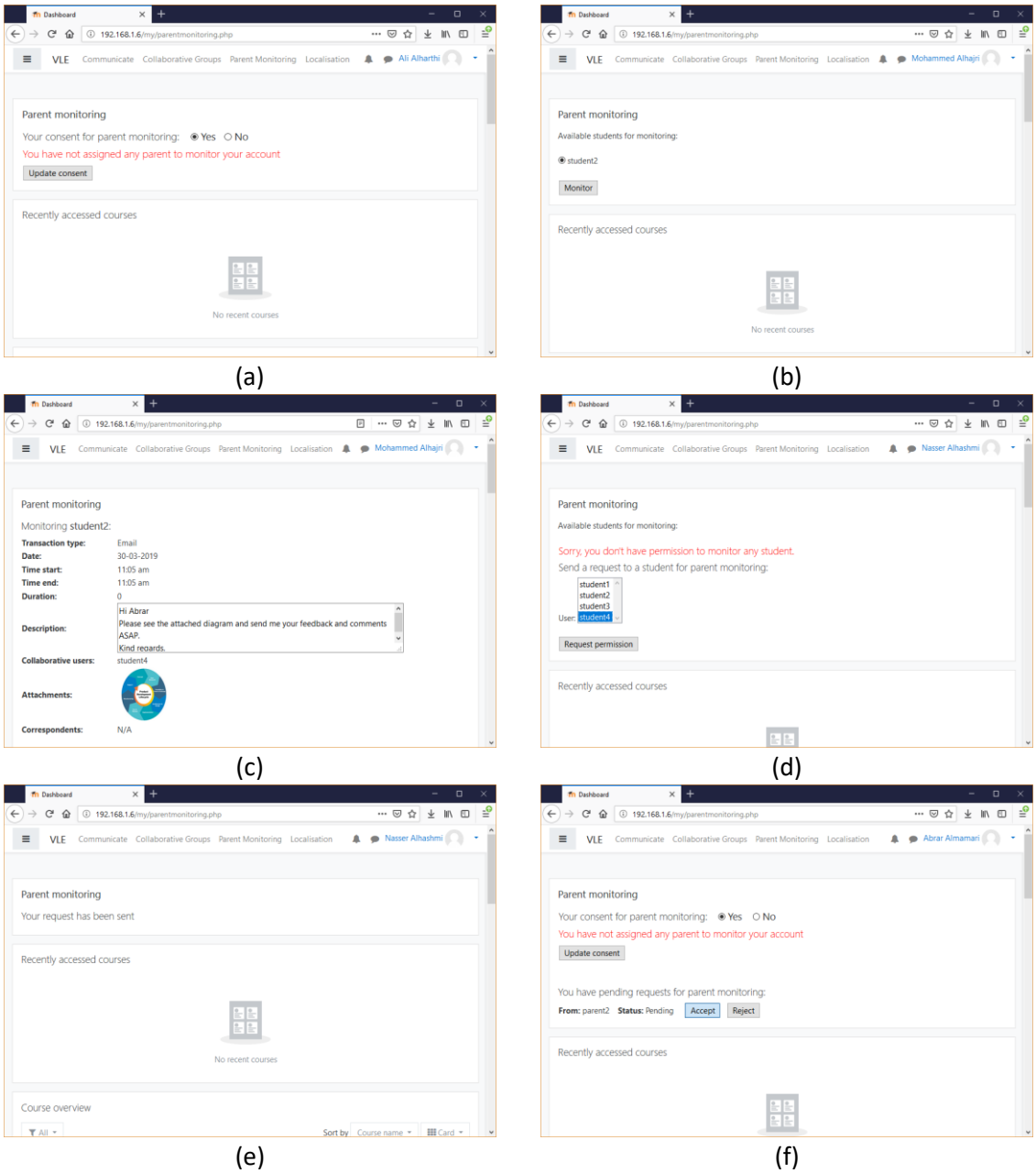


Figure 9.16: Screenshots of implementing scenario 5 "parents monitoring".

9.2.4.6. Localisation

Figure 9.17 demonstrates how users are provided with options to select the way of presenting content and communicating within VLE tools. The user has two options; native or localised versions including tools and apps, educational materials, and communications. The default option in the proposed prototype, which is set to "Localised", unless it is changed by the user.

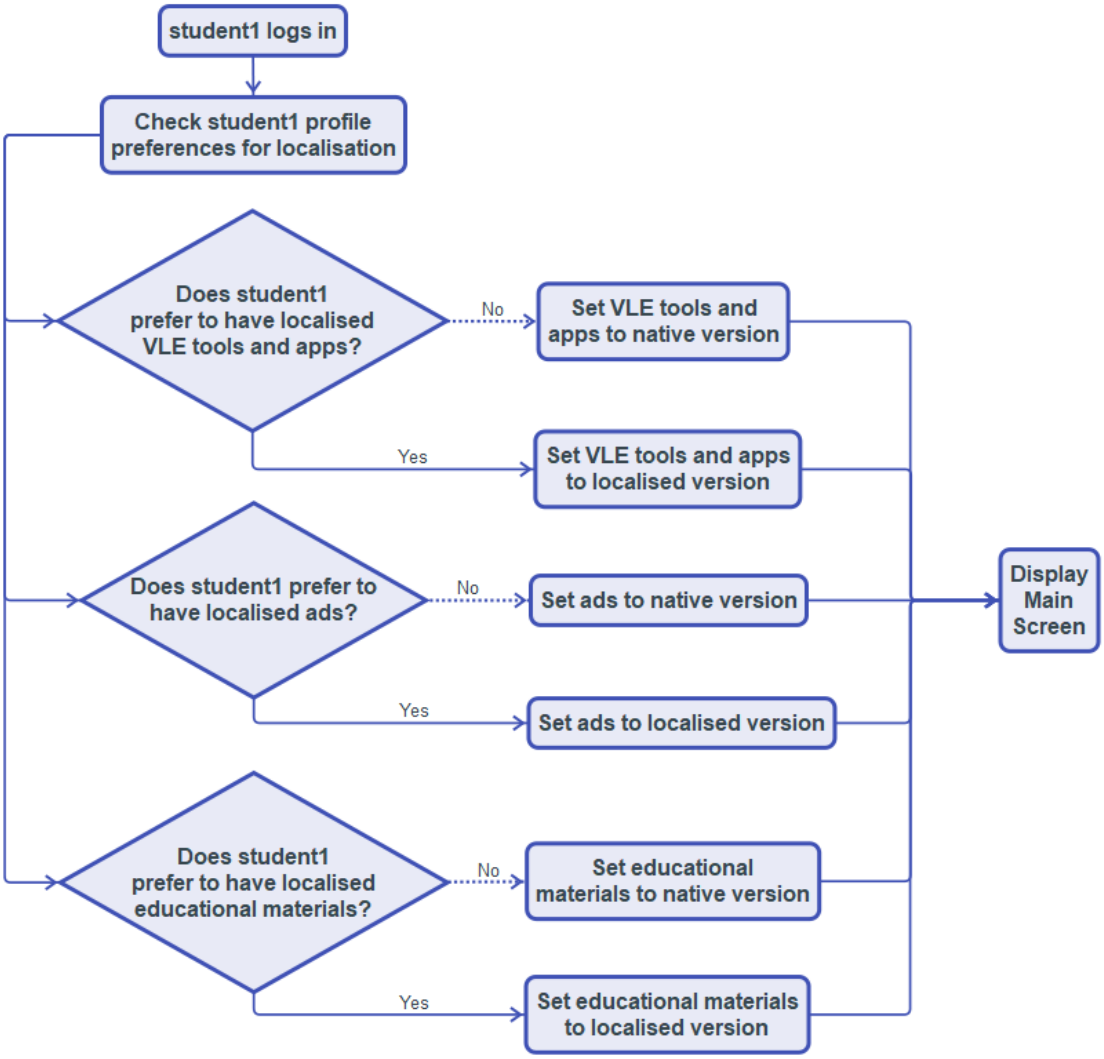
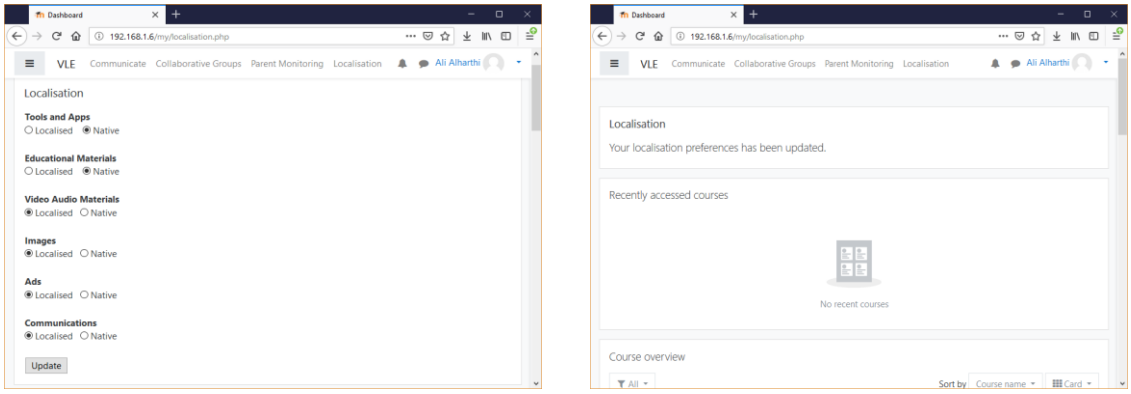


Figure 9.17: Scenario 6 - localisation of VLE tools, ads and educational materials.

Figure 9.18 shows some screenshots that illustrate the functionality of scenario 6 which includes some system's responses and messages displayed to the user.



(a) (b)

Figure 9.18: Screenshots of implementing scenario 6 “localisation”.

9.3 LIMITATIONS

The main scope of work of the prototype was to illustrate how some issues can be tackled and resolved within VLE tools. However, several aspects were not taken into consideration within the prototype such as:

- Design modification of the VLE tools (Moodle).
- Design aspects.
- Design or development of built-in collaborative tools (Moodle).
- Usability.
- Users’ expectations of features.
- Targeting users’ experience.
- Compatibility with mobile devices.

9.4 CHAPTER SUMMARY

The chapter outlined the prototype development which was demonstrated through a web based VLE package (Moodle). The ordinary user profile was extended to include features to meet user’s local culture. The prototype proved the ease of customising an open source VLE tool which can be massively upgraded to meet the requirements of both users and HEIs. Parent monitoring was proposed to contribute as a motive for improved utilisation of a CBCVLE. Localisation of content and VLE tools were also recommended as well as the preferences relating to gender which would facilitate more use and acceptance of a CBCVLE. The prototype is evaluated alongside with the framework (see Chapter 10).

CHAPTER 10: EVALUATION OF FRAMEWORK AND PROTOTYPE

This chapter focuses on the evaluation of the proposed framework and its associated prototype. A questionnaire is developed to gather participants' views on the framework, as well as the prototype.

10.1 INTRODUCTION

This evaluation was developed to assess the proposed framework for a CBCVLE. According to Straub (1989) and Sperber (2004), the validation (evaluation) process is crucial to research. Hammersley (2008, p.44) argues that "*validity is singular not multiple; it concerns whether the findings or conclusions of a study are true*". The validity differs upon the nature of research methods used and the related findings (Hammersley 2008). Therefore, may be noted that the researcher can judge these conditions and corresponds accordingly to select the most appropriate assessment. However, the presence of assessment methods in a research does not assure its validity of findings while the absence of such methods does not imply the invalidity of the findings (Hammersley 2008).

This stage of research considers three main steps including preparation, implementation and interpretation. These steps also can be subsequently extended to include: (1) development of a conceptual model of the research outcomes, (2) creating evaluation questions, (3) development of evaluation design, (4) data collection, and (5) data analysis and presentation (Brown University, 2019). A questionnaire is used for this evaluation.

10.2 THEORETICAL TESTING OF THE FRAMEWORK

The elements which were incorporated in the prototype are tested. However, the relationships between the remaining elements are tested theoretically. This section provides insights on the relationships between the elements of the framework to indicate their validity and importance.

ICT infrastructure and services were found to have a great impact over the users' experience and expectations. For example, with a low speed Internet in campus, users may avoid using VLE tools, and also the same applies when users lack sufficient Internet connectivity outside campuses. In addition, lack of training and technical support would distract users from utilising their VLE tools. Furthermore, users may seek alternatives once they are not confident about their respected VLE tools.

In regard to operational environment, the more challenges and concerns in collaborative VLE, the more users' experience is affected. Security concerns, for example, if not taken into consideration, the VLE tools will be accompanied by fears which deter users from utilising these tools. This would establish a barrier that may result badly in the users' experience in terms of the use of collaborative VLEs. Another example is the collaboration between HEIs in terms of VLE whereas policies are not supportive to maintain a sustainable collaboration. In this situation, users may lose confidence in their official VLE tools which subsequently results in discontinuing using VLE or seeking alternatives. Most of challenges and concerns that relate to operational environment may result in users' dissatisfaction which also negatively contributes to decrease or even eliminate their intention to use VLE tools.

Regarding the factors affecting the users' acceptance, a set of incentives was found to have a positive impact over users' experience. HEIs capacity in term of ICT and human resources would encourage users to develop positive expectations with which their intention to use VLE tools is assured. Moreover, HEIs would promote the certainty among users with new technologies to assure and enhance the users' experience.

Cultural influences were found to have extreme relationships over the users' experience and expectations. Gender, for instance, is potentially affecting communications over collaborative VLE tools especially in Omani society. Assigning members of collaborative groups are also affected by gender whereas female students for example normally avoid being assigned to mixed gender groups. This was found to be linked to religion and local customs and traditions.

As stated by this research, Moodle was found more feasible for implementing this framework due to its technical nature and capabilities to serve educational activities and to accept ever changing requirements. Moodle is open source VLE tools which can be easily modified and customised to meet any technical requirement. Therefore, the proposed configurations can be applied and implemented easily in Moodle by modifying the source code. In addition, Moodle as a VLE package can be accessed through its free mobile application which would facilitate a wide access to users through mobile devices. The size of screen was emphasised by participants (users in HEIs) to be a reason among others to prefer accessing VLEs through their desktops and laptops. Although this may be applied to Moodle to some extent as well as to other VLE packages, suitable educational materials such as video can extensively be adopted due to its popularity, interoperability and compatibility. Furthermore, Moodle requires a minimal amount of ICT resources to be implemented compared to closed source VLE packages. Financially, Moodle can be beneficial in terms of the cost of licenses and the hardware required for implementing such solution.

Some aspects (e. g. design aspects and usability) were not considered in the prototype but they are exist in Moodle which can easily be customised and upgraded by incorporating add-ons modules to support ever changing requirements. However, managing technical factors (e.g. Internet connection and compatibility with mobile devices) may help to facilitate a stable implementation of Moodle as well as consistent utilisation. Further, it should be noted that there is no apparent limitation which may prevent the implementation of the prototype into Moodle. Hence, it is a matter of programming to adopt any new ideas into VLE tools. Also, Moodle can be adapted to make any desirable configuration required to meet the HEIs' needs either included in the framework or as an extension to it. For example, collaboration could include a wide range of options as stated by the framework. Overall, implementing the proposed solution through Moodle including the framework as a whole is possible when applicable.

10.3 PURPOSE AND OBJECTIVES OF THE EVALUATION

The purpose of this evaluation is to validate each of the following: the framework, its main elements and sub-elements, the associated issues and relationships, and finally the prototype. Upon the development of this evaluation it was intended to fulfil the following objectives:

1. Evaluate the overall **relevance** of elements and sub-elements within the proposed framework for a CBCVLE.
2. Evaluate the overall **appropriateness of the relationships** of elements and sub-elements within the proposed framework for a CBCVLE.
3. Evaluate the overall **consistency of the relationships** of elements and sub-elements within the proposed framework for a CBCVLE.
4. Evaluate the overall **usefulness** of the proposed framework for a CBCVLE.
5. Evaluate the overall **effectiveness** of the proposed framework for a CBCVLE.
6. Evaluate the overall **coherence** of the proposed framework for a CBCVLE.
7. Evaluate **how well** the **prototype resolves** some **cultural influences** that would otherwise deter use of a CBCVLE.
8. Evaluate the overall **effectiveness** of the **prototype**.
9. Revise the framework based on **suggestions** and **issues** offered by users and apply them where applicable.

10.4 PROCESS

The questionnaire was translated into Arabic to allow participants to navigate through the instructions and questions in both English and Arabic. According to Sperber (2004), translation of a research instrument is recommended for transforming it cross-culturally. Hence, an Arabic translation of the questionnaire was provided side by side with English. According to Sperber (2004), the translation of an instrument into a foreign language could compromise the validity of the research. However, the translation in the context of this evaluation was only for the questions and instructions. It was ultimately difficult to translate the framework document including all the diagrams.

The questionnaire was administered using "SmartSurvey" (Smartsurvey 2016), a commercial statistical software package which was used to publish the questionnaire online. The questionnaire was accessible between Mid-March and End-April 2019. The SSP provides a user-friendly interface and the platform is compatible with most devices.

A separate document containing details and diagrams regarding the framework was also published and a link to this document was made available within the questionnaire. A video clip demonstrating the prototype was also made available via YouTube.

The questionnaire contained three sections. The first section covered personal information such as occupation, qualification, gender, age group and name of institution. In the second section (framework), participants were required to provide their views about the framework by responding to 8 questions. In the third section (prototype), participants were asked to watch a short video clip demonstrating the prototype and answer the three questions in this section.

The questionnaire was piloted using four academics to identify any possible errors or statements which may require further clarification. Some comments and feedback were received, and the questionnaire was corrected accordingly.

Invitations were sent to the expected participants through Emails and WhatsApp messages to request them to participate in the evaluation. Some clarification and confirmation of completion of the questionnaire were received via Email and WhatsApp messages. The confidentially of participants' information was treated carefully as their identity was anonymous.

10.5 METHODOLOGY

A mixed method survey (questionnaire) was developed to validate the proposed framework and its associated prototype following the University's ethics procedures. An introduction was provided to participants highlighting some information about the questionnaire and the purpose of this evaluation. Brief details about the framework and the prototype were also stated. Participants were given the email and WhatsApp ID of the researcher for any clarification required concerning any part of the evaluation.

The questionnaire (see Appendix 8) was divided into three sections: Section A intended to obtain information about the participants' demographic characteristics including occupation, qualification, gender, age group, and institution (optional).

Section B focused on the framework and included eight items as follows:

1. rating the relevance of the five main elements included in the framework in regard to increasing the use of a CBCVLE, particularly in respect to Oman.
2. rating the appropriateness of the relationships between sub-elements and the five main elements included in the framework.
3. rating the consistency of the relationships shown between sub-elements and the five main elements included in the framework.
4. suggesting any missing relationship between sub-elements (including problems and views presented in the figures) that would help to improve the framework.
5. Rating the extent to which the framework would encourage HEIs in Oman to utilise CBCVLEs to the full potential.
6. Rating the extent to which the framework would aid HEIs to mitigate the effects that may limit the use and acceptance of a CBCVLE.
7. Rating the extent to which the framework reflects challenges/issues that may affect the use and acceptance of a CBCVLE.
8. asking for comments or missing aspects which participants would consider important to be included in the framework as well as any changes and suggestions.

Section C discussed the prototype (see Chapter 9) and comprised of three questions as follows:

1. Rating the main four aspects of the prototype concerning some of the cultural influences that may encourage utilisation of a CBCVLE.
2. Rating the extent to which the features implemented in the prototype would aid potential users to accept and use a CBCVLE.

3. asking for comments or missing aspects which the participants would consider important to be included in the prototype from a cultural perspective as well as any changes and suggestions.

Apart from Likert-type scale questions, the questionnaire incorporated three open-ended questions to allow the participants to indicate more issues and comments about the framework and the prototype. Additionally, at the bottom of every Likert scale question, participants were asked to provide reasons for their negative rating such as "*Disagree*" or "*Strongly Disagree*".

10.6 PARTICIPANTS (DEMOGRAPHIC PROFILE)

In respect of the evaluation, it was planned that the participants for the questionnaire to include Faculty members, students, admins/technicians, and parents. In total 42 requests were sent to participants inviting them to provide their feedback and comments. The intention was to have representatives from a diverse range of audience covering all types of HEIs (public, private, University, College), different types of qualifications (PhD, Masters, Bachelor/University-College Degree, High School Diploma), age (18 to 60), and gender (Male and Female). Participants also were selected to represent various cities and governorates in Oman to guarantee participations from culturally different regions. It was intended to have more faculty members as it was anticipated that these users have more experience in research methodologies.

Generally, the evaluation questionnaire employed a selective sample. This is supported by Saumure and Given (2008) who indicate that researchers are reluctant to employ a random sample to avoid repeating a similar input or to count irrelevant responses. Moreover, and due to the sensitivity of research materials that are intended to be viewed by validators, participants were not randomly selected, therefore, the sample size of normal questionnaires could not be applied in the context of this validation study.

Additionally, and based on the nature of this questionnaire, the outcome will not be used for generalising the results to the entire population, and instead it was only planned to contribute to the modification of the framework and the prototype wherever necessary.

There were only 69% (29) of the total number of responses returned fully completed. Figure 10.1 shows the composition of the participants who responded to all questions of the questionnaire. Most of the participants were faculty members, followed by parents,

admins/technicians and students respectively (see Figure 10.1). Regarding qualifications, most of the respondents were holding Masters degrees (34.5%) followed by PhD and Bachelor/University-College Degree (27.6% for each) while the remaining participants (10.3%) had High School Diploma. With regards to the age, the highest age group of participants were between 35 and 44 years old followed by the age group 45-60 as shown in Figure 10.1.

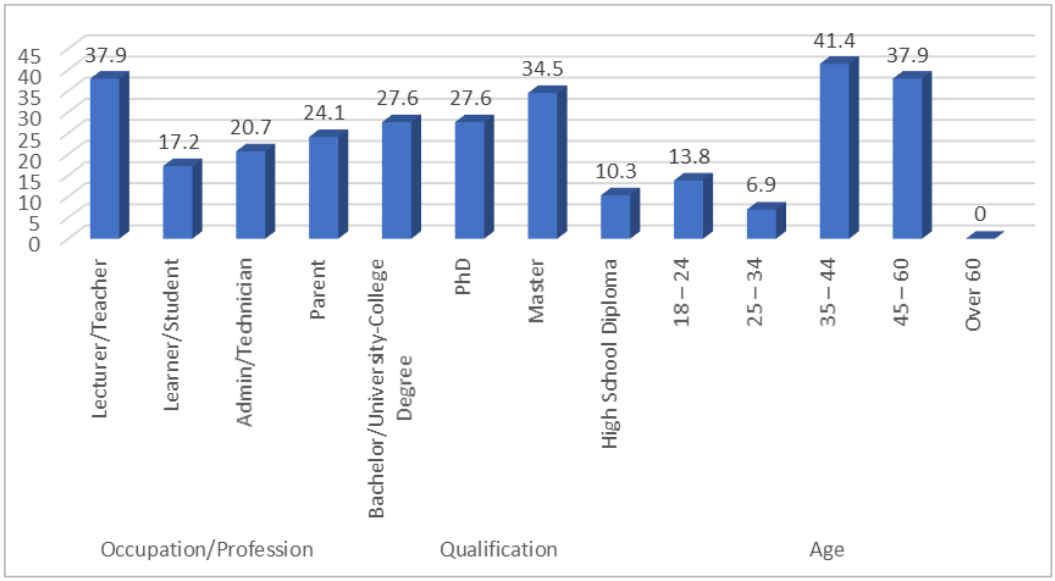


Figure 10.1: Demographic profile of participants.

10.7 ANALYSIS

Calculation and interpretation of Cronbach's Alpha (Peterson 1994) (Reliability Test) was done using SPSS for sections B and C of the questionnaire. The distribution of the collected data was generally normal. The recorded Cronbach's Alpha values ranged between 0.824 and 0.973 which are considered as acceptable values in this measure and participants were highly consistent within groups, and therefore, other tests and measures can be performed for this dataset.

SPSS and Excel software were utilised to analyse quantitative data gathered by the questionnaire. Charts are produced to present the results in a graphical form. Descriptive statistics were used to determine how validators rated every question or statement.

The Median values were calculated for Likert-type scale questions (B:1, B:2, B:3, B:5, B:6, B:7, C:1 and C:2) which produce ordinal data. According to Laerd (2017) and Quickmba (2017), the Median is the most suitable for this type of data.

Cross-tabulation method which is best used for non-experimental quantitative (categorical) data (Hellevik 1984) was employed to analyse the results. Independent variables are used for

categorising study groups while dependent variables are compared to illustrate proportions. The outcome of this evaluation is discussed in the section 10.8.

10.8 EVALUATION RESULTS

The Mean and Median scores were calculated for every Likert-type scale question. As shown in Table 10.1, the Median scores were all far high above the average as well as the Mean values which indicates a positively good response to the questions.

Section: Question	Mean	Median
B: 1	4.43	4.8
B: 2	4.48	4.8
B: 3	4.47	5
B: 5	4.52	4
B: 6	4.24	4
B: 7	4.55	5
C: 1	4.38	4.5
C: 2	4.31	4

Table 10.1: Results of statistical analysis.

10.8.1 FRAMEWORK

This section provides an analysis of the responses from the participants regarding the relevance of the five main elements in respect of appropriateness and consistency of the relationships. It also discusses the results in terms of the usefulness, effectiveness, impact and the coherence within the framework.

10.8.1.1. Relevance of the Main Elements of Framework

The participants were asked, "*Please rate the relevance of the five main elements included in the framework in regard to increasing the use of a cloud-based collaborative VLE, particularly in respect to Oman.?*". Most of the responses were positive which was shown by the selection of the options of "*Very Relevant*" and "*Relevant*" for all elements of the framework.

In total, the scores for "*Very Relevant*" and "*Relevant*" for all of the five elements were 93.1%, 89.7%, 89.6%, 93.1% and 82.7% respectively. The option "*Not Relevant*" received no response

for all the elements while very few of the evaluators indicated "*Less Relevant*" (between 3.4% and 6.9%)(see Figure 10.2). Overall, these results indicate that the elements used in the framework are extremely relevant.

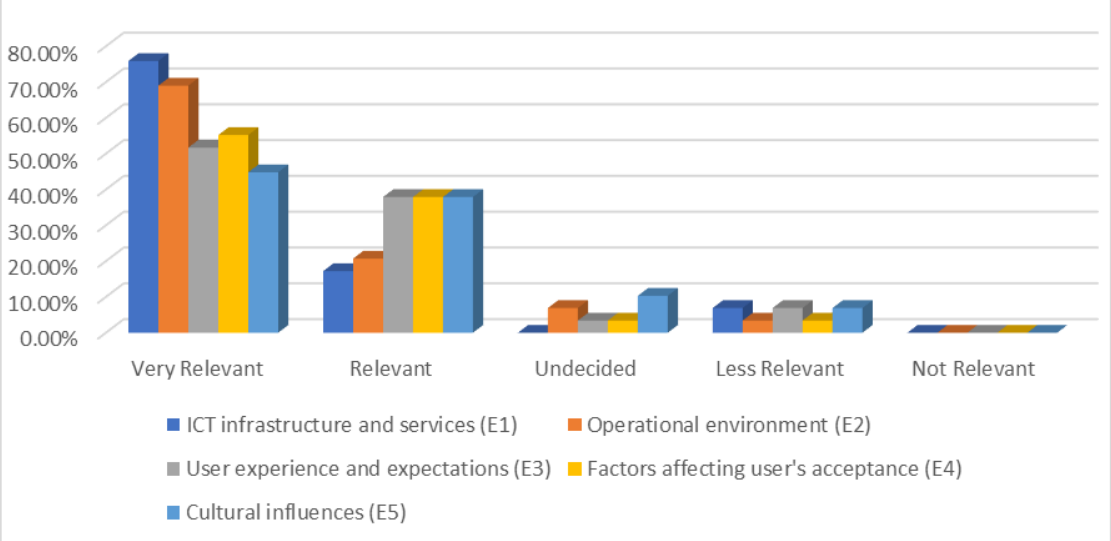


Figure 10.2: Participants responses to the relevance of the main elements of framework.

10.8.1.2. Appropriateness of the Relationships of the Main Elements of Framework

To gather the evaluators views about the appropriateness of the proposed framework, participants were asked "*Referring to figures 3 – 7, to what extent do you agree on the appropriateness of the relationships between sub-elements within the five main elements included in the framework.*" (see Figure 8.4, Figure 8.5, Figure 8.7, Figure 8.9 and Figure 8.10). The vast majority of the responses were positive.

As shown in Figure 10.3, the average scores received of the participants answered for all of the five elements for "*Very Appropriate*" and "*Appropriate*" were 96.5%, 96.5%, 89.7%, 93.1% and 82.7% respectively. The option "*Not Appropriate*" had no response for all elements while very small number of the evaluators said "*Less Appropriate*" (3.4% except for E3 and E4). This gives an indication that the elements used in the framework are appropriate for its purpose.

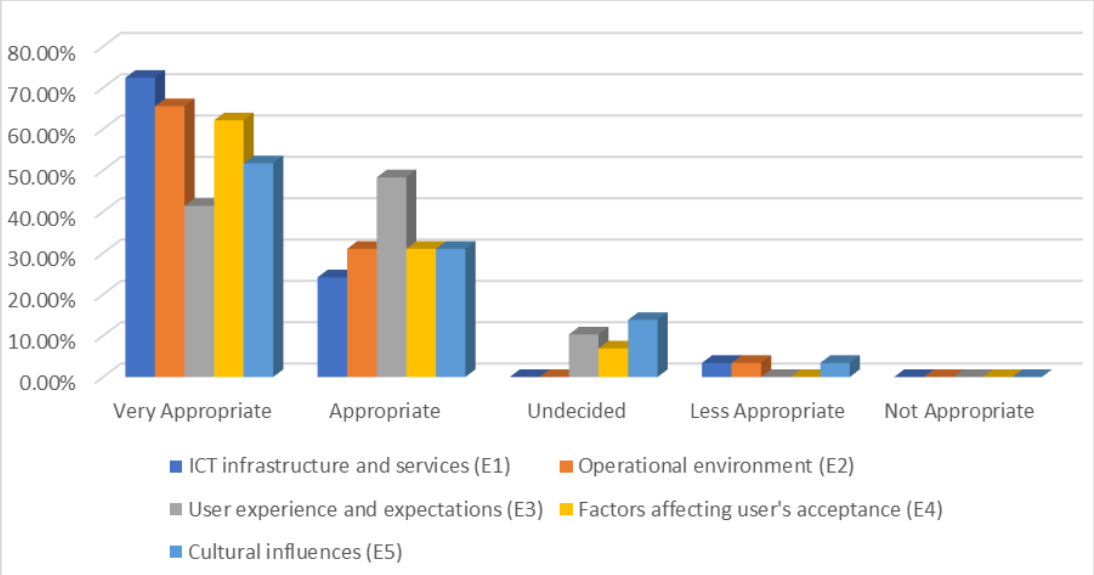


Figure 10.3: Participants responses for the appropriateness of the relationships between elements of framework.

10.8.1.3. Consistency of the Relationships of the Main Elements of Framework

To check the consistency of the relationships of the elements and sub-elements proposed in the framework, evaluators were questioned, "*Referring to figures 3 – 7, please comment on the consistency of the relationships shown between sub-elements within the five main elements included in the framework.*" (see Figure 8.4, Figure 8.5, Figure 8.7, Figure 8.9 and Figure 8.10). The majority of the responses were positive for all the elements in the framework.

As shown in Figure 10.4, the total of the participants answered "*Very Consistent*" and "*Consistent*" were 96.5%, 96.6%, 93.1%, 93.1% and 86.2% for all of the five elements respectively. The option "*Not Consistent*" received no response for all elements except for cultural influences (3.4%) while just a few of the evaluators said "*Less Consistent*" (3.4% except for E4). This question is crucial whereas responses prove that the relationships in the framework are consistent.

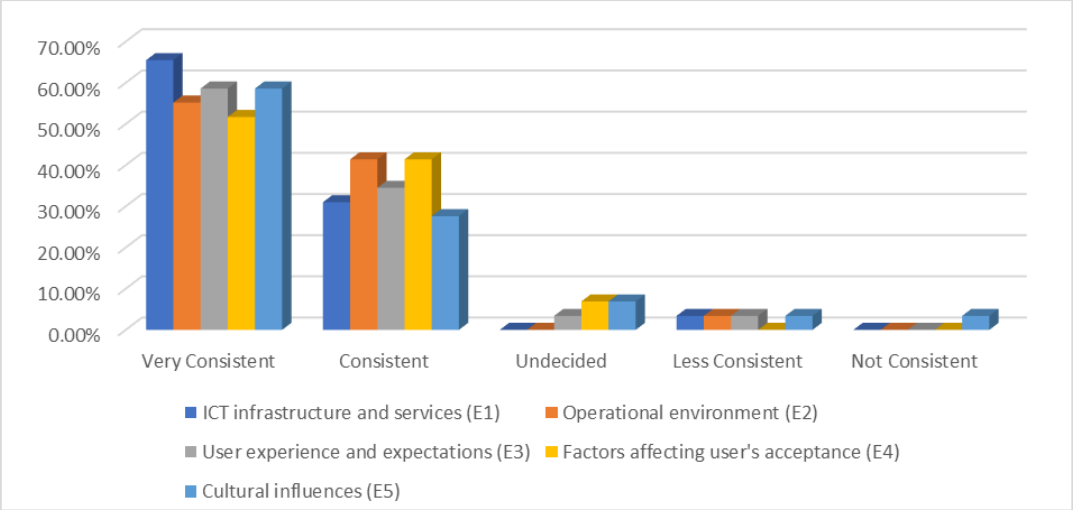


Figure 10.4: Participants responses for the consistency of the relationships of the main elements of framework.

10.8.1.4. Usefulness of the Framework

To check the usefulness of the framework, participants were asked, "*To what extent do you agree that this framework would encourage HEIs in Oman to utilise cloud-based collaborative VLEs to the full potential?*" Nearly all the participants (89.7%) answered "*Strongly Agree*" and "*Agree*", and the remaining were "*Undecided*" (10.3%). None of the participants negatively ("*Disagree*" or "*Strongly Disagree*") responded to this question (see Figure 10.5). This result highlights the usefulness of the framework which would encourage HEIs in Oman to utilise cloud-based collaborative VLEs to the full potential.

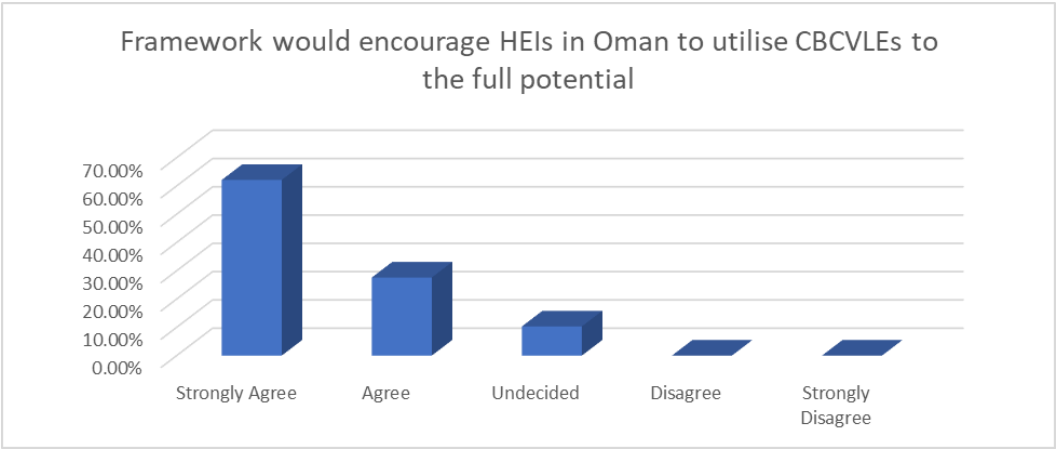


Figure 10.5: Participants responses for the usefulness of the framework.

10.8.1.5. Effectiveness/Impact of the Framework

To get the participants' views on the effectiveness and impact of the Framework, participants were asked, "*Overall, to what extent do you agree that the framework would aid HEIs to*

mitigate the effects that may limit the use and acceptance of a cloud-based collaborative VLE?". As illustrated in Figure 10.6, a high number of the participants (89.6%) answered "*Strongly Agree*" and "*Agree*" except those who were "*Undecided*" (6.9%). None of the participants selected "*Strongly Disagree*", however, a minority of 3.4% responded negatively and infrequently to this question. This shows that the majority of the participants found the framework to be effective and can improve the use of a CBCVLE.

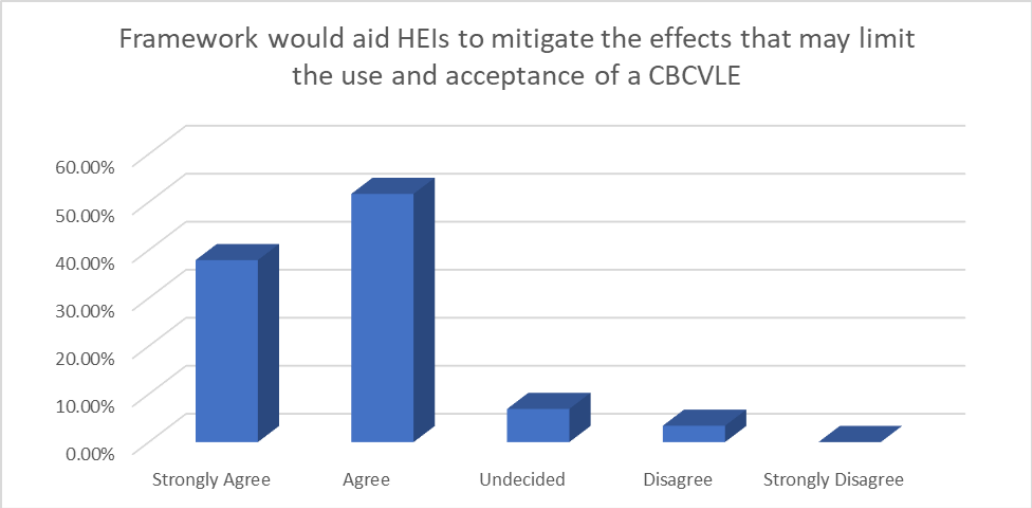


Figure 10.6: Participants responses for the effectiveness of the framework.

10.8.1.6. Coherence of the Framework

To check the coherence of the Framework, the participants were questioned, "*Overall, to what extent do you agree that the framework reflects the challenges/issues that may affect the use and acceptance of a cloud-based collaborative VLE?*". All the respondents (100%), as shown in Figure 10.7, answered "*Strongly Agree*" (55.2%) and "*Agree*" (44.8%). None of the participants had a negative view regarding this question nor they were "*Undecided*". This result reflects that the framework is comprehensive, and it covers most of the issues relating to the context of this research.

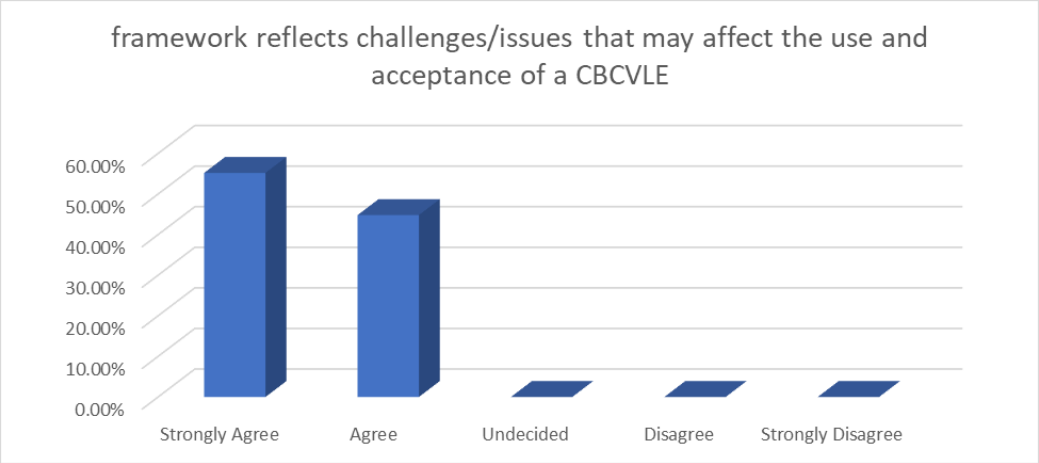


Figure 10.7: Participants responses for the coherence of the framework.

10.8.2 PROTOTYPE

This section provides an analysis of participants' responses regarding how well the prototype resolves cultural influences that would otherwise deter use of a CBCVLE. It also discusses the results in terms of the effectiveness of the prototype.

10.8.2.1. Cultural Influences

To gather the views about the importance of the prototype, participants were questioned, "*Please rate the following aspects of the prototype concerning some of the cultural influences that may encourage utilisation of a cloud-based collaborative VLE.*". Most of the responses were positive as shown in Figure 10.8.

The total scores for "*Very Important*" and "*Important*" were 75.9%, 93.1%, 93.1% and 89.6% for all of the four aspects respectively. The option "*Not Important*" received no response for all aspects, and similarly none of them selected "*Less Important*" except for the second aspect (3.4%)(see Figure 10.8). Overall, these results show that only one participant rated one out of the four aspects negatively which in general indicate the importance of all aspects ultimately.

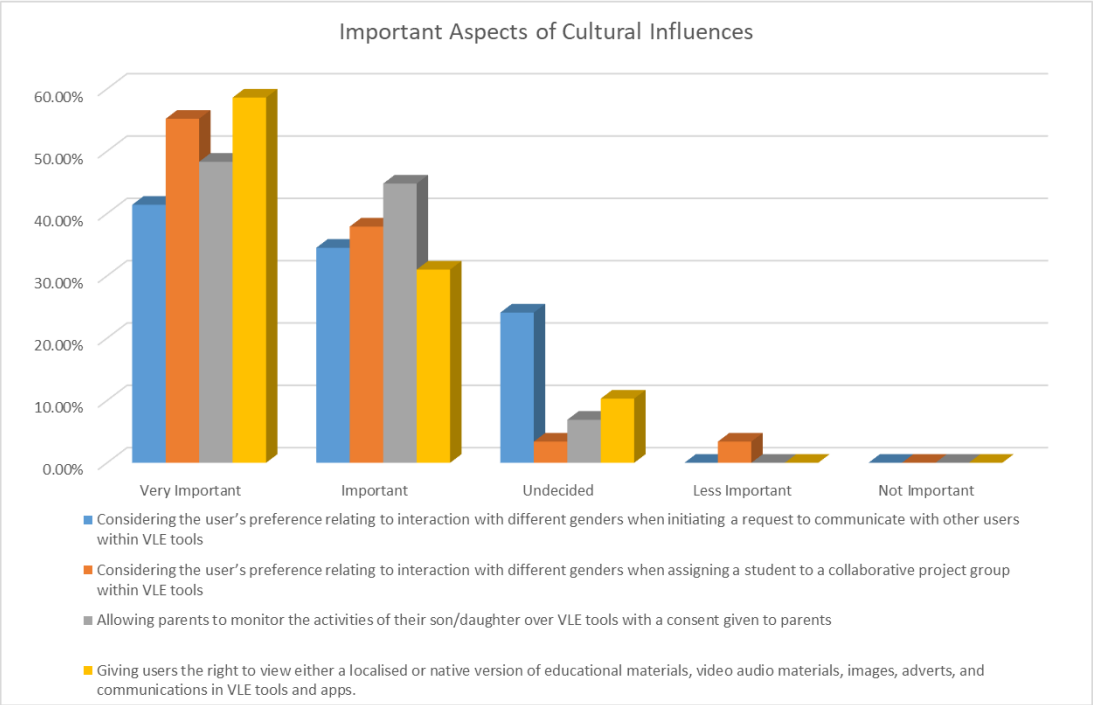


Figure 10.8: Participants rating important aspects of cultural influences.

10.8.2.2. Effectiveness of the Prototype

To get the views on the effectiveness/impact of the prototype, participants were asked, "*Overall, to what extent do you agree that the features implemented in the prototype would aid potential users to accept and use a cloud-based collaborative VLE?*"

Almost all the participants answered "*Strongly Agree*" and "*Agree*" (average scores 96.6%), and the remaining were "*Undecided*" (3.4%). None of the participants responded ("*Disagree*" or "*Strongly Disagree*") to this question (see Figure 10.9). This result highlights the participants view in terms of the effectiveness of the prototype which would improve the use and acceptance of a CBCVLE.

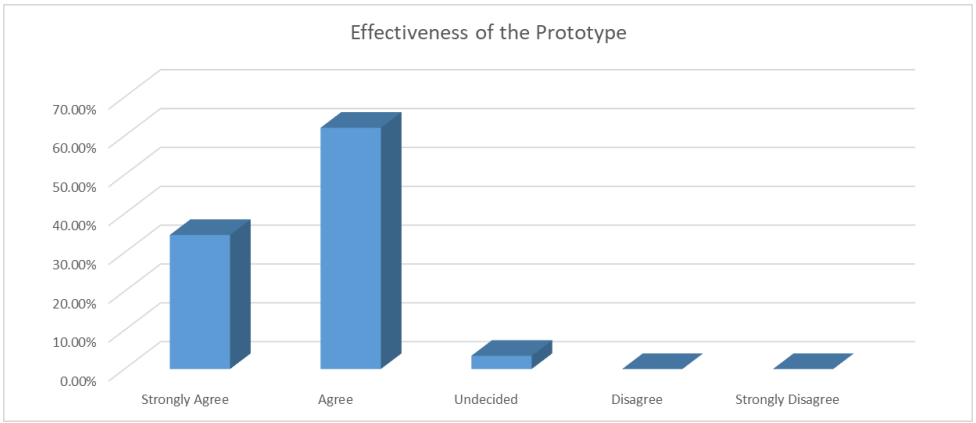


Figure 10.9: Participants responses for effectiveness of the prototype.

10.9 OVERALL SUGGESTIONS AND ISSUES REFLECTED BY PARTICIPANTS

Participants were asked three open-ended questions (see questions B:4, B:8 and C:3 in Appendix 8) to provide any suggestion for improvement or even to remind the researcher of any issue missed within the framework or the prototype. Overall, very few responded to these questions. Their responses were too broad and mostly irrelevant to the questions. However, this indicates that there were neither critical issues suggested nor identified by the evaluators.

10.10 OVERALL REFLECTION

The results showed that there are no significant differences between all respondents of any group/category including occupation, qualification or age. Additionally, only very few participants contacted the researcher for clarifications, and hence, this indicates that most respondents have understood the questionnaire including related document and video clip. The overall response to all question was quite positive which indicates a high agreement and satisfactory views of participants to all items of the evaluation.

10.11 MODIFICATION TO THE FRAMEWORK

As described in the results section in this chapter, none of the evaluators have pointed out critical suggestion to modify or improve the framework and the prototype. Therefore, no modification was applied either to the framework or to the prototype.

10.12 CHAPTER SUMMARY

This chapter provided insights from participants' views regarding the proposed framework and the prototype. A questionnaire which included mixed method questions was used to collect data. Although the sample population was small, it represented the actual population by including all potential users in HEIs as well as parents. The results confirmed that all participants regardless their occupation, qualification and age have agreed of the validity of the framework and the prototype. The prototype also has so far confirmed the effectiveness of the framework which may be used by HEIs in Oman, and also globally but with modifications whereas required.

CHAPTER 11: CONCLUSION AND FUTURE WORK

This chapter summarises the research findings and outcomes. The recommendations for future research are presented based on the study's findings. The research contributions to knowledge are outlined as well as the limitations and future work.

11.1 CONCLUSION

The aim of the study, as discussed in Chapter 1, was to develop a framework for a CBCVLE for HEIs in Oman and to provide guidelines to improve the use and acceptance of a CBCVLE. The framework illustrates the elements and associated relationships that may have effects on the use of a CBCVLE. This study has provided insights into understanding the issues and factors in terms of the utilisation of a CBCVLE. The study used a mixed-methods approach to collect data and to propose the structure for the framework. Various instruments were employed in this research including semi-structure interviews, questionnaire, and structured interviews.

The existing literature reviewed in this study provided the relevant knowledge base and background of the research. The topics reviewed included VLEs, collaborative VLE, cloud computing, HEIs, Oman, and culture which were extensively explored in chapters 2 and 3. It was found that many HEIs in Oman employ traditional VLE tools while cloud-based VLE tools are rarely used. Additionally, the traditional VLE tools are not extensively utilised by users to support their studies. Some users use them for uploading and downloading course materials. Therefore, this study focused on challenges and concerns that limit or even prohibit the use of a CBCVLE. Moreover, this study has aimed to disclose the influences of Omani culture upon utilising a CBCVLE. The use of cloud computing as a core element for hosting and running VLE tools would extend the capabilities and features (e.g. ease of access, elasticity, cost sharing, etc.) to go even beyond users' expectations. Although cloud computing technology provides very supporting communications, there are some issues concerning communication with opposite gender. These issues may conflict with users' national culture including religious instructions and customs and traditions. Therefore, users' prior experience would take precedence and a CBCVLE receive less use and acceptance.

The issues identified by reviewing the existing literature were grouped under five headings as follows: (1) ICT infrastructure and services, (2) operational environment, (3) user's experience and expectations, (4) factors affecting the use and acceptance, and (5) cultural influences. The thesis implemented a mixed-methods approach to investigate the related issues.

A preliminary study was conducted to direct the primary research for further investigations (see Chapter 4). Moodle, a free open source VLE package was found employed by the majority of HEIs in Oman. Moreover, the study confirmed the fact that some HEIs lack the financial resources to establish their own ICT infrastructure while some HEIs seem to have a very good ICT infrastructure including data centres and networks.

A survey (see Chapter 5) was conducted to investigate users' perception of a CBCVLE in universities and colleges in Oman. The survey which received 205 responses, focused on faculty members, students, researchers and administrators/technicians as the target audience. The aim of the survey was to explore key issues and the relationships between them in respect to the collaborative environment. Generally, the findings were discussed in relation to the relevant literature highlighting a set of contributing factors that support the use of a CBCVLE. The findings focused on (1) current ICT infrastructure and services of HEIs in Oman, (2) current use of cloud computing in HEIs in Oman, (3) collaborative environment in HEIs in Oman, and (4) potential features of CBCVLE. Users in HEIs have knowledge and have the experience and are happy to use their own mobile devices to access resources on the Internet. Additionally, the survey revealed that the current ICT infrastructure and services in some HEIs can be partially sufficient to start with. Moreover, the survey highlighted users' interests and willingness to move to the cloud. Personal devices such as mobile phones and tablets may facilitate the way for users to utilise a CBCVLE. Moodle was preferred by the majority of the participants. Users' experience was extremely as an important influence to support the utilisation of a CBCVLE.

Structured interviews were conducted by the researcher to receive in-depth responses of 38 participants including teachers, students and admins/technicians (see chapters 6 and 7). The purpose of the interviews was to explore the factors affecting the use and acceptance of a CBCVLE by users in HEIs in Oman and then to identify the areas that need consideration when employing such system. Five themes were identified to classify issues emerged within the analysis. The findings indicate a lack of sufficient ICT infrastructure and services. Collaborative VLEs in HEIs in Oman were examined and stated while factors that relate to HEIs were identified. Moreover, user's preferred devices for accessing VLE were highlighted. In regard to operational environment, a wide range of concerns and challenges were identified by participants. Various issues were found to have an impact on the use of VLE tools and collaborative environment.

In regard to user experience and expectations, participants highlighted issues that relate to intention to use, application of cloud computing in education, perceived benefits, user

satisfaction, and user's expectations. Factors affecting the use and acceptance of a CBCVLE were also highlighted and classified as motivators and deterrents. Both categories were explained and supported by examples from the participants points of views. Finally, cultural influences were identified and discussed to highlight their possible effects on the use and acceptance of a CBCVLE (see chapter 7). This is also confirmed by relevant literature (see Chapter 2).

The survey has uncovered many issues that can influence utilisation and acceptance of a CBCVLE. Cultural influences were found to be critical and vital to users, whereas local culture affects their thinking, attitude, and behaviour. It was clear from the findings that family, religion, language, customs and traditions, and gender can have a critical effect on the users' participation in collaborative projects. The collaborative environment can be influenced by communication between members to coordinate tasks. However, local culture may restrict such communication with the opposite gender as customs and traditions disallow it based on the local interpretation of religion. The survey brought to light the role of the local language for the use and acceptance of a CBCVLE. It was found that the use of the local language in the CBCVLE can improve the rate of its acceptance. Overall, cultural influences are considered by this study as being the most important challenges contributing to the use and acceptance of a CBCVLE.

Thus, from the findings of survey 1 and survey 2 and the literature a framework (see chapter 8) was devised to articulate the possible issues and factors that relate to the utilisation and the acceptance of a CBCVLE that can be improved. The proposed CBCVLE framework aims to improve VLE utilisation and collaborative activities between potential users. Recommendations are proposed for HEIs (see chapter 8) to help to mitigate the possible effects that may prevent or even limit the use of a CBCVLE. The potential issues were categorised into five main elements which form the structure of the framework. Each main element was divided into several sub-elements to articulate issues that relate to the "parent" element. Entities and associated relationships between sub-elements were illustrated and explained. Key aspects of the framework were prototyped (see chapter 9). The aim of the prototype was to implement some of the features proposed in the CBCVLE framework for the purpose of illustration and the proof of concept. The prototype incorporates two cultural influences; gender and language. The default user profile was extended to include features to meet user's local culture. The prototype proved the ease of customising an open source VLE tool which can be massively upgraded to meet the requirements of both users and HEIs. Parent monitoring was proposed to contribute as a motive for improved utilisation of a

CBCVLE. Localisation of content and VLE tools were also recommended as well as the preferences relating to gender which would facilitate more use and acceptance of a CBCVLE.

The framework and the prototype were evaluated by 29 participants from different HEIs in Oman (see chapter 10). The framework was found as a relevant, appropriate, useful, effective, and a reflective guide for HEIs to promote a successful utilisation of collaborative VLEs. The evaluators confirmed the consistent relationships between the elements of the framework including sub-elements. The evaluators' views reflected on the effectiveness of the framework to workout issues that can be managed by HEIs to increase the utilisation of a CBCVLE. The prototype was also found to be representative as it demonstrated how the identified cultural issues can be tackled in terms of considering cultural issues in the design and the implementation of a CBCVLE.

11.2 RECOMMENDATIONS

The role of the Government is very important which can contribute positively to the promotion of CBCVLEs. On the one hand, the ICT infrastructure and services including national backbone of Internet alongside with eliminating the knowledge gap between different regions of the country would facilitate and maintain a continuous utilisation of CBCVLEs. On the other hand, the national programs of ICT training organised by different entities of the Government would be considered ultimately crucial to the utilisation and acceptance of a CBCVLE. Moreover, it is recommended that the Government plays a coordination role in facilitating the way for HEIs to share a unified national network that enriches the experience of sharing resources and support collaboration. Further, it is also recommended that the Government facilitates the provision of a sufficient ICT infrastructure and services throughout the country not only for HEIs but also for all citizens in general.

As a mean of raising the awareness among users, HEIs may use social media such as Twitter, Facebook, WhatsApp, YouTube and Instagram to encourage knowledge sharing platforms. The existing ICT infrastructure (e.g. servers, web hosting, etc.) in some HEIs can be utilised and shared with other HEIs.

Users in HEIs should become fully aware of cloud features and services, collaborative tools, and the potential features of a CBCVLE. In addition, HEIs should provide sufficient training to their potential users covering the related areas and issues that may contribute to widening and enriching users' knowledge, skills and abilities towards the use of a CBCVLE.

It is important that the effect of continuance intention to use a CBCVLE is considered when designing such environment. The users' experience including satisfaction, intention to use,

expectations, etc. should be taken into consideration when designing online tools for an e-learning collaborative environment. In order to improve the users' confidence in using CBCVLEs, HEIs need to ensure the privacy of their users' data and reveal to them the ways how personal data are treated and protected by the institution.

Considering cultural influences when designing apps and tools for collaborative VLE is extremely important. Users are anticipated to have different cultural backgrounds and will respond differently. The proposed CBCVLE is ultimately equipped with the required features that meet the users' preferences concerning the language of VLE tools and course materials, and gender settings in terms of communicating with other users or participating in collaborative project groups. Families' views should be considered at all stages of the implementation and utilisation of a CBCVLE. Opportunities should be provided to parents and other family members to participate in training sessions and workshops to develop skills and experience in ICT. Generally, HEIs should be able to gauge the success of their VLEs in terms of use, acceptance, and collaboration.

Overall, the following list concludes a range of recommendations that may contribute to more utilisation and acceptance of a CBCVLE:

- Provision of training to users institutionally.
- Provision of appropriate ICT and mobile infrastructure including Internet connectivity.
- Provision of appropriate strategies for ICT developments.
- National strategy for Internet dissemination.
- Extending coverage of stable Wi-Fi within HEIs.
- Strategic and implementation plan for staff development.
- Continuous technical awareness provided for users in HEIs.
- Maintaining a continuous awareness program of ICT technologies including cloud computing to the public either by HEIs or by the Government across the country.
- Provision of adequate number of PCs in HEIs.
- Meeting the compatibility requirements of VLE tools with mobile devices.
- Establishment of a national consortium of HEIs for a CBCVLE.
- Developing collaborative strategy for CBCVLEs for individual HEIs or a group of HEIs.
- Replacement of traditional VLE tools by cloud-based tools and apps.
- Introducing new ever-developing free cloud-based collaborative tools and apps to users in HEIs.
- Maintaining a good user's experience to facilitate the way for the acceptance and the use of a CBCVLE.

- Developing more and enhanced users' involvement.
- Promoting the use of a CBCVLE through a variety of incentives that encourage users to participate and use the environment and related tools.
- Considering users' culture in the design of VLE tools or in customising imported tools and apps.
- Localising VLE tools including user interfaces and course materials.
- Enhancing the family involvement in CBCVLEs by allowing parents to monitor their son/daughter's online activities.

11.3 CONTRIBUTIONS TO KNOWLEDGE

The aim of this thesis was to develop a framework to mitigate the effects of issues affecting the utilisation of a CBCVLE. Therefore, the main contribution to knowledge is the development of a novel framework to help HEIs in Oman to increase utilisation of CBCVLEs. The study has also validated the effect of the operational environment within HEIs highlighting challenges and concerns. The diversity of challenges demonstrates their diversity and contexts.

Further, this study identified the relationships between culture and collaborative VLE environments in particular communication between different genders. Therefore, cultural influences were given a special attention in this thesis resolving some of the cultural concerns that distract users from using collaborative VLEs.

In terms of the practical contribution, the study proposed:

- **Customisation and extension of user profiles** within currently used VLE tools to meet users' needs and requirements including language preferences, gender settings and consents.
- **The concept of localisation** and its integration of a CBCVLE.
- **The concept of parent monitoring** system to provide awareness of activities between genders (if it is acceptable by the society).

All the three proposed ideas above correspond to users' needs in terms of national culture which was found by this study to have a great impact on the utilisation and acceptance of a CBCVLE.

The framework which is proposed by this study will be of an immense value to the academic community including faculty members, students and researchers in Oman and developing countries in the region. Even though some researchers have addressed cultural issues and

their effects on VLE globally, no research was found to focus on cultural influences that may affect the use and acceptance of a CBCVLE in HEIs in Oman.

In general, it should be noted that there is a limited number of articles on cloud computing services and applications for collaborative activities in Oman. Their scope is limited to general outlines of cloud computing initiatives without reference to its educational context. This research focuses primarily on examining aspects related to CBCVLEs in HEIs in Oman.

11.4 LIMITATIONS

The accessibility to some information such as the specifications of ICT infrastructure within HEIs is restricted due to the confidentiality of issues and policies. Therefore, this affects the comprehensiveness and the coverage of the scope of this research. The researcher also experienced this difficulty in data acquisition as described previously when discussing the preliminary study. Several IT managers were hesitant to disclose information about their units as they considered it confidential.

The generalisability of the findings of this research represents another limitation. The findings which relate to Oman that may not be fully applicable to other developing countries due to the diverseness of local culture and eco-social economy. Moreover, the findings may not be generalised to other geographical areas unless modified to meet a specific region among other developing countries in respect of the culture.

Many areas such as users' attitudes, usability and human computer interaction were not covered due to to the scope of this research. More information is provided in the next section.

11.5 FUTURE WORK

This research mainly considers issues of CBCVLE from the users' perspective. Consequently, this gives more opportunities for conducting further studies to explore other perspectives that relate to this environment and its related technologies. Further studies are required to investigate whether the findings of this study can be applied in other developing countries.

There was no opportunity to involve users with performing collaborative tasks which could be studied and investigated. Further studies would provide more in-depth insights into related issues such as collaborative environment and users' experience in terms of communicating with opposite gender.

Three different instruments were used in this research. This includes a preliminary study with semi-structure interviews, questionnaire, and structured interviews. Further instruments can be used in future studies to elaborate practical issues from the environment.

It should be noted that regardless of covering a wide range of challenges and concerns relating to a CBCVLE, still there are issues such as meeting legal requirements that may arise with any entity. The legal issues surrounding the implementation and the utilisation of a CBCVLE may be further studied and explored. This study has not extensively investigated issues relating to the design of VLE tools. A more comprehensive investigation may include aspects such as usability and human computer interaction.

Further, the prototype partially implemented some aspects to demonstrate the ability to tackle some cultural issues and give the users the choices to customise related preferences to meet their requirements. However, more advanced prototyping may be done to address all relevant aspects. Moreover, a completed prototype may be considered and installed in an HEI to be utilised by their potential users for a certain period of time (e.g. one semester) while an investigation is carried out by a researcher.

Overall, further research may be done to investigate the:

- Change of students' learning habits and styles and its effects on a CBCVLE.
- Attitudes towards online collaboration.
- CBCVLEs from other stakeholders' perspectives.
- CBCVLEs from other contexts.
- Effects of VLE localisation on user's experience.
- Effects of social media on CBCVLEs.
- Whether the findings can be applied or extended to neighbouring countries.
- Cross-cultural influences and consequent effects on the use of a CBCVLE.
- Parents IT skills.

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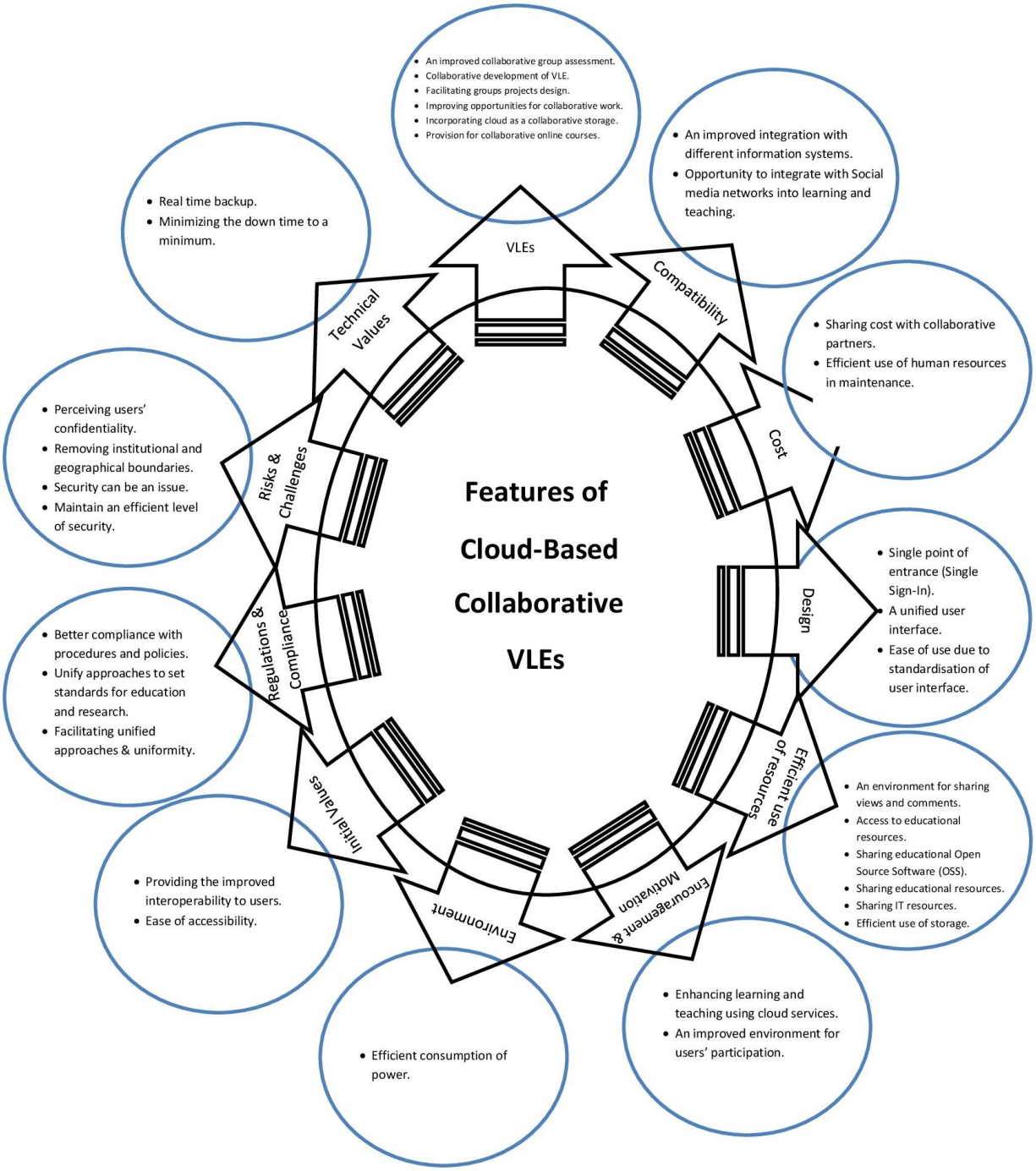
APPENDICES

Appendix 1: Features of Cloud-Based Collaborative VLEs.



Appendix 2: Interviews' Questions of the Preliminary Study.

Section 1: General Information

1.1 Name: ……

1.2 Occupation: ……

1.3 Experience (years): ……

1.4 Contact details: ……

1.5 Institution: ……

1.6 Colleges/Academic Departments: ……

1.7 IT/ICT department: ……

1.8 Total number of IT/ICT Staff: ……..

1.9 Total number of academic staff: ……

1.10 Total number of students: ……

1.11 Total number of administrative staff: ……

Section 2: Collaboration

2.1 Do you share any collaborative service with other Universities/Colleges? If yes, please give details.

2.2 How is your network connected to other Universities/Colleges.

2.3 What is your view on sharing of teaching resources between departments/colleges within your institution?

2.4 What is your view on sharing of teaching resources with other Universities/Colleges?

2.5 Are students motivated and engaged in collaborative projects in courses? Give examples.

2.6 What other examples of collaboration are commonly used by students and faculty members for academic purposes in your institution?

2.7 What other types of collaboration are not currently used by students and faculty members for academic purposes in your institution?

2.8 What is your view on collaborative virtual learning environment that you currently use in your institution?

2.9 How does your institution support and motivate the collaborative environment activities and services?

Section 3: Information Systems and VLEs

3.1 What Information Systems are currently implemented in your Institution?

3.2 Where do you host your Information Systems? Locally or with a provider?

3.3 What VLE/e-learning system do you employ for your Institution?

3.4 Where is the VLE/e-learning system hosted?

3.5 What are your views about the collaboration features of VLE used by academic staff and students?

3.6 What is your annual budget for e-learning management system (ELMS) and annual maintenance contract (AMC)?

3.7 Do you perform monthly/annual assessment of utilisation of your VLE? Any statistics/data?

3.8 What OS (Windows-MAC iOS-Android)/Devices(PC-Tablet-Smartphone) your VLE can be accessed through?

3.9 Do you have mobile applications either to access your VLE or any other system in your institution? Give details.

3.10 What are the architecture and specifications of your Network? Including hardware, software.

Section 4: ICT Infrastructure

4.1 Description of Internet Services (Lines, speed, bandwidth, provider, proxy servers):

4.2 What are the specifications of your servers? Including hardware, software.

4.3 What are the limitations of Internet service you provide for your stakeholders?

4.4 Description of IT Services: ……

4.5 Description and specifications of the data centre of the institution: ……

Section 5: Cloud Computing

5.1 What is your understanding of cloud computing?

5.2 Do you host your Institution e-mail locally or via a cloud vendor such as Google or Microsoft? Explain and list features.

5.3 What cloud services are you currently using in your Institution?

5.4 If none, what are the challenges that prevent such services from being utilised in your Institution?

5.5 What cloud services are planned to be implemented on the next three years? why? and How?

5.6 What are your plans to utilise on cloud computing service for educational purposes?

5.7 What other purposes may you find cloud computing useful for your Institution?

5.8 Who do you think will play huge role towards implementation of cloud computing services in your Institution? How?

5.9 To what extent do you have an adequate IT technical support for the implementation of cloud computing? Including number of total IT staff, systems programmers and developers, network specialists and administrators, systems managers, system analysts … etc.

5.10 What is the possibility that you may be given the opportunity to share one cloud network with other Universities/Colleges?

5.11 What benefits and features do you think you will gain from sharing one cloud network with other Universities/Colleges?

5.12 What challenges may prohibit or lower the progress of establishing a shared cloud network between Universities/Colleges in Oman?

5.13 What deployment model (Public, Private, Hybrid or Community) of cloud computing do you prefer to be adopted in your institution? Why?

5.14 Do you have any concerns/objections in regard to shifting your information systems, data and services to cloud? Such as security, data ownership, resistance to change, vendor lock-in, culture change, overestimate cost, administrative hesitation, lack of knowledge.

5.15 Is your institution including higher management and IT staff, aware of the potential benefits and features of utilising cloud computing in VLE? Explain.

5.16 How do you think that cloud computing would enhance educational services in your institution?

5.17 How frequently have cloud computing and its related issues been discussed in your institutional meetings?

5.18 Is there any governmental support for your institution to adopt cloud computing? If yes, please give details.

5.19 Have you ever participated in training on cloud computing? Please give details.

5.20 How do you assess the knowledge and experience of your IT staff in cloud computing?

5.21 How do you assess the knowledge and experience of your academics and students in cloud computing.

5.22 Do you provide training and workshops to the members of your institution on how to use educational cloud-based services such as Google Docs, Dropbox, OneDrive, etc.? Give details?

5.23 Have you ever participated in a governmental research/studies/surveys in cloud computing and related issues? Explain.

5.24 Is there a taught course on cloud computing available to students in your institution either electively or compulsory? Give details.

5.25 What is your view of cloud-based virtual learning environment for your institution?

5.26 What is your view on readiness of your institution to encourage and adopt a collaborative cloud-based virtual learning environment?

5.27 What obstacles or challenges may your institution face in terms of encouraging and adopting a collaborative cloud-based virtual learning environment?

5.28 How do you consider readiness/competent of students and faculty members in your institution in respect of ICT for a collaborative cloud-based virtual learning environment?

Section 6: Student Learning Culture

6.1 Are you aware of any students' learning approaches/habits? Please explain.

6.2 What is your view about the change of students' learning habits and styles?

Appendix 3: Questionnaire (Survey 1).

Questionnaire (Cloud-Based Collaborative VLE)

Thank you for agreeing to participate in a survey on cloud-based collaborative virtual learning environment (VLE). The purpose of this questionnaire is to explore the current limitations and potential, and propose a model for cloud-based collaborative VLE for the higher education institutions in Oman.

The questionnaire may take about 15 minutes to complete. Your personal details will be treated confidentially and the results will only be used for the purpose of this research.

Please do your best to respond to all the questions.

The results on this questionnaire will only be used for the purpose of this research.

Your participation, time, corporation and patience are truly appreciated.

For further information or in case of problems please contact: Mohammed Al Hajri
malhajri@bournemouth.ac.uk

Section A: Personal Information

Please fill in the relevant space or select the most appropriate answer.

Occupation/Profession:

- ☐ Lecturer/Teacher
- ☐ Learner/Student
- ☐ Researcher
- ☐ Admin/Technician

Educational Qualification:

- ☐ PhD
- ☐ Master
- ☐ Bachelor/University-College Degree
- ☐ High School Diploma
- ☐ Other (Specify): ……

What is your age? ……

Institution Name: ……

Name of Learning Management System (or VLE) in your institution (if known):

☐ Moodle ☐ Blackboard ☐ other (specify): ……

☐ I don't know ☐ No VLE is used in my institution

How can you describe your computer skills?

- ☐ Non-IT user (need some help)
- ☐ General user (can run by yourself)
- ☐ IT Professional (can help others)
- ☐ Other (Specify): ……..

Which is your current year? (Students only):

☐ Foundation ☐ Year 1 ☐ Year 2 ☐ Year 3 ☐ Year 4 ☐ Year 5

Section B: General

Please choose the most suitable score by placing a tick mark (✓).

Rating Scale: 5- Strongly Agree, 4- Agree, 3- Neutral, 2– Disagree, 1- Strongly Disagree

	Topic	Score				
		5	4	3	2	1
1.	High speed Internet connection is available in my institution.					
2.	Technical IT support is available when needed in my institution.					
3.	I am aware of the Internet security policies in my institution.					
4.	My institution provides me with sufficient storage space on local servers.					
5.	I use USB flash drives as my primary storage medium.					
6.	I use my institution's e-mail account.					
7.	I use only my personal e-mail account.					

Section C: Rating of current services

Please choose the most suitable score by placing a tick mark (✓).

Rating Scale: 5- Strongly Agree, 4- Agree, 3- Neutral, 2– Disagree, 1- Strongly Disagree

	Topic	Score				
		5	4	3	2	1
1.	E-mail service provided by my institution is reliable.					
2.	Storage service provided by my institution is sufficient.					
3.	E-learning Management System (Blackboard, Moodle, etc.) in my institution is reliable.					
4.	I have never experienced downtime of learning management system in my institution.					
5.	Wi-Fi in my institution is available.					
6.	Wi-Fi in my institution is reliable.					
7.	I use my smartphone to access the E-learning Management System.					
8.	I often use my tablet (IPad, Galaxy Tab, etc.) to access the E-learning Management System.					

9.	I often use my smartphone to access my institution e-mail.					
10.	I often use my tablet (IPad, Galaxy Tab, etc.) to access my institution e-mail.					
11.	I often use my mobile devices to access my institution's resources and other information systems such as: Library System, Registration System … etc.					
12.	I often use mobile devices to access learning materials from the Internet.					
13.	I often use computers to access learning materials from the Internet.					
14.	I prefer using smartphones/tablets than computers in my learning/teaching.					
15.	I received training from my institution when needed for the E-learning Management System and other related issues.					

Section D: Use of Cloud Services

Please choose the most suitable score by placing a tick mark (✓).

Rating Scale: 5- Strongly Agree, 4- Agree, 3- Neutral, 2– Disagree, 1- Strongly Disagree

	Topic	Score				
		5	4	3	2	1
1.	I use web-based email such as Yahoo, Gmail and Hotmail, … etc.					
2.	I use cloud storage such as Dropbox, OneDrive, Google Drive, iCloud, MS Live@Edu … etc.					
3.	I use web-based email such as Yahoo, Gmail and Hotmail … etc., to save my files and documents.					
4.	I use YouTube to enhance my learning/teaching.					
5.	I use Social Media sites such as twitter, Facebook, Instagram … etc. to enhance my learning/teaching.					
6.	I am aware of cloud-based educational services.					
7.	My institution offers academic courses through the cloud.					
8.	My institution encourages me to employ cloud services in learning/teaching.					
9.	My institution supports cloud services by organising events and workshops in the field.					
10.	I receive a current awareness from my institution about new trends and services in cloud computing.					
11.	My institution offers cloud services to faculty members and students.					
12.	I am satisfied with the current situation of implementing cloud computing services and applications in my institution.					
13.	I have used cloud computing services before joining my institution.					
14.	I believe I have the ability to use cloud services in my learning/teaching.					
15.	I intend to use cloud services in the future.					

16.	Cloud services have facilitated my learning/teaching.					
17.	Cloud services have enhanced my learning/teaching.					
18.	I am knowledgeable about cloud computing.					

Section E: Collaborative Environment

Collaborative environment for the purpose of this research is defined as an environment where IT, educational and research resources can be shared between the educational communities.

Please choose the most suitable score by placing a tick mark (✓).

Rating Scale: 5- Strongly Agree, 4- Agree, 3- Neutral, 2– Disagree, 1- Strongly Disagree

	Topic	Score				
		5	4	3	2	1
1.	I have already used cloud services in collaborative learning/teaching projects.					
2.	I have been involved in a collaborative assignment/project within my institution using cloud-based services.					
3.	I have been involved in a collaborative assignment/project with external institution using cloud-based services.					
4.	I have shared educational resources with other users inside my institution.					
5.	I have shared educational resources with other users outside my institution.					
6.	Students are motivated and engaged in collaborative projects in my institution.					
7.	I am willing to be more involved in collaborative projects in learning/teaching.					
8.	I am very interested in collaborative activities to help my learning/teaching.					
9.	My institution highly supports collaborative activities between students and faculty members.					
10.	I am able to access educational resources owned by other educational institutions in Oman.					
11.	Using cloud services in education encourages me to participate in group projects.					
12.	Cloud security concerns such as privacy would affect the utilisation of cloud-based collaborative VLE.					
13.	The provision of institutional support would affect the utilisation of cloud-based collaborative VLE.					
14.	The availability of technical support would affect the utilisation of cloud-based collaborative VLE.					
15.	More knowledge and experience among students would enhance the utilisation of cloud-based collaborative VLE by them.					
16.	More knowledge and experience among faculty members would enhance the utilisation of cloud-based collaborative VLE by them.					

17.	The ability to use mobile devices such as smartphones and tablets would help and encourage utilisation of cloud-based collaborative VLE by students and faculty members.					

Section F: Potential features which may be included in collaborative VLE

This section relates to your expectation of cloud-based collaborative virtual learning environment.

VLE: **V**irtual **L**earning **E**nvironment (Learning Management System).

Please choose the most suitable score by placing a tick mark (✓).

Rating Scale: 5 - Highly Expected 4 - Expected 3 - Lightly Expected

2 - Not Expected 1 – No views

	Topic	Score				
		5	4	3	2	1
1.	Group assessment for students located in a wide geographical area.					
2.	Collaborative development of VLE.					
3.	Facilitating groups projects.					
4.	Opportunities for collaborative work in research and Education.					
5.	Cloud as a collaborative storage.					
6.	Provision for collaborative online courses.					
7.	Integration of VLE and information systems between different institutions.					
8.	Integration with social media networks for learning and teaching.					
9.	Sharing cost of VLE with collaborative partners (institutions).					
10.	Efficient use of human resources for maintenance.					
11.	Single point of entrance (Single Sign-In) for all systems including VLE.					
12.	A unified user interface (One homepage).					
13.	Ease of use due to standardisation of user interface.					
14.	An environment for sharing views and comments.					
15.	Ease of access to a wide range of educational resources.					
16.	Sharing educational Open Source Software.					
17.	Sharing IT and educational resources with other users and institutions.					
18.	Efficient use of storage.					
19.	An enhanced learning and teaching environment using cloud services.					
20.	An improved environment for users' participation for collaborative projects.					
21.	Efficient consumption of power.					

22.	Better environment for interoperability between operating systems.					
23.	Ease of accessibility globally.					
24.	Compliance with procedures, policies and standardisation.					
25.	Compatibility with user devices.					
26.	A unified approach to set standards for education and research.					
27.	Protecting users' confidentiality.					
28.	No institutional and geographical boundaries.					
29.	Maintain an efficient level of security.					
30.	Reliable backup.					
31.	Reduced down time of the collaborative system.					
32.	Collaborative environment between students and faculty members.					
33.	Reduced demand for technical support required by users.					

Please add any feature not listed above which you would like to have in a cloud-based collaborative VLE.

Section G: Further Comments

Please add further comments if you wish.

Please add your email address in order to send the research results to you when ready.

* Your email address will be confidentially saved and used for corresponding with you about issues of this research.

Thanks for your time and co-operation.

Appendix 4: Survey 1 Variables and Coding.

Sections B and C: ICT Infrastructure

Statement	Item Code	Study Variable	Variable Code
High speed Internet connection is available in my institution.	SecB_1	Internet service	SecBC_Var_1
Technical IT support is available when needed in my institution.	SecB_2	Technical support	SecBC_Var_2
I am aware of the Internet security policies in my institution.	SecB_3	Awareness of IT policies	SecBC_Var_3
My institution provides me with sufficient storage space on local servers. I use USB flash drives as my primary storage medium. Storage service provided by my institution is sufficient.	SecB_4 SecB_5 SecC_2	Storage service	SecBC_Var_4
I use my institution's e-mail account. I use only my personal e-mail account. E-mail service provided by my institution is reliable.	SecB_6 SecB_7 SecC_1	E-mail service	SecBC_Var_5
E-learning Management System (Blackboard, Moodle, etc.) in my institution is reliable and usable. I have never experienced downtime of learning management system in my institution.	SecC_3 SecC_4	E-learning Management System	SecBC_Var_6
Wi-Fi in my institution is available. Wi-Fi in my institution is reliable.	SecC_5 SecC_6	Wi-Fi	SecBC_Var_7
I use my smartphone to access the E-learning Management System. I often use my tablet (IPad, Galaxy Tab, etc.) to access the E-learning Management System. I often use my smartphone to access my institution e-mail. I often use my tablet (IPad, Galaxy Tab, etc.) to access my institution e-mail. I often use my mobile devices to access my institution's resources and other information systems such as: Library System, Registration System … etc. I often use mobile devices to access learning materials from the Internet. I prefer using smartphones/tablets than computers in my learning/teaching.	SecC_7 SecC_8 SecC_9 SecC_10 SecC_11 SecC_12 SecC_14	Mobile devices	SecBC_Var_8
I often use computers to access learning materials from the Internet.	SecC_13	Computers	SecBC_Var_9
I received training from my institution when needed for the E-learning Management System and other related issues.	SecC_15	Training	SecBC_Var_10

Sections D: Cloud Computing & Services

Statement	Item Code	Study Variable	Variable Code
I use web-based email such as Yahoo, Gmail and Hotmail, … etc.	SecD_1	Cloud-Based E-mail	SecD_Var_1
I use cloud storage such as Dropbox, OneDrive, Google Drive, iCloud, MS Live@Edu … etc. I use web-based email such as Yahoo, Gmail and Hotmail … etc., to save my files and documents.	SecD_2 SecD_3	Cloud Storage	SecD_Var_2
I use YouTube to enhance my learning/teaching. I use Social Media sites such as twitter, Facebook, Instagram … etc. to enhance my learning/teaching.	SecD_4 SecD_5	Social Media	SecD_Var_3
I am aware of cloud-based educational services. I receive a current awareness from my institution about new trends and services in cloud computing.	SecD_6 SecD_10	Awareness of cloud services	SecD_Var_4
My institution offers academic courses through the cloud. My institution encourages me to employ cloud services in learning/teaching. My institution offers cloud services to faculty members and students.	SecD_7 SecD_8 SecD_11	Use of cloud computing in education	SecD_Var_5
My institution supports cloud services by organising events and workshops in the field.	SecD_9	Institutional Support	SecD_Var_6
I am satisfied with the current situation of implementing cloud computing services and applications in my institution.	SecD_12	Users' satisfaction	SecD_Var_7
I have used cloud computing services before joining my institution. I believe I have the ability to use cloud services in my learning/teaching. I am knowledgeable about cloud computing.	SecD_13 SecD_14 SecD_18	Users' experience and readiness	SecD_Var_8
I intend to use cloud services in the future.	SecD_15	Intention to use cloud services	SecD_Var_9
Cloud services have facilitated my learning/teaching. Cloud services have enhanced my learning/teaching.	SecD_16 SecD_17	Perceived usefulness	SecD_Var_10

Sections E: Collaborative Environment

Statement	Item Code	Study Variable	Variable Code
I have already used cloud services in collaborative learning/teaching projects. I have been involved in a collaborative assignment/project within my institution using cloud-based services. I have been involved in a collaborative assignment/project with external institution using cloud-based services.	SecE_1 SecE_2 SecE_3	Users' experience and readiness	SecE_Var_1
I have shared educational resources with other users inside my institution. I have shared educational resources with other users outside my institution. I am able to access educational resources owned by other educational institutions in Oman.	SecE_4 SecE_5 SecE_10	Sharing resources	SecE_Var_2
I am willing to be more involved in collaborative projects in learning/teaching. I am very interested in collaborative activities to help my learning/teaching.	SecE_7 SecE_8	Intention and desire to use	SecE_Var_3
Students are motivated and engaged in collaborative projects in my institution. My institution highly supports collaborative activities between students and faculty members.	SecE_6 SecE_9	Institutional Support	SecE_Var_4
Using cloud services in education encourages me to participate in group projects.	SecE_11	Users' Confidence of Using Cloud-Based Collaboration	SecE_Var_5
Cloud security concerns such as privacy would affect the utilisation of cloud-based collaborative VLE. The provision of institutional support would affect the utilisation of cloud-based collaborative VLE. The availability of technical support would affect the utilisation of cloud-based collaborative VLE. More knowledge and experience among students would enhance the utilisation of cloud-based collaborative VLE by them. More knowledge and experience among faculty members would enhance the utilisation of cloud-based collaborative VLE by them. The ability to use mobile devices such as smartphones and tablets would help and encourage utilisation of cloud-based collaborative VLE by students and faculty members.	SecE_12 SecE_13 SecE_14 SecE_15 SecE_16 SecE_17	Factors affecting utilisation of cloud-based collaborative VLE	SecE_Var_6

Sections F: Potential features of Collaborative VLE

Statement	Item Code	Study Variable	Variable Code
Group assessment for students located in a wide geographical area.	SecF_1	VLEs	SecF_Var_1
Collaborative development of VLE.	SecF_2		
Facilitating groups projects.	SecF_3		
Opportunities for collaborative work in research and Education.	SecF_4		
Provision for collaborative online courses.	SecF_6		
Collaborative environment between students and faculty members.	SecF_32		
Integration of VLE and information systems between different institutions.	SecF_7	Compatibility	SecF_Var_2
Integration with social media networks for learning and teaching.	SecF_8		
Sharing cost of VLE with collaborative partners (institutions).	SecF_9	Cost	SecF_Var_3
Efficient use of human resources for maintenance.	SecF_10		
Single point of entrance (Single Sign-In) for all systems including VLE.	SecF_11	Design	SecF_Var_4
A unified user interface (One homepage).	SecF_12		
Ease of use due to standardisation of user interface.	SecF_13		
An environment for sharing views and comments.	SecF_14	Efficient use of resources	SecF_Var_5
Ease of access to a wide range of educational resources.	SecF_15		
Sharing educational Open Source Software.	SecF_16		
Sharing IT and educational resources with other users and institutions.	SecF_17		
Efficient use of storage.	SecF_18		
An enhanced learning and teaching environment using cloud services.	SecF_19	Encouragement & Motivation	SecF_Var_6
An improved environment for users' participation for collaborative projects.	SecF_20		
Efficient consumption of power.	SecF_21	Environment	SecF_Var_7
Better environment for interoperability between operating systems.	SecF_22	Initial Values	SecF_Var_8
Ease of accessibility globally.	SecF_23		
Compliance with procedures, policies and standardisation.	SecF_24	Regulations & Compliance	SecF_Var_9
Compatibility with user devices.	SecF_25		
A unified approach to set standards for education and research.	SecF_26		
Protecting users' confidentiality.	SecF_27	Risks & Challenges	SecF_Var_10
No institutional and geographical boundaries.	SecF_28		
Maintain an efficient level of security.	SecF_29		
Cloud as a collaborative storage.	SecF_5	Technical Values	SecF_Var_11
Reliable backup.	SecF_30		
Reduced down time of the collaborative system.	SecF_31		
Reduced demand for technical support required by users.	SecF_33		

Appendix 5: Survey 2 Questions

Survey 2 (Cloud-Based Collaborative VLE)

I am Mohammed Al Hajri, a PhD student at Bournemouth University, UK.

Thank you for agreeing to participate in this interview exploring your views on a cloud-based collaborative VLE. The purpose of this interview is to identify the issues that relate to a cloud-based collaborative VLE for the higher education institutions in Oman.

The interview should take about 35 minutes. All the information that is collected during the course of this interview will be kept strictly confidential. Any comments will be anonymised and it will not be possible to identify individual participants in any reports or publications arising from this interview.

Your participation, time, co-operation and patience are truly appreciated.

Please don't hesitate to contact me for further comments or clarification (email: malhajri@bournemouth.ac.uk, Mobile: +96899435401, Whatsapp: +96899435401)

Do you have any objection if the interview is recorded? ☐ No ☐ Yes

Section A: General information

Please answer the following questions about yourself.

A.1. What is your Occupation/Profession? …….

☐ Lecturer/Teacher ☐ Learner/Student

☐ Researcher ☐ Admin/Technician

A.2. What is your educational qualification? …….

☐ PhD ☐ Master

☐ Bachelor/University-College Degree ☐ High School Diploma

☐ Other (Specify): …….

A.3. What is your age? …….

A.4. What is your gender? ☐ Male ☐ Female

A.5. How do you describe your computer skills?

☐ IT Professional ☐ General user

A.6. What is the total number of hours you spend per week in (For Lecturer/Teacher only):

☐ Research ☐ Teaching ☐ Administrative work

A.7. What do you categorise your knowledge and experience in cloud computing?

☐ 5- Professional ☐ 4- Advanced ☐ 3- Intermediate ☐ 2– Beginner ☐ 1- None User

A.8. What do you categorise the knowledge and experience of academics in your HEI in cloud computing?

☐ 5 = Excellent ☐ 4 = Very good ☐ 3 = Adequate

☐ 2 = Limited ☐ 1= Very low

A.9. What do you categorise the knowledge and experience of students in your HEI in cloud computing?

☐ 5 = Excellent ☐ 4 = Very good ☐ 3 = Adequate

☐ 2 = Limited ☐ 1= Very low

A.10. How much time per week do you spend using a mobile device (e.g. smartphone, tablet) for educational purposes (in hours)?

☐ None ☐ 1-5 ☐ 6-10 ☐ 11-20 ☐ More than 20

A.11. How much time per week do you spend using a computer for educational purposes (in hours)?

☐ None ☐ 1-5 ☐ 6-10 ☐ 11-20 ☐ More than 20

Section B: VLE Software Tools

B.1. Please name the Learning Management System (or VLE software tools) in your institution (if known):

☐ Moodle ☐ Blackboard ☐ Other (specify): …….

☐ I don't know ☐ No VLE software tools is used in my institution

B.2. Please rank the following devices in the order of preference for accessing the VLE tools in your HEI (1 to 4 where 1 denotes most favourable and 4 represents least favourable).

☐ Smartphone ☐ Tablet ☐ Laptop/Notebook ☐ Desktop PC

B.3. What device do you prefer to use for accessing your VLE tools (such as Moodle or Blackboard or any other tools)? And why?

B.4. What concerns/challenges are currently preventing you from getting the maximum value out of using your VLE tools?

B.5. What are your views about the existing collaborative features of the VLE tools used by academic staff and students in your institution?

B.6. What would you suggest for improving your VLE tools to support a collaborative environment?

B.7. Do you use mobile applications other than web browsers either to access your VLE tools or any other system in your institution? Give details.

B.8. Are you aware of potential benefits and drawbacks when utilising cloud-based VLE tools? Please explain.

B.9. Would uncertainty with new technology be considered as a challenge for users to accept and use a cloud-based collaborative VLE? Please explain.

B.10. Do you think that there will be a resistance from users towards employing new technologies such as cloud-based services for a collaborative VLE? Please explain.

B.11. Do you think that limited technical knowledge of users will affect the utilisation of a cloud-based collaborative VLE? Please explain.

Section C: Collaborative VLE

C.1. Do you have experience of sharing resources with other users in your institution or external institutions? Please explain.

C.2. What would you expect a collaborative VLE tool to offer to the Omani Higher Education Institutions?

C.3. What facilities would you like to see in a cloud-based collaborative VLE?

C.4. Do you have any collaborative projects with other users online in your institution or external institutions?

C.5. What is your view on the existing collaborative environment that you use in your institution?

C.6. To what extent are you satisfied with the status of the collaborative VLE tools used in your institution?

☐ 5- Strongly Satisfied ☐ 4- Satisfied ☐ 3- Neutral ☐ 2– Unsatisfied ☐ 1- Strongly Unsatisfied

C.7. How does your institution support and motivate participation in collaborative activities and use of collaborative services?

C.8. Are students motivated and engaged in collaborative projects in your institution? How? Give examples.

C.9. Please give an example of a collaborative assignment/project that you were involved recently. (details of course, no of people, time length, collaborative tool, etc.)

C.10. What examples of collaboration are used by students and faculty members for academic purposes in your institution?

C.11. What types of useful collaboration can you identify that are not currently used by students and faculty members for academic purposes in your institution?

C.12. How do you think the application of cloud computing could enhance collaborative educational services in your institution?

C.13. How do you rate the readiness/competence of students in your institution in respect of a cloud-based collaborative VLE?

C.14. How do you rate the readiness/competence of faculty members in your institution in respect of a cloud-based collaborative VLE?

C.15. What is your view on the readiness of your institution to adopt a cloud-based collaborative VLE?

C.16. What would you like to see in a cloud-based collaborative VLE?

C.17. Do you feel more encouraged and comfortable when collaborating online for educational activities? Please explain.

C.18. What concerns and challenges do you think may affect your current utilisation of VLE tools?

C.19. Please explain how to mitigate the effects of the challenges to improve your current utilisation of VLE tools?

Section D: Design

D.1. What would you like to see in your collaborative VLE tools in terms of the design including their user interfaces?

D.2. What features would you like to be included in your future VLE tools to support collaborative activities?

D.3. What drawbacks would you not like to see in your VLE tools design?

D.4. What elements would you like to see in the user interface of future collaborative VLE tools?

Section E: Cultural Influences

E.1. What is your view about cultural influences on the utilisation cloud-based collaborative VLE?

E.2. Do you think the language would be an issue when using a cloud-based collaborative VLE? Please explain. (In another word, if English is not your first language, would this affect your use of a cloud-based collaborative VLE? Please explain).

E.3. Do you prefer delivering educational materials and applications in your native language or in English? Please explain.

E.4. Do you think that the digital divide (some regions, people, or socio-economic class have more access to ICT) has an impact on the utilisation of a cloud-based collaborative VLE? Please explain.

E.5. Do you think that the ICT knowledge gap (for those who have less access to technology) has an impact on the utilisation of a cloud-based collaborative VLE? Please explain.

E.6. Do you think that the media globalisation (media supported by technology to connect people to exchange ideas) can influence utilisation of a cloud-based collaborative VLE? Please explain.

E.7. In respect to local culture in Oman, what parts of the technology (ICT, Internet, mobile applications, social media, etc.) can mostly improve the utilisation of a cloud-based collaborative VLE?

E.8. To what extent do you think gender would be an issue when using a cloud-based collaborative VLE?

E.9. In Oman, do you think that male would have more power and freedom to use a cloud-based collaborative VLE than female? Please explain with examples.

E.10. In Oman, do you think that female would be criticised for collaborating online with males in educational activities? Please explain.

E.11. Do you think that customs and traditions of Oman would affect the utilisation of a cloud-based collaborative VLE? Please explain.

E.12. Do you think collaborating online for educational activities will affect the local norms, values and traditions? Please explain.

E.13. Do you think that the family in Oman can influence the extent of the utilisation of a cloud-based collaborative VLE? Please explain.

E.14. Do you think being brought up in a family with a good experience and knowledge in ICT would encourage a user to use a cloud-based collaborative VLE? Please explain.

E.15. Do you think that the use of a cloud-based collaborative VLE will fit with your lifestyle? Please explain.

E.16. What other cultural issues do you think that may affect the utilisation of a cloud-based collaborative VLE?

E.17. Do you think that customising a cloud-based global service, application, or innovation to your local culture would fit to your needs? Please explain.

E.18. Do you think peer pressure can create a competitive environment when using a cloud-based collaborative VLE? Please explain.

E.19. From your point of view, which of the following would have most influence on the use of a cloud-based collaborative VLE (dress, religious practices, customs and traditions, gender, age, social values, family obligations and pressure, and non-verbal behaviour)? Please explain.

E.20. Are you aware of any preferences by students in their learning approaches? Please explain.

E.21. Do you think that limited conformity with learning culture and style by students would affect the utilisation of a cloud-based collaborative VLE? Please explain.

E.22. What is your view about the change of students' learning habits and styles in relation to VLEs?

Section F: Further Comments

F.1. Would you like to add any further information related to issues mentioned above?

F.2. Please give your email address in order to follow up if needed.

* Your email address will be confidentially saved and used for corresponding with you about issues of this research.

Thanks for your time and co-operation.

Appendix 6: Participants' Responses to Survey 2 (Themes 1-4).

Section	Participant	Response
6.4.1	**TL3**	"*Laptop provides me with **big screen** with keyboard and it is portable from any location I can use it*."
	TL1	"*I prefer using Laptop, it is **comfortable** regarding you know the **navigation**. For navigation, it is comfortable compared to smartphone*."
	TL5	"*I am using desktop more and sometimes I use my laptop because I am a kind of person who **like to have a huge screen** in front of me so that to finish all of the professional works or whatever tasks for me. **Phone and tablet** it is more for just like filling time, enjoying times, it is **not something for work***."
	TL2	"*I **prefer** using **smartphone** because it is with us every day and **easy** for management if it is like you design in apps and it is **most useful** compared to laptop it is hard to open it anywhere and you **cannot carry it anywhere** compared to smartphone*."
	TL4	"*Smartphone, it is **easy to carry** and **easy to handle***."
	TL1	"*Actually, **for educational purpose we have not any mobile application***."
	TL3	"*Right now, **we are not using any other application** because we are using only Blackboard.*"
	TL6	"*Yes, we use mobile applications to enhance the learning process, **but not to access the application Blackboard***."
	TL5	"***No**, just the browsers, web browsers.*"
	TL18	"*Unfortunately, I **do not use any mobile application** for educational purposes.*"
	TL20	"*I **do not use a mobile phone**, only computer.*"
	TL6	"*we have created ourselves alternative programs we use **Classrooms**, we use **WhatsApp**, of course we use it in the field of non-academic activities more, and **Classrooms** in the promotion of class but in we use **Google drive**, we use **Google Docs**, we use all these elements, we try to use them through tablets to enhance the learning process.*"
6.4.2	**TL2**	"*It is **not utilised** or **not used that much** and maybe as data subscription maybe we are scared to be to it and maybe **environment it will affect** …*"
	TL3	"*Some concerns are like this if **Internet is not available** I am not able to access the Blackboard or the VLE and sometimes the **students** whatever we are **uploading** they **are not checking them**, **we have to ask them** to go and see Blackboard.*"
	ST1	"*I find that the **weakness of the Internet** in many sites, **both in the university and at home** is the main reason for not being able to access the information in a timely manner or the fast time in which I can take the information at full speed.*"
	TL8	"*… as well as the **network [Internet connection] is weak** …*"
	TL11	"*Maybe the **Internet connection** because I believe that it should have a very good Internet connection and sometimes the Internet connection is **very weak** so that is the main challenge for me.*"
	TL16	"*Crowding of the time tables for lecturers and students.*"
	AT2	"*There is **no mandatory procedure** that makes the student and professor to rely on individual initiatives, but the obligation is limited in the framing of the use of Platform, which is Blackboard …*"
	TL6	"*As for the difficulties or challenges we face, these devices are also related to students' use of them. **Students use computers a little**. Students are **mostly dependent on smart mobile phones** …*"

TL8	"*I think sometimes the **high load teaching** limits the person from the use of technology, as well as **office** and **consulting hours** spent with students.*"
TL7	"*There are two things, first of all, the users were from side of teachers and **students are not really series about the effectiveness of this tool**. Secondly, there is a problem in terms of **accessing the hardware**, students don't possess a laptop or a tablet.*"
TL8	"*… the **weakness of technical support** in the College.*"
TL17	"*Sometimes the **Moodle is not accessible from outside university**.*"
ST2	"*Some of these programs **do not work sometimes** and perhaps if working in a computer that **does not open in others** and ...*"
TL4	"*… **students are not aware** of the things [VLE tools and features], so it is the main challenge, so we have to make the students to understand these types of things available.*"
TL14	"***Lack of experience** Because all my use of these techniques is self-effort, I did not introduce training courses, I hope that my institution provides me with ongoing experiences in this area.*"
AT1	"***Lack of knowledge** of teachers using the system ...*"
TL20	"*They **do not integrate with student registration systems**, requiring re-entry of information into other systems and this is an additional burden and sometimes inaccurate reliance on virtual environment programs.*"
AT1	"*The e-learning management system has been discontinued, and the **central management of this system** is considered outside the control of the college as technicians and administrators.*"
TL16	"*There are **no clear laws, educational guides, ways and means** of how to use and activate virtual learning environment programs and applications ...* **Lack of motivation among students** …"
AT1	"***Duplicate user accounts** where some have more than one account in the system.*"
TL3	"*Yes, a little bit not much, the reason behind that is that when the people are using something they become comfortable with that, and when some new things will be introduced they have to leave that comfort to learn how to use the new technology. So, sometimes they give some resistance about it.*"
TL6	"*The **resistance** is natural and predictable, overcome by clarifying the advantages of these systems and offering training courses for people to faculty members and users.*"
TL5	"***Nowadays no**, previously maybe because it depends like people use traditional methods then you are asking them to apply technology, if they are not from as they call it; IT generation; the technology and immediate people who just want to finish things quickly then of course like previously they will be like they will have a step like we don't want to use these, but **now I don't think it will be**, people just would like to try something but they need to know everything about it.*"
TL2	"*The majority they will not resist it, maybe we'll find it a little bit difficult for them to like **be aware of this technology** maybe they will not want this to be in their institution because they want to stick with their tradition.*"
TL4	"*Of course, in many cases it is like, technical knowledge if they don't have automatically people will say will not accept it. The **knowledge** about a particular thing is **very important**, so then only they can use it.*"
ST1	"*There is no doubt that the user must have knowledge and knowledge of using techniques so that he can, for example, rule or comply with the cloud systems and can benefit from them as much as possible, the **lack of sufficient knowledge***

		has no success *in choosing or in keeping with this technology must have sufficient knowledge to be used and developed.*"
	TL6	"*Yes, of course, cloud computing requires a high level of expectation of using the skills of the computer or mobile device or these programs itself must be an advanced technical level on the basis that you can activate these programs, and this requires that you develop* ***staff*** *with you in the* ***institution*** *and* ***raise their level*** *to have the ability and ability to use these devices and software.*"
	TL20	"*Certainly, the greater the technical knowledge, the less resistance will be, and effort will be spent effort to learn new technologies, which encourages academics to rely on the virtual learning environment.*"
	TL3	"*In some what if the person who is going to use it is completely not aware about the mobile/smart phones and PCs then definitely yes, it is, but* ***nowadays*** *I can say that* ***everyone is using smartphone*** *at least, so it is not a big issue I think.*"
	TL3	"***Definitely****, because if new things going to be introduced we are going to change the* ***habits*** *of the people who are using them, so they are not sure that how it will work, and whether it will be successful or not, so we need to provide them some* ***training*** *and* ***explanation*** *about that technology.*"
	TL5	"***Yes****, for sure because now with all of these technologies maybe the VLE tools sometimes it is not dealing too much with the* ***personal information*** *or whatever, but still because now all the* ***drawbacks*** *related to social media and all of that technologies people starts being more careful with using anything dealing with technology and online things. So, I think this one if people are* ***not aware*** *totally about this technology or this tool they will* ***avoid using it*** *or they will use it in a way that OK that is it I am not going to use it more or go deeper in that technology, so sure.*"
	TL2	"***No****, I feel the* ***new technology is ready to adapt*** *this cloud computing because like for example now storage I will not say 100% I didn't use the Flash for one year but mainly I'm using Dropbox to store my files, to open the lecturer I go to class and open Drobox and download from them now we are mainly using cloud computing without maybe even* ***awareness****. I think the* ***technology is ready for adopting this****.*"
	TL8	"*This sometimes wants to be in the human or user* ***doubts*** *and* ***hesitation*** *in the use of technology as well as* ***age*** *has a role as* ***new generations*** *more use of technology and therefore more understanding and skill from the* ***previous generations****.*"
6.4.3	**TL2**	"*... they have the knowledge about it they know the importance, but they need like a little bit of motivation and time.*"
	TL16	"*... lack of awareness among officials of the importance of using virtual education programs and applications …*"
	ST13	"*Because of the lack of sufficient culture among students of the importance of these projects.*"
	TL7	"*... we have not started any of the collaborative assignment.*"
	TL10	"*... the students pretty much willing to learn new techniques and especially techniques that will help them to be fast and productive in their life …*"
	TL5	"*About the readiness of the students to participate in these cloud-based collaborative VLE tools; the students, the current situation that students are not ready to use that, or they are not willing to start using it …*"
	TL6	"*The ability exists, with the exception of a few of the old ones whose experience in technology is limited. The majority of the ability with them is present, but the motivation must be provoked because the incentive is not present …*"

TL3	"*... Internet is not available I am not able to access the Blackboard or the VLE and sometimes the students whatever we are uploading they are not checking them …*"
AT3	"*Frustration and doubt limit the users' acceptance where they generate hesitation of any experience based on cloud computing.*"
TL4	"*through the teachers because many teachers have students to follow them to use the Blackboard and other tools, so even teachers are encouraging students, even in my class I will ask all the students to upload their assignments only in Blackboard, and even any material if I want to distribute to them only through Blackboard. So, we are also from the teachers we are motivating the students to use.*"
TL8	"*They may have enthusiasm and desire, but participation is weak and perhaps this is due to teachers not using this type of teaching and learning medium.*"
TL3	"*Initially when students get admission we give them training and how to use the Blackboard. Basically, it is the requirement since all the courses what they are going to learn they need to get through the learning management system only, so we are providing motivation and we are making them engaged to use that …, we are giving them some training and motivation.*"
TL11	"*They are not really engaged in collaborative projects, they accept sometimes if I give them like a project to deal with. sometimes they are groups of 4 or 5 students. They always have also the same issue where they can come next day, and they are going to say that we could not interact with each other or we are not together, so they always prefer to work individually instead of collaboratively.*"
ST1	"*For students, I find that most of them have the competence to take advantage of this educational platform and cloud.*"
TL2	"*I feel they are ready just they want somebody to guide them how to use it … and they just need somebody to guide them and they are ready to implement it.*"
TL3	"*... this technology is new, and we are introducing it nowadays and currently students are not aware about that what are the features and facilities available over the cloud. So, once they will become familiar then only they will be able to use it.*"
TL3	"*I will say average because since not everyone is working with cloud and having knowledge of cloud because it is a new technology has come only three four years back, and faculty members they have done their studies 15 or 20 years back so those who are willing to learn only they are able to work with this technology.*"
TL1	"*... we have an experience normally as far as the head of the department is concerned we are* ***sharing the questions papers among the heads of the departments*** *and we are also collaborating with the system coordinators where the system coordinators share the* ***content among other local coordinators*** *…*"
TL2	"*... maybe we'll find it a little bit difficult for them to like be aware of this technology maybe they will not want this to be in their institution because they want to stick with their tradition but I feel the new employees or who wants like and even upset about the new technologies will find cloud computing is the main theme.*"
TL4	"*... nowadays we cannot find anybody without a mobile phone so the mobile phone brings everything in your life, so using an Internet connection, so people slowly are moving from the traditional education system to the mobile based. So, in that case definitely we can have a cloud-based collaborative [VLE]*"

TL11	"*Myself actually I would really like to have a collaborative like cloud-based services not just to interact with my students and my colleagues since I know everything about it.*"
TL10	"*I would say **unsatisfied** because there is **no VLE collaborative tool** as I said, the only thing is what we **use to communicate with students** is Blackboard but **would not say that it is well used**, it can be used much better, I know certain things which are there available in the Blackboard the people here **are not aware** of those kinds of uses, I would be unsatisfied with the way in which it is used.*"
TL1	"*... we are using this, know, for this type of **sharing information** for exams and other things we use **Drobox**, **Google** and other things. So, if there is a **facility in the tool itself like Blackboard** which is among the **all** the Higher education institutions it will be really worth process, so it will be part of the system … If **it is part of the Blackboard or Moodle** so the **security** which we are discussing can be within the system and it will be really useful for us.*"
TL2	"*I feel **Blackboard should be improved** to be like a number one for collaboration until now **I don't feel it's like ready to be utilised that much** but for like sharing documents I **prefer using Google Drive** because we already have like a permission not everybody can see it like you can specify who can see that document ...*"
TL8	"*I expect it to offer new experience and service in the virtual collaborative learning environment.*"
ST2	"*To be able to **open** these programs and applications **quickly**, **easily** and **without technical problems** even at peak hours so as **not to stop working**.*"
TL13	"*A **quick solution to some immediate problems**, …*"
TL19	"*Easy access to academic programs and their documentations across Oman. Easy access to latest publications by Omani HEIs.*"
TL3	"*... we need some type of training to the students so that they must know how to access those devices, so they can get the course materials and the content … with their education.*"
TL2	"*... if we want to give a homework for example I was planning to give them a homework in the class before the end of the class I forgot and it was mandatory to give them at that time what I will do if I have a cloud computing application like this and I have a group of that student I can give them anytime even at 12 a.m. whatever I want to send they will get a notification in their smartphones …*"
TL1	"*... If I am able to get the **statistics** of these things in my VLE tools so I can plan for my effective way of communicating to the students the best I can do. And **feedback system** is there, the feedback system can also be improvised in this new system.*"
TL2	"*... should be icon with very colorful buttons and if that icon is like it should be designed in a way that I understand the service directly without reading the title beneath it or next to it like from the icon …*"
TL11	"*The only element which I would really like to see in the user interface of future collaborative VLE is **finding people very easily** because sometimes we deal with **hundreds of people across the colleges** and sometimes it is **very hard to go and search** for one person, so if there is like a tool or a feature allows me to find people in an easy way that will be better actually.*"
TL2	"*... I will not say we should, we must have a colorful page now people moving to like very good design in web based and we should have easy access to the resources maybe I don't need more than three clicks to reach the services on that*

		interface and also we are expecting all people using that interface should be written in an easy way in English simple words …"
	TL1	"*It should be **compatible with the mobile phone**, what I have found with the present VLE tools is like the user **design is not**, I have taken into the consideration of these small smart devices, so … the reason why I am not using the mobile phone is like, the comfortability, so if it is there I think it is better like in future we have to do things by means of mobility.*"
	TL4	"*... Access ability is a problem, this is a problem that access ability should be very easy for anybody, it should be like more in depth menus like sub menus …*"
	TL5	"*One of the drawbacks which is currently there and I hope it will not be there for example in the Blackboard we **cannot upload a folder** unless we just compress it, so for example now if we want our course materials we will have one folder with too many files inside it but we cannot upload it in the same time, we need to upload each, we need to open a folder there and start uploading each single file in a time so it will take from us too many time, if there is a feature if they make it like we can upload all of the folder once it will be easier. So, this drawback I think they like they need to enhance the thing so that we will just get rid of this drawback.*"
	TL8	"*The most important defects are the frequent **malfunctions of computers** and sometimes **delays in the repair** and also the **disruption of the Internet** and **frequent lack of availability in the classroom**, which disrupts the use of virtual learning environment, we always ask the college administration to avoid such **recurring problems**, but how much I heard if I was alive and **sometimes stopped the system for days, sometimes weeks and sometimes The holidays** are simple but take time to fix.*"
	TL5	"*... working in the same document or a same file, this will make it easier if they did have this feature so that more collaborative work will be there …*"
6.5.4	**TL11**	"*… Myself actually I would really like to have a collaborative like cloud-based services not just to interact with my students and my colleagues since I know everything about it …*"
	TL6	"*... we have created ourselves alternative programs we use Classrooms, we use WhatsApp, of course we use it in the field of non-academic activities more, and Classrooms in the promotion of class but in we use Google drive, we use Google Docs, we use all these elements, we try to use them through tablets to enhance the learning process.*"
	TL12	"*... cloud-based services for a collaborative VLE because as we said it provides a lot of services and it enables ubiquitous access to shared pools of configurable system resources and higher-level services that can be rapidly provisioned with minimal management effort, often over the Internet.*"
	ST1	"*It is clear that if it proves its efficiency, and its strength, its high quality, and its confidence in it, it will provide a good learning environment that Oman can use with confidence.*"
	TL3	"*... it is really a good thing because all the assistance and teaching like providing the course materials, assignments to the students it can be easily done with the help of Blackboard and whatever the assignments students are doing they can upload it they can provide it to the faculty by using the Blackboard. I prefer to use it. The feature is that we can use for conducting the class test, for distributing the course materials, for submission of assignments by the students.*"

TL9	"*I think it will improve education because if you can share things it will make things more effective, it will save time whether it is between faculty members or between staffs [admins], faculty, students faculty, students themselves …*"
TL8	"*this depends on the language of teaching or the language of education. The Arabic language is better because the student when he learns in his language, he makes one effort to the content of the article so that the content can be understood and expressed in his style while if he learns without his language here he needs to make a double effort one language and the other content Subject.*"
TL4	"*Application of cloud computing definitely it will enhance the education system, there is no doubt in it. So how it will be means? So, like it will make like team works among the students. OK it will understand the students how to work with others, so this type of things definitely it will improve if we are going further collaborative education.*"
TL2	"*You see cloud computing it needs Internet 24/7 Internet and it's not if we disconnect from the Internet maybe like 90% of the services in the cloud computing will not be available because mainly we have it like from other side and we should have like strategies …*"
AT2	"*The need for clear policies in the institution to support the improvement and use of this technology …*"
TL1	"*... From users' point of view, we have to give a simple training which is sufficient as well as users I am considering students also as users as well as administrative people are concerned they have to be given training on 100% training on that aspect because they have to completely move from a standard environment or server environment management to a cloud-based. So, they really need a training.*"
ST2	"*They may be ready but there are aspects you need to develop such as the Internet and hardware.*"
TL10	"*I would say unsatisfied because there is no VLE collaborative tool as I said …*"
TL2	"*... and also mainly we are you using* ***Google Drive*** *because it's* ***provided by the ministry*** *and we have like a huge maybe 1 terabyte as storage ...*"
TL6	"*... Now, the student has asked for something that interests him, wants activities, he wants to train, wants to ask him to form groups to work with his colleagues, now students' aptitude values of education that fit these patterns of learning are based on the fact that the student is the focus of the educational process is better than before.*"
TL6	"*... we have created ourselves alternative programs we use Classrooms, we use WhatsApp, of course we use it in the field of non-academic activities more, and Classrooms in the promotion of class but in we use Google drive, we use Google Docs …*"
TL4	"*It should be more user friendly and it should be very attractive and easy to use for the students.*"
TL5	"*If we came to peer pressure it is there everywhere, and it is having a huge impact, it is not just in the VLE world, it is even there in the normal life in our face to face communication. So, peer pressure of course will create a competitive environment for the students …*"
TL2	"*... the main problem is in my mind is the Internet the disconnection of the Internet as I told it will lose a lot of the features of cloud computing and we should have a strategy for connection.*"

TL3	"*My concern regarding the speed of Internet because if the content what we are providing through the learning system and the students face the problem to access them because of slow speed of Internet, they may lose the interest.*"
TL1	"*… the development in security is not fully fledged …*"
TL3	"*... some confidential information is there … some security issues would may arise …*"
TL10	"*… How much of collaborative VLE facility is available in Blackboard I am not sure …*"
TL1	"*Regarding integrating collaborative features, it is one of the interesting ideas, but that should be a consistent training required for collaborative operations like once implemented it should be given a consistent training …*"
TL8	"*... and the weakness of technical support in the College … and provide the appropriate and fast technical support.*"
TL2	"*it should be a gap if there is no knowledge if there is like people having a workshop about cloud computing and there will be educated, and they know totally about cloud computing and the other part or the other region they just having the service without knowing how to use it …*"
ST1	"*...the lack of sufficient knowledge has no success in choosing or in keeping with this technology must have sufficient knowledge to be used and developed.*"
TL2	"*... the availability of that service and if we said like if it's available and some parts and it's not available in other parts definitely it will be a big issue because just service should be provided to all people with an equal access not giving the others like high policies to access some services and others will not access it like if they want to access they should pay money for it for example, … there is no balance if we give others living in Muscat high accessing in services compared to Al Sharqiyah region …*"
TL19	"*... there is a tendency for students to prefer traditional tools of learning, which they are familiar with, compared to new tools they are yet to learn at the same time with their core learning objectives (learning their courses).*"
TL3	"*Definitely, because if new things going to be introduced we are going to change the habits of the people who are using them, so they are not sure that how it will work, and whether it will be successful or not, so we need to provide them some training and explanation about that technology.*"
ST1	"*… I also find away from these programs or the absence of these programs or* ***these devices with many groups of people do not have devices*** *that may not be online will be far from these aspects.*"
TL7	"*... the current VLE system is centralized where we find it difficult to get responses on time plus sometimes the system is not updated, that is another concern.*"
AT1	"*The e-learning management system has been discontinued, and the central management of this system is considered outside the control of the college as technicians and administrators.*"
TL6	"*... included in the final evaluation of faculty members I do not know at this time. In my experience of the year and a half, no one asked me what programs you use with your students. I almost know that the administration does not know that I use this collection of programs. I expect that they are not present in the evaluation …*"

Appendix 7: Participants' Responses to Survey 2 (Theme 5).

Section	Participant	Response
7.1.1	**TL2**	"*...Maybe sometimes if we make it a little bit truly about **the girls maybe it should be monitored by the parents** and they will **ask why you are using this application** why this for what benefits and maybe they will **ask some questions** about it but mainly they **will not stop them from using it**.*"
	TL4	"*It is depending upon the **educational level of the family**, so some families may be **educated**, some families may **not be educated**…*"
	TL5	"***Not every family** will accept that my boy or my girl is having a collaborative work in VLE any tools of that, because **they are afraid** from whatever they are hearing now like we have too **many problems in social media about the privacy**...*"
	ST1	"*May be different here, families, **open-minded families** that **love knowledge** love to know that you love to be open to many things to know them and **other families** clinging to themselves or may **be far from knowledge** in general and far from reading and knowledge will have another idea or **opposition to these aspects of cloud**.*"
	TL3	"*Yes, definitely, because those people who are using the ICT they know that what are the benefits, what are the features and how it can be helpful for learning purpose, they definitely promote to use the cloud-based collaborative VLE.*"
	TL13	"*Yes, I do. Yes, I think it will encourage maybe just it will raise more awareness about the privacy issue that will include.*"
7.1.2	**ST1**	"*I find from my point of view that it will have a great impact on using the virtual learning environment, for example, religious practices. If, for example, there are objections in some aspects, such as religious differences, it will have a great influence, and social values are always linked to religious aspects. Of the trends of these uses will have a negative role.*"
7.1.3	**TL3**	"*My personal view is that everyone feels comfortable in their own native language, so if the technology is available in Arabic or in their native language, definitely they are going to use it more in comparative to is this technology will be provided in English.*"
	TL2	"*...we have seen this one in Chrome directly if you open a page in Chinese it will ask you do you want to translate to English or not because they know from the history or the case that's store there you are not speaking Chinese or even didn't open any page previously about Chinese they know your location also and it gives you the suggestion to translate to English.*"
	TL4	"*Definitely because if you are presenting something in the mother tongue it will reach fast, so definitely there will be some issues in that.*"
	TL5	"*... not everyone is talking **for example English** and if that tool or interface is totally in English **then people will get lost**.*"
	TL5	"*... for example, you have **Facebook**, there is an **Arabic** in Facebook. If you go to **Instagram** or something once it starts it is in English but then people are **depending on icons now**, they do understand the icons, so they know that I can do this from this icon*"
	ST1	"*... there is a segment of the community want to benefit from this aspect as well, but the **problem is then the English language**. The absence of Arabic language in the system will be difficult for those.*"

	TL1	"*... most of the students till school days they are coming up with Arabic as their first language and after that they are starting with English, so, what I have noticed this like each and everything they are trying to find the meaning in Arabic in the initial stage of studies …*"
	TL1	"*... I used to receive a lot of Arabic mails, what normally I used to do is like I used to get support from someone who is always in Arabic and get the translation and always I go for, you know, copy that information and put it in Google translate and try to find out what is the meaning …*"
	TL1	"*...even I can give a lot of example in this part but at this moment I expect from these tools is like it should give a **basic detail**, you should involve other cloud-based features and utilise it and should **be provided the translation service** in the existing document which is forwarded to the students.*"
	TL10	"*... but the **problem** is again who is **non-native speaker of Arabic would have difficulties**, so **multilingual** would be the best, when you have like a test in English and Arabic, **one international language and one local language** would be the best …*"
	TL9	"*… will definitely will **affect** because I will **not be able to interact effectively** with other users who know English better.*"
	TL16	"*Yes, no doubt the effect of this may be the **biggest drawback** in learning in such environments so that students come from different environments that **do not have** academic **language skills**.*"
	TL19	"*Certainly. **English language is major issue** for our students **in general**, and it will certainly be an issue when using VLE.*"
	TL20	"*...Most of the **scientific material** available on the Internet is in English, and learning English will provide an opportunity to learn about the greatest scientific content. However, if the **educational institutions** decided to **produce applications** for the virtual environment **in local languages**, this will reduce the proportion of this problem.*"
	ST9	"*Yes, it may be **difficult for the majority of students** who do not have enough language to use these programs.*"
	ST14	"*... the **language** would be **an issue** when using a cloud-based collaborative VLE. You **do not want to use** when you do not understand the language.*"
7.1.4	**TL8**	"*...Of course, this depends on the language of teaching or the language of education. The Arabic language was better because the student when he learns in his language, he makes one effort to the content of the article so that the content can be understood and expressed in his style while if he learns without his language here he needs to make a double effort one language and the other content Subject.*"
7.1.5	**TL5**	"*...and but still they **will encourage using technology**, but you need to keep your norms, and I think that is fine, it is **not a big deal** to or that. We are **not a kind of traditions that is strict** and we cannot allow this thing to come in. we can use the thing.*"
	ST1	"*...I **do not think** that the cloud collaborative environment is in fact violating Omani customs and traditions **but rather encouraging** knowledge, culture and science.*"
	TL10	"***Oman is more open**, a kind of place where in which we have **more freedom** and more **liberty**, so I **don't think** the current situation should affect badly for any VLE system cloud-based.*"

	TL13	"*No because I see that for them it is the same thing as mobiles and laptops **except for the problem of privacy** maybe.*"
	TL20	"*I **do not think** it will have such a big impact, especially that **modern generations go beyond many customs and traditions and accept dealing less cautiously** than before, while the Omani tradition imposed many caveats.*"
	TL2	"*In **some parts** of Oman, it will be a little bit **difficulty** …*"
	TL3	"*Maybe initially in **some remote areas** which are not familiar with the Internet, smartphones and the laptops etc. they may have **some doubts** about this technology …*"
	ST2	"*Yes, such customs and traditions that **prevent the contact of the female with males**.*"
	TL11	"*... you have to be strict, you have to be like a professional and serious about everything if you are **interacting with the opposite gender**.*"
	TL12	"*It is certain that customs and traditions **will affect** the use so that some traditions prevent communication **between male or female**. The customs and traditions were **found at a time** when there is no openness and **no matter how much I tried to convince** parents that communication is educational or communication for a functional purpose, will adversely affect.*"
	TL2	"*... if we like understand and we **know the exactly benefits** from these applications or these services will like it will be ok for us compared to the traditional systems.*"
7.1.6	**TL1**	"***No, I don't think gender is an issue** here, like as far as the utilisation of technology is concerned, they are in par … with the males so **I don't think this will have an impact** in utilisation of cloud-based [VLE]. They are technologically and technically competent.*"
	TL4	"*I **never think about this gender classification** anybody either male or female so the **interest is important**.*"
	TL7	"*... Socially, a place like Oman you may find that **privacy** is a big concern so most of them if female students are not interested in recording lecture feeling that their privacy is being questioned. So, this could be **one of the issues and obviously this will affect**.*"
	TL9	"*... Yes, as I said like gender could be an issue because, you know, some **cultures** they **don't like interaction between different genders**, it could be an issue.*"
	TL2	"*... to be clear more like we don't have sometime **we cannot create WhatsApp group with male and female** this one it **will be an issue** relating to the **culture** as first and **religion** as one part from it and should be studied carefully if the mix of genders in that part in one place should be monitored may be with somebody who manage that group and they should not be using it for making a relationships or other than for the main thing the main purpose.*"
	TL3	"*Here I will say that **my personal experience is that females are much more devoted to studying, learning and using of technology in comparison to males**. So, since they are much aggressive and they are much familiar with the technology, so the **females are going to easily adopt this type of technology** which includes cloud-based collaborative VLE.*"
	TL20	"*It is possible to **consider the gender difference in the design of application interfaces in terms of colors**. You can also **consider this difference in terms of program design**, since it is known that males are attracted by the applied things more than theoretical things.*"
	TL3	"*In my personal opinion I have seen that **in Oman the male and female are always equally** to it. Even I find in lots of situations whether it is a **bank or some other***

	places *we find* ***mostly females are working****. So, personally I don't think that the males have more power and freedom here.*"
ST3	"***No****, I think it would be* ***more acceptable for females*** *since it includes* ***less going out*** *in the real world.*"
TL5	"*In somehow yes like it depends actually in families, some of the families from the beginning it is like maybe because of their backgrounds or maybe they did live abroad or something so it is OK for them. But* ***most of the families you will find the males are free to use these more than the females****. A* ***simple example****, if we go to let us say in the social media, back* ***to social media*** *or even the* ***video*** *you will find like brothers can put their* ***photographs****, they can have a* ***video call with everyone****, but once it came to a* ***female to have a video or to post photographs or uploading video related to the house or the family then it will be a problem****. So, I think the male is having more power and freedom to use these things.*"
TL11	"*Yes, I think because usually here* ***in our country culturally male they can use different applications****, they can use a cloud-based collaborative VLE freely but* ***females usually it is not appropriate for them*** *if especially if there is like an* ***interaction with the other gender****.*"
ST6	"*Yes, our because we are* ***more of a masculine country****.*"
TL1	"*No, my answer will be different,* ***female will have more power and freedom to use cloud****. Actually, as I have noticed like, know, they are technical, they are becoming technical savvy now when compared to male they are more into technologies. This may be, because what I have noticed is like, there are a lot of improvements because of this infrastructure as I have told you, whatever the technology and utilisation is happening by means of male we can say that the same amount of utilisation is happening with the female also, effective utilisation.*"
TL8	"*I do not think this also* ***depends on the environment or educational institution****. Is the* ***majority of its members*** *male or female and also the administrators, whether* ***administrators*** *or* ***academics*** *are the majority of males or females, of course, this will have a role in the most users and beneficiaries.*"
TL5	"*… for example a female instructor or a* ***female teacher*** *then* ***people will not criticise her like even especially from the family itself****, maybe* ***people from outside the family*** *they will start saying something but then they will be used to it, because as a teacher they know that in work I need to collaborate with males, for example, I need to work with students like male students so the families are accepting that* ***but as a student here is the problem*** *sometimes you will find that even it is* ***online****, even it is* ***face to face*** *time as a teacher when I am asking OK I will have a group exercise or a group collaborative project and I will* ***assign two boys for example with three girls together****, then you will find like you* ***will not be relaxed*** *that day because the* ***girls*** *will come to the office "we don't want that" and then the* ***boys*** *themselves will come "****we don't want to work with girls****" … it is because of* ***their culture*** *especially someway it depends on the* ***region****, if I give you an example, in Nizwa College, even if you go to Sultan Qaboos University, most people are from where? From everywhere but mostly from Muscat, Albatinah region and all that region. In this region people* ***are now becoming more like OK****, you have to do work with a male it is OK you can work but it is like in the border of the work. Rural people like for example here, … or whatever they* ***will not accept that****, some of them, and the problem we are having here mostly it will be with them like* ***no way I am going to work in a group with boys*** *...*"

	TL6	"***Yes, we are criticized**, we noticed that sometimes some groups on the **Whatsapp**, which includes male and female are criticized by some say **why a group is created in which men and women**? **Women prefer not to go into a mixed group** and they want a special group for females. **Criticism exists but it is not the criticism that disrupts**, the possibility exists, the **opportunities are available** and there are other means available now to communicate with the privacy of the individual. All **programs designed for education preserve the privacy and respect of the person and protect against the misuse of technology**. Before some, it is possible to have some non-educational programs such as **social media** where this aspect is used if used for education, but programs designed for education find women safe.*"
	TL14	"*If sometimes some professors organize activities between male and female and therefore this is a **gap in our culture**, the teacher can associate females with females and male with males, but **if freedom is released, this does not suit our Omani culture**.*"
	ST13	"*Yeah. Because **our society at present does not accept such a situation**, but on the other hand, how can it not be criticized if it is for the **purpose of education** only and the **presence of the supervisor** of the subject and **family knowledge of the subject**.*"
	TL3	"*No, as I told you that we promote here so that they should use the technology, the **female must come for learning** and we have seen that **more females are devoted for learning and using the technology** here.*"
	ST3	"*No because **she is already in the online world for reasons that are not for learning** so the idea will be accepted.*"
	TL11	"*Well, sometimes it **depends on the family**, but generally **if it only for educational activities and for educational purposes then it is fine** but if it goes beyond that then it would be, yes, **they will criticize the female for doing that**.*"
	TL10	"***It is education**. I really appreciate if it is not at least here the physical barrier is definitely there, the main thing of cloud, the male and the female cloud it is not much accepted, but at least in the **cloud-based if it is happening that could improve their education facilities** and the system and **they can exchange ideas**, and they can **exchange information online**. So definitely it should improve the system.*"
7.1.7	**TL2**	"*Exactly it will fit in our lifestyle and it will be a part in our lifestyle as social media has been a part in our lifestyle in these days. Cloud computing will be.*"
	TL3	"*...Yes, now life style is changing, now everyone is having smartphone, laptop with them and if the cloud-based collaborative VLE will be used it will be included in their life style because it is going to assist it in their comfortably use of learning.*"
	TL4	"*Yes, it will fit. Actually, nowadays we cannot find anybody without a mobile phone, so the mobile phone brings everything in your life, so using an Internet connection, so people slowly are moving from the traditional education system to the mobile based. So, in that case definitely we can have a cloud-based collaborative [VLE], we have to accept it.*"
	ST2	"*Yes, because most of our time is online and there are no difficulties in using or accessing.*"
	TL9	"*Yes, I guess, it definitely because it makes things easier and things are faster, so definitely it will.*"
7.1.8	**TL3**	"*Definitely, see when you are going to **provide some things which is according to their culture** like what **they want to see** or all those things in which **they are***

		comfortable *if it will be provided definitely* ***it will help*** *to adopt and use the collaborative VLE.*"
	TL2	"*I feel it sometimes it's ok to make like* ***customizing this for Oman or some parts of Oman*** *form or* ***some parts of culture****, but I prefer to be open to internationally and maybe if you* ***customize as colours as icons as a language*** *if it's written in Arabic maybe can be understandable by Omanis.*"
	TL5	"*It would be good to have a customized like cloud-based global service because sometimes especially with the application* ***you will find some advertisement pop out of that application and those ads are not fitting to our cultures like pictures*** *or whatever, this is* ***noticeable now even in some of the applications via phone****, if you just go there then you will have* ***too many ads*** *which I can say are* ***culturally sensitive*** *to us. So, this kind of ads if the* ***program or application is customized to our culture so that we are not going to get all of these ads****, this will be* ***good for sure****, for the educational application rarely you will find these ads but then generally I would like to have something which I can customize according to my culture.*"
	TL10	"*Yes, that is what I said, when you are setting up a new cloud-based system it is always* ***better to architect it in such a way it is within the norms and traditions*** *like wherever possible it can be incorporated, that way is not,* ***it is more welcomed by the families and the people*** *who are using it.*"
	TL11	"*Yes, exactly because if the thing is* ***close to my culture then that definitely will like*** *will be better and it is going to* ***fit my needs*** *because it is* ***culturally accepted****, it does not have anything that, for example,* ***it does not have anything that harm my culture****, so I think yes, definitely yes.*"
	ST2	"*It* ***may not be****, because* ***some programs show ads that do not suit my culture****, some are* ***in English*** *and I* ***may not understand them*** *clearly, even if my language is better.*"
7.1.9	**TL8**	"*I do not think that* ***any aspect or element of culture can negatively impact the failure to use the virtual learning and learning environment****. Our local culture elements encourage the use of this kind of technology.*"
	TL6	"*... there are trends in interpersonal relationships, such as the* ***quality of the language used****. For example, some statements between young people and girls are difficult and unacceptable. In another learning environment, for example, you deal with the assumption that we are beyond Oman, there is a set of issues that are inevitably raised and dealt with while using these issues.*"
	TL11	"*Beside the contacting with the opposite gender I think maybe the cloud-based collaborative VLE can maybe if someone* ***use them in a bad way*** *they can maybe* ***share****, I mean* ***not accepted cultural like things, pictures, photos or maybe websites*** *they are not really accepted culturally, so that would be another thing.*"
7.1.10	**ST14**	"*it is different from old generation to new generation to adopt new technology. The* ***old generation has difficulty in adopt new technology****, but* ***new generation adopt easily*** *to new technology.*"

Appendix 8: Framework and Prototype Evaluation.

Thank you for agreeing to participate in the evaluation of the proposed framework for a cloud-based collaborative virtual learning environment (VLE). A link to a brief explanation about the framework is given bellow in Section B.

The framework covers many areas. However, to illustrate some of its principles, the focus is on culture, and a prototype has been developed to demonstrate how cultural issues can be tackled using the VLE.

A prototype of the VLE has also been developed. The prototype extends the default user profile fields of typical software tools such as Moodle and associated features to enhance the way the system responds to cultural factors. It gives users the opportunity to customize preferences and presentation of content.

The purpose of this evaluation is to validate each of the following: the framework, its main elements and sub-elements, the associated issues and relationships, and finally the prototype.

A questionnaire is used for this evaluation. The questionnaire consists of three parts: Section A is for general information of participants, Section B focuses on the framework while Section C concerns the prototype.

The questionnaire may take approximately 25 minutes to complete. Your personal details will be treated confidentially. Any information recorded will be anonymized.

The results of this questionnaire will only be used for the purpose of this research.

Your participation, time, cooperation and patience are truly appreciated.

For further information or in case of a difficulty please contact: Mohammed Al Hajri
malhajri@bournemouth.ac.uk , WhatsApp +96899435401

تقييم إطار العمل والنموذج الأولي

شكرًا لك على موافقتك على المشاركة في تقييم إطار العمل المقترح لبيئة التعلم الافتراضية التعاونية (VLE) القائمة على الحوسبة السحابية وسوف يرد رابط لشرح موجز عن الإطار في الجزء ب من هذه الاستبانة.

يغطي الإطار العديد من المجالات. لكن، لتوضيح بعض مبادئه، سوف ينصب التركيز على الجانب الثقافي، وقد تم تطوير نموذج أولي لإظهار كيف يمكن معالجة بعض القضايا الثقافية باستخدام برامج بيئة التعلم الافتراضية.

لقد تم تطوير النموذج الأولي من برامج بيئة التعلم الافتراضية. يعتمد النموذج الأولي على تطوير وتحديث حقول بيانات تعريف المستخدم الافتراضية لأدوات البرامج النموذجية مثل Moodle والميزات المرتبطة بها لتحسين طريقة استجابة النظام للعوامل الثقافية. يتيح النموذج الأولي للمستخدمين الفرصة لتخصيص التفضيلات (الإعدادات) وعرض المحتوى.

الغرض من هذا التقييم هو التحقق من صحة كل مما يلي: إطار العمل، عناصره الرئيسية وعناصره الفرعية، القضايا والعلاقات المرتبطة بها، وأخيرا النموذج الأولي.

يتم استخدام استبانة لهذا التقييم. تتكون الاستبانة من ثلاثة أجزاء: القسم (أ) مخصص للمعلومات العامة للمشاركين، بينما يركز القسم (ب) على الإطار ويهتم القسم (ج) بالنموذج الأولي.

قد تستغرق الاستبانة حوالي 25 دقيقة لاستكمالها. سيتم التعامل مع بياناتك الشخصية بسرية تامة. أية معلومات مسجلة سيتم إخفاء هويتها ولن يتم استخدام نتائج هذا الاستبانة إلا لغرض هذا البحث.

نقدر لكم مشاركتكم ووقتكم وتعاونكم وصبركم معنا.

لمزيد من المعلومات أو في حالة وجود أية صعوبات، يرجى الاتصال بـ: محمد الحجري malhajri@bournemouth.ac.uk واتساب +96899435401

Section A: Personal Information القسم أ: المعلومات الشخصية

Please select the relevant box or fill in the space provided.

تكرما اختار الإجابة الأكثر ملاءمة لك أو املأ الفراغ.

What is your occupation/profession? ما هي مهنتك؟

☐ Lecturer/Teacher ☐ Learner/Student ☐ Admin/Technician ☐ Parent/Guardian

محاضر / مدرس متعلم / طالب مسؤول / فني ولي الأمر / الوصي

What is your highest qualification? ما هو أعلى مؤهلاتك الدراسية؟

☐ PhD ☐ Master ☐ Bachelor/University-College Degree ☐ High School Diploma
☐ Other (Specify): .....

☐ دكتوراه ☐ ماجستير ☐ بكالوريوس / جامعة - درجة جامعية ☐ دبلوم ثانوية

☐ غير ذلك (حدد): .....

What is your gender? ما هو جنسك؟ ☐ Male ذكر ☐ Female أنثى

What is your age group? ما هي مجموعتك العمرية؟ ☐ 18-24 ☐ 25-34 ☐ 35-44

☐ 45-60 ☐ Over 60 أكبر من

What is the name of your institution? (Optional) ..... ما هو اسم مؤسستك؟ (اختياري)

Section B: Framework القسم ب: إطار العمل

Please use the following link to view the framework and kindly answer the questions below:

يرجى استخدام الرابط التالي لعرض إطار العمل ومن ثم الإجابة على الأسئلة أدناه:

http://www.omanisoft.net/vle/eval/Framework.pdf

Question 1: السؤال 1

Please rate the **relevance** of the **five main elements** included in the framework in regard to increasing the use of a cloud-based collaborative VLE, particularly in respect to Oman.

يرجى تقييم مدى صلة وعلاقة العناصر الرئيسية الخمسة المدرجة في إطار العمل فيما يتعلق بزيادة استخدام بيئة التعلم الافتراضية التعاونية القائمة على الحوسبة السحابية، وهذا خاصة فيما يتعلق بسلطنة عمان.

Rating Scale: 5- Very Relevant 4- Relevant 3- Undecided 2– Less Relevant 1- Not Relevant

مقياس التقييم: 5- له علاقة كبيرة 4- له علاقة 3- محايد/متردد 2- أقل علاقة 1- ليس له علاقة

	Topic	Score				
		5	4	3	2	1
1.	ICT infrastructure and services (Element 1) البنية التحتية وخدمات تكنولوجيا المعلومات والاتصالات (العنصر 1)					
2.	Operational environment (Element 2) البيئة التشغيلية (العنصر 2)					
3.	User experience and expectations (Element 3) خبرات المستخدم وتوقعاته (العنصر 3)					
4.	Factors affecting user's acceptance (Element 4) العوامل المؤثرة في قبول المستخدم (العنصر 4)					
5.	Cultural influences (Element 5) التأثيرات الثقافية (العنصر 5)					

If you selected “Less Relevant” or “Not Relevant”, please give the reason.

إذا اخترت "أقل علاقة" أو " ليس له علاقة"، فيرجى توضيح السبب.

Question 2: السؤال 2

Referring to figures 3 – 7, to what extent do you agree on the **appropriateness** of the **relationships** between sub-elements within the five main elements included in the framework.

بالإشارة إلى الأشكال من 3 إلى 7، إلى أي مدى توافق على ملاءمة العلاقات بين العناصر الفرعية ضمن العناصر الرئيسية الخمسة المدرجة في إطار العمل.

Rating Scale: 5- Very Appropriate 4- Appropriate 3- Undecided 2– Less Appropriate 1- Not Appropriate

مقياس التقييم: 5- مناسب للغاية 4- مناسب 3- محايد/متردد 2- أقل ملاءمة 1- غير مناسب

	Topic	Score				
		5	4	3	2	1
1.	ICT infrastructure and services (Element 1) – Figure 3 البنية التحتية لتكنولوجيا المعلومات والاتصالات وخدماتها (العنصر 1) - الشكل 3					
2.	Operational environment (Element 2) – Figure 4 البيئة التشغيلية (العنصر 2) - الشكل 4					
3.	User experience and expectations (Element 3) – Figure 5 خبرات المستخدم وتوقعاته (العنصر 3) - الشكل 5					
4.	Factors affecting user's acceptance (Element 4) – Figure 6 العوامل المؤثرة في قبول المستخدم (العنصر 4) - الشكل 6					
5.	Cultural influences (Element 5) – Figure 7 التأثيرات الثقافية (العنصر 5) - الشكل 7					

If you selected “Less Appropriate” or “Not Appropriate”, please give the reason.

إذا قمت بتحديد "أقل ملاءمة" أو "غير مناسب"، فيرجى توضيح السبب.

Question 3: السؤال 3

Referring to figures 3 – 7, please comment on the **consistency** of the **relationships** shown between sub-elements within the five main elements included in the framework.

بالإشارة إلى الأشكال 3 - 7، يرجى التعليق على اتساق العلاقات بين العناصر الفرعية ضمن العناصر الرئيسية الخمسة المدرجة في إطار العمل.

Rating Scale: 5- Very Consistent 4- Consistent 3- Undecided 2– Less Consistent 1- Not Consistent

مقياس التقييم: 5 - متسق للغاية 4 - متسق 3 - محايد/متردد 2 - أقل اتساقا 1 - غير متسق

	Topic	Score				
		5	4	3	2	1
1.	ICT infrastructure and services (Element 1) – Figure 3 البنية التحتية لتكنولوجيا المعلومات والاتصالات وخدماتها (العنصر 1) - الشكل 3					
2.	Operational environment (Element 2) – Figure 4 البيئة التشغيلية (العنصر 2) - الشكل 4					
3.	User experience and expectations (Element 3) – Figure 5 خبرات المستخدم وتوقعاته (العنصر 3) - الشكل 5					
4.	Factors affecting user's acceptance (Element 4) – Figure 6 العوامل المؤثرة في قبول المستخدم (العنصر 4) - الشكل 6					
5.	Cultural influences (Element 5) – Figure 7 التأثيرات الثقافية (العنصر 5) - الشكل 7					

If you selected “Less Consistent” or “Not Consistent”, please give the reason.

إذا اخترت "أقل اتساقا" أو "غير متسق"، فيرجى توضيح السبب.

Question 4: السؤال 4

Referring to figures 3 – 7, please **suggest** any **missing relationship** between sub-elements (including problems and views presented in the figures) that would help to improve the framework.

بالإشارة إلى الأشكال 3 - 7، يرجى اقتراح أي علاقة مفقودة بين العناصر الفرعية (بما في ذلك المشكلات والآراء المقدمة في الأشكال) والتي من شأنها أن تساعد في تحسين إطار العمل.

Question 5: السؤال 5

To what extent do you agree that this **framework would encourage HEIs in Oman to utilise** cloud-based collaborative VLEs to the full potential?

إلى أي مدى توافق على أن هذا الإطار سيشجع مؤسسات التعليم العالي في عمان على الاستفادة من بيئة التعلم الافتراضية التعاونية القائمة على الحوسبة السحابية إلى أقصى إمكاناتها؟

Rating Scale: 5- Strongly Agree 4-Agree 3-Undecided 2-Disagree 1-Strongly Disagree

مقياس التقييم: 5 - أوافق بشدة 4 – أوافق 3 – محايد/متردد 2 - لا أوافق 1 – لا أوافق بشدة

If you selected “Disagree” or “Strongly Disagree”, please give the reason.

إذا اخترت "لا أوافق" أو "لا أوافق بشدة"، فيرجى توضيح السبب.

Question 6: السؤال 6

Overall, to what extent do you agree that the **framework would aid HEIs** to mitigate the effects that may limit the use and acceptance of a cloud-based collaborative VLE?

بشكل عام، إلى أي مدى توافق على أن هذا الإطار سوف يساعد مؤسسات التعليم العالي على تخفيف الآثار التي قد تحد من استخدام وقبول بيئة التعلم الافتراضية التعاونية القائمة على الحوسبة السحابية؟

Rating Scale: 5- Strongly Agree 4-Agree 3-Undecided 2-Disagree 1-Strongly Disagree

مقياس التقييم: 5 - أوافق بشدة 4 – أوافق 3 – محايد/متردد 2 - لا أوافق 1 – لا أوافق بشدة

If you selected “Disagree” or “Strongly Disagree”, please give the reason.

إذا اخترت "لا أوافق" أو "لا أوافق بشدة"، فيرجى توضيح السبب.

Question 7: السؤال 7

Overall, to what extent do you agree that the **framework reflects challenges/issues** that may affect on the use and acceptance of a cloud-based collaborative VLE?

بشكل عام، إلى أي مدى توافق على أن هذا الإطار يعكس التحديات/القضايا التي قد تؤثر على استخدام وقبول بيئة التعلم الافتراضية التعاونية القائمة على الحوسبة السحابية؟

Rating Scale: 5- Strongly Agree 4-Agree 3-Undecided 2-Disagree 1-Strongly Disagree

مقياس التقييم: 5 - أوافق بشدة 4 – أوافق 3 – محايد/متردد 2 - لا أوافق 1 – لا أوافق بشدة

If you selected “Disagree” or “Strongly Disagree”, please give the reason.

إذا اخترت "لا أوافق" أو "لا أوافق بشدة"، فيرجى توضيح السبب.

Question 8: السؤال 8

Please add any **comment or missing aspect** which you would consider important to be included in the framework. Please provide any changes you'd suggest.

يرجى إضافة أي تعليق أو موضوع لم يتم ذكره وتعتبره مهما ليتم تضمينه في إطار العمل. يرجى تقديم أية تغييرات أو مقترحات تراها مناسبة.

Section C: Prototype القسم ج: النموذج الأولي

Please watch the following **video clip** that **illustrates** the research **prototype** and kindly answer the questions below:

يرجى مشاهدة مقطع الفيديو التالي الذي يوضح النموذج الأولي للبحث ومن ثم الإجابة على الأسئلة أدناه:

https://www.youtube.com/watch?v=uKNOe9RGy4Y

Question 1: السؤال 1

Please rate the following **aspects of the prototype concerning some of the cultural influences** that may encourage utilisation of a cloud-based collaborative VLE.

يرجى تقييم الجوانب التالية من النموذج الأولي فيما يتعلق ببعض التأثيرات الثقافية التي قد تشجع على استخدام بيئة التعلم الافتراضية التعاونية القائمة على الحوسبة السحابية.

Rating Scale: 5- Very important 4- Important 3- Undecided 2– Less important 1- Not important

مقياس التقييم: 5- مهم جدًا 4- مهم 3- محايد/متردد 2- أقل أهمية 1- غير مهم

	Topic	Score				
		5	4	3	2	1
5.	Considering the user's preference relating to interaction with different **genders** when initiating a request to **communicate** with other users within VLE tools. النظر في تفضيلات المستخدم فيما يتعلق بالتفاعل مع الجنس الآخر عند بدء طلب التواصل مع المستخدمين الآخرين ضمن برامج بيئة التعلم الافتراضية.					
6.	Considering the user's preference relating to **interaction with different genders** when **assigning a student** to a collaborative project **group** within VLE tools. النظر في تفضيلات المستخدم فيما يتعلق بالتفاعل مع الجنس الآخر عند تعيين طالب في مجموعة تعمل في مشروع تعاوني ضمن برامج بيئة التعلم الافتراضية.					

7.	Allowing **parents** to **monitor** the activities of their son/daughter over VLE tools with a consent given to parents. السماح للوالدين بمراقبة أنشطة ابنهم/ابنتهم على برامج بيئة التعلم الافتراضية بموافقة مسبقة من الأبناء للوالدين.					
8.	Giving users the right to view either a **localised or native version** of VLE Tools and Apps, Educational Materials, Video Audio Materials, Images, Ads, and Communications. منح المستخدمين الحق في مشاهدة إصدار مترجم (مخصص) أو أصلي من برامج بيئة التعلم الافتراضية والمواد التعليمية ومواد الصوت والفيديو والصور والإعلانات والاتصالات.					

If you selected “Less important” or “Not important”, please give the reason.

إذا قمت بتحديد "أقل أهمية" أو "غير مهم"، فيرجى توضيح السبب.

Question 2: السؤال 2

Overall, to what extent do you agree that the **features implemented in the prototype** would aid potential users to accept and use a cloud-based collaborative VLE?

بشكل عام، إلى أي مدى توافق على أن الميزات المطبقة في النموذج الأولي ستساعد المستخدمين المحتملين على قبول واستخدام بيئة التعلم الافتراضية التعاونية القائمة على الحوسبة السحابية؟

Rating Scale: 5- Strongly Agree 4-Agree 3-Undecided 2-Disagree 1-Strongly Disagree

مقياس التقييم: 5 - أوافق بشدة 4 – أوافق 3 – محايد/متردد 2 - لا أوافق 1 – لا أوافق بشدة

If you selected “Disagree” or “Strongly Disagree”, please give the reason.

إذا اخترت "لا أوافق" أو "لا أوافق بشدة"، فيرجى توضيح السبب.

Question 3: السؤال 3

Please add any **comment or missing aspect** which you consider important to be included in the prototype from a **cultural perspective**. Please provide any changes you'd suggest.

يرجى إضافة أي تعليق أو موضوع لم يتم ذكره وتعتبره مهما من منظور ثقافي ليتم تضمينه في النموذج الأولي. يرجى تقديم أية تغييرات أو مقترحات تراها مناسبة.

Many thanks for your participation in this evaluation.

شكرا جزيلا لمشاركتك في هذا التقييم.