Interaction and Engagement in Online Education: Impacts of Student Characteristics and Perceptions

By

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A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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Statement of Originality

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

(Signed)

Afrooz Purarjomandlangrudi
05/04/2018
ABSTRACT

Online learning has become a common method for providing learning at different levels of education. It uses a new form of technology in the field of education to improve classroom activities, overcome the limitations of traditional learning methods, and attract more learners around the world. Online learning has facilitated learning in many ways. It has made it more flexible and available than previous methods. Web-based learning provides students with more opportunities than traditional pedagogical learning to obtain information, gain increased access to different learning resources, and collaborate with others. In spite of the above mentioned benefits and the rapid growth of online education, being successful and persistence with this system is one of the important aspects of online learning settings, and it relies on a variety of factors. Investigating the reasons why students drop out of online education courses or programmes and the contributing factors is essential.

One of the greatest issues in online learning systems, contributing to the failure of online education and student dropout, is a lack of interaction. In learning, interaction between students themselves, with the course content, and course instructors is important for conveying information, enhancing teaching quality, giving directions, and many more functions. Different factors that contribute to the online interaction and engagement of students have been explored in the
literature. Generally, they are categorised in this study as individual and behavioural factors, and course design and administrative factors. Although previous studies have discussed factors influencing student online interaction and engagement, there is a lack of research investigating the dynamics of these relationships and discussing the impact of a comprehensive set of factors on student online interaction at the same time. This study seeks to fill this gap by employing causal loop diagrams (CLDs) to uncover the interrelationships between these contributing factors. Therefore, a rich qualitative data set was collected from an online course, and a thematic analysis was conducted. The results from the analysis of qualitative data generate a comprehensive CLD to propose a big picture of factors that impact on students’ online interaction and engagement and their causal relationships.

Another aim of this research is to propose a conceptual framework that determines the factors contributing to the success of online learning systems. Individual behavioural traits, which are termed “students’ personal characteristics” and “students’ perceived course characteristics”, are investigated through a quantitative research approach. The first category involves a student’s self-regulated learning, communication competencies, and attitude toward online education, and the second category includes a student’s sense of presence, sense of identity, and sense of purpose regarding online interaction. A quantitative research approach was employed and the data for this research
were collected by survey from 246 students from an Australian university doing online courses. Partial least squares (PLS) was then used as a method to test the research model and hypotheses. The results reveal that personal characteristics of self-regulated learning and communication competencies have a positive significant effect on students’ online engagement, and attitude towards online learning also has a significant impact on learners’ online interactions. The findings also show that perceived course characteristics, including a sense of identity, presence, and purpose, significantly influence students’ online interaction and engagement.

The proposed model is used to determine the factors that may impact on a student’s online interaction and engagement in online learning courses. This research focuses on the experience of higher education entities applying online learning in their educational systems. The results of this study could be of potential benefit for both students and course instructors and provide a clearer and better understanding of how universities and higher education providers are responding to the emergence of online learning innovations. Another potential contribution of this research would be in confirming the ability to replicate the integrated research model of this study into other research contexts. It may provide a methodological contribution to the literature and proposes instruments that can improve online interaction and engagement in online learning systems.
LIST OF PUBLICATIONS

Journal papers

• Investigating the Drivers of Student Interaction and Engagement in Online Courses: A Study of State-of-the-art (Informatics in Education, 15(2), 269, ISI listed journal with impact factor)

• A Systematic Review Approach to Technologies Used for Learning and Education (International Journal of Learning and Change, 8(2), 162–177, ERA ranking B)

• A Causal Loop Approach to Uncover Interrelationship Between Student Online Interaction and Engagement and their Contributing Factors (Research in Learning Technology (submitted))

• Exploring the Influence of Learners’ Personal Traits and Perceived Course Characteristics on Online Interaction and Engagement (Education and Information Technologies, ISI listed journal with impact factor, revised and resubmitted)

Conference papers

• State-of-the-art of Recent Research on Educational Technologies: A Literature Survey, International Conference for Teaching and Education, Florence, Italy, 2015. Published in International journal of Arts and Sciences
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Chapter 1

INTRODUCTION

1.1 Chapter Overview

The objective of this chapter is to provide a short description of the key points. It starts with a brief summary of the study background to online education and learning (Section 1.2), including a definition of the concept of online education, its advantages and disadvantages, and existing issues in this new learning method. Section 1.3 identifies the problem statement and the importance of interaction in online learning educational systems. Section 1.4 presents the research gap in the literature, followed by the objectives of this research and present research questions (Section 1.5). Section 1.6 describes the potential significance of this research. Section 1.7 proposes a review of research methodology and Section 1.8 is an outline of the remaining chapters. Finally, Section 1.9 elaborates on the key terms of the research, including online education systems, online interaction, social media, the causal loop diagram (CLD), and the research model.
1.2 Background of the Study

The US Department of Education has provided a definition of online education: “A formal education process in which the student and instructor are not in the same place. Thus, instruction may be synchronous or asynchronous, and it may involve communication through the use of video, audio, or computer technologies, or by correspondence (which may include both written correspondence and the use of technology such as CD-ROM)” (Parsad, Lewis, & Tice, 2008).

Online educational systems use a new form of technology that has been applied in the field of education, and its global expansion has encouraged instructors to employ online learning environments (OLEs) to enhance classroom activities, to overcome the limitations of traditional learning methods, to increase participation, and to compete with other educational institutes (Finegold & Cooke, 2006). According to the 2010 Sloan Survey of Online Learning, approximately 30% of university and college students take at least one course online (Allen & Seaman, 2010; J, 2010). Based on Allen and Seaman’s survey, conducted by the Babson Survey Research Group, the rate of online enrolment has continued to grow very rapidly in the United States and more than one in four higher education students now take at least one online course.
Online education is an educational medium that has enabled communities of learners and their teachers to interact with one another even while located in different geographical locations. Research has shown that well-designed and high-quality instructional materials can make online learning as effective as face-to-face learning (Mayadas, Bourne, & Bacsich, 2009). Many higher education students have taken online courses and the number continues to rise steeply (Allen, Seaman, & Garrett, 2007). By 2020, current predictions are that the demand for “seats” in higher education will reach 200 million, up from the current demand of 115 million, and that many of the available seats will be offered in online classes (Redden, 2009).

Increased Internet access nowadays provides students with the opportunity to undertake their education experience online (Greenland & Moore, 2014). Massive Open Online Courses (MOOCs), which are designed by professional instructors, are taken by an increasingly large number of people these days. In place of traditional face-to-face (F2F) classrooms, online learners use asynchronous and synchronous types of communication within a virtual environment (Ku & Chang, 2011). The courses are presented through virtual learning environments while emphasising the learning outcomes, student satisfaction, and student engagement. The wide variety of multimedia resources in OLEs help students to acquire the knowledge needed for their learning.
Online course settings have various advantages when compared with traditional teaching methods. The most important and noticeable advantage is flexibility, which makes education accessible for students whose location or schedule prevents them from attending physical classes (Waschull, 2001). In contrast to traditional classes, OLEs overcome time and space obstacles and empower students to learn asynchronously, and exceed the standards of synchronous learning (Ku & Chang, 2011). Web-based learning provides learners with more opportunities than face-to-face learning to obtain information, gain greater access to different learning resources, and collaborate with others (Barbara Means, Yukie Toyama, Robert Murphy, Marianne Bakia, & Karla Jones, 2009b).

In spite of these benefits and advantages, success in online learning systems is not easily achievable and relies on different factors that are not the same as in the traditional F2F learning system (Carr, 2000; Rochester & Pradel, 2008). Various factors contribute to the failure of online education, which generally relies on a student’s personal characteristics (Carr, 2000). There are parameters that cause student attrition, such as: the academic programme being too difficult/demanding, a lack of interest in the material or the programme not meeting expectations, the learning environment being too depersonalised, or a lack of technical preparation for the programme (Willging & Johnson, 2009).

Among many different contributing factors, and due to the increasing number of students enrolling in online courses, understanding how students engage and
interact is essential for improving learning and teaching quality (Croxton, 2014; Erbaggio, Gopalakrishnan, Hobbs, & Liu, 2016; Gebre, Saroyan, & Bracewell, 2014; Y.-C. Kuo, Walker, Schroder, & Belland, 2014; Ma, Han, Yang, & Cheng, 2015). Interaction between students themselves and other course instructors is important in learning for conveying information, enhancing teaching quality, giving directions, and many more functions (Suhadi et al.).

1.3 Challenges in Online Education and the Role of Interaction

Online learning has experienced rapid growth in recent decades in that the number of students enrolling in online courses has increased more than ten times as rapidly as the number of enrolments in post-secondary education (Smith, Samors, & Mayadas, 2008). With this growth in the number of Internet-based online courses, it is becoming more important to assess and understand the parameters contributing to the success of online learning instruction. The rate of students who are not successful in completing their online courses varies from 10% to 50% (Carr, 2000; Jun, 2005) and these attrition rates result in increases in costs and expenses for the students, and decreases in student satisfaction and learning outcomes. Investigating the factors that can cause dropouts in online courses is essential and thus deserves special attention from educational organisation management and course designers (Liu, Gomez, Khan, & Yen, 2007; Willging & Johnson, 2009).
Online and distance learning differs considerably from traditional methods in the way students interact with each other and their teacher or instructor. Online courses should be well designed, and appropriate technologies should be employed by course designers to overcome fundamental barriers such as limited interaction. A lack of interaction may cause dissatisfaction among students and have an adverse impact on their performance and academic achievement (Chang & Smith, 2008; Levitz, 2011).

One of the key elements of effective teaching and quality online learning is providing ways for students to exchange their ideas with teachers and among themselves (Y.-C. Kuo, Walker, Schroder, et al., 2014). Interaction has been identified as an essential component of online learning and a major key to increasing student learning outcomes, satisfaction, and engagement (Kang & Im, 2013; Yoo, Jeong Kim, & Young Kwon, 2014). It has been shown that higher levels of interaction with the teacher and other learners lead to greater satisfaction, improved engagement with course content, and better outcomes (Veletsianos, 2010).

One of the advantages of online learning is that it has the ability to support interactive group processes (Jain, Sachin Jain, & Jain, 2011). This interaction enables students to make a connection between pre-existing knowledge and new information. This is directly related to the quality of learning (Han & Johnson, 2012), low attrition (Juwah, 2006), the effectiveness of online learning
(Lee, 2012; Nandi, Hamilton, & Harland, 2012), and online collaborative learning (Kim & Lee, 2012). A high frequency of interaction creates a significant increase in student achievement due to sharing information with the teacher and peers. Satisfaction and involvement with course elements will improve through meaningful interaction (Murray, Pérez, Geist, & Hedrick, 2012).

Common methods employed to foster such interactions include sharing opinions with others, asking questions, and arguing about different subjects. In fact, the success of many online courses relies on effective online interactions. To address this fundamental need, Web-based learning provides students and instructors with the ability to interact with each other through different technologies such as email, discussion boards, synchronous chat areas, etc. Social media (SM) and other Web 2.0 technologies have also been widely adopted for educational purposes (Ellison, Steinfield, & Lampe, 2006; Lenhart, Purcell, Smith, & Zickuhr, 2010; Stutzman, 2006). Although SM outlets have not been developed for online education, some of SM's built-in functionalities and capabilities may prove useful in this regard (Andersen, 2007; Fernstrom, Henderson, O'Grady, Shurville, & Eijkman, 2008; Hung & Yuen, 2010; McLoughlin & Lee, 2010; G. Merchant, 2012; Selwyn, 2010).

Furthermore, researchers who applied Adobe Connect Pro investigated its effect on the synchronous interaction of students in online courses (Torun,
The authors in (Bubas, Coric, & Orehovački, 2010) investigated the potential uses of the online community tool “Ning” in a hybrid university course for part-time students. Using virtual collaboration, voice, video, and instant messaging to improve interaction with the teacher and other classmates is considered in the literature (Chen Wang & Morgan, 2008; Girard, Willoughby, & Berg). Virtual worlds are types of technology that are very popular these days for course designers and universities to enhance online interaction in their online learning courses (Duck, 2014; Minelli de Oliveira, Esteve, & Camacho, 2013; Noteborn, Dailey-Hebert, Carbonell, & Gijselaers, 2014).

Despite the attempts of course instructors and researchers to increase and cultivate students’ online interaction and engagement through different elements, this issue still remains one of the major concerns. There are many students that complain about a lack of interaction and engagement in their feedback and online educational systems continue to suffer from this issue. It is thus essential for e-learning course instructors, university faculties, and researchers to investigate and explore factors that influence student online interaction and engagement in online learning systems.
1.4 Research Gap

Wagner defined interaction as “interplay and exchange in which individuals and groups influence each other” (Wagner, 1994, p. 20). Interaction and engagement are important in all forms of learning systems (M. G. Moore & Kearsley, 2011), particularly when it comes to online learning. Many researchers have worked on online interaction and its effectiveness in online learning. They have applied different research methods in their studies, including quantitative (Y.-J. Chen & Chen, 2007; Sher, 2009; Tatar, Gray, & Fusco, 2002), qualitative (Hammer, 2002; H. Wang, 2005; York & Richardson, 2012), and mixed research methods (Ellis & Romano, 2008; Su, Bonk, Magjuka, Liu, & Lee, 2005; Wilson, 2007).

In addition to technologies and administrative features that will be discussed in the next chapter, there are different drivers and factors that significantly influence students’ online interaction and engagement. Different studies have been conducted on these factors, which include students’ self-efficacy (Y.-C. Kuo, Walker, Belland, Schroder, & Kuo, 2014; Y.-C. Kuo, Walker, Schroder, et al., 2014), levels of readiness and computer literacy (Kaymak & Horzum, 2013), interaction behaviours (Daradoumis, Xhafa, & Marques, 2003), age and ethnicity (Ke & Kwak, 2013), learning styles (Hao, 2006), cultural diversity (Bing & Ping, 2008), and attitude toward distance and online learning (Brooks, Resta, & Schmidt, 2004). Generally, they can be presented as research
investigating individual and behavioural factors, course design, and administrative factors (see Section 2.7) that impact on online interaction and engagement in online education systems.

However, there is a lack of research analysing rich qualitative data and focusing on generating a comprehensive picture of the different contributing factors and their causal relationships, which is an important gap in the literature. A useful means of analysing qualitative data and capturing the structure of the system that has been used extensively is the causal loop diagram (CLD) (Miles & Huberman, 1985; Sterman, 2000). This is a method of analysis used to develop an understanding of complex systems. The main purpose of a CLD is to display causal relationship to present the structure of the system aggregate illustration, which helps the user to discuss the feedback structure and underlying assumption (Sushil, 1993). This diagram illustrates relationships and connections that are difficult to explain verbally. This is because normal language represents interrelations in linear cause-and-effect chains, while the diagram indicates circular chains of cause and effect in an actual system (Kirkwood, 1998).

The second gap that can be identified from the previous studies is that there are still important factors that are not taken into account and investigated properly. These consist of individual behavioural traits, which are referred to in this study as “students’ personal characteristics” and “students’ perceived course
Introduction

characteristics”. The first category contains students’ communication competencies, self-regulated learning, and attitude towards online education and the reason for this labelling is that it is traced back to the students’ personal characteristics. In the second category, which includes students’ sense of presence, sense of identity, and sense of purpose towards online interaction, the levels of these characteristics depend on the specific online course they are attending. The term “perceived course” is thus used to identify these traits.

1.5 Research Objectives and Questions

Exploring and investigating different behavioural characteristics of students is essential in order to determine the prerequisites for an effective e-learning system in higher education settings. This can inform educational designers, instructors, and students with a view to achieving better online interaction and engagement. Previous studies have shown the importance of online interaction in terms of student learning outcomes and satisfaction (Y.-J. Chen & Chen, 2007; J. Richardson, Tunwall, & Carnevale, 2000; Wilson, 2007), and investigating different elements and factors that lead to stimulating online interaction in online learning is of great importance for researchers and learning system designers.

In order to achieve our research objective mentioned above, first we aim to respond to a broad research question: what factors impact on online interaction
and engagement in online courses in higher educational systems? Then, with deeper insight into the literature, the research question is narrowed down. Thus, the research questions that will help to achieve the objective of this research by filling the above-mentioned gaps in the literature are as follows:

**RQ1-** What are the factors and their causal relationships that impact on students’ online interaction and engagement in online courses?

**RQ2-** What are the impacts of students’ personal characteristics on their online interaction and engagement?

**RQ3-** What are the impacts of students’ perceived course characteristics on their online interaction and engagement?

### 1.6 Research Significance

With the new millennium and with the emergence of the Internet, an opportunity was provided to stimulate participation and interaction within a technologically mainstream and cost-effective learning environment. In addition to various interactive opportunities available in the online environment, this improvement can be achieved in the light of the fact that high levels of interaction have positive effects on the learning experience (Y.-J. Chen & Chen, 2007; J. Richardson et al., 2000; Sher, 2009; Wilson, 2007). Failure to adequately consider the relational dynamics in OLEs may incur feelings of isolation in
online courses, decrease student satisfaction, and cause deficient learning outcomes and performance, as well as high attrition rates. Given the current conditions, online interaction is one of the most important components of the online learning setting, and therefore it is necessary to explore and elaborate the different parameters and factors contributing to higher and more effective interaction.

This research results in significant findings for both theory and practice. The potential implication of CLDs for instructors, university faculties, students and learners, course designers, and conveners is that they provide a big picture of several factors influencing online interaction and engagement in learning. Therefore, course designers and conveners can take these factors into account when designing an online course to promote and cultivate online interaction and engagement with a view to obtaining better student academic performance and satisfaction. In addition to having several practical implications, it could help researchers, particularly new researchers, to learn about these factors in a very convenient way, and more importantly, it can depict the causes and effects of all these parameters and their internal relations and interplay between them, which is essential for conducting comprehensive research and enables instructors and researchers to select the factors that are most relevant to their work.
The results of this study could play a substantial role in the work of practitioners in OLEs. By getting to know the specific personal and perceived course characteristics of students, practitioners could participate in improving and enhancing the online interaction and engagement of students, and could achieve better results and outcomes in online learning by manipulating and controlling these traits.

For instance, if a learner’s attitude toward OLEs is one of those factors that have a positive impact on online interaction, educational experts and instructors will be able to increase online interaction in their courses by adjusting the learners’ attitude to give accurate and aggregate perspectives to learners. On top of that, the students can be aware of these characteristics and try to improve them themselves. Investigating aspects that have not been considered in previous research will enrich the literature and help in accomplishing existing works that would help researchers to contribute to a better understanding of these fields and give directions for the future of their research, as well as identifying gaps in the body of knowledge in this area.

1.7 Overview of Research Methodology

The positivist approach, which has been selected for this study, seeks precise indicators for formulating research questions and tests hypotheses by accurately
quantifying concepts and analysing numbers from indicators. The research has employed both qualitative and quantitative approaches for data collection and analysis. Qualitative data have been collected through an online focus group from an online e-commerce course at Griffith University. Students were asked some open-ended questions and thematic analysis was carried out to extract contributing factors and themes in students’ online interaction and engagement and the results are shown in CLDs.

A questionnaire has been developed and used for capturing individuals’ perceptions of online course interaction as well as identifying factors that may impact on it. The context of this study is Griffith University online courses. The research has also applied multiple data analysis techniques for analysing the quantitative data. Through a careful review of current taxonomies, explanatory factor analysis (EFA) and confirmatory factor analysis (CFA) have been chosen to discover underlying factors of the latent constructs of the research model as well as to choose indicators with high loadings on corresponding factors. Moreover, PLS-based structural equation modelling (SEM) has been employed to test the initial research hypotheses and to primarily assess interrelationships between independent and dependent factors of the model. The validity of SEM estimations has been assessed through the level of R-square, the power of the analysis, and factors loadings. In addition, the reliability and discriminant and convergent validities of the results of the study have been tested.
1.8 Organisation of the Dissertation

This dissertation contains six chapters, starting with this introductory chapter, which provides an overview of the study. The remaining chapters of this thesis are as below.

1.8.1 Chapter 2: Literature Review

Chapter 2 provides some background information on online learning, outlines various online education tools, online learning facilitators, and barriers, and reviews the literature on students’ online interaction and engagement. The chapter then identifies students’ positive outcomes and factors that impact on online interaction from the literature. Finally, the research gaps are presented in this chapter.

1.8.2 Chapter 3: Research Model and Hypotheses

Chapter 3 outlines the research model developed to fulfil the objective of this study. The chapter begins by presenting the research questions and frameworks and research design. It then continues by describing the development of the research hypotheses and research model.

1.8.3 Chapter 4: Qualitative Research

Chapter 4 presents the research methodology selected to carry out the qualitative study and introduces the environment under study, which is the e-commerce online course. Subsequently, the chapter describes the data
collection, followed by the ethical considerations and demographic characteristics of participants in this part of the study. The chapter then provides data analysis and results from the qualitative section of the research.

1.8.4 Chapter 5: Quantitative Study

The results of the quantitative study are presented in Chapter 5. In this chapter, the research hypotheses and interrelationships between constructs in the research model are investigated with a large data set and bigger sample size. This chapter then interprets the findings of the PLS estimation and discusses the validity of the findings of the research model. Finally, the chapter assesses the convergent and discriminant validities as well as the reliability of the findings.

1.8.5 Chapter 6: Discussion and Conclusion

This chapter overviews the importance, significance, and motivations of this study and discusses the research findings and implications. It discusses the research model and hypotheses and overviews the research findings that support the interrelationship between constructs in the research model. Furthermore, this chapter addresses the research questions. Finally, the limitations of this study are outlined and recommendations for future studies are discussed.
1.9 Definition of Key Terms

In this section we define the key terms used in the present dissertation.

*Online learning environment (OLE):* this is a new learning environment that goes beyond the replication of traditional F2F classrooms and employs digital technology that relies on the Internet. It provides different ways of learning and a potentially richer learning environment to cater for different learning styles and greater access to information and learning sources.

*Online learning technologies:* employing technological and computer-based learning tools such as multimedia materials and the use of networks and communications systems for educational purposes, for the enhancement of teaching, learning, and assessment (Richey, Silber, & Ely, 2008).

*Online interaction:* this means providing ways for students to exchange their ideas with teachers and among themselves in an online learning environment (Y.-C. Kuo, Walker, Schroder, et al., 2014). Moore & Kearsley defined interaction in distance learning as “two way communication among two or more persons for purposes of explaining and challenging perspectives” (M. G. Moore & Kearsley, 2011).

*Factor/latent construct:* “Operationalization [of a concept] in structural equation modelling; a latent construct cannot be measured directly but can be
represented or measured by one or more indicators” (Hair Jr, Anderson, Tatham, & William, 1995).

*Item/indicator:* “Observed value (manifest variable) used as a measure of concept or latent construct that cannot be measured directly. The researcher must specify which indicators are associated with each construct” (Hair Jr et al., 1995).

*Structural equation modelling (SEM):* Also known as LISREL analysis, it is a multivariate analysis method that is distinguished from other techniques “by two characteristics: (1) estimation of multiple and interrelated dependence relationships, and (2) the ability to represent unobserved concepts in these relationships and account for measurement error in the estimation process” (Hair Jr et al., 1995).

### 1.10 Chapter summary

This chapter started with a preliminary overview of the definition of the online learning concept, followed by a background to the study of OLEs and how this new learning system can help higher education entities to enrich their learning systems. The importance of interaction and engagement in the structure of an online course was described in the problem statement section and the gap in literature regarding both causal loop diagrams and students’ personal and perceived course characteristics were elaborated. The research objectives and
questions were discussed and finally the definitions of key terms were explained in the last section.
Chapter 2

LITERATURE REVIEW

2.1 Chapter Overview

This chapter reviews the definitions of online learning and outlines the relevant literature that explores online learning technologies and online interactions, and factors influencing them. The first section of the literature review presents the background to online learning and definitions of online learning concepts and environments. The next section contains a review of the technologies used in OLEs and proposes a classification of these technologies. The following section discusses the facilitators and advantages of, and barriers to, online learning systems. This is followed by a review of the literature about online interaction in education. Factors that affect online interaction and engagement are then reviewed and positive outcome variables that are influenced by online interaction are introduced. Finally, gaps in the current literature are identified regarding qualitative data analysis, CLDs, and some unrecognised influencing factors. Figure 2.1 presents an outline of the current chapter.
2.2 Background on Online Learning

In this section the definition of online learning from different perspectives and references is discussed and this is followed by the history of emerging online learning systems in education.
2.2.1 Definitions of Online Learning

Several definitions of online learning or e-learning have been proposed in the literature since the late 1990s, which saw the introduction of online learning (Gerhard & Mayr, 2002). Romiszowski (2004) provided more than 20 different definitions of 50 articles in his studies (Romiszowski, 2004). The comprehensive description of online learning proposed by Tavangarian et al. (Tavangarian, Leypold, Nölting, Röser, & Voigt, 2004) that is adopted in this study expresses it as “all forms of electronic-supported learning and teaching, that are procedural in character and aim to affect the construction of knowledge with reference to the individual experience, practice and knowledge of the learner. Information and communication systems, whether networked or not, serve as specific media ...to implement the learning process” (p. 274).

Educational systems have witnessed transformational changes in recent decades through the emergence of new technologies, driven by the Internet and the World Wide Web (WWW), that have made online learning communities one of the fastest-growing online communities (Harasim, 2000). Evidence from past research shows that it has attracted extensive attention and is becoming very popular at different educational levels, particularly higher education (Huang, Yen, Lin, & Huang, 2004; Strijbos & Weinberger, 2010). Vinagre (2008) describes online learning as “the type of learning that takes place through the exchange and sharing of information and opinions between pairs of students or
peer groups. Students work together, searching for understanding, meaning or solutions; and collaboration is thus seen as an act of shared creation and/or discovery. Within the context of electronic communication, collaborative learning can take place without members being physically in the same location” (Vinagre, 2008) pp. 1022–1023). According to Harris (1999), online learning is defined as an environment where people from different locations work together using Internet tools and resources (Harris, 1999). There is also another definition by Luppicini (2007) that explains it as “the process by which people create, exchange, and perceive information using networked telecommunications systems that facilitate encoding, transmitting, and decoding messages” ((Luppicini, 2007) p. 143).

The prompt acceptance and adoption of technology has transformed the way in which educators teach and students learn. Nowadays a lot of information and teaching resources are made available on the Internet or course websites. These changes provide the ability to deliver traditional F2F classes via the Internet and bring about substantial changes in learning methods, as well as campus landscapes (Kutlok & Gülmez, 2014). Various online devices and tools such as smartphones, personal digital assistants (PDAs), and portable computers or laptops facilitate online education and enable users to gain access to information and rich learning sources much more easily, and to communicate
with other people, and share different documents, files, etc. (Hussin, Manap, Amir, & Krish, 2012).

### 2.2.2 History of Online Learning

Education is one of the fields taking advantage of technology in the form of online learning. Paul Saettler (Seattler, 2004) believes that technology is an approach towards developing knowledge more efficiently to overcome existing problems. The author clarifies the term “online” as referring to any activity performed by any electronic device such as a computer or smartphone, and also any type of information transferred via the Internet for educational purposes. In light of these definitions, the literature indicates that online learning is a relatively new phenomenon that has become very popular since the 1990s.

The history of online courses can be traced back to the nineteenth century when universities offered distance education courses. This learning scheme has been the subject of both research and controversy, and the first entirely online course for adults was delivered in 1981 with non-credit “mini-courses” and executive training programmes (Harasim, 2000). In the early 1990s, with the development of new technologies, the ability to offer online courses and also entire degrees through the Internet became possible for colleges and universities across the world (Wallace, 2003). According to Rumble (2001), the evolution of the history of distance learning can be described as an evolution “from a modernist form of education to a phenomenon that fits with
postmodernist developments such as consumerism, the emergence of the post-
bureaucratic organization, and globalization” (Rumble & Latchem, 2004) p. 31).

Online learning course websites have since become more widespread as people come to appreciate the benefits of learning online and how it can transform the quality of education. In 2001, Seal and Przasnyski (Seal & Przasnyski, 2001) employed the Web to deliver course materials and activities. They provided six feedback forms and asked students to give their feedback during the semester. The results showed that the course website was very beneficial for students in helping them to learn and understand course material. Lin and Hsieh (2001) reviewed the research evidence regarding learner control in online learning environments, as well as the conditions that contribute to facilitating learning more effectively (Lin & Hsieh, 2001). Gal-Ezer and Lupo (2002) claim that if students are more progressive and advanced in terms of adopting technology, they will employ and apply the Web more efficiently to promote their online learning performance (Gal-Ezer & Lupo, 2002).

In this advanced technological era, the population of higher education students has increased immensely. In the twenty-first century online learning has outstripped traditional distance learning systems that relied on correspondence-type courses and educational television programmes (J. L. Moore, Dickson-Deane, & Galyen, 2011). According to a survey by the US Department of Education in INFOGRAPHIC ("INFOGRAPHIC: The Growth of Distance
Learning," 2012), there was a 150% increase in the undergraduate student enrolment rate in online courses between 1998 and 2008. This success shows that online learning allows learning to take place in a variety of contexts and locations, and at various times. These flexibilities are transforming the landscape of teaching and learning.

2.3 Literature Review on Online Education Tools

Online learning or e-learning relies on electronic learning technology and has become an indispensable part of education systems all over the world. Different definitions of e-learning have been presented in the literature, and in this study e-learning is “all forms of electronic-supported learning and teaching that are procedural in character and aim to affect the construction of knowledge with reference to the individual experience, practice and knowledge of the learner. Information and communication systems, whether networked or not, serve as specific media...to implement the learning process” (Tavangarian et al., 2004) p. 274).

Online education consists of various elements and employs different types of technologies that have been influenced remarkably by advanced changes and are adopted widely by different educational institutions. Almost 95% of educational institutions are using at least one form of e-learning technology in their educational system (Committee, 2005). Online learning facilitates
education and makes learning more efficient by increasing accessibility at a lower cost for users and students. With today’s rapid development of technology, institutions and organisations can enhance their quality by implementing e-learning in their learning process. Online learning takes advantage of the Internet and enables users to gain access to learning materials and sources at any time and in any place. In fact, e-learning has eliminated time and distance barriers (Gunasekaran, McNeil, & Shaul, 2002).

There is a wide range of e-learning technologies. Educators are required to be familiar with these in order to apply them more effectively in their teaching. However, the variety of these technologies continues to grow apace. Some were not originally designed for education, such as social networks, but they are now extensively used in learning processes (Amador & Amador, 2014; Veletsianos, 2012). Some were specifically developed for educational use, such as learning management systems (LMSs) (Williams van Rooij, 2012).

With the expansion of online learning and its continuing development, some investigations have reviewed the existing technologies and researched different e-learning disciplines (Chapelle, 2004; Conole & Warburton, 2005; Dash, Magidin de Kramer, O’Dwyer, Masters, & Russell, 2012; Felix, 2005). However, there is a lack of research reviewing the vast range of e-learning technologies and investigating the trends in their use by various educators. This review of the literature is about the current e-learning disciplines, elements, and technologies
applied for different learning purposes. It proposes a classification of the main elements and offers some subcategories and examples for each. It also highlights applications by educators and the opportunities they provide.

2.3.1 Review Steps

In this study, we have carried out a systematic literature review to identify studies on the application of technologies in education and learning. A systematic literature review is a type of research methodology that focuses on a topic or research question to identify and interpret available empirical studies. It involves planning the review, conducting the review, and reporting on the review. The following steps are taken to finalise this systematic literature review.

2.3.1.1 Study Selection Process and Criteria

From different research sources, we selected the following journals that are relevant and include most of the important databases. In order to create a state-of-the-art analysis of recent e-learning technologies and elements, the last few years (2012, 2013, 2014, 2015, and 2016) were chosen for conducting the review. **Table 2.1** indicates the journal names, databases, and the total number of papers in their published issues in these years.

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<td>Educational Technology Research and Development</td>
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<td>James Nicholas</td>
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<td>International Journal of Computer-Supported Collaborative Learning</td>
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2.3.1.2 Study Screening

Based on Table 1, the total number of papers that were selected was 461. At this stage some were excluded because they were about e-learning reviews or did not examine e-learning technologies. The final set of 343 papers was then selected.

![Stages of study process.](image)

2.3.2 Outcome of Review

2.3.2.1 A Classification of Online Technologies and Elements

Different classifications for the use of technology in education have been proposed. In this study nine main categories are defined for this purpose: Social Network, Management & Administration Tools/LMSs, Online Communication, Assistive Software/Hardware, Digital Technologies, Mobile Apps, Online/Digital Games, Podcasts/Streaming, and Wikis.
Figure 2.3 illustrates all these categories and the subcategories that are discussed in detail below.
Figure 2.3 A classification of online learning tools and elements.

Figure 2.4 is a pie chart showing the percentage of each main technology employed in the papers. At first glance it is clear that Assistive Software/Hardware is the most dominant technology, making up 25% of the total, and the second most dominant is Management & Administration Tools/LMSs, at 21%. The proportion of Online Communication was quite similar to Social Network and Digital Technologies, at 15%, 13%, and 10%, respectively. Apart from Online/Digital Games, which constitutes 9%, other technologies contribute less to education systems. The following is a brief description of each technology and some examples of their applications in learning.
Social Networking

Social networking is a way for people to communicate online and share their interests, activities, backgrounds, and real-life connections. It is a Web-based service in which every user can create a profile that consists of their social links, connections, and a variety of additional services offered by Web-based services, and the ability to share them with others.

A wide range of social networking sites like Facebook and Twitter have been adopted for use as tools to enhance learning and education. For instance, Bowman and Akcaoglu, in (Bowman & Akcaoglu, 2014), have created a course-
specific Facebook group on a mass media course as a supplemental space for course discussion. The results at the end of the semester showed that the Facebook group user grades were significantly higher than those of other students. A 3D virtual world is another learning environment adopted by academics for educational purposes. Merchant et al.’s (Z. Merchant et al., 2013) study is an explanatory example of using Second Life (SL), a three-dimensional virtual world, to improve student learning of chemistry concepts.

**Management & Administration Tools/LMSs**

This category contains the tools used for teaching, course management, student administration, and their progress, and even tools for the detection of plagiarism. It also includes a learning management system (LMS), which is a system for managing the administration, documentation, tracking, reporting, and delivery of online or blended/hybrid educational courses. It is used throughout universities and other institutions to invigorate and augment their courses and educational systems.

Much research has examined online courses and LMS technology, as well as their impact on student learning outcomes. Yuan and Kim (Yuan & Kim, 2014) investigated dropout problems with online courses and the lack of interaction, which might lead to student isolation. The effects of LMSs on learner satisfaction and how they cater for their needs in online courses are discussed in
(Rubin, Fernandes, & Avgerinou, 2013). The authors propose a model to explain the influence of LMSs on the community of inquiry.

**Online Communication**

Online communication technology is divided into two main categories, synchronous and asynchronous communication. Synchronous communication is a form of technology that enables people to communicate in real time and to collaborate at the same time in different places. The main problem with these tools is the difference in time zones and conflicting schedules, which can create communication challenges. Synchronous tools can be based on text or audio and can contain video, documents, multimedia, and desktop sharing. This includes audio, video- and Web conferencing, chat and instant messaging, application sharing, online forums, and discussion. Some research has investigated the implementation and impact of this technology in education. Çelik employed an online discussion board in a course and explored student concerns and outcomes (Çelik, 2013).

In an asynchronous environment, communication and collaboration are conducted over a period of time at different times in different places. Asynchronous tools provide people from various time zones with the ability to connect at each person’s own convenience, and are useful for sustaining collaborations. The most common types of these tools are e-mail, streaming
audio and video, narrated slideshows, discussion boards, e-portfolios and Web logs (blogs), which were implemented by Tang and Lam (Tang & Lam, 2014) to build an effective online learning community (OLC) to fulfil the objectives of blog-based teaching portfolios.

**Assistive Software/Hardware**

Computer technology in today’s classroom has provided teachers with a wide range of tools to make teaching more professional and easier. Assistive computer-based technology is a form of technology that enables users to enhance their functional abilities for their learning needs. It includes computer software and hardware that is used for different learning purposes. This can contribute to making training hours more interactive and to stimulating students’ computer skills.

There have been many classifications of the different types of educational computer software and new ones have been invented over the years. Some test the students and some aim to help them to achieve a better understanding of concepts. Simulation software is one type/classification of software employed by researchers to stimulate students’ learning skills, especially in reading and writing. For example, the authors in (Liou, Yang, & Chang, 2012) developed a system called “WriteAhead”, which provides different types of suggestions for non-native English students from various disciplines who are writing journal
paper abstracts, and assessed its effectiveness. Nivala et al. (Nivala, Rystedt, Säljö, Kronqvist, & Lehtinen, 2012) investigated the use of a new hardware tool, a virtual microscope, in a medical pathology course with a view to improving their collaborative skills.

**Digital Technologies**

This category covers a plethora of different content utilised through the Internet. It contains three subcategories: Shared Documents/Scripts, Internet Surfing, and E-books. Shared documents contain technologies such as Google Docs, Zoho Writer, SlideShare, Elgg, Clearspace etc. (Craig, Coldwell-Neilson, Goold, & Beekhuyzen, 2012). Some, like Google Docs, are considered particularly useful when users employ Gmail as their email system, which has been the case in many Australian universities (Yoo et al., 2014).

Collaboration scripts are very useful and important elements in computer-supported collaborative learning (CSCL), as they help students collaborate and provide more interaction in learning activities. Gijlers et al. applied computer-supported collaborative drawing scripts to investigate the influence of this technology on students’ knowledge acquisition (Gijlers, Weinberger, van Dijk, Bollen, & van Joolingen, 2013). The authors in (Popov, Biemans, Brinkman, Kuznetsov, & Mulder, 2013) also adopted a collaboration script to improve the quality of students’ discussion skills.
The phrase “Internet surfing” comprises a plethora of different Internet-based activities, such as using different search engines, websites, databases, social bookmarking, and so on. Actually, most students are engaged in this activity when performing their tasks and assignments as they obtain help from different websites and carry out research. Various research has been conducted regarding different aspects of information seeking via the Internet. Eynon and Malmberg (Eynon & Malmberg, 2012) investigated the impact of information-seeking activities on young people’s learning.

E-book (also known as “e-text” or “e-textbook”) applications have developed across the globe in recent years and with different kinds of digital materials, such as laptops, tablets, e-readers, and smartphones. Their implications for learning and education have also been explored in much of the literature. Ciampa conducted a pilot study on the impact of online reading on the reading motivation and listening comprehension of students (Ciampa, 2012).

**Online/Digital Games**

Digital game-based learning (DGBL) has become popular and widespread in recent years and is seen as a very effective tool for educational purposes (Hwang & Wu, 2012). It connects learning material with the computer and can be applied for a broad spectrum of applications and subjects. Users of this technology assert that it can help students to engage in interactive instruction
and gain a better understanding of concepts. DGBL can facilitate teaching and learning by simulating the real process, providing learners with the ability to experience situations that are not easy to deal with in the real environment (Purarjomaldlangrudi & Ghapanchi, 2013).

Hsiao et al. (Hsiao, Chang, Lin, & Hu, 2014) developed a digital game called ToES to improve students’ creativity. Their research goal was to investigate how DGBL systems can affect student motivation and improve their creativity. Their results not only showed that it is a very effective tool for cultivating student skills, but it also contributes to accelerating improvement and facilitates learning performance.

**Mobile Applications**

Learning through smartphones, or m-learning, is one of the recent developments that employ mobile devices in education and learning. This technology enables users to follow training programmes without the need to access a computer system. Gikas and Grant (Gikas & Grant, 2013) conducted research that investigated the impact of mobile devices such as cellphones and smartphones on learning and teaching. They included students and teachers in their research and explored how they integrated m-learning into their courses.

**Wikis**
Wikis are a collection of websites that are fully editable and enable multiple users to read and write in them at any time and from anywhere. This ability has brought about a very convenient environment for online collaboration. It is also an excellent tool for online learning and educational purposes (Augar, Raitman, & Zhou, 2004). It has a variety of uses in the academic context. Woo et al. (Woo, Chu, & Li, 2013) investigated the use of wikis for collaborative writing at primary levels in a Chinese primary school. The authors concluded that wikis can be helpful and can provide support for students’ writing skills.

**Podcasts/Streaming**

In this study, a podcast is an educational audio or video file that can be created, uploaded, or downloaded from websites to a digital device such as a computer, tablet, or smartphone. Streamed files are compressed-format files that can be played at the same time in various destinations, depending on the Internet speed, and can be stopped and started while playing. This technology has been extended throughout universities performing online and distance learning in recent years (Kathy Swan & Hofer, 2011).

2.3.2.2 Objectives and Goals of Online Learning Technologies

In this review the problems and aims of the research are categorised into seven groups. This classification was based on the overall idea of the research. Figure 2.5 demonstrates the categories and their contributions. “E-learning
effectiveness on learning” makes up 48% of the pie chart, which means most of the papers investigate the effectiveness of e-learning in education and learning outcomes. The next areas of exploration of significant proportions are “e-learning user acceptance” (22%) and “e-learning behavioural impacts” (18%). There are a few papers that explore “e-learning use barriers” (8%), “sustainable e-learning” (2%), “e-learning organisational changes” (1%), and “e-learning accessibility” (1%).

**Figure 2.5 Problems and aims of e-learning studies.**

2.3.2.3 Geographical Locations

Figure 2.6 provides a breakdown of the frequency of studies authored in different countries. It shows that the United States has been the most prolific, with 128 papers affiliated with US universities, followed by Taiwan (29), the
United Kingdom (20), the Netherlands (18), Canada (18), Australia (14), and Germany (11). As the chart illustrates, some countries have contributed fewer than 10 papers, such as Finland, Spain, China, and Sweden. Countries that have produced only one paper have not been included in the bar chart, namely: Egypt, Macedonia, Serbia, the United Arab Emirates’, India, Cyprus, Romania, South Africa, Saudi Arabia, Iran, Jordan, Oman, Croatia, Switzerland, Zambia, and Georgia. Examining e-learning technologies seems to be stronger in the US than in other countries.

![Geographical locations of research papers.](image)

**Figure 2.6 Geographical locations of research papers.**

### 2.3.3 Analysis of Research into Online Technologies

This section contains a brief analysis of research trends and discusses the implications of online learning technologies for practitioners and researchers.
Based on the results of this study, it can be seen that Assistive Software/Hardware and Management & Administration Tools/LMS technologies are employed more than other technologies in education, while Wikis and Podcasts/Streaming technologies need to be further addressed.

As Figure 2.5 demonstrates, the majority of research has been carried out on exploring the effectiveness of e-learning technologies used for various educational purposes. There is a lack of research and investigation into the accessibility and sustainability of these technologies, where it is very important to know how an invented technology can be used continually, and whether it is a sustainable system. With reference to Figure 2.6, there are appreciable differences between countries applying online learning technologies.

Online learning technology has matured rapidly throughout the world and different organisations, such as corporations, government organisations, and educational institutions, are taking advantage of it and adopting e-learning techniques in their unique environments. There are three main categories of these users: universities and higher education establishments, schools and educational institutions, and e-learning technology design companies.

Universities and higher education centres, which are our main focus in this research, are the dominant users of online learning technologies. The vast majority of these organisations employ online learning in their learning
processes and online courses to enhance learning efficiency and facilitate education. Different forms of these technologies are adopted to improve learners’ skills and knowledge linked with their business needs and personal career fulfilment. Blended learning and distance learning are two examples of implementing online learning technologies to make studying more flexible for learners. Educational institutions and schools also use several types of digital games and mobile applications. They apply these technologies successfully to teach and explain different scientific subjects, such as mathematical concepts and solving problems (Li, Lemieux, Vandermeiden, & Nathoo, 2013). They also take advantage of these technologies to help disabled learners to study and practise different subjects and improve their understanding and outcomes (Y. T. Chen, 2014).

There is a plethora of online learning content development companies in the e-learning industry. They design, simulate, and develop different e-learning software and make them ready for use by the customer. Many companies are involved in this area, such as City & Guilds Kineo, Skillsoft, Tata Interactive, Epic Learning Group, and Allen Interactions. The services they provide include:

- E-learning custom, multi-device, rapid, and ready-to use content
- Portals and learning platforms
- Blended and managed programmes
• Consultancy and support

• Apprenticeships, qualifications, and accreditations

Any new technology will have different impacts on the people who use it and on society as a whole and online learning technologies are no exception. There are various elements and topics for researchers to work on and different aspects of implementing these technologies to be investigated. Much research has been done in this area but the problem is that in this advanced world all technologies are growing very rapidly and people are confronted with a large number of new technologies daily.

Experts in this area can explore several aspects of applying e-learning technologies, some of the most important ones being how they could contribute to enhancing student and learner learning skills and outcomes, and user acceptance of educational technologies, which includes learner feedback and adoption patterns. There is a major lack of research about e-learning sustainability and investigating methods helping to establish the continued use of these technologies. There are psychological elements – such as the behavioural impact on users of employing online learning technologies – that should be taken into account by researchers.

In the next section, online learning facilitators and barriers are investigated to narrow down the research on the most important challenge in online
educational settings, which will be the lack of students’ online interaction. Later on, the research is going to focus on investigating the impact of behavioural factors that are personal and perceived course characteristics on learners’ online engagement and interactions.

2.4 Facilitators and Barriers in Online Education

In this section some online learning facilitators and advantages will be discussed, including how they can facilitate learning and what contributions they make to learning and teaching systems. The barriers and disadvantages of online learning are discussed. Different issues and problems encountered by learners or instructors are elaborated.

2.4.1 Online Learning Facilitators

Technology is an inevitable part of new societies and has penetrated different aspects of life, and education is no exception. “Whether or not you’re keen on using technology for learning, the fact is that it’s here to stay. Technology has become an essential way to handle the education, training, and retraining needs of an expanding knowledge society” (Shank & Sitze, 2004). Applying technology in learning, like any other sectors, has brought different advantages and disadvantages. Table 2.2 indicates some important facilitators and barriers of online education.
There are so many factors and the most popular ones are listed in the table. The common facilitators are flexibility and convenience, fast and great access, quick information retrieval, easy to store, edit, and archive materials, easy to participate, easy knowledge sharing, time and resource saving, e-learning adoption, active collaboration, freedom to create their own schedule and adds flexibility, more communication opportunities, cooperative teaching practices, and off-campus collaboration. The most common barriers of online learning environments are computer literacy, internet connection, lack of motivation, information overload, electronic plagiarism, health problem, lack of F2F interaction, pedagogical issues, quality control issues, access equality issues, difficulties in ensuring appropriate and sufficient learning experience, challenges in motivating and engaging students, protection of intellectual property.

**Table 2.2 Online learning facilitators and barriers**

<table>
<thead>
<tr>
<th>Facilitators</th>
<th>Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility and convenience</td>
<td>Computer literacy</td>
</tr>
<tr>
<td>Fast and great access</td>
<td>Internet connection</td>
</tr>
<tr>
<td>Quick information retrieval</td>
<td>Lack of motivation</td>
</tr>
<tr>
<td>Easy to store, edit, and archive materials</td>
<td>Information overload</td>
</tr>
<tr>
<td>Easy to participate</td>
<td>Electronic plagiarism</td>
</tr>
<tr>
<td>Easy Knowledge sharing</td>
<td>Health problem</td>
</tr>
<tr>
<td>Time and resource saving</td>
<td>Lack of F2F interaction</td>
</tr>
<tr>
<td>E-learning adoption</td>
<td>Pedagogical issues</td>
</tr>
</tbody>
</table>
One of the best and foremost facilitators is its convenience (Song, Singleton, Hill, & Koh, 2004). It allows both educators and instructors fast access to all the materials and information they need. It gives them the freedom to create their own schedule and adds flexibility (Bell & MacDougall, 2013). It can provide quick information retrieval, and easy storing, editing, and archiving of study materials (Keengwe & Kidd, 2010).

Ease of participation is another advantage of online education and enables students to participate in courses in different formats such as asynchronous, synchronous, or blended learning. Students can interact in chat rooms, by emails or blogging, in forums etc. Another type of learning is hybrid or blended learning. “As the name implies, there is a blend of various forms of learning activities. These may include classroom, learning experiences, and e-learning or various forms of e-learning or some combination of all three” (Steen, 2008) p. 528). This form of education meets the expectations of both traditional and online learning advocates.

<table>
<thead>
<tr>
<th>Active collaboration</th>
<th>Quality control issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freedom to create their own schedule and</td>
<td>Access equality issues</td>
</tr>
<tr>
<td>adds flexibility</td>
<td></td>
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<tr>
<td>More communication opportunities</td>
<td>Difficulties in ensuring appropriate &amp;</td>
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<tr>
<td></td>
<td>sufficient learning experience</td>
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<tr>
<td>Cooperative teaching practices</td>
<td>Challenges in motivating &amp; engaging</td>
</tr>
<tr>
<td></td>
<td>students</td>
</tr>
<tr>
<td>Off-campus collaboration</td>
<td>Protection of intellectual property</td>
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</tbody>
</table>
As for facilitators of online learning, we can refer to student success. A study at the University of Central Florida (2005) on Web-based learning showed that success rates were much higher than for traditional learning, students achieved better results, and the number of withdrawals was lower (University of Central Florida, 2005) p. 3). There are several other advantages, such as cost-effectiveness for the university, knowledge sharing and active collaboration, time and resource savings, enhanced communication opportunities, managing and analysing student learning processes, cooperative teaching practices, off-campus collaboration, etc (Barbara Means, Yuki Toyama, Robert Murphy, Marianne Bakia, & Karla Jones, 2009a).

2.4.2 Online Learning Barriers

Despite the advantages of online learning mentioned in the last section, there are major concerns that need to be brought to light. Computer literacy is a barrier that is generally supposed to be an individual factor. Although it seems obvious that people doing online education have to be computer literate, there are individuals who are not adequately prepared to embark on work in a technology-based learning environment (Ratliff, 2009). Before applying any type of technology in a course, therefore, designers and instructors have a responsibility to provide users with an adequate level of computer and technology skills, which can take a lot of the instructor’s time.
One of the limitations of online education is the lack of access to online networks, which may occur for economic or logistic reasons (Schuck, Prescott, & Buchanan, 2007). This is a barrier for all educational systems that are reliant on the Internet. In addition to access, the quality of transmission may also be a problem for online learners, particularly those who use video streaming or graphical environments such as 3D virtual worlds. The other issues are clashes between the tools used and individual learning style, the lack of motivation and self-organisation (Aragon & Johnson, 2008), information/content overload, electronic plagiarism and cheating, and health problems (Ardichvili, 2008).

Another drawback of online learning is the lack of physical presence and interaction, particularly for students who prefer special learning styles such as those who learn via tactile or kinaesthetic modality and are used to moving, touching, and being active when learning. Learning through online classes and not having a physical presence on campus means students suffer from a lack of social interaction, belonging, and adequate support and guidelines for their study as they are supposed to do their assignments and exams on their own.

According to Sims (1999), interaction in electronic learning processes has many educational functions related to learner control over system responses, adaptation to user input, allowing for participation and communication, and helping to provide meaningful learning (Sims, 1999). In light of the importance of interaction in online learning, the following section will provide a literature review of online interaction in education.
2.5 Literature Review on Online Interaction and Engagement in Education

One of the essential elements of online learning is student interaction, which substantially influences effective learning by exchanging ideas and intellectual stimulation (Wanstreet, 2009). Previous studies suggest that interaction in online education and interactivity on courses have a direct impact on the level of student satisfaction (Durrington, Berryhill, & Swafford, 2006), as well as student achievement and learning outcomes (Bernard et al., 2009). Moore (1989) proposed three types of interaction: interaction with the content, interaction with the instructor, and interaction with other students (M. G. Moore, 1989). He argued that student-content interaction is “the process of intellectually interacting with the content that results in changes in the learner’s understanding, the learner’s perspective, or the cognitive structures of the learner’s mind” (p. 2) when learners have access to course materials via the Internet that contain video, text, audio, and/or graphic images.

Learner-instructor interaction is very important for nurturing a student’s interest in the course content, and stimulating their motivation for learning. Instructors can make a considerable contribution to students’ understanding of course concepts and clarify misunderstanding through different strategies. Learner-learner interaction takes place among students individually or in a group, and may focus on building knowledge and developing specific skills (M.
G. Moore, 1989). In a traditional face-to-face learning system, with a teacher-centric style, students interact with instructors directly via F2F interaction. Distance education and online learning environments have caused a big shift towards learning decentralisation and provided more online learners. Today e-learning technologies have brought about many fundamental changes in learning styles, and focus more on students “by enabling multiple interactions among all the different agents involved – learners, instructors and course designers, tutors, contents, interfaces, administrative staff, codes, environments, etc.” (Agudo-Peregrina, Iglesias-Pradas, Conde-González, & Hernández-García, 2014) p. 542).

According to the literature, developing and promoting online interaction is vital in online learning and there are different studies involving this issue. Some apply a specific technology, such as social media, to increase interaction and create an interactive environment in their online courses (Bubas et al., 2010; Cardona-Divale, 2012). Other studies use various learning management systems (Carrick-Simpson & Armatas, 2003; Kang & Im, 2013; Ke & Kwak, 2013; Sargeant, Curran, Allen, Jarvis-Selinger, & Ho, 2006), Web 2.0 technologies (Torun, 2013), video teleconferencing (Kirby, 1999) etc. In addition to technologies and administrative features, the individual and behavioural factors of students that significantly influence their online interaction and engagement have been considered. These factors include a student’s self-efficacy (Y.-C.
Kuo, Walker, Belland, et al., 2014), levels of readiness and computer literacy (Kaymak & Horzum, 2013), interaction behaviours (Daradoumis et al., 2003), age and ethnicity (Ke & Kwak, 2013), learning styles (Hao, 2006), cultural diversity (Bing & Ping, 2008), and attitude toward distance and online learning (Brooks et al., 2004). The details of different factors extracted from the literature and their exact categorisations are given in Section 2.7.

2.5.1 Review Steps

This systematic literature review was conducted on studies involving online interaction in online learning in higher education entities in order to identify what factors influence online interaction and the engagement of students. As mentioned before, a systematic literature review as a research methodology aims to address research questions by elaborating and interpreting existing research and providing a big picture of the field. The steps taken are planning, conducting, and reporting the review. The next steps are carried out to meet these purposes.

2.5.1.1 Study Selection Process and Criteria

A comprehensive study has been carried out in this literature review. There are no excluding or including criteria for sources and we searched in different databases such as “Google Scholar”, “Taylor & Francis”, “Elsevier”, “Wiley”, “Editlib”, “Springer”, and “Eric”. The exact details of each database and the number of studies we found in them are indicated in Figure 2.7. This shows
that “Taylor & Francis” accounts for the biggest percentage of the total, at 24%, followed by “Elsevier” at 13%. Research terms include “online interaction and engagement in education”, “online interaction and engagement in learning”, “factors influencing online interaction”, and “online interaction parameters”. In order to present a state-of-the-art analysis of recent studies about online interaction and engagement, the review focused on research after 2000. Another excluding criterion was applied regarding research in higher education entities including colleges and universities.

![Figure 2.7 Databases and number of studies of each one.](image)

2.5.1.2 Study Process

When reviewing studies carried out after 2000 and using the above-mentioned search terms, the total number of studies founded was 362. Afterwards, the
titles of the papers were considered and those that were not related to the area were excluded, which resulted in 156 studies remaining. In the next step, the studies were reduced to 74 once their abstracts had been studied carefully. Finally, after reading the full text of remaining studies, I had 66 studies to be included in this literature review. Figure 2.8 indicates the study process.

![Figure 2.8 Stages of the study process.](image)

### 2.5.2 Outcome of the Literature Review

#### 2.5.2.1 Research Trend and Geographical Locations

This review verified factors that impact on online interaction and engagement in online education systems. The outcomes of this review regarding research trends and frequency in different geographical locations are displayed in the figures below. Figure 2.9 illustrates the trend in the period 2000 to 2015. It shows a steady increase in the number of publications between 2000 and 2009, and a dramatic upward trend in 2010; however, there was a sharp reduction in
2011. It can be concluded that this is a very open area of research and has proved an attractive topic in recent years.

Figure 2.9 Research trend.

Figure 2.10 displays the frequency of studies authored in different countries. The results show that the USA surpassed others by publishing 40 publications in this period. Other countries have substantially lower rates, suggesting researchers have paid less attention to this area. These include Spain and Turkey with four each, Australia and Taiwan with three each, Hong Kong, Croatia, China, and Malaysia with two each, and finally Korea, the UAE, Canada, and Finland with one each.
2.5.2.2 Types of Participants and Research Methodology

This literature review involves higher education organisations. We have classified the participants of the reviewed research into five main categories: university graduate, undergraduate and postgraduate, and college graduate and undergraduate students. Figure 2.11 is a bar chart of these categories and the number of studies in each one. It can be implied that most of the studies have been conducted on university undergraduate students.

**Figure 2.10 Frequency of research in geographical locations.**
Different research approaches and methodologies have been employed in the reviewed literature. Some studies applied a quantitative method, which is an objective and systematic process where numerical data are used to obtain information about the research objectives. As Figure 2.12 shows, it dominates the other methods with 61% of the total percentage. Some authors have selected a qualitative approach to find out underlying reasons, opinions, and motivations, and to provide a deeper insight into the issues, or to help to develop ideas or hypotheses for potential quantitative research; this approach comprises 14% of the total percentage. The last approach applied in the reviewed studies is a mixed-method one, which means that research contains both a quantitative and qualitative methodology and comprises 25% of all studies reviewed.

**Figure 2.11 Research participants.**
As Figure 2.12 shows, most studies used a quantitative research methodology. For instance, the authors in (Kang & Im, 2013) investigated factors in learner-instructor interaction and engagement that can predict the learner’s outcomes in an online learning environment. Agudo-Peregrina et al. (Agudo-Peregrina et al., 2014) defined three system-independent classifications of interactions and evaluated the relationship between their components and academic performance across two different learning modalities: virtual learning environment (VLE)-supported face-to-face (F2F) and online learning.

Purely qualitative research methods are adopted in only a few of previous literature studies. Examples of such research include where Wang in (M.-j. Wang, 2010) conducted research to determine the online utterances and offline interactions of students, to determine the extent of collaborative learning.
among students, and where Sargeant et al. (Sargeant et al., 2006) explored instructor roles in enhancing online learning through interpersonal interaction.

Mixed methods that contain both quantitative and qualitative methodologies are used in some author research such as that of Ke and Kwak (Ke & Kwak, 2013), which claims that online learning interaction participation, perception, and learning satisfaction would be consistent across various age and ethnicity groups. The authors in (Nor, Hamat, & Embi, 2012) also attempted to determine how students interact and collaborate in the process of online learning topics that had previously been discussed in a face-to-face mode. Other samples of this research include how different aspects of online courses impact on the way students enter into discussions online, and consequently, what they have an opportunity to learn (McCrorry, Putnam, & Jansen, 2008), and how instructors and students perceive the importance of online interaction and engagement which instructional techniques enhance them (Su et al., 2005), focusing on e-connectivity, instructor presence, and positive communication in online courses (Cheng & Suan). Appendix A contains more details about all the investigated studies in the literature of this review.

As one of the results of this review, in the following sections, the most important positive outcomes of online educational systems, which are very important for instructors and course developers, will be discussed. By improving these outcomes, the quality and performance of online learning
systems will also improve in many aspects. Then, the characteristics that are going to impact on these outcomes will be represented and categorised.

2.5.3 Review of Literature of Engagement on Education

Students engagement has attained enjoyed considerable attention in the literature since the mid-1990s. It basically started in Alexander Astin’s work on student involvement (Astin 1984). Student engagement has become the latest focus of attention among those aiming to improve teaching and learning in higher education, headlining meeting agendas and theming conferences in campuses around the world. Following on this attention, a sound body of literature has established strong relationship between student involvement in a subset of educationally purposive activities, and positive outcomes of student success and development, including satisfaction, persistence, academic achievement and social engagement (Astin, 1984, 1993; Berger & Milem, 1999; Chickering & Gamson, 1987; Goodsell, 1992; Kuh, 1993, 1995, 2005; Kuh & Vesper, 1997; Pace, 1995; Pascarella & Terenzini, 1991). Higher education institutions experiencing increasingly straitened economic conditions that attracts and retains students, satisfies and develops them to become successful, productive citizens. Kuh (Kuh, 2011) discusses that what students do during their time as a student is more matter to their success and development than what they bring to higher education, or where they study.
Harper and Quaye (Harper & Quaye, 2009) discuss the concept of engagement is more than involvement or participation – it requires feelings and should make sense, as well as activity. Acting without feeling engaged is just involvement; feeling engaged without acting is dissociation. Focusing on engagement in educational level, Fredricks et al. (Fredricks, Blumenfeld, & Paris, 2004), usefully describe three dimensions to student engagement, which are behavioural engagement, emotional engagement, and cognitive engagement.

Student engagement has been determined in different perspectives. Hu and Kuh (Hu & Kuh, 2002) define engagement as “the quality of effort students themselves devote to educationally purposeful activities that contribute directly to desired outcomes”. It was described as “participation in educationally effective practices, both inside and outside the classroom, which leads to a range of measurable outcomes” (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2011), and as “the extent to which students are engaging in activities that higher education research has shown to be linked with high-quality learning outcomes” (Krause & Coates, 2008). On the other hand, others have defined engagement as “the process where by institutions and sector bodies make deliberate attempts to involve and empower students in the process of shaping the learning experience” (HEFCE, 2008). Considering these two view points, Kuh (Kuh, 2009a) has described student engagement as “the time and effort students devote to activities that are empirically linked to desired outcomes of
college and what institutions do to induce students to participate in these activities (Kuh, 2001, 2009a)”

Coates (Coates, 2007) describes engagement as “a broad construct intended to encompass salient academic as well as certain non-academic aspects of the student experience”, including: active and collaborative learning; participation in challenging academic activities; formative communication with academic staff; involvement in enriching educational experiences; feeling legitimated and supported by university learning communities.

There are three main stream of student engagement in the body of literature, individual student learning, structure and process, identity. Individual student learning represents that individual works can be located according to their concern, or perspective, on the individual student learning dimension of student engagement. Structure and process focuses on issues of structure and process, including student representation, students’ role within governance, student feedback processes, and other such matters. Identity focuses on issues of identity. This can range from concerns about how to generate a sense of belonging for individual students, to concerns about how to engage specific groups of students (Trowler, 2010).

Coates (Coates, 2007) proposed a typology of student engagement styles within two axes, social and academic. The styles are categorized into: intense,
independent, collaborative, and passive. Here are quotes for each of them:

“Students reporting an intense form of engagement are highly involved with their university study … They tend to see teaching staff as approachable, and to see their learning environment as responsive, supportive and challenging.” (Coates, 2007, 132-133). “An independent style of engagement is characterised by a more academically and less socially orientated approach to study … Students reporting an independent style of study see themselves as participants in a supportive learning community. They see staff as being approachable, as responsive to student needs, and as encouraging and legitimating student reflection, and feedback. These students tend to be less likely, however, to work collaboratively with other students within or beyond class, or to be involved in enriching events and activities around campus.” (Coates, 2007, 133-134).

“Students reporting a collaborative style of engagement tend to favour the social aspects of university life and work, as opposed to the more purely cognitive or individualistic forms of interaction … High levels of general collaborative engagement reflect students feeling validated within their university communities, particularly by participating in broad beyond-class talent development activities and interacting with staff and other students.” (Coates, 2007, 134). “It is likely that students whose response styles indicate passive styles of engagement rarely participate in the only or general activities and conditions linked to productive learning.” (Coates, 2007, 134).
2.6 Online Learning Positive Outcomes

Previous research has shown that online interaction and engagement have a strong impact on different students’ positive outcomes, such as student satisfaction and motivation (Y.-C. Kuo, A. Walker, & K. Schroder, 2010; Y.-C. Kuo, Walker, Belland, et al., 2014; Moallem, Pastore, & Martin, 2013; Shank & Doughty, 2002), active learning (Y.-C. Kuo et al., 2010), learning outcomes, prospects, and performance (Beatty, 2002; Daradoumis et al., 2003; Heinemann, 2007; Kang & Im, 2013; Y.-C. Kuo et al., 2010; Okonta, 2010; Tatar et al., 2002). Some researchers introduced new ways to improve online interaction and engagement within online courses. For instance, Kang and Im (2013) tried to identify the factors in online interaction that can predict a learner’s outcomes. They concluded that “factors related to instructional interaction predicted perceived learning achievement and satisfaction better than factors related to social interaction. However, it was revealed that social interaction such as social intimacy could negatively affect perceived learning achievement and satisfaction” (Kang & Im, 2013 p. 292). Abrami et al. (2011) discuss different types of online interaction and suggest how these results may foster instructional improvement. They also highlight several evidence-based approaches that may be useful in the next generation of distance and online learning (Abrami, Bernard, Bures, Borokhovski, & Tamim, 2011; Bing & Ping, 2008; Brooks et al., 2004).
On the other hand, some studies experienced failure in adopting some techniques for stimulating online interaction and engagements. For example, Okonta (Beatty, 2002; Okonta, 2010) investigated the effect of the parallel use of Facebook and Twitter to increase online interaction among college undergraduate students and the results indicated that there was interaction between learners and other learners but it was minimally used in their courses and for academic purposes (Okonta, 2010). Belinda Carrick-Simpson and Christine Armatas from Deakin University, Australia, explored the factors that influence online interaction and better engagement, and the results of their study demonstrated that designing online learning activities with opportunities for interactivity is not sufficient to engage student interest (Carrick-Simpson & Armatas, 2003).

Figure 2.13 displays all the positive outcome factors extracted from the literature and its subcategories in the middle of the figure. There are three main categories: (1) psychological factors, (2) learning factors, and (3) behavioural factors. The first contains variables such as student motivation, student self-regulation, student appreciation, and student problem solving. The second category includes learning outcome/performance, student learning style, learning quality, learning effectiveness, academic achievement, and student success. The last comprises student interaction, student collaboration, student engagement, student attrition, and student perception.
2.7 Factors Impacting on Online Interaction

The main contribution of this literature review is identifying and classifying those factors that impact on online interaction. As mentioned before, there are several factors that contribute to online interaction and engagement improvement and development. This literature review proposes four main groups for these influencing factors: 1 – Students’ individual characteristics, 2 – Students’ behavioural factors, 3 – Course design factors, and 4 – Course delivery factors. Figure 2.13 shows the details of the classifications and all contributing factor categories.

Individual characteristics can be identified as having originated from a particular person or source, with a high degree of certainty. In this study they refer to traits that are instinctively institutionalised in each individual. The characteristics extracted from the literature in the area of online interaction and engagement in higher education entities include student expectation, self-expression, interest, cognitive abilities, leadership, self-efficacy, creative thinking, confidence, learning flexibility, and knowledge sharing (Hao, 2006; Ke & Kwak, 2013; Y.-C. Kuo, Walker, Belland, et al., 2014).

Behavioural factors are traits that are owned by an individual. The behavioural factors identified so far in the literature that affect online interaction and engagement are social intimacy, attitude, readiness, interaction, content
understanding, group functioning, collaboration, cooperation, and participation (Kaymak & Horzum, 2013; Sher, 2009).

Course design factors are explained as factors in relation to instructing and developing course materials and contents, and refer to the traits that directly contribute to presenting a course. Those that are found in literature that impact on online interaction and engagement in online learning are course clarity, task design, and academic integrity (Bubas et al., 2010; Lamy & Hassan, 2003; Karen Swan, 2002; Torun, 2013).

Course delivery factors refer to parameters that are related to the administration of the course, such as active discussion, feedback, technical support, academic support, and pedagogical support (Mohamad, Yusof, & Aris, 2014; Nor et al., 2012; Swanson, 2010).

According to the literature regarding course design and course delivery factors, various parameters have been considered, such as focusing on e-connectivity and instructor presence (Swanson, 2010), which used a mixed method of a qualitative study with a quantitative component in the affective domain emphasising e-connectivity, instructor presence, and positive communication. The instructor’s role and course content as used to enhance online learning through interpersonal interactions is another interest of researchers in this area (Cheng & Suan). The authors in (Lamy & Hassan, 2003) presented the
relationship between changing task designs and learner behaviour in online courses, and their results showed that task type is the main predictor of the volume of reflective interaction.

In terms of individual and behavioural traits, some research has been conducted in regard to student characteristics that have an impact on their online interactions. Examples include the effect of interactions and Internet self-efficacy on student satisfaction (Y.-C. Kuo, Walker, Belland, et al., 2014), student readiness levels for online learning (Kaymak & Horzum, 2013), interaction behaviours of different collaborative group types (Daradoumis et al., 2003), the age and ethnicity of students (Ke & Kwak, 2013), learning styles (Hao, 2006), cultural diversity (Bing & Ping, 2008), and student attitudes toward distance and online learning (Brooks et al., 2004).
Factors impacting on student interaction and engagement:

**Individual Characteristics:**
- Expectation
- Self-expression
- Interest
- Cognitive Abilities
- Leadership
- Self-efficacy
- Creative Thinking
- Confidence
- Learning Flexibility
- Knowledge Sharing

**Behavioural Factors:**
- Social Intimacy
- Attitude
- Readiness
- Interaction
- Content Understanding
- Group Functioning
- Collaboration
- Cooperation
- Participation

**Course Delivery Factors:**
- Active Discussion
- Feedback
- Technical Support
- Academic Support
- Pedagogical Support
- E-connectivity

**Course Design Factors:**
- Course Clarity
- Task Design
- Academic Integrity

**Positive Outcome Factors**

- Psychological Factors:
  - Student Motivation
  - Student Self-regulation
  - Student Appreciation
  - Student Problem-solving

- Learning Factors:
  - Learning Outcome/Performance
  - Student learning style
  - Learning Quality
  - Learning Effectiveness
  - Academic achievement
  - Student Success

- Behavioural Factors:
  - Student Interaction
  - Student Collaboration
  - Student Engagement
  - Student Attention
  - Student Perception

Figure 2.13 Factors impacting on student interaction and engagement.
2.8 Literature Gap

In the previous section most of the existing factors affecting student online interaction and engagement in online learning environments are identified and classified into four main categories: individual, behavioural, course design, and administrative factors. Among the examples of traits that are investigated in the literature are student expectation, self-expression, cognitive abilities, leadership, self-efficacy, creative thinking, confidence, learning flexibility, knowledge sharing, social intimacy, readiness, interaction, and content understanding.

Some traits are not, or less, investigated in existing studies, such as students’ self-regulated learning, communication competencies, student attitudes towards online education, a sense of presence in OLEs or virtual co-presence, a sense of identity and belonging, and a sense of purpose in online interaction. The aim of this research is to explore and investigate the impact of these traits on students’ online interaction and engagement in online learning environments.

In this study six traits are selected for investigation of their impacts on student online interaction and engagement. The process of how to identify these traits is discussed later. As mentioned before, three are termed students’ personal characteristics: self-regulated learning, communication competencies, and attitude toward online education. Some are considered in online learning literature, such as self-regulated learning. Self-regulated learning (or self-
regulation) refers to learning that is the outcome of a student’s self-generated thoughts and behaviours that are oriented towards achieving their goals (B. Zimmerman & Schunk, 2001). The author in (McGhee, 2010) investigated how asynchronous interaction, online technology self-efficacy, and self-regulated learning influence academic achievements. Communication competence is also considered to be a person’s ability to choose communication behaviour, which is suitable for achieving the aim of a social relationship (Spitzberg & Cupach, 2012). This characteristic is essential for both students and teachers in all learning concepts. There is also research regarding student attitudes towards online learning and online distance education. Watson (Watson, 2010b) has worked on the attitudes of students enrolled in a distance education MBA programme towards interacting more with other students online.

The second category is a student’s perceived course characteristics that contain a sense of presence and sense of identity in the specific online learning environment used in their course, and a sense of purpose toward online interaction in their course. Some of these traits are defined in other concepts in literature, and some are self-developed. A sense of presence or virtual co-presence in an online learning environment has emerged as evolving in computer-mediated interaction and communication. It helps individuals to represent themselves in their online environment. A sense of presence is a social feature that shows student’s perceptions of their availability and
enthusiasm to engage and connect with other learners. A sense of identity refers to a personal characteristic that is defined as being identified or recognised in a society. It is a self-concept extracted from an individual’s perceived membership in a relevant group. Finally, the sense of purpose in online interaction means the purposefulness of online interaction and engagement, from the student’s perspective, in the specific course they are taking.

In light of the outcome of the review, a qualitative research methodology, which constituted the lowest percentage of all studies (see Figure 12), is one of the methods that we are going to employ in this research. This method will be applied to analysing qualitative data and creating a CLD to provide a big picture of different individual and behavioural contributing traits and their causal relationships. CLDs display an accumulated illustration of causal hypotheses to present the structure of the system for users to discuss the feedback structure and underlying assumptions (Sushil, 1993). This diagram will show relationships and connections that are not easy to describe in words. In this study we are going to analyse qualitative data collected from an online course at Griffith University to create a comprehensive CLD for all contributing factors in student online interaction and engagement in OLEs.
2.9 Chapter Summary

This chapter began with the background to online learning and proposed some definitions, concepts of online education, and its history in Section 2.2. In Section 2.3 a systematic literature review of technologies applied in online learning environments was carried out. All technologies were introduced and a classification was demonstrated. This was followed by a conclusion in Section 2.4 that discusses online learning facilitators and barriers. A comprehensive literature review was conducted in Section 2.5 on online interaction and engagement in education. It was followed by introducing student positive outcome variables that exist in literature in Section 2.6, and in Section 2.7 impacting factors were proposed with a detailed categorisation of all factors affecting online interaction and engagement. Finally, literature gaps were discussed in Section 2.8.
Chapter 3

RESEARCH MODEL AND HYPOTHESES

3.1 Chapter Overview

The objective of this study is to investigate the impact of student communication competencies, self-regulated learning, students’ attitudes towards online education, a sense of presence, a sense of identity and belonging, and a sense of purpose in online interaction and engagement in higher education online courses. This chapter aims to outline the research methodology chosen to fulfil this objective. It begins with the research approach, questions, and framework that are applied in this study (Section 3.2). Then the qualitative study design is introduced in Section 3.3. Subsequently, Section 3.4 proposes the hypotheses development, and the theoretical background and research model are discussed in Section 3.4. This is followed by the quantitative study design and research model in the next section (3.6), and finally Section 3.7 provides a summary of the chapter. Figure 3.1 presents an outline of Chapter 3.
3.2 Research Approach, Questions, and Framework

One of the areas in philosophy that elaborate the creation of knowledge is epistemology (W. Lawrence Neuman, 2013). There are three main epistemologies in the field of information systems (IS): positivism, interpretivism, and design science (Orlikowski & Baroudi, 1991). Positivism refers to epistemology that describes “an organised method for combining deductive logic with precise empirical observations of individual behaviour in
order to discover and confirm a set of probabilistic causal laws that can be used to predict general patterns of human activity” (W. Lawrence Neuman, 2013). The interpretivist epistemology application is to determine social life, to construct meaning in natural settings, and to describe how people develop and employ IS in society (Willcocks & Mingers, 2004). The design science approach is applied when creating or developing new approaches or methods for coping with current problems (von Alan, March, Park, & Ram, 2004).

This study is going to adopt a positivist approach. Researchers in this approach typically hypothesise a series of connections and relationships among different variables within phenomena and employ a structured instrument to explore or elaborate those relationships. Positivist epistemology basically seeks “to test theory, in an attempt to increase the predictive understanding of the phenomena [p. 51]” (Orlikowski & Baroudi, 1991). Neuman (W. Neuman, 2006) introduced the following six steps for a typical positivist research:

1- Formulate a theory about some observed aspect of the world

2- Derive hypothesis

3- Test hypothesis objectively

4- Observe results

5- Confirm or refute hypothesis
6- Accept, modify or reject theory

The current study aims to discover causal relationships between online interaction and engagement, and its proposed antecedents (communication competencies, students’ self-regulated learning, student attitudes towards online education, virtual co-presence, a sense of identity and belonging, and a sense of purpose) through careful empirical observations, identically quantifying the concepts and analysing the measures. This approach is consistent with positivist epistemology, where the objective is to describe causal connections between concepts and objects (W. Neuman, 2006). Employing this epistemology is based on previous studies in regard to online interaction and engagement in higher education online courses, which are mentioned in the literature review chapter (Chapter 2), where researchers adopted this approach.

Quantitative and qualitative methodologies are the two main methodologies used in academic research (Creswell, 2005). The quantitative approach involves “educational research, in which the researcher decides what to study, asks specific narrow questions, collects numeric (numbered) data from participants, analyses these numbers using statistics, and conducts the inquiry in an unbiased, objective manner” (Creswell, 2005). The main objective of the quantitative research method is to create and develop mathematical models, theories, and hypotheses.
The qualitative research method attempts to gain a comprehensive understanding of a specific phenomenon rather than a superficial presentation of a large sample of populations (Creswell, 2005). It comprises five main approaches: case studies, phenomenology, ethnography, grounded theory, and narrative research (Cooper & Schindler, 2005). In case studies the research focuses on specific events in relation to individuals instead of a group of people. In phenomenology, the research approach is based on empirical observation of a phenomenon. The ethnography qualitative research design includes description, analysis, and interpretation of cultural phenomena based on knowledge, beliefs, and language. In the grounded theory approach, researchers attempt to create new theory grounded in data that leads to the eliciting of conceptual categories. Narrative studies are aimed at finding out the meaning of different aspects of people’s lives based on their history, drama, and folklore.

3.3 The Qualitative Study Design

For the first gap in the literature, introduced in Chapter 2 (Section 2.8), and to answer Research Question 1 (What are the factors and their causal relationships that impact on a student’s online interaction and engagement in online courses?), a qualitative research approach is designed to investigate factors that contribute to a positive impact on students’ learning outcomes, and to evaluate satisfaction and engagement in online courses by focusing on students’ online
interaction. In this stage of the study, a qualitative case study approach is going to be employed to determine different factors impacting on the online interaction, participation, and engagement of students in higher education online learning entities.

For this qualitative section the data were collected through an online focus group and the qualitative data collected were analysed using the qualitative data analysis software NVivo (Gibbs, 2002). The results of this part are used to generate a comprehensive causal loop diagram. CLDs are essential to enable researchers and other users to gain a better understanding of causal relationships between different elements of a phenomenon in an aggregate illustration (Sushil, 1993).

3.4 Theoretical Background and Hypotheses Development

The aim of this research is to explore and investigate the impact of these traits on students’ online interaction and engagement in online learning environments. In this study six traits are selected for investigation of their impacts on student online interaction and engagement. The process of how to identify these traits is discussed in chapter 2. As mentioned before, three are termed students’ personal characteristics: self-regulated learning, communication competencies, and attitude toward online education. Some are considered in online learning literature, such as self-regulated learning. Self-regulated learning (or self-regulation) refers to learning that is the outcome of a
student’s self-generated thoughts and behaviours that are oriented towards achieving their goals (B. Zimmerman & Schunk, 2001). The author in (McGhee, 2010) investigated how asynchronous interaction, online technology self-efficacy, and self-regulated learning influence academic achievements. Communication competence is also considered to be a person’s ability to choose communication behaviour, which is suitable for achieving the aim of a social relationship (Spitzberg & Cupach, 2012). This characteristic is essential for both students and teachers in all learning concepts. There is also research regarding student attitudes towards online learning and online distance education. Watson (Watson, 2010b) has worked on the attitudes of students enrolled in a distance education MBA programme towards interacting more with other students online.

The second category is a student’s perceived course characteristics that contain a sense of presence and sense of identity in the specific online learning environment used in their course, and a sense of purpose toward online interaction in their course. Some of these traits are defined in other concepts in literature, and some are self-developed. A sense of presence or virtual co-presence in an online learning environment has emerged as evolving in computer-mediated interaction and communication. It helps individuals to represent themselves in their online environment. A sense of presence is a social feature that shows student’s perceptions of their availability and enthusiasm to engage and connect with other learners. A sense of identity refers
Research Model and Hypotheses

to a personal characteristic that is defined as being identified or recognised in a society. It is a self-concept extracted from an individual’s perceived membership in a relevant group. Finally, the sense of purpose in online interaction means the purposefulness of online interaction and engagement, from the student’s perspective, in the specific course they are taking.

As discussed in Chapter 2 (Section 2.8), this study employs six specific student personal and perceived course characteristics affecting online interaction and engagement. Addressing the gap discussed in Section 2.8, this section seeks to postulate the potential interrelationships between these traits and online interaction and engagement. In what follows, these interrelationships are hypothesised.

3.4.1 The Impact of Communication Competencies on Students’ Online Interaction and Engagement

According to social cognitive theory (SCT), there is a reciprocal interaction between human behaviours, cognitive personal factors, and environmental variables (Bandura, 1977, 1986). This theory, which is used in psychology, education, and communication, states that human cognitive personal factors can influence external environmental variables. Figure 3.2 (Schunk, 1989) is a schematic of this theory. According to SCT, which states that human cognitive personal factors affect external environmental variables, and if online interaction and engagement are identified as external environment variables,
communication competencies as a human behaviour could have a positive impact on students’ online interaction and engagement. Therefore, Hypothesis 1 can be formulated as follows:

**H1.** Communication competencies are positively associated with a student’s: (a) online interaction and (b) engagement.

![Diagram](image)

**Figure 3.2** Social cognitive theory.

### 3.4.2 The Impact of Self-Regulated Learning on Student Online Interaction and Engagement

Although different theoretical definitions have been proposed for self-regulated learners, generally self-regulating students are described as learners who have metacognitive, motivational, and behavioural active characteristics in their learning (B. J. Zimmerman, 1989). Self-regulation involves factors of self-direction and the ability to learn independently, which has been recognised as a driver of learning effectiveness in distance and online learning (M. G. Moore, 1989).
Based on SCT, self-regulated learning traits, which are a cognitive personal factor, influence online learning environment variables as an external environment. Connectivism theory (Siemens, 2014), which is a new learning theory, implies that online interaction, and engaging and connecting with different ideas, are core variables in the online learning environment. Referring to SCT, and due to the fact that online interaction and engagement are counted as external environment variables, we hypothesise that self-regulated learning traits could have a positive impact on a student’s online interaction and engagement in online educational systems. In light of this, we formulate Hypothesis 2 as follows:

\[ H2. \text{Self-regulated learning is positively associated with a student’s: (a) online interaction and (b) engagement.} \]

### 3.4.3 The Impact of Attitude Toward Online Education on a Student’s Online Interaction and Engagement

In this study, attitude toward online education refers to the sum of a student’s beliefs and insights with regard to adopting online learning in their educational process and the way they think about its usefulness. The theory of reasoned action (TRA), which was proposed by Ajzen and Fishbein (Ajzen & Fishbein, 1988), is a theory for predicting behavioural intention, extending predictions of attitude and predictions of behaviour (Figure 3.3). TRA states that a person’s behavioural intention depends on their attitude to behaviour and subjective
norms. Simply, behavioural intention is affected directly by the attitude of a person toward that behaviour.

Applying TRA in our concept, students’ attitude towards online education directly influences their behavioural intention to use it in their learning systems. Based on TAM theory as discussed in the previous section, the behavioural intention to use a system affects the actual use of the system, which online is interacting and engaging in OLEs. Combining these two theories, we thus hypothesise that a student’s attitude toward online learning can influence their online interaction and engagement in online education settings.

**H3.** *Attitude towards online learning is positively associated with a student’s: (a) online interaction and (b) engagement.*

![Figure 3.3 Theory of reasoned action (TRA).](image-url)
3.4.4 The Impact of Sense of Presence in OLEs on Students’ Online Interaction and Engagement

A sense of presence or virtual co-presence in an online learning environment has emerged as an evolving computer-mediated interaction and communication. It helps individuals to represent themselves in their online environment. A sense of presence is a social feature that shows students’ perceptions of their availability and enthusiasm to engage and connect with other learners in their specific online community. It is represented by the way communication is undertaken and messages are posted and interpreted by other participants. A sense of presence is derived from the social presence ability of an individual. The more students perceive their presence in an online community, the more they will participate and communicate with others, which in turn affects their ability to communicate effectively (Kehrwald, 2008).

Social presence theory, which was developed by Short, Williams, and Christie (Short, 1976), states that the degree of social presence is equated to the degree of an individual’s sense of awareness and presence in their communications in a community. According to social presence theory, communication is effective if the communication medium has the appropriate social presence required for the level of interpersonal involvement required for a task (Sallnäs, Rasmus-Gröhn, & Sjöström, 2000). Given that a sense of presence is one of the fundamental components of social presence, a higher level of a sense of presence and awareness leads to a higher social presence and
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more effective communication and interaction in a specific community. Therefore, in a specific online learning environment, and based on the argument mentioned above, we hypothesise that a sense of presence could have a direct impact on a student's online interaction and engagement in the particular online environment that they use for their online course.

**H4.** A sense of presence is positively associated with a student’s: (a) online interaction and (b) engagement.

### 3.4.5 The Impact of Sense of Identity on a Student’s Online Interaction and Engagement

The word “identity” is ubiquitous in different concepts of social science, psychology, sociology, and history; however, the common usage of the term “identity” is very different from its conceptual meanings and its theoretical role (Tajfel & Turner, 1979). In this study “sense of identity” refers to the personal characteristics that are defined as being identified or recognised in a society. Henri Tajfel and John Turner in the 1970s and 1980s (Tajfel & Turner, 1979) introduced a theory called “social identity theory”. It explains that an individual’s self-concept is extracted from their perceived membership in a relevant group, and introduces the concept of a social identity as a way in which to explain intergroup behaviours.

Social identity theory focuses on the connection between self, role, and society, and in this concept, the self is made up of multiple selves or a community
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(Stryker, 1980). It states that interpersonal behaviours shape social behaviours and, in turn, interpersonal relationships that exist between two or more people in a group. We can attribute a sense of identity in a society or community as an interpersonal characteristic. Based on social identity theory, this trait can shape an individual’s social behaviour and affect their interpersonal relationships, including their connections, engagements, and interactions.

When students use a specific online interaction tool for their online course, they will experience different levels of a sense of identity in that online environment. As argued above, this experience can affect their social behaviour in that online learning course, which influences their online interaction and engagement with that course (Albert, Ashforth, & Dutton, 2000; G. Merchant, 2006; Xu-gui, 2011). We thus hypothesise that a student’s sense of identity in an online learning environment has a direct effect on their online interaction and engagement with their online course.

**H5.** A sense of identity is positively associated with a student’s: (a) online interaction and (b) engagement.

3.4.6 The Impact of Sense of Purpose Toward Online Interaction on a Student’s Online Interaction and Engagement

Generally, a sense of purpose toward everything, for example a system, means that the people in that system believe and experience the usefulness and purposefulness of it. A sense of purpose in a system, particularly in an
educational system, seems to be very important for the growth and development of that system (Chickering & Reisser, 1993; Frankl, 1985). Moran (Moran, 2001) attracted educational affairs professionals’ attention to develop learners’ sense of purpose toward their learning system and he argued that it increases a student’s connectedness with the learning community and environment. Previous research has shown that having a sense of purpose toward a system or technology will lead to greater use and adoption of that technology or system (Hanson, 2006).

According to the technology acceptance theory (Davis, 1989) explained in Section 3.4.2, the sense of purpose toward a system as an external variable positively affects perceived usefulness, which in turn affects the actual use of that system. As a result, in an online course where a specific online interaction tool is used, if students are informed about the usefulness and purposefulness of online interactions that are undertaken through that tool, their actual use of that tool will be increased. In other words, by increasing the perceived usefulness of online interaction in an online learning environment, the actual use of that online interaction tool will also escalate. Considering online interaction and engagement in an online course as the attributions of the actual use of the online interaction tool in that course, and based on technology acceptance theory and the above arguments, we hypothesised that a sense of purpose towards online interaction via an online interaction tool in an online
learning environment can positively influence a student’s online interaction and engagement in that online course.

**H6. A sense of purpose toward online interaction is positively associated with a student’s:**

(a) online interaction and (b) engagement.

### 3.4.7 The Impact of a Student’s Online Interaction on their Engagement

In this part, to predict the impact of the mediator variable of online interaction on student engagement, an IS success model is used. To provide a comprehensive and general definition of IS success, Delone and McLean introduced an integrated view of the concept of information systems success. After reviewing existing definitions of IS success and their associated measures, they categorised them into six major classes. In fact, they generated a multidimensional measurement model with interdependencies between the different success categories (Delone, 2003), information, system and service quality, (intention to) use, user satisfaction, and net benefits (Figure 3.4). The interpretation of the model is that “a system can be evaluated in terms of information, system, and service quality; these characteristics affect the subsequent use or intention to use and user satisfaction. As a result of using the system, certain benefits will be achieved. The net benefits will (positively or negatively) influence user satisfaction and the further use of the information system” (Delone, 2003).
In this research, the last part of the updated IS Success model is employed to support our hypothesis development. When students using online learning environment and interact with this environment, they use online learning tools to interacting and connecting to the course conveners, course content, and other students. In better words, their interaction with online environment is through the use or intention to use of the system. Therefore students’ online interaction can be attributed as use or intention to use of the system.

As mentioned before, student engagement with a course is the aim and desire of every unit of teaching. Previous studies have shown that student engagement plays an important role in their learning and educational benefits and performances. When their engagement with the teaching contents improves, their outcomes and success also enhance (Coates, 2005; Dixson, 2012;
Lamborn, Newmann, & Wehlage, 1992). Considering the students’ engagement as one of the important benefits of the learning and educational systems, it can be attributed to the net benefits of the online learning systems.

Based on the IS success model of Delone and McLean and considering student online interaction as system use or intention to use and student engagement with that course and online learning as system benefits, we can hypothesise that students’ online interaction in an online environment can have a direct impact on their engagement with that online course.

**H7. Students’ online interaction is positively associated with students’ engagement.**

### 3.5 Study Research Model

Figure 3.5 summarises the hypotheses that are proposed in this study. As is shown in this figure, the dependent variables of our research model are student learning outcomes and satisfaction. There are six independent variables: self-regulated learning, communication competencies, attitude towards online education, sense of presence, sense of identity, and sense of purpose towards online interaction. There are also two dependent variables in our research model: students’ online interaction and engagement. Previous studies have shown the importance of online interaction in terms of student learning outcomes and satisfaction, and they have proven that investigating the different elements and factors that lead to stimulating online interaction in online learning is of great importance for researchers and learning system designers.
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(Y.-J. Chen & Chen, 2007; J. Richardson et al., 2000; Wilson, 2007). Therefore, because a direct positive impact of students’ online interaction and engagement on students’ learning outcomes and satisfaction has been demonstrated by previous studies (the dotted line in Figure 3.5), in this research we address the other parts of this model.
Figure 3.5 Proposed research model.
3.6 The Quantitative Study Design

As mentioned previously, there are four major categories of parameters that impact on students’ online interaction and engagement: individual, behavioural, course design, and administrative factors. The main objective of this study is to focus on individual and behavioural factors that we have categorised as students’ personal and perceived course characteristics that could contribute to enhancing students’ online interaction and engagement. The researcher aims to work on the traits that are not investigated or are less explored in the literature, including students’ communication competencies, self-regulated learning, attitude toward online education, sense of presence in OLEs or virtual co-presence, sense of identity and belonging, and sense of purpose toward online interaction. The research questions associated with this part are:

**RQ2**- What is the impact of a student’s personal characteristics on their online interaction and engagement?

**RQ3**- What is the impact of a student’s perceived course characteristics on their online interaction and engagement?

To conduct this part of the research, a quantitative methodology has been adopted. The main objective of the quantitative research method in this study is to mathematically measure and investigate the research hypotheses proposed in the last section. The quantitative research method is described by the collection
of information that can be analysed numerically, the results of which are typically presented using statistics, tables, and graphs. The following figure displays a typical research process from research problem to conclusion formulation.

**Figure 3.6 Quantitative research process schema**

To fulfil our research objective via the quantitative approach, data will be collected through a questionnaire in one of the Griffith University’s online courses. The questions that are going to be used in the survey are concept-based, using the student personal and perceived course variables introduced in the proposed research model (Figure 3.5). To perform data analysis in this part of the research, partial least squares will be employed. More details of this part of the study are discussed in Chapter 5.
3.7 Chapter Summary

This chapter has outlined the research approach and methodology as well as data collection and analysis techniques for the qualitative and quantitative research of this thesis. A multi-method approach for the research methodology, which consists of a survey research and a quantitative content analysis, has been outlined in this chapter. The qualitative research is designed to answer Research Question 1 and the quantitative research is designed to answer Research Questions 2 and 3. Furthermore, the chapter explained the environment under study and data collection. To address the identified gaps, this chapter presented the research hypotheses as well as the relationship between factors in the research model. Lastly, this chapter has outlined the quantitative research study and introduced PLS for structural equation modelling to assess the interrelationships between the factors in the research model.
Chapter 4

RESEARCH METHOD AND RESULT: QUALITATIVE STUDY

4.1 Chapter Overview

This chapter aims to answer the first research question of this study: What are the factors and their causal relationships that impact on students’ online interaction and engagement in online courses? In this chapter, a qualitative research approach is employed to serve this purpose. The chapter starts with the research methodology and details about the qualitative research in Section 4.2. Then the research participants, data collection, and research instrument will be discussed in Sections 4.3 and 4.4. This is followed by the ethical considerations in the next section (Section 4.5). Section 4.6 presents the demographic characteristics of the research participants to provide a clear understanding of the environment under study. In Section 4.7 the collected qualitative data are analysed by introducing NVivo as a software for analysing the content of qualitative data. The results of the data analysis are discussed in Section 4.8 and demonstrated through CLDs. Finally, Section 4.9 provides a summary of the chapter. Figure 4.1 presents an outline of this chapter.
Figure 4.1 Outline of Chapter 4.

4.2 Research Design

Previous studies have shown the importance of online interaction in terms of student learning outcomes and satisfaction (Y.-J. Chen & Chen, 2007; J. Richardson et al., 2000; Wilson, 2007). Many researchers have worked on online interaction and its role in online learning. However, there is a lack of research
uncovering the dynamics of these relationships and focusing on generating a comprehensive picture of the different contributing factors and their causal relationships, which is an important gap in the literature. To address this research gap, a qualitative research design has been employed to investigate factors that contribute to a positive impact on students’ learning outcomes, and to evaluate satisfaction with, and engagement in, online courses by focusing on students’ online interaction.

To select the research method, according to previous research, case studies can be employed to explore, elaborate, or describe events or phenomena in the everyday contexts in which they occur (Yin, 2013). This proves that an important strength of case studies is the ability to conduct an investigation of a phenomenon in its context, and that replicating the phenomenon in a laboratory or experimental setting does not necessarily provide a better understanding. As a result, case studies are extremely valuable for exploring environments (William Lawrence Neuman, 2005). In other words, exploratory case studies are generally a suitable approach for addressing “what”-, “how”-, and “why”-type questions, as this research approach explores a contemporary phenomenon (Rowley, 2002). Therefore this method has been selected for this part of the research.

An exploratory case study approach is applied to identify different factors and parameters and to address these research questions regarding what factors
contribute to student online interaction, participation, and engagement, and what their causal and internal relationships are with students’ involvement, satisfaction, and learning outcomes. This exploratory case study has been conducted by posing open-ended questions to second-year online students in an online IT course, which were then thematically analysed to extract the fundamental factors and their internal relationships. Then a series of causal loop diagrams (CLDs) has been generated to clearly indicate the results.

4.3 Participants

The participants of this part of the research were higher education students and academic learners who were enrolled in an online course and used an online environment for interaction. In order to provide a rich qualitative data set, an online course at Griffith University Information and Communication Technology (ICT) School was selected. They use Facebook as a part of their course material for online interaction.

For this qualitative section the data were collected through an online focus group (Gaiser, 2008). An online focus group is adopted for studies containing open-ended questions that provide the opportunity for students to express their points of views about their online interaction in their online course, as well as their opinions about the pros and cons of their experience with it and its impact on their academic prospects. Collecting text data from online forums in the
form of online focus groups is a better approach than interviewing students on online courses because they are mostly off campus and distance students.

4.4 Data Collection and Instrument

To achieve in-depth insight and investigate the research problem, qualitative data were collected from undergraduate students enrolled in an online course offered by an Australian university. The course contained more than 100 students and an online group discussion was conducted at the end of the semester, in May 2015, where the qualitative data were collected. An online focus group approach was adopted and conducted with open-ended questions (Appendix C) that provided the opportunities for students to express their points of view regarding their online interaction in their online course, as well as their opinions about the pros and cons of their experience with the course and its impact on their academic prospects (Gaiser, 2008). This approach of collecting text data from online forums in the form of online focus groups is a practical method for online courses because their students are mostly off campus and distance students.

4.5 Ethical Considerations

Students were asked to answer and discuss open-ended questions about the online interaction they had in the course. Potential participants were asked to sign a consent form indicating their voluntary participation and their participatory status will not be revealed to the teaching team until after the
grades for a semester have been issued. They were also assured that participating in the study would not affect their course grade in any way. Ethics approval was obtained from the Griffith University Human Research Ethics Committee for the content analysis of this thesis. The ethics approval number for both the qualitative and quantitative research of this study is 2015/755, issued on 30/09/2015. A copy of the approval letter is provided in Appendix B.

4.6 Demographic Characteristics of Participants

From a demographical perspective, the total participation rate of students was 43%, of which 86% were males and 14% were females. The age of the participants varied significantly: 16% of the participants were under 20 years of age, 37% were between 21 and 30 years of age, 27% were between 31 and 40 years of age, and 20% were over 40 years of age. Figure 4.2 indicates the participant distribution.
4.7 Data Analysis

The data collected were analysed using the qualitative data analysis software NVivo (Gibbs, 2002). This software is designed to organise data and conduct thematic analysis. Thematic analysis is prevalent among researchers in qualitative research approach studies (Boyatzis, 1998; Braun & Clarke, 2006). Analytic themes in this concept involve identifying the patterns in data sets, which are most important for explaining and describing particular events or areas associated with a specific research objective. It is therefore a very effective method for compiling and analysing focus group data.

There are six main steps required to conduct a thematic analysis: familiarising the analyst with the data, coding data, searching for themes, reviewing themes,
defining and naming extracted themes, and presenting the results. The entire
data set was read very carefully several times to become familiar with it (Braun
& Clarke, 2006). Then, with the help of NVivo software, the data were coded
and themes extracted. The next section details these steps, explains the process
of thematic analysis with NVivo software and furnishes the results of that
analysis. After that, themes are reviewed and named and the results presented
through a causal loop diagram (CLD).

One of the most useful ways of analysing qualitative data and capturing the
structure of the system is a CLD, an extensively used approach (Miles &
Huberman, 1985; Sterman, 2000). After analysing the data and creating the
output of the thematic analysis, the findings were used to generate a list of
potentially important variables associated with online interaction and
engagement in an online course. These variables were then used to develop
descriptive CLDs through the employment of Vensim software (6.3D, 2013).
Traditionally, causal modelling results in a developed network of variables and
explicit delineation of their internal relationships. The main purpose of a CLD
is to display causal hypotheses in order to present the structure of the system in
an aggregate illustration. This structure helps the user discuss the feedback
structure and underlying presumption (Sushil, 1993). It contains parameters or
variables connected by arrows indicating the causal relationship or influences
among them. A positive mark on the link indicates a positive relation and
means that the two variables change in the same direction. When one increases
the other also starts to increase; similarly, if the node in which the link starts decreases the other node decreases as well. A negative mark shows a negative influence and means the two nodes change in opposite directions (G. P. Richardson, 1986).

Figure 4.3 shows a simple CLD with A, B, and C variables and their causal relations. There is a positive relation between variables A and B and a negative relation between variables B and C. The closed loops are defined as Reinforcing (R) or Balancing (B) loops. The R loop is a cycle in which the change of one variable will reinforce the effect of the initial deviation. For instance, if A increases, then B will increase and the effect through the cycle will return an increase to A again and vice versa. In B loops the effect of a variation in every variable boosts throughout the loop and returns an opposite deviation to that variable; consequently they will reach a plateau.

![Figure 4.3 A simple CLD with R and B loop.](image)

The qualitative data collected were analysed using the qualitative data analysis software NVivo (Gibbs, 2002). This software is a good choice for organising
data and conducting thematic analysis of qualitative data. Thematic analysis is very popular among researchers in qualitative research approach studies (Boyatzis, 1998; Braun & Clarke, 2006). Themes in this concept involve patterns in data sets that are more important and critical in order to explain and describe particular events or areas associated with a specific research objective. It is therefore a very effective method for compiling and analysing focus group data.

Figure 4.4 illustrates the word frequency query of qualitative data that is generated by NVivo. Word frequency query is conducted to list the most frequently occurring words or concepts. It is normally employed to identify possible themes, particularly in the early stages of a project, and to analyse the most frequently used words in a particular demographic. It is very helpful for looking for exact words, or broadening the search to find the most frequently occurring concepts. Figure 4.4 is just an example to give us a big picture of possible themes and nodes; the larger the words, the more frequently they appear in the data.
NVivo is qualitative data analysis computer software. It has been designed for analysing qualitative data and for the use of researchers working with very rich text-based and/or multimedia information, where deep levels of analysis on small or large volumes of data are required. The data are read and coded by researchers through the software, and nodes (the term used by NVivo to represent a code, theme, or idea about data that are intended to be included in the project) are created. Coding is an explicit and iterative process in which the researchers will alter and modify the analysis as reflected by the data and as
ideas emerge. To ensure the integrity of the codes, they were developed and reviewed by all people in the research team. The researchers read and reread the data, and double-checked the codes for consistency and validation. Course assessment, communication skills, course engagement, learning improvement, assignments and quizzes, knowledge sharing, discussion, feedback, learning skills, personal characteristics, motivation, medium features, and course administration are some of the nodes created. Then, themes and subthemes are identified, finalised, and named from the coded data in the results part. The following figures (Figure 4.5 and Figure 4.6) provide examples of word trees created by NVivo to visualise some nodes that exist in the data.
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Figure 4.5 Word tree for node “learning”.

Figure 4.6 Word tree for node “discussion”.

outcomes and academic achievement
success in the course
ability and improvement
clarification
success of this course
experience as
a lot of
you can get
from other people's experience and
has its advantages because we
is definitely the future
platforms Facebook is interesting for online
through the course materials
will vary 15 hrs

a huge impact to the
impact on your
is very important method for
much it has affected
of it in terms of
an outlet for our
linked to individual motivation for
online or face-to-face
terms of engaging students with

useful is perhaps a group
but prove difficult for serious
I reckon it's useful for
everyone to take part in
present and reading over
the Facebook forum and
the idea of having
wasn't a Facebook group,
to become engaged in online
using Facebook, added something to

being largely irrelevant
are archived so you can
on
readings and the assignments
the homework of the
to any other platform would
board on Facebook
from anywhere they can find
over Facebook rather than other
regarding uni work, timing
would have been held on
4.8 Results

When coding of the entire data set had been completed, reviewed, and labelled, themes were extracted, finalised, and labelled by the researchers. Table 4.1 presents the final results of thematic analysis. There are seven main themes: participation, adoption, involvement, interaction, learning outcome, engagement, and satisfaction. Each theme has been labelled based on coding of the data. For instance, in the learning outcome theme there are six subthemes: post-lecture links and videos, self-paced learning, knowledge acquisition, interact with other students, give directions for assignments, and improve learning and giving feedback.

Table 4.1 Thematic analysis themes and subthemes

<table>
<thead>
<tr>
<th>Major Theme</th>
<th>Categories of subthemes</th>
</tr>
</thead>
</table>
| Participation | • Organizing information  
|             | • Lack of participation  
|             | • 1-to-1 and group discussion  
|             | • Individual motivation  
|             | • Polls & quizzes  
|             | • Easy to use, up to date, and fast to access medium  |
| Adoption    | • Picture display ability  
|             | • Get into it everyday  
|             | • Organizing information  
|             | • Time-consuming to read all comments  |
| Involvement | • Good commenting and alert system  
|             | • Live update  
|             | • Easy to access and notify  
|             | • Keep connected via frequent notification  
|             | • Distracted by other notifications  |
| Interaction | • Easy to use, discuss, and focus  
|             | • Group discussion and live chat  
|             | • More interaction with visual representation  
|             | • Involved with course content  |
| Learning outcome | • Post-lecture links and videos  
|             | • Self-paced learning  
|             | • Knowledge acquisition  
|             | • Interact with other students  
|             | • Give directions for assignments  
|             | • Improve learning and giving feedback  |
| Engagement  | • Increase sense of presence  
|             | • Easy to follow comments  
|             | • Allow every student to get involved  
|             | • Keep connected to other students and course content  
|             | • Increase individual motivation  |
After analysing the data and creating the thematic analysis, the findings were used to generate a list of potentially important variables associated with online interaction and engagement in an online course, and used to develop descriptive CLDs using Vensim software (6.3D, 2013). In recent years, applying causal modelling has become widespread as a means to understand organisations and businesses (Senge, Kleiner, Roberts, Ross, & Smith, 1994). In this study, we employed this perspective and decided to develop causal loop diagrams to achieve comprehensive results out of the data set. At the first level all variables and potential relations and causes have been extracted. At each stage, separate causal diagrams were generated to document different factors and their influences on students’ positive outcome features such as learning outcome, satisfaction, and engagement in the online course. An example of such a causal model can be found in Figure 4.7.
Figure 4.7 indicates that factors including accessibility, organising information, functionality, group discussion, individual motivation, polls and quizzes, communicationality, and technology aptitude have a positive impact on participation. These factors also generate positive feedback on students’ learning outcome, satisfaction, and engagement. The term “technology aptitude” in this study means abilities to use and navigate electronics and technology as intended by the designers (Olaniran & Rodriguez). These can include a wide range of tools, such as discussion board, email, blog, Facebook, Twitter, Google Plus, 3D virtual worlds, etc., that are adopted as tools to enhance learning and education (Bowman & Akcaoglu, 2014; Z. Merchant et al., 2013).
Previous research has shown that online interaction has a strong impact on various positive student outcomes, such as student satisfaction and motivation (Y.-C. Kuo et al., 2010; Y.-C. Kuo, Walker, Belland, et al., 2014; Moallem et al., 2013; Shank & Doughty, 2002), learning outcomes, prospects, and performance (Beatty, 2002; Daradoumis et al., 2003; Heinemann, 2007; Kang & Im, 2013; Y.-C. Kuo et al., 2010; Okonta, 2010; Tatar et al., 2002). Figure 4.8 illustrates the same relationship among communicationality, technology aptitude, sociability, and live updates in that they have a positive effect on involvement. In the same way, involvement has a direct positive relationship with students’ learning outcomes, satisfaction, and engagement.
Figure 4.9 indicates that some features, including visualising ability, organising information, and sociability, have a direct positive impact on interaction in online learning environments. It also shows the positive relationships that exist between interaction and students’ outcomes. However, in Figure 4.10, the factor “time consumption” has been connected to an adoption feature with a negative sign, meaning this factor has a reverse effect on social media adoption. Some students noted that it takes time to read all the comments and messages to keep up to date with the discussion. “Distraction” similarly has a direct
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negative relationship with “learning outcome” and “satisfaction” in Figure 4.11.

Figure 4.10 CLD for “Adoption”.

Figure 4.11 CLD for other factors.

Figure 4.12 is the final CLD generated from the qualitative data analysis and includes all of the extracted and contributing factors in students’ online interaction. It depicts all elements and their causal relationships simultaneously. There are different loops, negative and positive relationships, for interpreting
this diagram. It can easily convey important information and help the reader understand the impact of, and correlation between, different factors affecting students’ online interaction and engagement in an online learning environment.

4.9 Chapter Summary

Chapter 4 sought to represent the qualitative data analysis phase of this research as well as to present the results of the analysis. This chapter starts by presenting the methodology employed to analyse the content of the collected qualitative data. It also provides a description of, and demographic information about, the sample under study and information about how the data are collected from participants. Ethical considerations and approvals are then discussed in this chapter. The thematic analysis is conducted on the collected data in this stage of the study through NVivo software. The procedure and step-by-step data analysis are described in this chapter. Finally, the themes are extracted from the data and presented. Then the results of analysing qualitative data are presented through CLDs to illustrate and provide a better output and a big picture of the nodes or themes and the contributing factors and their causal relationships.
Figure 4.12 CLD for contributing factors.
Research Method and Result: Quantitative Study

Chapter 5

RESEARCH METHOD AND RESULT: QUANTITATIVE STUDY

5.1 Chapter Overview

In Chapter 3, the research model and hypotheses are proposed. In this chapter they are going to be validated through a quantitative data set. A research instrument (questionnaire) is administered to a large sample size of 246 participants. The objectives are: (1) to test and confirm the factor structure and the loadings in the measurement model; (2) to examine the research hypotheses and interrelationships between constructs in the structural model; (3) to verify model estimations regarding the significance of loadings and the power of analysis; (4) to assess the convergent and discriminant validities as well as the reliability of the constructs. The data collection is conducted and the measurement model will then be examined and a confirmatory factor analysis will be performed to check factor loadings. The structural model will be estimated by SmartPLS to investigate the research hypotheses and interrelationships between constructs. Based on this estimation, the research model is examined and the supported hypotheses are demonstrated. Figure 5.1 presents an overview of this chapter.
5.2 Research Design

There are three main research approaches in the field of information systems (IS): positivism, interpretivism, and design science (Orlikowski & Baroudi, 1991). The positivist approach is defined as “an organised method for combining deductive logic with precise empirical observations … in order to discover and confirm a set of probabilistic causal laws” (Neuman, 2006, p. 65).
The interpretivist approach is employed to understand social life, to explain how people develop and use IS, and to construct meaning in natural settings (Mingers & Willcocks, 2004). The design science approach is used to develop creative approaches or methods for dealing with an existing issue within a problem area (von Alan et al., 2004).

Positivist researchers typically hypothesise a set of relationships between variables within phenomena under study and investigate those relationships by using a structured instrument. Positivist studies seek primarily “to test theory, in an attempt to increase the predictive understanding of the phenomena” (Orlikowski & Baroudi, 1991, p. 51). A typical positivist research takes the following steps (Neuman, 2006):

i. Formulate theory about some observed aspect of the world;

ii. Derive hypothesis;

iii. Test hypothesis objectively;

iv. Observe results;

v. Confirm or refute hypothesis; and

vi. Accept, modify, or reject theory.
This chapter is focused on the individual and behavioural factors of students that significantly influence their online interaction and engagement. This is consistent with positivist epistemology, where the ultimate purpose is to explain causal relationships between concepts and objects. The objective of this research is to investigate and emphasise individual and behavioural traits, which are labelled in this study as students’ personal characteristics and perceived course characteristics. The first category comprises students’ communication competencies, self-regulated learning, and attitudes towards online education. The second category includes students’ sense of presence, sense of identity, and sense of purpose towards online interaction. As discussed in Chapter 3, to address Research Questions 2 and 3, this study develops a research model of the effects of students’ personal characteristics and perceived course characteristics on students’ online interaction and engagement (Section 3.5).

To examine the research model and test the hypotheses proposed by the research model of this study, a quantitative research approach is employed and researchers have collected the data through conducting a survey of 246 students who were participating in online courses at Griffith University. Then partial least squares (PLS) was used as a method to test the research model and hypotheses.
5.3 Participants

The main objective of the quantitative research method in this study is to mathematically measure and investigate the research hypotheses that are proposed in the section above. The quantitative research method is described by the collection of information that can be analysed numerically, the results of which are typically presented using statistics, tables, and graphs. To validate the research model, a survey was conducted and distributed to students who were enrolled in Griffith University online courses.

To fulfil our research objective through the quantitative approach, the data were collected through a questionnaire that was conducted in the context of Griffith University online courses. An online questionnaire was distributed through the Health, Business, Sciences and Arts, Education, and Law faculties to students who were enrolled in online courses.

5.4 Data Collection and Instrument

As mentioned earlier, one of the research methodologies of this thesis is survey research. The associated technique for this methodology is a questionnaire. There are several studies in the literature that have employed surveys to conduct research and obtain results. Neuman (W. Neuman, 2006) noted that surveys are useful for questions that address self-reported perceptions and beliefs. This thesis developed a questionnaire through a careful review and evaluation of related instruments in the literature. Previously developed questionnaires in the
literature were reviewed, and through a selection process, a number of indicators/items for the three latent constructs from the reviewed questionnaire were selected. The selection process involved first creating a pool of items. This means that indicators of the reviewed instruments were separately listed for each latent construct. Those indicators that were repeated in more than one instrument/questionnaire were identified and consolidated. If two or more indicators had the same or a similar name or definition, or their corresponding definition reflected the same concept, they were merged.

The questions that were used in the survey were concept-based, using student personal and perceived course variables, which are introduced in the proposed research model (Figure 3.5). Appendix D shows the questionnaire with 25 items excluding the demographic questions prepared for the quantitative study. The survey analysed participant levels of agreement with various questions based on the Likert scale approach (Matell & Jacoby, 1971). There were 246 completed surveys.

5.5 Ethical Considerations

Students were asked to answer the questionnaire and also a link to a consent form, indicating that their voluntary participation and their participatory status would not be revealed to the teaching team, was provided in the survey email. They were also assured that participating in the study would not affect their course grade in any way. Ethics approval was obtained from the Griffith
University Human Research Ethics Committee for the content analysis of this thesis. As mentioned before, the ethics approval number for both the qualitative and quantitative research of this study is 2015/755, issued on 30/09/2015. A copy of the approval letter is provided in Appendix E.

5.6 Demographic Characteristics of Participants

The majority of the participants are from the School of Health with 108 students. They are composed of 84% females and 16% males, of which 119 are full-time students and 127 are part-time students. The results show that 81% of them are 25 years old or older. Approximately 13% are between 21 and 25. Among all participants, 43% are employed full-time, 39% have part-time jobs, and 18% are not employed. The year of their study differs, with 37% being in their first year, 22% in their second year, 12% in their third year, and 29% in their fourth year and higher. It is the first online course experience for 92 students; 37 of them had taken one online course excluding the current course, and 116 students had taken more than two online courses.

5.7 Data Analysis and Results

To address Research Questions 2 and 3 in this study, partial least squares (PLS), which is a statistical method that bears some relationship to principal components regression and could model latent constructs under conditions of non-normality, was employed to analyse the research model and hypotheses. PLS is a component-based technique that “focuses on maximising the variance
of the dependent variables explained by the independent ones instead of reproducing the empirical covariance matrix” (Haenlein & Kaplan, 2004, p. 290). The main objective of PLS is to explain the variances of factors and to show significant t-values (Gefen, Straub, & Boudreau, 2000), and it is more suitable for exploratory studies and for the purpose of theory building (Chin, Marcolin, & Newsted, 2003).

The reason for choosing this method is its ability to predict the variability of the dependent construct and to manage reflective measures (Eikebrokk & Olsen, 2007). This selection was based on the fact that this method can predict the interrelationship between multiple independent and dependent variables while supporting unobserved or undefined variables (Gefen et al., 2000). In this study, SmartPLS 2.0 M3 (http://www.smartpls.de) was used to estimate the parameters of the inner and outer model with the minimum number of bootstrap samples of 5,000, and 246 cases, which is equal to the number of observations (Hair, Ringle, & Sarstedt, 2011).

5.7.1 Measurement Model

To analyse the collected data, the structural equation modelling (SEM) technique is employed. SEM is a quantitative research technique that is used to show the causal relationships between variables. SEM is mostly applied to confirm a research design rather than exploring or explaining a phenomenon. In other words, it helps researchers to examine the strength of the relationships between variables in a hypothesis. SEM has two basic parts: a measurement
model and a structural model. The first model shows the relationships between the variables (both measured and latent), and the second model only shows the relationships between the latent variables.

To develop a PLS model, in the first stage, the measurement model (outer model) is examined by conducting reliability and discriminative validity analyses on each of the measures to ensure that all of the measures of the constructs are reliable and valid. This determines the relationships between the independent and dependent latent variables. In the next stage, to test the structural model (inner model), the paths between the constructs, their significance, and the predictive ability of the model are estimated. The model defines the relationships between the latent variables and their observed indicators (Figure 5.2) (Wong, 2013).

A measurement model addresses the loadings of the indicators on their associated latent constructs, and PLS tests the significance of such loadings (Chin, 1998b). As Figure 5.2 shows, there are three latent constructs (independent variables) for student personal characteristics – communication competencies, self-regulated learning, and attitude toward online learning – and three for perceived course characteristics: sense of presence, sense of identity, and sense of purpose. There are also two dependent variables: student engagement and online interaction. The indicators of these variables are coded CC_1, CC_2, CC_3 for communication competencies, SRL_6, SLR_7 for self-regulated learning, ATOE_8, ATOE_9, ATOE_10 for attitude toward online
education, SPR_11, SPR_12, SPR_13 for sense of presence, SID_14, SID_15, SID_16 for sense of identity, SPUR_17, SPUR_18, SPUR_19 for sense of purpose, ENG_20, ENG_21 for engagement, and INT_22, INT_23 for online interaction. Table 5.1 indicates the measurement model.

Figure 5.2 Inner vs. outer model in an SEM diagram.
Table 5.1 Measurement model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication competencies</td>
<td>CC_1, CC_2, CC_3</td>
</tr>
<tr>
<td>Self-regulated learning</td>
<td>SRL_6, SLR_7</td>
</tr>
<tr>
<td>Attitude toward online learning</td>
<td>ATOE_8, ATOE_9, ATOE_10</td>
</tr>
<tr>
<td>Sense of presence</td>
<td>SPR_11, SPR_12, SPR_13</td>
</tr>
<tr>
<td>Sense of identity</td>
<td>SID_14, SID_15, SID_16</td>
</tr>
<tr>
<td>Sense of purpose</td>
<td>SPUR_17, SPUR_18, SPUR_19</td>
</tr>
<tr>
<td>Engagement</td>
<td>ENG_20, ENG_21</td>
</tr>
<tr>
<td>Online interaction</td>
<td>INT_22, INT_23</td>
</tr>
</tbody>
</table>

5.8  Reliability and Validity

The following section is about testing the different levels of validity and reliability of the proposed model, and it investigates the indicators and latent variables of reliability and validity.

5.8.1 Indicator Reliability and Validity

The other results of the outer models are shown in Table 5.2. To ensure that all of the indicators are reliable in this model, the “indicator reliability” was checked. Table 5.2 indicates that all of the indicators have individual indicator reliability values that should not be less than the minimum acceptable level of 0.4 and preferably close to level 0.7 (Wong, 2013). The results show that all of the indicators in this model meet the requirements and are reliable.
### Table 5.2 Results of indicator reliability and validity

<table>
<thead>
<tr>
<th>Construct/Factor</th>
<th>Indicator</th>
<th>Indicator Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication competencies</td>
<td>CC_1</td>
<td>0.740</td>
</tr>
<tr>
<td></td>
<td>CC_2</td>
<td>0.624</td>
</tr>
<tr>
<td></td>
<td>CC_3</td>
<td>0.722</td>
</tr>
<tr>
<td>Attitude toward online education</td>
<td>ATOE_8</td>
<td>0.722</td>
</tr>
<tr>
<td></td>
<td>ATOE_9</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>ATOE_10</td>
<td>0.792</td>
</tr>
<tr>
<td>Self-regulated learning</td>
<td>SRL_6</td>
<td>0.689</td>
</tr>
<tr>
<td></td>
<td>SLR_7</td>
<td>0.656</td>
</tr>
<tr>
<td>Sense of identity</td>
<td>SID_14</td>
<td>0.593</td>
</tr>
<tr>
<td></td>
<td>SID_15</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>SID_16</td>
<td>0.706</td>
</tr>
<tr>
<td>Sense of presence</td>
<td>SPR_11</td>
<td>0.706</td>
</tr>
<tr>
<td></td>
<td>SPR_12</td>
<td>0.722</td>
</tr>
<tr>
<td></td>
<td>SPR_13</td>
<td>0.608</td>
</tr>
<tr>
<td>Sense of purpose</td>
<td>SPUR_17</td>
<td>0.757</td>
</tr>
<tr>
<td></td>
<td>SPUR_18</td>
<td>0.774</td>
</tr>
<tr>
<td></td>
<td>SPUR_19</td>
<td>0.706</td>
</tr>
<tr>
<td>Engagement</td>
<td>ENG_20</td>
<td>0.828</td>
</tr>
<tr>
<td></td>
<td>ENG_21</td>
<td>0.504</td>
</tr>
<tr>
<td>Online interaction</td>
<td>INT_22</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>INT_23</td>
<td>0.792</td>
</tr>
</tbody>
</table>

#### 5.8.2 Internal Consistency Reliability

Generally, the internal consistency reliability describes the consistency of the results that are delivered in a test, which ensures that the various items that measure the different constructs deliver consistent scores. Previous literature has suggested the use of “composite reliability” (CR) to measure internal consistency reliability (Bagozzi & Yi, 1988). Table 5.3 indicates that all of the
reflective variables have high levels of internal consistency reliability due to CR values that are above 0.6 or preferably 0.7.

**Table 5.3 Results of consistency reliability**

<table>
<thead>
<tr>
<th>Construct/Factor</th>
<th>Communication competencies</th>
<th>Attitude toward online education</th>
<th>Self-regulated learning</th>
<th>Sense of identity</th>
<th>Sense of presence</th>
<th>Sense of purpose</th>
<th>Engagement</th>
<th>Online interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite Reliability</td>
<td>0.856</td>
<td>0.8935</td>
<td>0.8197</td>
<td>0.8834</td>
<td>0.8684</td>
<td>0.9023</td>
<td>0.7928</td>
<td>0.8651</td>
</tr>
</tbody>
</table>

**5.8.3 Convergent Validity**

Convergent validity is measured when the following two criteria are fulfilled: (1) the items significantly load on their corresponding factor and the standardised loadings are higher than 0.6, and (2) the AVE values are greater than 0.5. The first condition has already been satisfied earlier in this chapter, as Table 5.6 shows all items significantly loaded on their corresponding factors. To evaluate convergent validity, each latent variable’s average variance extracted (AVE) was considered. Table 5.4 shows the AVE values of the constructs of the research model. This table indicates that all of the AVE values exceed the acceptable threshold of 0.5, which secures the convergent validity. This means indicators of each construct highly correlate with one another (Hair et al., 2011).

**Table 5.4 AVE value of constructs in the research model**

<table>
<thead>
<tr>
<th>Construct/Factor</th>
<th>Communication competencies</th>
<th>Attitude toward online education</th>
<th>Self-regulated learning</th>
<th>Sense of identity</th>
<th>Sense of presence</th>
<th>Sense of purpose</th>
<th>Engagement</th>
<th>Online interaction</th>
</tr>
</thead>
</table>
5.8.4 Discriminant Validity

Discriminant validity is applied to investigate whether the indicators that represent a latent variable are different from those that are not supposed to be related to that latent construct in the research model. It confirms that the square root of AVE in each latent variable is higher than the other correlation values of that latent construct (Fornell & Larcker, 1981). For this purpose, Table 5.5 was created, and the square root of AVE was manually calculated (written in bold). The numbers under each square root of AVE are the correlations between the latent variables. To confirm discriminant validity, the diagonal elements should be larger than the off-diagonal elements in the same row and column (F.-Y. Kuo, Tseng, Lin, & Tang, 2013).

Table 5.5 Results of discriminant validity

<table>
<thead>
<tr>
<th>Construct / Factor</th>
<th>Attitude</th>
<th>Communication competencies</th>
<th>Engagement</th>
<th>Online interaction</th>
<th>Self-regulated learning</th>
<th>Sense of identity</th>
<th>Sense of presence</th>
<th>Sense of purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td>0.858</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication competencies</td>
<td>0.330</td>
<td>0.816</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement</td>
<td>0.499</td>
<td>0.455</td>
<td>0.813</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online interaction</td>
<td>0.421</td>
<td>0.503</td>
<td>0.717</td>
<td>0.873</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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5.9 Structural Model

A structural model determines the relationship between latent variables through path coefficients and examines the strength of coefficients as well as the R-square and t-values of the model. The main reason to assess the structural model is to examine the interrelationships between the constructs and to rectify the research hypotheses. To do so, the dependent and independent variables are linked together in a diagram as shown in Figure 5.3. This diagram is a path model that indicates the theoretical relationship between the variables.
Results

In this stage of the study, confirmatory factor analysis (CFA) was employed to analyse the measurement models. In statistical analysis, CFA is a special form of factor analysis that is used to test whether the measures of a construct or factor are consistent with the understanding of the nature of that construct. CFA assesses a model to confirm the factor loadings and seeks to determine the extent to which structures of items load on their corresponding factors (Fabrigar, Wegener, MacCallum, & Strahan, 1999). Thus, the objective of
confirmatory factor analysis is to examine whether the data fit a hypothesised measurement model through factor loading.

**5.10.1 Measurement Model Results**

The first criterion to include or exclude an indicator in the CFA analysis is the assessment of the factor loadings. According to (Chin, 1998a) and (Hulland & Business, 1999), indicators loading on their associated factor should be higher than 0.60 or preferably 0.70 or above, which shows that each indicator explains at least 50% of the variance of the corresponding latent variable. Table 5.6 indicates the results of CFA for the proposed model. All of the variables have loading factors above 0.7, which means that all of them are accepted at this stage. In the next step, the t-values for each indicator are also computed. The above authors also stressed that the generated t-values must be equal to or greater than 1.96 and are significant at the 0.001 alpha level to confirm the presence of statistically significant loadings. Therefore, all of the factors are accepted in the model.

Table 5.6 Results of confirmatory factor analysis

<table>
<thead>
<tr>
<th>Variable/indicator</th>
<th>Loading</th>
<th>T-values*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication competencies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC_1 (question 1)</td>
<td>0.86</td>
<td>39.249</td>
</tr>
<tr>
<td>CC_2 (question 2)</td>
<td>0.74</td>
<td>13.680</td>
</tr>
<tr>
<td>CC_3 (question 3)</td>
<td>0.84</td>
<td>33.003</td>
</tr>
<tr>
<td><strong>Self-regulated learning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRL_6 (question 6)</td>
<td>0.85</td>
<td>20.634</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Variable</th>
<th>R²</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLR_7 (question 7)</td>
<td>0.80</td>
<td>14.234</td>
</tr>
<tr>
<td><strong>Attitude toward online education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATOE_8 (question 8)</td>
<td>0.85</td>
<td>31.251</td>
</tr>
<tr>
<td>ATOE_9 (question 9)</td>
<td>0.81</td>
<td>18.448</td>
</tr>
<tr>
<td>ATOE_10 (question 10)</td>
<td>0.89</td>
<td>41.707</td>
</tr>
<tr>
<td><strong>Sense of presence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPR_11 (question 11)</td>
<td>0.84</td>
<td>25.979</td>
</tr>
<tr>
<td>SPR_12 (question 12)</td>
<td>0.85</td>
<td>37.317</td>
</tr>
<tr>
<td>SPR_13 (question 13)</td>
<td>0.79</td>
<td>33.222</td>
</tr>
<tr>
<td><strong>Sense of identity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SID_14 (question 14)</td>
<td>0.77</td>
<td>20.244</td>
</tr>
<tr>
<td>SID_15 (question 15)</td>
<td>0.90</td>
<td>68.316</td>
</tr>
<tr>
<td>SID_16 (question 16)</td>
<td>0.85</td>
<td>35.799</td>
</tr>
<tr>
<td><strong>Sense of purpose</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPUR_17 (question 17)</td>
<td>0.87</td>
<td>45.424</td>
</tr>
<tr>
<td>SPUR_18 (question 18)</td>
<td>0.88</td>
<td>40.814</td>
</tr>
<tr>
<td>SPUR_19 (question 19)</td>
<td>0.85</td>
<td>32.877</td>
</tr>
<tr>
<td><strong>Engagement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENG_20 (question 20)</td>
<td>0.91</td>
<td>70.530</td>
</tr>
<tr>
<td>ENG_21 (question 21)</td>
<td>0.71</td>
<td>11.359</td>
</tr>
<tr>
<td><strong>Online interaction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INT_22 (question 22)</td>
<td>0.86</td>
<td>29.097</td>
</tr>
<tr>
<td>INT_23 (question 23)</td>
<td>0.89</td>
<td>68.452</td>
</tr>
</tbody>
</table>

*All significant at alpha=0.00

* Significant at 0.1 level; **significant at 0.05 level; ***significant at 0.01 level; ****significant at 0.001 level

Figure 5.4 indicates the results of the structural analysis. In a structural model, the first element to evaluate is the predictive power of the research model. This quantity is measured by variance explanation power (R²). This evaluation is
consistent with the PLS objective to maximise the variance that is explained in the endogenous variables. The recommended values for $R^2$ are categorised as 0.67 for substantial, 0.33 for moderate, and 0.19 for weak (Chin, 1998b). Table 5.7 shows the $R^2$ values for the proposed research model, and based on the above-mentioned details, the variance explanation power for this model is considered to be substantial.

![Figure 5.4 Structural model analysis results](image-url)
Table 5.7 Variance explanation power ($R^2$)

<table>
<thead>
<tr>
<th>Latent variables</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement</td>
<td>0.6529</td>
</tr>
<tr>
<td>Online Interaction</td>
<td>0.617</td>
</tr>
</tbody>
</table>

Table 5.8 shows the results of the structural analysis and summarises the hypothesis verification. For each hypothesis path coefficient, which is produced to show the interrelationships between the independent and dependent latent variables, the sample mean, standard deviation, and t-values are represented. The number of bootstrap “samples” is 5000 and the number of bootstrap “cases” is the same as the number of valid observations, 246 (Hair et al., 2011). Based on these measurements, a decision is made for each hypothesis.

Hypothesis 1: The results show that “communication competencies” has a positive effect on “student engagement”, and the path coefficient between “communication competencies” and “engagement” is 0.197 (t-value=2.98), which is supported by the significance level of 0.01. Therefore, Hypothesis 1a is confirmed. However, the path coefficient for the effect of “communication competencies” on “online interaction” is 0.024 (t-value=0.37, less than 1.65) (Gefen et al., 2000), which is not supported by the significance level of 0.1. Therefore, based on this research, Hypothesis 1b is not confirmed.
Hypothesis 2: Table 6 indicates that “self-regulated learning” has a significant positive effect on engagement with a path coefficient of 0.189 (t-value=3.28), which is significant at a level of 0.01. Thus, Hypothesis 2a is supported and confirmed. Meanwhile “self-regulated learning” does not have a significant impact on “online interaction”: the path coefficient is 0.054, and the t-value is 1.49. As a result, Hypothesis 2b is also not confirmed in this study.

Hypothesis 3: The results from the hypothesis verified that “attitude toward online education” has a highly substantial effect on student engagement (path coefficient 0.270, t-value 5.18), and this is supported at a significance level of 0.001. It also has a significant effect on “online interaction” (path coefficient 0.220, t-value 3.56), and Hypothesis 3b is strongly supported at a level of 0.001, and thus it is confirmed.

Hypothesis 4: The results indicate that the same story applies for the independent construct of “sense of presence”. It has a highly significant effect on student engagement (path coefficient 0.358, t-value 4.67) at a level of 0.0001, and it has a positive impact on student “online interaction” (path coefficient 0.170, t-value 1.96) at a level of 0.1. Therefore, Hypothesis 4a and Hypothesis 4b are confirmed.

Hypothesis 5: According to Table 4, “sense of identity” has a positive direct impact on “engagement” at a 0.01 significance level and a path coefficient of 0.194 (t-value=2.75). It also has a highly positive effect on “online interaction”
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at a significance level of 0.001 (path coefficient 0.314, t-value 4.21). Consequently, both Hypotheses 5a and 5b are confirmed.

_Hypothesis 6:_ The results reveal that “sense of purpose” has a considerable positive effect on both students’ “engagement” and “online interaction”, and it is significant at a level of 0.001. The path coefficients and the t-values are 0.336, 7.09 and 0.708, 11.01, respectively. Thus, Hypotheses 6a and 6b are confirmed.

_Hypothesis 7:_ The results from the hypothesis specified that student “online interaction” has a positive effect on student “engagement”. It has a high significance level of 0.001 with a path coefficient of 0.326 and a t-value of 7.2. Hence, Hypothesis 7 is also confirmed.

Table 5.8 Summarised results of the hypotheses verified

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path Coefficient</th>
<th>Sample Mean (M)</th>
<th>Standard Deviation (STDEV)</th>
<th>T Statistics</th>
<th>Confirmed/ Not confirmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1a Communication competencies =&gt; Engagement</td>
<td>0.197***</td>
<td>0.1279</td>
<td>0.0634</td>
<td>2.9856</td>
<td>Confirmed</td>
</tr>
<tr>
<td>H1b Communication competencies =&gt; Online interaction</td>
<td>0.024</td>
<td>0.0145</td>
<td>0.0438</td>
<td>0.3709</td>
<td>Not confirmed</td>
</tr>
<tr>
<td>H2a Self-regulated learning =&gt; Engagement</td>
<td>0.189***</td>
<td>0.1681</td>
<td>0.0359</td>
<td>3.2862</td>
<td>Confirmed</td>
</tr>
<tr>
<td>H2b Self-regulated learning =&gt; Online interaction</td>
<td>0.054</td>
<td>0.0459</td>
<td>0.0305</td>
<td>1.4972</td>
<td>Not confirmed</td>
</tr>
<tr>
<td>H3a Attitude toward online education =&gt; Engagement</td>
<td>0.270****</td>
<td>0.1732</td>
<td>0.0331</td>
<td>5.1846</td>
<td>Confirmed</td>
</tr>
<tr>
<td>H3b Attitude toward online education =&gt; Online interaction</td>
<td>0.220****</td>
<td>0.1135</td>
<td>0.0319</td>
<td>3.569</td>
<td>Confirmed</td>
</tr>
<tr>
<td>H4a Sense of presence =&gt; Engagement</td>
<td>0.358****</td>
<td>0.263</td>
<td>0.0564</td>
<td>4.6778</td>
<td>Confirmed</td>
</tr>
</tbody>
</table>
With regard to the importance of the hypotheses, the results indicate that the relationship between a sense of purpose and online interaction has the highest path coefficient of 0.708. This means that this variable has a stronger impact on online interaction than the other variables. Then, the impact of a sense of presence and sense of purpose on engagement and a sense of identity on online interaction are very strong with path coefficients of 0.358, 0.336 and 0.314, respectively. Attitude towards online education is at the next level of importance with a path coefficient of 0.27 on engagement and 0.22 on online interaction. Among the confirmed hypotheses, a sense of presence has the lowest impact on student online interaction with a path coefficient of 0.17. Researchers and course designers can improve their course engagement and online interaction by considering the level of importance of these factors.
5.11 Chapter Summary

In this chapter the proposed research model was examined through a quantitative data set with a large sample size. Data collection and the environment under study were discussed in this chapter. Demographic information about the participants and ethics consideration were also revealed. Then, in the data analysis section, the measurement and structural models were proposed. The confirmatory factor analysis examined factor loadings and confirmed that items loaded highly on corresponding constructs. This finding supports the allocation of indicators to their corresponding constructs in the research model.

This chapter demonstrated that all factor loadings are statistically significant and are above 0.70, which supports the allocation of indicators to their corresponding constructs. Then it confirmed the research model based on different criteria such as R-Square. Moreover, the achieved variance explanation power ($R^2$), which evaluated the predictive power of the research model to be as high as 0.6, indicates a substantial probability of detecting statistically significant relationships in the research model. Finally, the reliability and validity of the constructs were examined. The AVE values were also captured to assess the convergent and discriminant validities of the research model.

The findings of this chapter also support the power of the research model, which is measured by variance explanation power and for this model is
considered to be substantial. The results of structural analysis indicate that most of the constructs have a significant impact on the dependent latent variables and their hypotheses are confirmed. The results of this part will be discussed in detail in the next chapter. Additionally, the high level of R-square, the high factor loadings, and the significant path coefficients support the validity of the model. Furthermore, the high reliability of the instrument ensures that the indicators of each construct correlate with one another. The findings of this chapter also successfully pass the discriminant validity test, which indicates that the research constructs are distinguishable from one another, and the convergent validity test, which shows that the research indicator loads highly on its corresponding construct. As previously mentioned, further discussions on the implications of the findings of this chapter will be outlined in the next chapter.
Chapter 6

DISCUSSION AND CONCLUSION

6.1 Chapter Overview

Exploration and investigation of different elements and characteristics of students is necessary to determine the prerequisites for an effective e-learning system in higher education settings. It can help instructors and students to achieve better online interaction and engagement. The goal of this research is to investigate the role of students’ personal characteristics and perceived course characteristics in their online interaction and engagement in online educational systems. This chapter elaborates on how this research has addressed the research questions and objectives. It identifies the key findings of the study and investigates all the proposed hypotheses. It then discusses this study’s contributions to both research and practice, highlights the research limitations, and suggests future works. Finally, the conclusion section wraps up this chapter. Figure 6.1 provides an overview of the chapter.
One of the most important problems in online learning systems that play a major role in the failure of online education and student dropout is a lack of interaction (Banna, Lin, Stewart, & Fialkowski, 2015; Kyei-Blankson, Ntuli, & Donnelly, 2016). In learning, engagement and interaction between the students themselves, with the course content, and with course instructors is important.
for conveying information, enhancing teaching quality, giving direction, and many other functions (Kang & Im, 2013; Yoo et al., 2014). Given the importance of online interaction in e-learning environments, investigation and exploration of the different contributing factors are essential for attaining considerable improvements in this area.

One of the important gaps in the literature, as mentioned in Chapter 1, is a lack of research analysing rich qualitative data and focusing on generating a comprehensive picture of the different contributing factors and their causal relationships. The other gap is that there are still some important characteristics that are not considered in the literature that affect students’ online interaction and engagement in different ways. The objective of this research is to investigate and emphasise individual and behavioural traits, which are labelled in this study students’ personal characteristics and students’ perceived course characteristics.

This section reviews and discusses the answers this study found to the proposed research questions.

**RQ1-** What are the factors and their causal relationships that impact on students’ online interaction and engagement in online courses?

Given the importance of online interaction and engagement in online courses and their role in students’ satisfaction and learning outcomes, in this research,
data from online forums have been collected in online courses and the results of this data analysis, which are displayed in the form of a CLD, reveal the causal relationships between different factors influencing online interaction in online courses. This study does not attempt to dictate the structure of online courses to online course developers or researchers, nor does it attempt to explain every element that might have influenced online interaction in the course. Rather, its intention is to introduce an awareness of additional underlying factors and drivers affecting online learning derived from the detailed observations and analyses of data generated from a particular online course. These factors are proposed below. Researchers and practitioners should judge whether the findings relate and are applicable to their particular circumstances.

In this study, a thorough thematic analysis has been conducted to extract different elements and features of online learning that have a direct impact on students’ online interaction and engagement from a rich set of qualitative data. The contributing factors of the findings from this part of the study can be divided into two main categories: individual and behavioural characteristics, and course related- and technology design factors. This grouping indicates that online interaction and involvement in an online course are influenced by different aspects of educational drivers. Only applying an interesting medium or technology in the course does not guarantee a high level of interaction among students.
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There are also some personal and psychological elements that influence student online interaction. For instance, one of the issues seemingly impacting on online interaction is quick feedback. Students believed that the lack of immediate feedback was a discouraging driver and contributed to their limited engagement and participation in online discussion. They argue that when there is no prompt feedback, they are less motivated to continue posting comments and they feel they are posting to a non-responsive network. Other factors include: sense of presence, technology aptitude, individual motivation and communicationality for the individual and behavioural characteristics category. Also included were organising information, accessibility, functionality, polls and quizzes, visualising ability, live updates, and quick feedback for course-related and technology design factors. To facilitate understanding, the results of this research and findings are depicted through a CLD (Figure 4.12).

**RQ2-** What are the impacts of students’ personal characteristics on their online interaction and engagement?

Investigating different personal elements and traits is necessary to determine the prerequisites for an effective e-learning system in higher education settings. It can help educational designers, instructors, and students to achieve better online interaction and engagement. This study focused on three types of personal characteristics, communication competencies, self-regulated learning, and attitude towards online learning, which are students’ personal
characteristics, apart from the type of online course in which they participate. In addressing the research questions and gaps, the findings prove that all three of the personal characteristics that we have examined have a positive and direct impact on students’ engagement with online courses. However, this study can only confirm the positive impact of attitude towards online learning on online interaction. The positive impact of communication competency and self-regulated learning on online interaction remains unconfirmed.

**RQ3** - What are the impacts of students’ perceived course characteristics on their online interaction and engagement?

In the second category, there are three types of perceived course characteristics, a sense of presence, a sense of identity, and a sense of purpose, which are dependent upon the specific online course that is being taken and the online interaction tool that is used in that course. The results show that “sense of identity”, “sense of purpose”, and “sense of presence” have a substantial positive and direct impact on both student engagement and online interaction.

This means that a student’s perception of being identified among other learners and educators and having more of a sense of presence can directly improve that student’s engagement and online interaction in an online learning environment. Moreover, when they have a better realisation of the purposefulness of an online course, students will become more engaged with it; this is also true when students are encouraged to engage in increased online interaction.
6.3 Study Contributions

The results of this study show that personal and perceived course traits are highly influential in students’ online interaction and engagement. They also suggest the overall factors that contribute to students’ online interaction and engagement and their causal relationships. The findings of this research reveal valuable information regarding different student characteristics that can improve online interaction and engagement in online learning systems and make several contributions and implications for promoting online learning settings in both research and practice.

6.3.1 Contribution to Research

This thesis has resulted in making the different contributions to research. The potential implication of CLD representations for instructors, university faculties, students and learners, course designers, and conveners is that they provide an overall picture of the various factors influencing online interaction and engagement in online learning. This allows educators to take these factors into account when designing an online course in order to promote and cultivate online interaction and engagement, thereby facilitating better student academic performance and satisfaction. In addition to having several practical implications, these results could also help researchers, particularly new researchers, to understand these factors in a very convenient way.
More importantly, CLD representation can depict the causes and effects of all important parameters of online learning as well as their internal relations and interplay, the knowledge of which is essential for conducting comprehensive research, and enables instructors and researchers to select the factors most relevant to their work. One of the contributions of this study is the result of the structural model and the research hypotheses. This study distinguishes between the impact of personal traits and perceived course characteristics on student online interaction and engagement. This research also investigates the effects of the perceived course characteristics, which are dependent on the structure and design of each course, and on student online interaction and engagement. The results show that “sense of identity”, “sense of purpose”, and “sense of presence” have a substantial positive and direct impact on both student engagement and online interaction. This means that a student’s perception of being identified among other learners and educators and having more of a sense of presence can directly improve that student’s engagement and online interaction in an online learning environment.

The theoretical findings of this study suggest that most of these personal and perceived course characteristics have a significant direct impact on students’ online interaction, and all of them strongly influence student engagement, which is the goal of every online learning developer. Previous research has proven that the more online interaction and engagement students have, the greater the satisfaction and the higher the learning outcomes they will obtain.
Therefore, the results of the current study are valuable for increasing students’ satisfaction, and they substantially contribute to their academic achievements and outcomes.

6.3.2 Contribution to Practice

This research examined the factors that could contribute to students’ online interaction and engagement and also the impact of personal and perceived course traits on it. This section provides a pragmatic approach to user modelling for practitioners. The main practical contributions of this study are discussed here.

By gaining knowledge of which factors influence students’ online interaction and engagement, practitioners are better positioned to improve and enhance students’ online interaction and engagement, and to achieve better results and outcomes in online learning environments by effectively manipulating and controlling these traits. For instance, if a learner having a higher sense of purpose is a factor that has a positive impact on online interaction, instructors using this educational expertise will be able to increase online interaction in their courses by working on this specification or trying to improve the functionality and visual ability of the medium they use. The students can be made aware of those features that depend on their own characteristics and encouraged to try to improve on these.
Investigating aspects of online education that have not been considered in previous research will enrich the literature and enhance the impact of existing works. This contribution will further assist researchers by providing a better understanding of these fields and giving direction to their future, as well as identifying gaps in the body of knowledge in this area. The most important practical achievement and contribution of the present research is the development and validation of a research model and its instrument for measuring the dependent and independent constructs of the research model. This instrument has been tested with a large sample, and has demonstrated a high level of validity and reliability. By providing an explicit list of indicators, this instrument can help online learning instructors and educators to measure proposed constructs and stimulate the online interaction and engagement of learners. The research model and instrument guide the required changes in online learning environments toward acquiring greater student online interaction and engagement.

The results of this research can make a valuable contribution to general practitioners of online learning environment users. In fact, any user that employs online learning environments can benefit from the results of this study. The following discussions include some suggestions for how they can take advantage of this research output.
1. Online universities and colleges and companies doing online training:

Students’ self-regulated learning can be improved through online or in-person training sessions or workshops to teach them how to manage their time and schedules and provide comprehensive guidelines and instructions on how to study the course material more effectively. The results of this study indicate that students’ attitude toward online learning has a very significant impact on their online interaction and engagement. Universities or colleges can increase this feature in several ways. For instance, they can provide a workshop or seminar in their orientation programmes to inform students about the benefits and advantages of online learning. They can apply different visual methods to show learners that online courses can help them to save their time, decrease their costs, and improve their learning abilities. When the students have a better attitude toward this concept, their acceptance of e-learning will be increased and they can engage more with online programmes and courses.

Previous research has found that instructors’ attitude towards the use of online learning in teaching could positively influence their students’ attitudes (Sun, Tsai, Finger, Chen, & Yeh, 2008). When lecturers and teachers are committed to e-learning and present positive attitudes, the students will also sense this, and based on the results of this study, it will improve their engagement. In light of this, school administrators must be very careful in selecting instructors for teaching courses with adequate technology literacy and a positive attitude.
towards it. Universities, colleges, and companies should encourage instructors to develop their teaching materials and course designing in ways to enhance interaction. One of the best ways of achieving this is by exchanging teaching experiences online through seminars and workshops.

2. **Online learning teachers or lecturers:**

Although communication skills are somewhat determined by students’ culture and background, institutions and online educators can supply a preparation course for learners before engaging in an online course to teach them how to communicate online and to improve their communication competencies. Instructors can also develop the communication competency skills of learners through designing students’ assessments by applying group work activities and problem-based learning methods to push the students to communicate more with others. These methods help the students to improve their communication skills and prevent them from being isolated and therefore they have more interaction and engagement with the course.

Attitude toward online learning can greatly influence students’ online interaction. Educators can directly improve students’ online interaction through this attitude. This means that having a positive view of the educational setting of online learning can contribute to a greater online interaction on the part of learners. To positively influence students’ attitude, teachers can offer course-briefing sessions during the first week of classes to elaborate on and explain the
pedagogical advantages of online courses. Furthermore, teachers should make clear what they expect of the students in the online setting.

This research distinguishes between the effect of “a sense of presence” and “a sense of identity” on student engagement and online interaction. This can help course conveners and educators in designing the entire structure of online courses. The platform that they use and the media they employ to communicate with, and connect to, the learners should be selected on a basis that can create an atmosphere in which learners can be better identified and in which they can represent themselves in the online environment. By asking students to use their real names, having orientation sessions, and running activities such as online ice-breaking games, instructors can help students to be better identified in their group.

3. **Learning space designers and online course developers:**

The findings of the current study indicate that a sense of purpose in an online educational system is essential for the progress of online learning systems, and it can directly affect online student interaction and engagement. The more students understand the purposefulness and usefulness of online interaction in an online course, the more they will feel connected to, and engaged by, that course. Therefore, online learning developers can take advantage of this and promote learners’ understanding and realisation of the critical role of online interaction and its usefulness in terms of their learning quality in different ways.
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For instance, they can incorporate information about the benefits and advantages of engaging in online interaction with other students and educators for learners in a video or emphasise this concept in their lecture materials to help learners to be more motivated to engage with the course by pointing out the different privileges and rewards of engaging in online interaction.

4. **LMS producers:**

Today, with the advance of technology, most educational institutions have employed a learning management system, and instructional system developers continue to put efforts into updating advanced learning management systems (LMSs). In this context, LMSs should be improved in the ways they increase online interaction. Enhanced interaction should be built on collaboration between student and student, student and instructor. The results of this study can help show them how to design their LMS in a way that will improve personal and perceived course characteristics, which will lead to increasing online interactions and identifying what characteristics have more impact on it than others.

To enhance the sense of presence of learners, LMS producer companies should help students to have a better feeling of being present in the online environment. For example, they can employ platforms such as 3D virtual worlds whereby students can have a virtual avatar that can increase the sense of presence or the sense of identity of students. Another example is that when a
student is looking at lecture material through an LMS, s/he can see which other students are currently looking at the same material. These students can start a conversation (either text chat or voice) about this material. According to the results of this research, these traits can have a significant influence on students’ online interaction and engagement.

5. Education consultancy firms:

These have modelled opportunities and developed a road map for educational organisations and students. Therefore, it is very important for consultancy companies to improve the performance of organisations and give them the ability to attract quality learners. As student engagement is of great importance in their framework, the results of this study can significantly help them to improve their taxonomies and provide them with better consultancy. They are in charge of planning and implementing effective teaching and learning for students and educational settings. Knowing about the factors that can influence students’ learning outcome and their engagement, and their causal relationships, could help them to make an effective plan for their clients. When they are aware of traits such as students’ attitude towards an online learning system or communicational skills, they can empower their consultation taking these features into consideration. For instance, they can make plans for how to teach critical communication skills that lead to greater independence in the home,
work, school, and community settings for all students regardless of their communication modality.

6.4 Research Limitations

There were several limitations to our study. In the qualitative section, the first was the sample composition. The data were derived from students who fell into an age group of young people, which is unsurprising given that young people are in fact dominant on the Internet. This may affect the results of the study when its results are applied to other age groups. Second, the data were collected from one online course on the subject of e-commerce. Drivers that influence online interaction may differ from other students’ perspectives. Third, we conducted research on a course in which social media was used as a tool for promoting interactions and engagement; this context may limit their students’ opinions regarding online interaction.

With respect to the second part of the study, one of the limitations is that we only focused on certain personal and perceived course characteristics. Important psychological factors such as motivation, problem solving, and self-efficacy, or administrative factors such as technical support, e-connectivity, and pedagogical support, were not included. In fact, as suggested by the existing research regarding online interaction, these factors may interact with students’ online interaction and engagement and collectively with students’ learning outcomes. Another limitation of this part is the data collection, which was
Discussion and Conclusion

limited to one higher education institution and therefore could not embrace other online learning settings. Although the sample size of this study was sufficiently large for statistical analysis, including more institutions could improve the findings of the research.

Another limitation of this study is the application of the survey data collection methods. Put simply, different students may attach different meanings and concepts to the items under study. Moreover, external validity may be impacted by the context of the study or participant bias. Individual interpretations may influence the nature of technology integration in education and may not yet have been crystallised due to the newness of the innovation. Beginners and freshman students may not be prepared to embrace a student-centred attitude towards teaching and learning whether in the form of technology or the traditional face-to-face classroom.

6.5 Future Work

This section discusses the possible research that could further expand upon the current study, which was successfully implemented despite the challenges and constraints. The data collected during this study can be considered a valid and reliable data set and can also be used for further analysis. This research also opens new avenues for researchers’ future work, such as investigating the impact of certain administrative and course design factors. Moreover, they can verify the influence of the proposed characteristics on other positive student
outcomes such as motivation, attrition, and problem solving. There are some unconfirmed hypotheses in this study that can be addressed in future research, which can be investigated with different data sets and examined with other research participants to add value to the recent findings.

In this study, the impact of personal and perceived course characteristics on students’ online interaction and engagement is examined while finding the root causes of these features and how to improve them could be a subject for further investigation. Moreover, further studies may be outlined taking into consideration instructors’ characteristics that can influence learners’ online interaction and engagement, or other features such as learning environment attributes, schools’ ICT capacity, and study design methodology. Future research could address the influence of support from instructors and teachers and learners on the facilitation of a positive attitude towards online learning settings and the use of technology for learning, which, based on the results of this study, could enhance low student engagement.

The findings of this research illustrate the challenges and complexities surrounding the analysis of the factors and features that have an effect on the level of students’ interaction and engagement in online learning programmes, as well as the analysis of the causal relationships between the contributing factors. Discovering all contributing factors that impact on student online interaction and engagement remains difficult and open to further debate. It is the
researchers’ hope that the findings may be able to provide useful suggestions related to improving the level of learners’ online interaction and engagement and subsequently their learning satisfaction and outcome.

6.6 Conclusion

With the emergence of the Internet, online learning has expanded rapidly. In addition to various interactive opportunities available in the online environment, opportunities for improvements in online education, particularly in the areas of interaction, are possible and necessary given that high levels of interaction have positive effects on the learning experience. Failure to adequately consider the relational dynamics in an online learning environment (OLE) may incur feelings of isolation and decreased student satisfaction, cause deficient learning outcomes and performance, and result in high attrition rates. Therefore, exploring and elaborating on the different parameters and factors contributing to more effective interaction in online courses was the main subject of this discussion. The highlights of the study can be summarized as significance, the outcomes, and the contributions of the study.

The significance of the study results in significant findings for both theory and practice. The potential implication of CLDs for instructors, university faculties, students and learners, course designers, and conveners is that they provide a big picture of several factors influencing online interaction and engagement in learning. Therefore, course designers and conveners can take these factors into
Discussion and Conclusion

account when designing an online course to promote and cultivate online interaction and engagement with a view to obtaining better student academic performance and satisfaction. In addition to having several practical implications, it could help researchers, particularly new researchers, to learn about these factors in a very convenient way, and more importantly, it can depict the causes and effects of all these parameters and their internal relations and interplay between them, which is essential for conducting comprehensive research.

The Outcome of this study illustrated by the CLD diagrams indicate that various factors, including accessibility, functionality, group discussion, students’ communicationality, technology aptitude, etc., have direct positive impacts on students’ engagement and satisfaction. Conversely, time consumption and distraction have negative influences. All the factors and features with their causal relationships are illustrated in a comprehensive CLD. These factors and their relationships can help researchers, course conveners, and students improve online interaction and engagement in online learning courses. The quantitative part of this study indicates that personal and course perceived characteristics affect students’ online interaction and engagement in online learning settings. It made several important contributions to this area through a validated research model, and it deepened our understanding of the factors and traits that contribute to students’ online interaction. It used different theories
and models to provide a solid theoretical foundation for its research hypotheses.

The contributions of the study of the proposed research model and validated hypotheses are benefits of online learners and educators by introducing some important and effective factors that affect students’ online interaction and engagement. Moreover, the study’s instrument provides a precise list of indicators that can help online learning developers and educators to measure the personal and course perceived characteristics of learners. The results of this research suggest that learners who are more self-regulated, have a better attitude toward online education and an understanding of its purposefulness, are able to present themselves in the online environment, and are identified by other learners and educators can enjoy better online interaction and engagement in online courses.
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Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information systems research, 14*(2), 189-217.


Freyer, E. I. (2008). *An Analysis of the Relationship between Learning Styles and Interaction in Online Discussions in Distance Education Courses at the University of Wisconsin-Stout.*


Girard, J., Willoughby, L., & Berg, K. ENHANCING INTERACTION IN ASYNCHRONOUS ONLINE INFORMATION SYSTEMS EDUCATION.


Kirby, E. (1999). Building Interaction in Online and Distance Education Courses.


References


Swanson, A. C. (2010). Establishing the best practices for social interaction and e-connectivity in online higher education classes.


Appendix A: Some samples of the body of literature

<table>
<thead>
<tr>
<th>Year</th>
<th>Journal/Conference name</th>
<th>Methodology</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>Technology, Pedagogy and Education</td>
<td>Qualitative</td>
<td>Communication between teachers and students in the process of virtual teaching (Gallego-Arrufat, Gutiérrez-Santiuste, &amp; Campaña-Jiménez, 2015)</td>
</tr>
<tr>
<td>2005</td>
<td>Annual Conference on Distance Teaching and Learning</td>
<td>Qualitative</td>
<td>ELearning Strategies with Enriched Interactions (Csete, Lam, &amp; Wong, 2005)</td>
</tr>
<tr>
<td>2012</td>
<td>Capella University thesis</td>
<td>Quantitative</td>
<td>Parallel use of Facebook and Twitter influence on sense of classroom community (Cardona-Divale, 2012)</td>
</tr>
<tr>
<td>2010</td>
<td>Capella University thesis</td>
<td>Quantitative</td>
<td>Effects of the four modes of online interaction on an e-mathematics learning outcome</td>
</tr>
<tr>
<td>2014</td>
<td>The International Review of Research in Open and Distributed Learning</td>
<td>Quantitative</td>
<td>The effect of interactions and Internet self-efficacy on student satisfaction (Y.-C. Kuo, Walker, Belland, et al., 2014)</td>
</tr>
<tr>
<td>2000</td>
<td>World Conference on Educational Multimedia, Hypermedia, and Telecommunications</td>
<td>Quantitative</td>
<td>Relationships that exist between students’ perceptions of interaction in online courses and overall course satisfaction (J. Richardson et al., 2000)</td>
</tr>
<tr>
<td>2007</td>
<td>The Journal of Human Resource and Adult Learning</td>
<td>Quantitative</td>
<td>Effect of online interaction on levels of satisfaction and learning occurring in an online program (Y.-J. Chen &amp; Chen, 2007)</td>
</tr>
<tr>
<td>2013</td>
<td>Educational Sciences: Theory &amp; Practice</td>
<td>Quantitative</td>
<td>Relationship exists between readiness levels of online learning students for online learning and the perceived structure and interaction in online learning environments (Kaymak &amp; Horzum, 2013)</td>
</tr>
<tr>
<td>2013</td>
<td>Procedia – Social and Behavioral Sciences</td>
<td>Quantitative</td>
<td>Effect of Adobe Connect Pro on synchronous interaction of online course students (Torun, 2013)</td>
</tr>
<tr>
<td>2001</td>
<td>University of Cincinnati thesis</td>
<td>Qualitative</td>
<td>Influence of interaction on active learning, learning outcomes, and community bonding (Hammer, 2002)</td>
</tr>
<tr>
<td>2007</td>
<td>University of Southern Queensland</td>
<td>Mixed-method</td>
<td>Interaction impact on the outcomes or satisfaction of learners (Wilson, 2007)</td>
</tr>
<tr>
<td>2013</td>
<td>Journal of Computer Assisted Learning</td>
<td>Quantitative</td>
<td>What factors in learner-instructor interaction can predict the learner’s outcomes in the online learning environment (Kang &amp; Im, 2013)</td>
</tr>
<tr>
<td>Year</td>
<td>Conference/Workshop</td>
<td>Method</td>
<td>Research Questions/Findings</td>
</tr>
<tr>
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</tr>
<tr>
<td>2010</td>
<td>21st Central European Conference on Information and Intelligent Systems</td>
<td>Quantitative</td>
<td>Uses of the online community tool Ning in a hybrid university course (Bubas et al., 2010)</td>
</tr>
<tr>
<td>2008</td>
<td>Asian Association of Open Universities Journal</td>
<td>Quantitative</td>
<td>Will the cultural diversity of learners affect their learning and interaction behaviour in the Web-based environment? (Bing &amp; Ping, 2008)</td>
</tr>
<tr>
<td>2011</td>
<td>The Turkish Online Journal of Educational Technology</td>
<td>Quantitative</td>
<td>Knowledge sharing is applied to achieve the appropriate interaction among participants in an online learning environment (Chao, Hwu, &amp; Chang, 2011)</td>
</tr>
<tr>
<td>2011</td>
<td>Journal of Systemics, Cybernetics and Informatics</td>
<td>Qualitative</td>
<td>Explores ways in which NodeXL, a relatively new tool for social network analysis, could be used as an element in evaluation of online learning experiences (Doran, Doran, &amp; Mazur, 2011)</td>
</tr>
<tr>
<td>2009</td>
<td>WSEAS transactions on information science and applications</td>
<td>Qualitative</td>
<td>Analyses the potential of online communication tools in creating student-centred digital communities of inquiry (Aleksić-Maslać, Magzan, &amp; Jurič, 2009)</td>
</tr>
<tr>
<td>2012</td>
<td>Journal of Asynchronous Learning Networks</td>
<td>Qualitative</td>
<td>Determines factors that increase interaction among students (York &amp; Richardson, 2012)</td>
</tr>
<tr>
<td>2002</td>
<td>World Conference on Educational Multimedia, Hypermedia and Telecommunications</td>
<td>Quantitative</td>
<td>Students’ perception of an asynchronous online discussion and learning to interact with others (Shank &amp; Doughty, 2002)</td>
</tr>
<tr>
<td>2003</td>
<td>Groupware: Design, Implementation, and Use workshop</td>
<td>Qualitative</td>
<td>Exploring the interaction behaviour of different collaborative group types with respect to their performance (Daradoumis et al., 2003)</td>
</tr>
<tr>
<td>2004</td>
<td>The University of Texas thesis</td>
<td>Mixed-method</td>
<td>Students’ attitudes toward four types of interactions: instructional, affective, collaborative, and vicarious (Brooks et al., 2004)</td>
</tr>
<tr>
<td>2005</td>
<td>International Journal of Technology in Teaching and Learning</td>
<td>Qualitative</td>
<td>Effect of social and interpersonal interaction in an online programme (H. Wang, 2005)</td>
</tr>
<tr>
<td>2013</td>
<td>Computers &amp; Education</td>
<td>Mixed-method</td>
<td>Online learning interaction participation, perception, and learning satisfaction would be consistent across varied age and ethnicity groups (Ke &amp; Kwak, 2013)</td>
</tr>
<tr>
<td>2013</td>
<td>Internet and Higher Education</td>
<td>Quantitative</td>
<td>Students’ self-regulation for interaction with others in online learning environments (M.-H. Cho &amp; Kim, 2013)</td>
</tr>
<tr>
<td>2013</td>
<td>Society for Information Technology &amp; Teacher Education International Conference</td>
<td>Mixed-method</td>
<td>Investigates whether various communication tools and methods influence student learning process, learning outcomes, motivation, self-regulation, and satisfaction (Moallem et al., 2013)</td>
</tr>
<tr>
<td>2002</td>
<td>Department of Instructional Systems Technology, Indiana University thesis</td>
<td>Mixed-method</td>
<td>Develops a “situationalities framework” that describes the situationalities – learning goals, values, conditions, and effectiveness outcomes (Beatty, 2002)</td>
</tr>
<tr>
<td>Year</td>
<td>Journal/Media/International</td>
<td>Method</td>
<td>Study Focus</td>
</tr>
<tr>
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<tr>
<td>2010</td>
<td>Educational Media International</td>
<td>Mixed-method</td>
<td>Examines relations between students' learning styles and factors influencing students' participation in asynchronous interactions in online courses (Küçük, Genç-Kumtepe, &amp; Taşçı, 2010)</td>
</tr>
<tr>
<td>2003</td>
<td>Open Learning</td>
<td>Mixed-method</td>
<td>Whether reflective interaction is more likely to arise from some task types than others (Lamy &amp; Hassan, 2003)</td>
</tr>
<tr>
<td>2012</td>
<td>Computer Assisted Language Learning</td>
<td>Mixed-method</td>
<td>How students interact and collaborate in the process of learning topics that had previously been discussed in a face-to-face mode (Nor et al., 2012)</td>
</tr>
<tr>
<td>2005</td>
<td>Australasian Journal of Educational Technology</td>
<td>Qualitative</td>
<td>A framework for deep learning for dynamic online discussion in distance education (Du, Havard, &amp; Li, 2005)</td>
</tr>
<tr>
<td>2010</td>
<td>Society for Information Technology &amp; Teacher Education International Conference:</td>
<td>Mixed-method</td>
<td>Redefine the social learning theory for the online learning environment (Tu, 2000)</td>
</tr>
<tr>
<td>2006</td>
<td>Journal of Continuing Education in the Health Professions</td>
<td>Qualitative</td>
<td>Explore instructor roles in enhancing online learning through interpersonal interaction (Sargeant et al., 2006)</td>
</tr>
<tr>
<td>2009</td>
<td>Journal of Interactive Online Learning</td>
<td>Quantitative</td>
<td>The relationship between interaction variables and student learning and satisfaction (Sher, 2009)</td>
</tr>
<tr>
<td>2004</td>
<td>Open Learning</td>
<td>Mixed-method</td>
<td>Lack of time and learners' preference for spending time on reading affect interaction in online discussion (Fung et al., 2004)</td>
</tr>
<tr>
<td>2002</td>
<td>Education, Communication &amp; Information</td>
<td>Quantitative</td>
<td>Course design factors affecting the success of synchronous online learning (Karen Swan, 2002)</td>
</tr>
<tr>
<td>2006</td>
<td>World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education</td>
<td>Quantitative</td>
<td>The relationships of student attitudes toward four types of interaction learning styles, and their online learning readiness (Hao, 2006)</td>
</tr>
<tr>
<td>2007</td>
<td>International Association for Computer Information Systems</td>
<td>Quantitative</td>
<td>How one may enhance interaction with instructors and classmates through the use of virtual collaboration, voice, and video (Girard et al.)</td>
</tr>
<tr>
<td>2013</td>
<td>The International Review of Research in Open and Distributed Learning</td>
<td>Quantitative</td>
<td>Examines how effectiveness varies with the degree of interaction intensity (Castaño-Muñoz, Sancho-Vinuesa, &amp; Duart, 2013)</td>
</tr>
<tr>
<td>2007</td>
<td>Christian Higher Education</td>
<td>Quantitative</td>
<td>Examines the relationships between three major types of teacher-student interaction (organisational, social, and intellectual) and two types of learning outcomes (cognitive and affective) (Heinemann, 2007)</td>
</tr>
<tr>
<td>Year</td>
<td>Journal/Thesis Source</td>
<td>Method</td>
<td>Research Focus</td>
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</tr>
<tr>
<td>2014</td>
<td>Internet and Higher Education</td>
<td>Quantitative</td>
<td>Interaction impact on the context of other critical student- and class-level predictors (Y.-C. Kuo, Walker, Schroder, et al., 2014)</td>
</tr>
<tr>
<td>2008</td>
<td>Journal of Computing in Teacher Education</td>
<td>Quantitative</td>
<td>Student perceptions of using instant messaging software for online interactive chapter discussions (Chen Wang &amp; Morgan, 2008)</td>
</tr>
<tr>
<td>2005</td>
<td>Christian Higher Education</td>
<td>Quantitative</td>
<td>Examining the relationships between three major types of teacher-student interaction (organisational, social, and intellectual) and two types of learning outcomes (cognitive and affective) (Heinemann, 2005)</td>
</tr>
<tr>
<td>2010</td>
<td>Australasian Journal of Educational Technology</td>
<td>Mixed-method</td>
<td>The attitudes of students enrolled in a distance education MBA programme towards interacting more with other students online (Watson, 2010b)</td>
</tr>
<tr>
<td>2014</td>
<td>Jurnal Teknologi</td>
<td>Mixed-method</td>
<td>Students’ opinion on using online forum discussion (FR), text chatting (CH), and online learning interaction (LI) (Mohamad et al., 2014)</td>
</tr>
<tr>
<td>2008</td>
<td>Journal of Technology and Teacher Education</td>
<td>Mixed-method</td>
<td>Aspects of online courses impact on the way students enter into discussions online, and consequently what they have opportunities to learn (McCrory et al., 2008)</td>
</tr>
<tr>
<td>1999</td>
<td>Society for Information Technology &amp; Teacher Education International Conference</td>
<td>Quantitative</td>
<td>Meaningful interaction that contributes to student growth and learning (Kirby, 1999)</td>
</tr>
<tr>
<td>2011</td>
<td>Journal of Computing in Higher Education</td>
<td>Quantitative</td>
<td>How three types of interaction may foster instructional improvement (Abrami et al., 2011)</td>
</tr>
<tr>
<td>2005</td>
<td>Journal of Interactive Online Learning</td>
<td>Mixed-method</td>
<td>How instructors and students perceive the importance of online interaction and which instructional techniques enhance those interactions (Su et al., 2005)</td>
</tr>
<tr>
<td>2010</td>
<td>Society for Information Technology &amp; Teacher Education International Conference</td>
<td>Quantitative</td>
<td>Which interaction and other predictors contribute to student satisfaction in online learning setting (Y.-C. Kuo et al., 2010)</td>
</tr>
<tr>
<td>2008</td>
<td>University of Wisconsin-Stout thesis</td>
<td>Quantitative</td>
<td>The Relationship between Learning Styles and Interaction in Online Discussions in Distance Education Courses (Freyer, 2008)</td>
</tr>
<tr>
<td>2012</td>
<td>College of Education and Organisational Leadership thesis</td>
<td>Quantitative</td>
<td>Identify the level of satisfaction as well as the preferences of students for online education and interaction (Yousef, 2012)</td>
</tr>
<tr>
<td>2010</td>
<td>University of Phoenix thesis</td>
<td>Mixed-method</td>
<td>Focusing on e-connectivity, instructor presence, and positive communication in online courses (Cheng &amp; Suan)</td>
</tr>
<tr>
<td>2010</td>
<td>MARYWOOD UNIVERSITY thesis</td>
<td>Quantitative</td>
<td>Importance of interaction to students involved with online graduate education courses (Cheng &amp; Suan)</td>
</tr>
<tr>
<td>2006</td>
<td>Jyväskylä University thesis</td>
<td>Quantitative</td>
<td>Learner interaction and the way in which learners build and maintain common ground so as to enable themselves to collaborate and learn together (Cheng &amp; Suan)</td>
</tr>
<tr>
<td>2010</td>
<td>Journal of Interactive Online Learning</td>
<td>Quantitative</td>
<td>Investigates the educational benefits associated with the use of SNSs such as Ning in online interaction (Cheng &amp; Suan)</td>
</tr>
<tr>
<td>Year</td>
<td>Journal Title</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>---------------------------------------------------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2014</td>
<td>Computers in Human Behavior</td>
<td>Quantitative</td>
<td>Defines three system-independent classifications of interactions and evaluates the relation of their components with academic performance across two different learning modalities: virtual learning environment (VLE)-supported face-to-face (F2F) and online learning (Agudo-Peregrina et al., 2014)</td>
</tr>
<tr>
<td>2014</td>
<td>Internet and Higher Education</td>
<td>Quantitative</td>
<td>Examines the relationship between instructor scaffolding for interaction and students’ academic engagement in an online learning environment (M.-H. Cho &amp; Cho, 2014)</td>
</tr>
<tr>
<td>2006</td>
<td>Distance Education</td>
<td>Quantitative</td>
<td>Investigates the degree to which students cognitively engage with their online courses (J. C. Richardson &amp; Newby, 2006)</td>
</tr>
</tbody>
</table>
Appendix B: Griffith University Human Research Ethics for qualitative part of education study

HUMAN†RESEARCH†ETHICS†COMMITTEE
ETHICAL†CLEARANCE†CERTIFICATE

This certificate generated on 07052015.
This certificate confirms that protocol 'NR: Investigating students' perception of the use of social computing technologies to enhance interactions in online courses' (GU Protocol Number ICT/11/15/HREC) has ethical clearance from the Griffith University Human Research Ethics Committee (HREC) and has been issued with authorisation to be commenced.
The ethical clearance for this protocol runs from 02052015 to 31122015.
The named members of the research team for this protocol are:

Dr Anne Nguyen
Dr David Chen
Dr Amir Hossein Ghapanchi
Ms Afrooz Purarjomandlangrudi

The research team has been sent correspondence that lists the standard conditions of ethical clearance that apply to Griffith University protocols.
The HREC is established in accordance with the National†Statement†on†Ethical Conduct†on†Research†Involving†HumansÆ†The operation of this Committee is outlined in the HREC Standard Operating Procedure, which is available from www.gu.edu.au/or/ethics.
Please do not hesitate to contact me if you have any further queries about this matter.

Rick Williams
Manager, Research Ethics
Office for Research
Bray Centre, N54 Room 0.15 Nathan Campus
Griffith University
Phone: 07 3735 4375
Facsimile: 07 373 57994
Email: rick.williams@griffith.edu.au
Appendix C: Online focus group open-ended questions

What is your opinion about using Facebook as a social media tool for interactions and a place to discuss your perspectives/your classmates’ perspectives on the topics of the course? What are its advantages and disadvantages?

1. Does the course Facebook forum help you in learning the topics and contents of the course? Explain how.

2. How interactive is the course Facebook forum? And how often do you visit the page?

3. To what extent are you satisfied with the course Facebook forum as a tool for students’ interactions in this course and why?

4. Do you have any suggestions to improve the online interaction in this course?
Appendix D: Online Survey

A student interaction and engagement in online courses

(Ethics clearance number 2015/755)

* Required

This questionnaire examines the impact of student characteristics and course perceptions on student engagement and interaction in online courses. Please help us in this scholarly research by spending 7-8 min of your valuable time and filling the following multiple choice questions. Be sure that your responses will be recorded anonymously. To access the consent form click on this link [https://docs.google.com/a/griffith.edu.au/document/d/1Iq6HlEYwXlqFGB7K2WixQZ0mjHhEw1QPi6P7DENGQ0/edit?usp=sharing]. Thanks for your cooperation in advance.

1. Please write the code of an online course you are doing this semester (e.g. 3212ICT) *

2. What tool(s) are used in this online subject of yours for online interaction (e.g., discussion board, Facebook, blog etc.)? *

3. Gender: *
   Check all that apply.
   - [ ] Male
   - [ ] Female

4. Your age: *
   Mark only one oval.
   - [ ] Under 18
   - [ ] 18-20
   - [ ] 21-25
   - [ ] 25 and older

5. Year of studies: *
   Mark only one oval.
   - [ ] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4 and higher

https://docs.google.com/forms/d/1LUVwMoQ6RUL66hpy6XXG1JSLLsLi1stqFijiGWNk/edit
6. Online Experience: * 
Mark only one oval.
- This is my first online course
- I have taken two online courses including this course
- I have taken more than two online courses including this course

7. Employment status: * 
Mark only one oval.
- Full-time
- Part-time
- Not employed

8. Enrolment status: * 
Mark only one oval.
- Full-time
- Part-time

Please rate the following questions regarding your online course experience in this course

9. 1- I am willing to participate in discussion with other students. * 
Mark only one oval.

   | 1 | 2 | 3 | 4 | 5 |
---|---|---|---|---|---|
Strongly disagree | | | | | Strongly agree

10. 2- I am relaxed and comfortable when communicating with others and convey my ideas. * 
Mark only one oval.

   | 1 | 2 | 3 | 4 | 5 |
---|---|---|---|---|---|
Strongly disagree | | | | | Strongly agree

11. 3- I pay attention to the conversation when I do online discussion. * 
Mark only one oval.

   | 1 | 2 | 3 | 4 | 5 |
---|---|---|---|---|---|
Strongly disagree | | | | | Strongly agree

12. 4- I'm familiar with Information Technology and do well in activities that use technology. * 
Mark only one oval.

   | 1 | 2 | 3 | 4 | 5 |
---|---|---|---|---|---|
Strongly disagree | | | | | Strongly agree

https://docs.google.com/forms/d/e/1CJkVGWz9HDIAl7Qy56ZG3I13Lduc1WqF7Q4N6e/dit
A student interaction and engagement in online courses

13. I am able to learn new technologies. *
Mark only one oval.

1 2 3 4 5

Strongly disagree Strongly agree

14. When I study for this class, I set goals and make a plan for myself in order to direct my activities. *
Mark only one oval.

1 2 3 4 5

Strongly disagree Strongly agree

15. I normally try to choose a time with less distraction for studying my online course. *
Mark only one oval.

1 2 3 4 5

Strongly disagree Strongly agree

16. I believe that online learning is an effective mode of learning as it integrates different types of media (text, audio, video, etc.). *
Mark only one oval.

1 2 3 4 5

Strongly disagree Strongly agree

17. I believe that convenience is an important feature of online learning. *
Mark only one oval.

1 2 3 4 5

Strongly disagree Strongly agree

18. I would be interested in studying courses that are online. *
Mark only one oval.

1 2 3 4 5

Strongly disagree Strongly agree

19. I feel comfortable participating in the online discussions of this course. *
Mark only one oval.

1 2 3 4 5

Strongly disagree Strongly agree
20. I am able to effectively communicate with other students in this course. *
Mark only one oval.

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Strongly disagree  Strongly agree

21. I feel my posts (i.e. questions/point of views/etc.) are usually read or attended in this course. *
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Strongly disagree  Strongly agree

22. I feel comfortable introducing myself to other students in this course. *
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Strongly disagree  Strongly agree

23. I feel I am a valued member of the group. *
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Strongly disagree  Strongly agree

24. My contribution is sometimes acknowledged by other students. *
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Strongly disagree  Strongly agree

25. The online interactions I have, allows me to receive useful feedback, which could improve my learning outcome. *
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Strongly disagree  Strongly agree

26. The online discussion and interaction help me to explore issues, take positions, and discuss my positions in an argumentative format. *
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Strongly disagree  Strongly agree
27. Discussing and communicating with other students of this course is a purposeful way to improve my learning. *
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28. Overall I feel involved with the course. *
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29. I usually watch online videos of the course and/or the online streaming of the concepts. *
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30. I have a reasonable level of online interaction in this course. *
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31. Online discussion in this course encourages me to connect to other students. *
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32. Overall I am happy with my learning achievements in this course. *
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33. Overall I am satisfied with this online course. *
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34. Would you like to add anything else?


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Google Forms

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Appendix E: Griffith University Human Research Ethics for quantitative part of education study

GRIFFITH UNIVERSITY HUMAN RESEARCH ETHICS REVIEW

Dear Dr David Chen

I write further to the additional information provided in relation to the provisional approval granted to your application for ethical clearance for your project "NR: Interaction and Engagement in Online Education: Impacts of Students Characteristics and Perceptions" (GU Ref No: 2015/755).

This is to confirm that this response has addressed the comments and concerns of the HREC.

The ethics reviewers resolved to grant your application a clearance status of “Fully Approved”.

Consequently, you are authorised to immediately commence this research on this basis.

Regards

Dr Gary Allen
Senior Policy Officer
Office for Research
Bray Centre, Nathan Campus
Griffith University
ph: 3735 5585
fax: 5552 9058
email: g.allen@griffith.edu.au
A systematic review approach to technologies used for learning and education

Afrooz Purarjomandlangrudi*, David Chen and Anne Nguyen

School of Information and Communication,
Abstract: E-learning is implementation of technologies in learning process and is growing at a very rapid pace. E-learning technology has matured noticeably and the majority of organisations are taking advantage of it in their educational systems. However, there is a lack of methodical and consistent paradigm of these technologies in literature. The purpose of this study is to conduct a systematic literature review on past research regarding application of technologies in education to propose a structured and taxonomic classification for technologies used in learning and education to shed a light on the way of their users. Reviewed studies were excluded on the basis of their title, abstract and full text to arrive at a final set of 343. The result of data analysis is nine
main categories of technologies. A summary of implications and conclusions of the research analysis are also provided for both industry practitioners and researchers to take advantage of them.

**Keywords:** Educational technology, e-learning, learning theories


**Biographical notes:** Afrooz Purarjomandlangrudi received her BSc in Electrical-Control Engineering in 2007 and her Master of Engineering in 2013 from Queensland University of Technology (QUT). She is a PhD student studying Information and Communication Technology in Griffith University in Brisbane, Australia. Her research interests include, learning technologies, e-learning, serious games and IT management.
David Chen is a Senior Lecturer and Program Director of Bachelor of Information Technology at School of Information and Communication Technology, Griffith University. He has more than 10 years of experience in research and teaching at university level. His research interests include learning and teaching, collaborative systems, networking and bioinformatics.

Anne Nguyen is a Senior Lecturer in the School of Information and Communication Technology at Griffith University. Her research interests include eEducation, eBusiness, and eGovernment, with specific focus on models and supporting systems.
Electronic learning (e-learning) is electronic learning technology and has become an indispensable part of education systems all over the world. Different definitions for e-learning have been presented by the literature and in this study e-learning is

“all forms of electronic supported learning and teaching, which are procedural in character and aim to effect the construction of knowledge with reference to the individual experience, practice and knowledge of the learner. Information and communication systems, whether networked or not, serve as specific media…to implement the learning process.” (Tavangarian et al., 2004).

There has been a remarkable increase in the impact of e-learning technologies due to their wide adoption by various educational institutions. Almost 95% of educational institutions are using at least one form of e-learning technology in their educational system (Committee, 2005). E-learning facilitates learning and makes it faster by increasing learning accessibility at a lower cost for users and students. With today’s rapid
development of technology, institutions and organizations can enhance their quality by implementing e-learning in their learning process. E-learning takes advantage of the Internet and enables users to have access to learning materials and sources at any time and in any place. In fact, e-learning has eliminated time and distance barriers (Gunasekaran et al., 2002).

There is a wide range of e-learning technologies employed by learners. Educators are required to be familiar with them in order to be able to apply them more effectively for their teaching purposes. However, the variety of these technologies continues to grow apace. Some of them are not originally designed for education, such as social network, but they are extensively used in learning processes (Amador & Amador, 2014; Veletsianos, 2012). Some are specifically developed for educational use, for example Learning Management Systems (LMS) (Williams van Rooij, 2012).

With the expansion of e-learning and its continuing development, there are some investigations aimed at reviewing the existing technologies and researching different e-learning disciplines (Chapelle, 2004; Conole & Warburton, 2005; Dash et al., 2012; Felix, 2005). However, there is a lack of research that provides a review that includes a vast range of technologies and investigates the trend of their implementation by various educators of different learning programs. This problem has been caused some barriers in technology adoption and there are limited sources that supply the users with
a structured and efficient categorization. Also, lack of consistent statistical and morphological research in this area has brought about different obstacles for researchers and program conveners. To address these problems, this study aims to present a comprehensive and systematized classification of e-learning technologies.

This study is a systematic review of the literature of current e-learning technologies applied for different learning purposes. It proposes a classification for the main technologies and offers some sub-categories and examples for each of them. It also highlights some of their applications by educators and the opportunities they provide. In section 2, the research methodology is discussed and the selection and study process are explained. Section 3 contains the results of analysing the selected data set and proposes the technology categories. Section 4 discusses the implication of e-learning technologies for both industry practitioners and researchers. And finally the study ends with a conclusion in section 5.

Research Methodology
In this study, we have carried out a systematic literature review to identify studies in the application of technologies in education and learning (Kitchenham, 2004). A systematic literature review is conducted based upon the guidelines proposed by Kitchenham et al. (Kitchenham et al., 2009). A systematic literature review is a type of research methodology that focuses on a topic or research question to identify and interpret available empirical studies. It involves planning the review, conducting the review, and reporting on the review. This review follows four steps: (1) identification of resources, (2) selection of resources, (3) extraction and synthesis of data, and (4) data analysis. The following steps are done to finalize this systematic literature review.

2.1. Selection Process and Criteria

Among different research sources, we selected the following journals which contain more publications about e-learning technologies and their applications and also they include the important databases. Then, to have a state-of-the-art analysis of recent e-learning technologies, the last three years (2012, 2013 and 2014) have been chosen to conduct the review. Table 1 indicates the journal names, databases, and the total number of papers in their published issues in these years.
Table 1. Journals and their selected criteria

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<td>Educational Technology Research and Development</td>
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<td>Information Technology, Education and Society</td>
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<td>International Journal of Computer-Supported Collaborative Learning</td>
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<td>Journal of Research on Technology in Education</td>
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2.2. Study Process

Based on Table 1, the total number of papers that were selected was 461. At this stage some of them were excluded because they were about e-learning reviews or did not examine e-learning technologies. Thereafter, the final set of 343 papers was selected. Figure 1 illustrates the number of papers after each stage.

![Fig.1. Stages of study process.](image)

Results

3.1. E-learning Technologies
There are several classifications for use of technology in education. In this study nine main categories are defined for this purpose which includes: Social Network, Management & Administration Tools/LMS, Online Communication, Assistive Software/Hardware, Digital Technologies, Mobile Apps, Online/Digital Games, Podcasts/Streaming and Wikis. Figure 2 illustrates all these categories and their sub-categories which are discussed in details below.

Fig.2. Technology for learning classifications.
Figure 3 is a pie chart showing the percentage of each main technology that is employed in the papers. At first glance it is clear that Assistive Software/Hardware is the most dominant technology, making up 25% of the total, and the second is Management & Administration Tools/LMS, at 21%. The proportion of Online Communication was quite similar for Social Network and Digital Technologies, 15%, 13% and 10% respectively. Apart from Online/Digital Games, which constitutes 9%, other technologies contribute less to education systems. The following is a brief description of each technology and some examples of their applications in learning.

*Social Networking*

Social networking is a way for people to communicate online and share their interests, activities, backgrounds and real-life connections. It is a web-based service in which every user can create a profile that consists of his or her social links, connections and a variety of additional services offered by the ‘web-based services and the ability to share them with others.
A wide range of social networking sites like Facebook and Twitter are adopted for use as a tool to enhance learning and education. For instance, N. D. Bowman and M. Akcaoglu (Bowman & Akcaoglu, 2014), have created a course-specific Facebook group in a mass media course as a supplemental space for course discussion. The results at the end of the semester showed that the Facebook group users’ grades were significantly higher than other students. A 3-D virtual world is another learning environment adopted by academic people for educational purposes. Z. Merchant et al. (Z. Merchant et al., 2013) study is an explanatory example of using Second Life (SL), a
three-dimensional virtual world, to improve students’ learning of chemistry concepts.

3.1.2. Management & Administration Tools/LMS

This category contains tools used for teaching, course management, students’ administration and their progress, and even tools for plagiarism detection. It also includes a learning management system (LMS), which is a system for managing administration, documentation, tracking, reporting and delivery of online or blended/hybrid educational courses. It is used throughout universities and other institutions to invigorate and augment their courses and educational systems.

A lot of research has been done about online courses and LMS technology, as well as their impact on students’ learning outcomes. J. Yuan and C. Kim (Yuan & Kim, 2014) have investigated dropout problems in online courses and the lack of interaction, which might lead to students’ isolation. The effects of LMS on learners’ satisfaction and how it caters for their needs in online courses are discussed in (Rubin et al., 2013). The authors proposed a model to explain the influence of LMS affordances on the community of inquiry.

3.1.3. Online Communication
Online communication technology is divided into two main categories, Synchronous and Asynchronous Communication. Synchronous communication is a form of technology that enables people to communicate in real-time and to collaborate at the same time in different places. The main problem with these tools is the difference in time zones and conflicting schedules, which can create communication challenges. Synchronous tools can be based on text or audio and can contain video, documents, multimedia and desktop sharing. This includes audio, video and web conferencing, chat and instant messaging, application sharing, online forums and discussion. Some research has been done about the implementation and impacts of this technology in education. S. Çelik employed an online discussion board in a course and explored the students’ concerns and outcomes (Çelik, 2013).

In an asynchronous environment, communication and collaboration are conducted over a period of time at different times in different places. Asynchronous tools provide people from various time zones with the ability to connect together at each person’s own convenience, and are useful for sustaining collaborations. The most common types of these tools are e-mail, streaming audio and video, narrated slideshows, discussion boards, e-portfolios and web logs (blogs), which are implemented by E. Tang and C. Lam (Tang & Lam, 2014) to build an effective online learning community (OLC) to fulfill the objectives of blog-based teaching portfolios.
3.1.4. Assistive Software/Hardware

Computer technology in today’s classroom has provided teachers with a wide range of tools to make teaching more qualified and easier. Assistive computer-based technology is a form of technology that enables users to enhance their functional capabilities with learning needs. It includes computer software and hardware that is used for different learning purposes. They can contribute to making training hours more interactive and to stimulate students’ computer skills.

There have been many classifications of different types of educational computer software and new ones have been invented over the years. Some of them test the students and some aim to help them to achieve a better understanding of concepts. ‘Simulation software is one type/classification of software employed by researchers to stimulate student learning skills, especially in reading and writing. For example, authors in (Liou et al., 2012) developed a system called “WriteAhead,” which provides different types of suggestions for non-native English students from various disciplines who are writing journal papers’ abstracts, and assessed its effectiveness. M. Nivala et al. (Nivala et al., 2012) have investigated the use of a new hardware tool, a
virtual microscope, in a pathology medical course to improve their collaborative skills.

3.1.5. Digital Technologies

This category covers a plethora of different contents that are performed through the Internet. It contains three sub-categories, including Shared Documents/Scripts, Internet Surfing and E-books. Shared documents contain technologies such as Google Docs, Zoho Writer, SlideShare, Elgg, Clearspace etc. (Craig et al., 2012). Some of them, like Google Docs, are considered particularly useful when users employ Gmail as their email system, which has been the case in many Australian universities (Yoo et al., 2014).

Collaboration scripts are very useful and important elements in computer-supported collaborative learning (CSCL), which help students collaborate and provide more interactions in learning activities. H. Gijlers et al. have applied computer-supported collaborative drawing scripts to investigate the influence of this technology on students’ knowledge acquisition (Gijlers et al., 2013). Authors in (Popov et al., 2013) have also adopted a collaboration script to improve the quality of students’ discussion skills.

The phrase “Internet surfing” comprises a plethora of different Internet-user activities, such as using different search engines, websites, databases, social
bookmarking and so on. Actually, most students are engaged in this activity when performing their tasks and assignments, getting help from different websites and doing research. Various research has been conducted regarding different aspects of information seeking from the Internet. R. Eynon and Malmberg investigated the impact of information-seeking activities on young people’s learning (Eynon & Malmberg, 2012).

E-books' (also known as “e-texts” or “e-textbooks”) application has developed across the globe in recent years with the increase of using different kinds of digital materials, such as laptops, tablets, e-readers and smartphones. Their implications in learning and education have also been explored in much of the literature. K. Ciampa conducted a pilot study on the impacts of online reading on the reading motivation and listening comprehension of students (Ciampa, 2012).

3.1.6. Online/Digital Games

Digital Game-Based Learning (DGBL) has become very popular and widespread in recent years and is counted as a very effective tool for educational purposes (Hwang & Wu, 2012). It connects learning material with the computer and can be applied in a broad spectrum of applications and subjects. Users of this technology assert that it can help students to engage in interactive instruction and gain a better understanding of concepts.
DGBL can facilitate teaching and learning by simulating the real process, providing the learners with the ability to experience situations that are not easy to deal with in the real environment (Purarjomaldlangrudi & Ghapanchi, 2013).

H. S. Hsiao et al. developed a digital game called ToES to improve students’ creativity (Hsiao et al., 2014). Their research goal was to investigate how DGBL systems can affect students’ motivation and improvement in creativity. Their results not only showed that it is a very effective tool in cultivating students’ skills; it also contributes to accelerating the improvement and facilitates their learning performances.

3.1.7. Mobile Applications

Learning through smartphones or m-learning, is one of the recent developments that employ mobile devices in education and learning. This technology enables users to follow training programs without the need to access to a computer system. J. Gikas and Grant conducted a research that investigated the impact of mobile devices such as cellphones and smartphones on learning and teaching (Gikas & Grant, 2013). They included students and teachers in their research and explored how they integrated m-learning in their courses.

3.1.8. Wikis
Wikis are a collection of websites that are fully editable and enable multiple users to read and write in them any time and from anywhere. This ability has brought about a very convenient environment for online collaboration. It is also a very excellent tool for online learning and educational purposes (Augar et al., 2004). It has a variety of in the academic context; M. M. Woo et al. investigated the use of wiki to collaborate writing in primary levels in a Chinese primary school(Woo et al., 2013). The authors concluded that wikis can be helpful and can provide support for students’ writing skills.

3.1.9. Podcasts/Streaming

In this study, podcast is an educational audio or video file that can be created, uploaded or downloaded from websites to a digital device such as a computer, tablet or smartphone. Streamed files are compressed format files that can be played at the same time in various destinations, depending on the Internet speed, and can be stopped and started during playing. This technology has been extended among universities in recent years performing online and distance learning (Kathy Swan & Hofer, 2011).

3.2. Learning Theories

The nature of learning and how one person can transfer information to another person has been a controversial subject. To put it simply, a theory is a combination of various factors merged together to describe the concept of
that theory. Many varieties of different learning theories have been proposed, of which those based on scientific evidences are more validated than theories based on personal opinion and experiments.

Different theories are used in literature and Figure 4 shows the type and the proportion of them in e-learning. As can be seen, Cognitivism is the most popular theory in e-learning literature and 14 papers have applied it. Then, Activity Theory and Cognitive Load are used by 4 and 3 papers respectively. There are some other theories which are applied less frequently, namely Behaviorism, Control-value, Social Presence, Information Foraging and Social Cognitive.
3.3. Problems and Aims

In this study the problems and aims of the papers are categorized into seven groups. This classification was done based on the whole idea of the research. Figure 5 demonstrates the categories and their contributions. “E-learning effectiveness on learning” makes up 48% of the pie chart, which means most of the papers investigate the effectiveness of e-learning in education and learning outcomes. The next areas of exploration that have significant proportions are “e-learning user acceptance” (22%), and “e-learning
behavioral impacts” (18%). There are a few papers that explore “e-learning use barriers” (8%), “sustainable e-learning” (2%), “e-learning organizational changes” (1%), and “e-learning accessibility” (1%).

Fig.5. Problems and aims of e-learning papers.

3.4. Geographical Locations
Figure 6 provides a breakdown of the frequency of the research papers authored in different countries. It shows that the United States was the most prolific, with 128 papers affiliated with US universities. This was followed by Taiwan (29), United Kingdom (20), The Netherlands (18), Canada (18), Australia (14), and Germany (11). As the chart illustrates, some countries allocated less than 10 papers, such as Finland, Spain, China, Sweden and so one. Countries that have produced only one paper have not been displayed in the bar chart, namely: Egypt, Macedonia, Serbia, Emirates, India, Cyprus, Romania, South Africa, Saudi Arabia, Iran, Jordan, Muscat, Croatia, Switzerland, Zambia, and Georgia. Examining e-learning technologies seems to be stronger in the US compared with other countries.
3.5. Learning and Teaching (L&T) Process Mapping

In order to design technology-enhanced learning experiences, a considered and programmatic approach is crucial to achieve ultimate success in learning and teaching experiences, particularly in relation to quality learning. Learning and teaching activities need to be meaningful and relevant in every curriculum. They should also be considered to be beneficial, well integrated to the course, and supported by the teacher. Accordingly, designing and implementing a competent and appropriate L&T process is essential, not only for the creation of a quality learning experience and improving students’ learning capacities, but also for efficient use of time in the course construction and resource maintenance.

The course curricula L&T process is usually conceived of in connection with the following major components: Content and Resources, Presentation, Discussion and Collaboration, Assessment, Feedback, and Management and Administration (Ignelzi, 2000). Figure 6 indicates a mapping of e-learning technologies in the L&T process. It categorizes proposed e-learning technologies that can be applied in each L&T component.
Fig. 6. E-learning technologies mapping with L&T process.

Discussion
This section contains a brief analysis of research trends and discusses the implication of e-learning technologies for practitioners and researchers. Based on the results of this study, it can be implied that Assistive Software/Hardware and Management & Administration Tools/LMS technologies are employed more than other technologies in education. While Wikis and Podcasts/Streaming technologies need to be further addressed. In terms of learning theories, it seems that most of the researchers tended to work more with the Cognitivism theory in e-learning concepts than with other theories, such as Behaviorism.

As Figure 5 demonstrates, the majority of research has been carried out exploring the effectiveness of e-learning technologies used for various educational purposes. There is a lack of research and investigations on the accessibility and sustainability of the technologies, when it is very important to know how an invented technology could be used continually and whether it would be a sustainable system. Also, with reference to Figure 6, there are appreciable differences between countries applying e-learning technologies. The greatest number of research has been undertaken in the US while in the Middle East, Africa and South America the percentage of research is low.
4.1. Implications for Practitioners

E-learning technology has matured rapidly throughout the world and different organizations, such as corporations, government organizations, and educational institutions are taking advantage of it and adopting e-learning techniques in their unique environments. There are three main categories of these users which include universities and higher education establishments, schools and educational institutions, and e-learning technology design companies.

Universities and higher education centers are the dominant users of e-learning technologies. The vast majority of them these days utilize e-learning in their learning processes and online courses to enhance students’ efficiency and facilitate education. Different kinds of these technologies are adopted to improve learners’ skills and knowledge linked with their business needs and personal career fulfillment. Blended learning and distance learning are some examples of implementing e-learning technologies to make studying easier for learners.

Various types of digital games and mobile applications are used by educational institutions and schools, particularly primary schools. They apply these technologies successfully to teach and explain different scientific subject, such as mathematical concepts and solving its problems (Li et al.,
They also take advantage of these technologies to help disabled learners to study and practice different subjects and improve their understanding and outcomes (Y. T. Chen, 2014).

There is a plethora of e-learning content development companies in the e-learning industry. They design, simulate and develop different e-learning software and make them ready for use by the customer. Many companies are involved in this area, such as City & Guilds Kineo, Skillsoft, Tata Interactive, Epic Learning Group, and Allen Interactions. The services they provide include:

- E-learning custom, multi-device, rapid and ready-to-use content
- Portals and learning platforms
- Blended and managed programs
- Consultancy and support
- Apprenticeships, qualifications and accreditations

4.2. Implications for Researchers

Any new technology will bring about different impacts on the people who use it and on the society as a whole and e-learning technologies are no exception. There are various aspects and topics for researchers to work on
and different aspects of implementing these technologies to be investigated. A lot of research has been done in this area but the problem is that in this advanced world all technologies are growing very rapidly and people are confronted with a large number of new ones daily.

Experts in this area can explore several aspects of applying e-learning technologies, of which some of the important ones are how they could contribute to students’ and learners’ learning skills and outcomes, and user acceptance of educational technologies, which includes learners’ feedback and adoption patterns. Also, there is a major lack of research about e-learning sustainability and investigating methods help to create a continual use of these technologies. There are some psychological aspects – such as the behavioral impact on users of employing e-learning technologies – that should be taken into account by researchers.

Conclusion
By increasing of educational technologies implementation by educators and many organizations, there is a necessary need to provide structured and consistent categorizations of these technologies to improve e-learning technology adoption and development. In this article, an attempt has been made to review the literature on e-learning technologies with the objective of proposing systematize and practical classification of them.

Six relevant journals are selected and the articles from their last three years’ issues are adapted. Base on Kitchenham systematic review guide lines, 343 paper were selected to analyze. Nine main technologies are proposed: namely, Management & Administration Tools/LMS, Assistive Software/Hardware, Social Network, Online Communication, Digital Technologies, Online/Digital Games, Mobile Apps, Podcasts/Streaming, and Wikis. The results show that many countries have adapted these technologies, particularly the US, and the most popular technologies are Management & Administration Tools/LMS, and Assistive Software/Hardware. The systemic literature review also revealed an overview on the learning theories applied in the literature, problems and aims of applying technologies, geographical locations, and also a Learning and Teaching (L&T) Process Mapping.
It should be noted that the results of this study are based on the information gathered from the literature. Hence, the validity threats to, and limitations of, our reference papers may also apply to this research. Although we have undertaken a thorough review of the literature on e-learning technologies, we note that with the increasing number of studies on the topic we cannot guarantee to have taken into account all the references in this area.

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STATE-OF-THE-ART OF RECENT RESEARCH ON EDUCATIONAL TECHNOLOGIES: A LITERATURE SURVEY APPROACH

Afrooz Purarjomandlangrudi, Anne Nguyen and David Chen
Technology adaption has become very popular for education and learning purposes throughout the world in recent years. A large number of institutions and educational organization are using these technologies to improve and enhance their learning systems and improve students’ learning outcomes. Due to the fact that understanding the different e-learning classifications is a prerequisite to understanding the effectiveness of specific e-learning formats, in this article, a review has been done on educational technology journals publications and a new classification of e-learning technologies is proposed.

1. Introduction

Implementing technology in education has gained a lot of attention and developed very rapidly these days. There is a substantial growth in employing these technologies in different learning systems and a lot of schools, universities and other educational institutions are adopting them to improve learning outcomes (Committee, 2005).

Electronic learning or e-learning are playing an important role to mitigate learning process and making course content more accessible for students by using various kind of technologies. And this contribution has been
strengthened after emerging the Internet. e-Learning has created a lot of opportunities for teachers and students to extend their technology adoption and enabled them to have access to many learning sources and materials without time and distance limitation (Gunasekaran et al., 2002).

With the rapid development of technologies in this advanced era, varieties of technologies are used in learning and educational systems and they grow continually (Chapelle, 2004; Conole & Warburton, 2005; Dash et al., 2012; Felix, 2005). Part of them are designed specifically for educational purposes such as Learning Management Systems (LMS) (Williams van Rooij, 2012), and some are designed for other purposes, such as social networking technologies, but are utilized by educators (Amador & Amador, 2014; Veletsianos, 2012). This study has categorized the main technologies used in recent three years in e-learning journals and proposed a new classification for them. Some sub-categories are also offered and then some explanations and examples are provided for more clarification.

This article is organized as follow: section 2 gives some background of the research and more definition of e-learning and applied technologies in it. In section 3 research methodology is discussed and study process is explained. Section 4 contains the results of analysing the selected data set and proposes the technologies classification and section 5 which is conclusion and contains the summary of research.
2. Research Background

Wide ranges of views about application of technology in education are offered by researchers from all over the globe. Some of them assert that e-learning technology is as effective as traditional methods (Rosenberg, Grad, & Matear, 2003) and there is not any marked differences in learning output of traditional and technological methods (Cavanaugh, 2001). While other argue that it has a substantial influence on academic performances and they propose very positive reviews (Breuleux, Laferrière, & Lamon, 2002; Kulik, 2003). Advocates of the application of electronic technologies in learning materials believe that computers have the potential to take over the learning environments and increase the quality of the learning. For instance, facilitating access to information (Bransford, Brown, & Cocking, 1999), making learning environment richer (Bagui, 1998) and improving students’ motivations and learning outcomes (Yazon, Mayer-Smith, & Redfield, 2002).

However, there are some researchers that explore the necessity of investigating different e-learning adoption issues and impacts on learning processes to develop operative strategies for teaching and learning (Meredith & Newton, 2003) and address students’ needs of the effective e-learning activities (Crawford, Gannon-Cook, & Rudnik, 2003). Some researchers xpress different concerns regarding the lack of empirical evidences to support the effectiveness of e-learning technology application (Torgerson & Elbourne,
2002). One difficulty facing the improvement of research in the field of reviewing e-learning technologies is the fact that e-learning researchers are not all identical in the methods used and technologies applied. This study aims to address this gap by proposing taxonomy for e-learning technologies to make a broader view for users and learners.

3. Research Methodology

In this study, we have carried out a systematic literature review to identify studies on the application of technologies on education and learning. A systematic literature review is a type of research methodology that focuses on a topic or research question to identify and interpret available empirical studies. It contains planning the review, conducting the review, and reporting on the review. The following steps are done to finalize this systematic literature review.

3.1. Selection process and Criteria

Among different research recourse, we selected the following journals that are completely relevant and include most of important databases. Then last three years (2012, 2013, and 2014) have chosen to conduct the review. Table 1 indicates the journal names, databases, and the total number of papers in their published issues in these years.

Table1. Journals and their selected criteria
### 3.2. Study Process

Based on table y the total numbers of papers that are selected were 461. In this step some of them excluded by reading the title of the papers, then the abstract of remain papers were studied and those were about e-learning research or did not examine e-learning technologies were discarded. Thereafter, the final set of
343 papers was defined based on reading the full text of the remaining research. Figure 1 illustrates the number of papers after each stage.

\[ \text{Fig.1. stages of study process} \]

### 4. Results

#### 4.1. E-learning Technologies

There are several classifications for use of technology in education. In this study, 9 main categories are defined for this purpose which includes: Social Network, Management & Administration tools/LMS, Online Communication, Assistive Software/Hardware, Digital technologies, Mobile apps, Online/Digital Games, Wikis and Podcasts/Streaming. Figure 2 illustrates all these categories and their sub-categories and Figure 3 shows the number of each main technology that employed in the papers. Assistive Software/Hardware is the most dominant technology used in 87 papers of the total and the second one is Management &
Administration tools/LMS, utilized in 72 papers. The number of papers that employed Online Communication, Social Network and Digital technologies are 51, 44 and 35 respectively. The following is a brief description of each technology and some examples of their applications in learning.

Fig.2. Technology for learning classifications
Social networking is a web-based services that every user can create a profile which consists of his or her social links, connections and a variety of additional services and the ability to share them with others. Wide range of social networking sites like Facebook and Twitter are adopted to use as a tool to enhance learning and education. For instance, N. D. Bowman et al. in (Bowman & Akcaoglu, 2014), have created a course-specific Facebook group in a mass media course and at the end of the semester the Facebook group users’ grade were significantly higher than others students.
Management & Administration tools/LMS contains tools using for teaching, course management, students’ administration and their progress, and even tools for plagiarism detection. It also includes learning management system (LMS) which is a system for managing administration, documentation, tracking, reporting and delivery of online or blended/hybrid educational courses. J. Yuan et al. (Yuan & Kim, 2014) have investigated about dropout problems in online courses and lack of interactions which might lead to students’ isolation.

Online Communication technology is divided into two sub categories, Synchronous and Asynchronous Communication. Synchronous Communication is a form of technology that enables people to communicate in real-time and collaboration in a same time in different places. It includes audio, video and web conferencing, chat and instant messaging, application sharing, online forum and discussion (Çelik, 2013). In asynchronous environment communication and collaboration are done over a period of time via different time in different places. Asynchronous tools provide people from multiple time zones the ability of connecting together at each person's own convenience and are useful for sustaining collaborations. The most common types of these tools are e-mail, streaming audio and video, narrated slideshows, discussion boards, e-portfolios and web logs (Blogs) (Tang & Lam, 2014).

Assistive computer-based technology is a form of technology that enables users to enhance their functional capabilities with learning needs. It includes
computer software and hardware that use for different learning purposes. There is a wide range of computer software in learning and there have been various classifications. Simulation software is one of them which are employed by researchers to stimulate students learning skills especially in reading and writing. For example, authors in (Liou et al., 2012) developed a system called “WriteAhead” which provides different types of suggestions for non-native English students from various disciplines who are writing journal papers’ abstracts and assessed its effectiveness.

Digital technologies covers a plethora of different contents that performing through internet, it contains 3 sub-categories including Shared Documents/scripts, Internet Surfing and E-books. Shared documents contain technologies such as Google Docs, Zoho Writer, SlideShare, Elgg, Clearspace and etc. Collaboration scripts help students collaborate and provide more interactions in learning activities (Gijlers et al., 2013). The phrase “Internet Surfing” comprises a plethora of different Internet using activities such as using different search engines, websites, data bases, Social Bookmarking and so on. There are various research has been done about different aspects of information seeking from the Internet (Eynon & Malmberg, 2012).

Digital game-based learning (DGBL) has become very popular and widespread in recent years and is counted as a very effective tool for educational purposes (Hwang & Wu, 2012). It connects learning material with computer and can be
applied in a broad spectrum of applications and subjects. This technology can facilitate the teaching and learning by simulating the real process and provide the learners with the ability to experience situations that are not easy to deal with in the real environment (Purarjomaldlangrudi & Ghapanchi, 2013).

Learning through smart phones or m-learning, is one of the recent developments that employ mobile devices in education and learning. This technology enables users to do training programs while they do not access to a computer system. J. Gikas et al. has done a research that investigated the impacts of mobile devices such as cellphones and smartphones on learning and teaching (Gikas & Grant, 2013). They included students and teachers in their research and explore how they integrated m-learning in their courses.

Wikis are collection of websites that enable multiple users to read and write any time and from anywhere which are fully editable. This ability has brought about a very convenient environment for online collaboration. It is also a very excellent tool for online learning and educational purposes (Augar et al., 2004). It has variety applications in the academic context, M. M. Woo et al. investigated the use of wiki to collaborate writing in primary levels in a Chinese primary school (Woo et al., 2013). The authors concluded that how wikis can be helpful and can provide support for students’ writing skills.

In this study, podcast is an educational audio or video file that can be created, uploaded or downloaded from websites to a digital device like computer, tablet
or a smart phone. Streamed files are compressed format files that can be played at the same time in destination and depend on the Internet speed, they can be stopped and started during playing. This technology has extended among universities in recent years to perform online and distance learning (Kathy Swan & Hofer, 2011).

### 4.3. Geographical locations

Figure 4 provides a breakdown of the frequency of the research papers authored in different countries. It shows that United State was the most prolific, with 39% affiliated with US universities. The second country was Taiwan (9%), and it was followed by United Kingdom, The Netherlands and Canada (6%). Australia constitutes 4% and some countries including Germany, Finland and Spain has the same percentage of 3%. As it illustrates, some countries, in the “other” section, have made up 1% and 2% which are depicted in second pie chart such as China, Sweden, Norway and so one. Also bellow countries contains only one paper which have not set in the pie chart: Egypt, Macedonia, Serbia, Emirates, India, Cyprus, Romania, South Africa, Saudi Arabia, Iran, Jordan, Muscat, Croatia, Switzerland, Zambia, and Georgia. Examining e-learning technologies seems to be stronger in the US compared with other countries.
5. Conclusion

Living in the information age, creates a great interest for using of various types of technologies in education. It provides many facilities for learners and enables them to enrich their learning environment. A large variety of technologies are implemented in educational systems by different organization all over the world. However, there is not many research has been done regarding currently used e-learning technologies. This study is a review of literature on educational technologies on the last three years issues of the relevant journals. The outcomes are a categorization of main technologies, Management & Administration tools/LMS, Assistive Software/Hardware, Social Network, Online Communication, Digital technologies, Online/Digital Games, Mobile
apps, Podcasts/Streaming, and wikis. This classification helps teachers and educators to make appropriate decisions in terms of educational technologies’ evaluations and consequent selection without the necessary knowledge. They can have a proper assessment and selection of e-learning technologies focusing on each category and its criteria for classifying and reviewing selected studies in order to find out the application possibilities of different technologies. The results show that the most technologies used in education were Assistive Software/Hardware and Management & Administration tools/LMS and also the geographical assessment reveals that many countries have adapted these technologies and it mostly encouraged in the US, but suprisingly Taiwan is the second country that has done a lot of research in this area. It shows that this country despite its little geographical space and population in compare with the US or other countries, has assigned 9% of the research and is considered as the second country in applying e-learning technologies.

6. References


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Abstract. Online learning has become a widespread method for providing learning at different levels of education. It has facilitated the learning in many ways and made it more flexible and available by providing learners with more opportunities to learn information, further access to different learning resources, and collaboration rather than face-to-face learning. In spite of these benefits and rapid growth of online education, success and persistence in such courses is one the important aspects of online learning research and it relies on different factors. Therefore investigating the reasons of students’ dropout of an online education course or program and its contributing factors is essential in this area. One of the most barriers in online learning system is lack of interactions. In learning, interaction between students themselves, with the course content, and course instructors is important for conveying information, enhancing teaching quality, give directions, and many more functions. The aim of this research is to review the literature to propose a clearer picture of studies have been conducted regarding online interaction and factors that impact it in online education systems.

Keywords: online interaction, student engagement, online learning.

Introduction
One of the essential elements of online learning is student interaction that substantially influencing effective learning by exchanging ideas and intellectual stimulation (Wanstreet, 2009). Past studies suggested that interaction in online education and interactivity in course has a direct impact on level of student satisfaction (Durrington et al., 2006) and student achievement and learning outcomes (Bernard et al., 2009). Moore (M. G. Moore, 1989) proposed three ways of interaction: interaction with the content, interaction with instructor, and interaction with other students. He argued that student-content interaction is “the process of intellectually interacting with the content that results in changes in the learner’s understanding, the learner’s perspective, or the cognitive structures of the learner’s mind” (M. G. Moore, 1989, p. 2) when learners have access to course materials via the Internet and contain video, text, audio, and/or graphic images.

Learner-instructor interaction is very important to nurture students’ interest to the course contents and stimulating their motivation of learning. Instructor can have a considerable contribution in students’ understanding of course concepts and clarify their misunderstanding through different strategies. Learner-learner interaction is the last type of interaction that happen among students individually or in a group that may focuses on building knowledge and developing specific skills (M. G. Moore, 1989). In traditional face-to-face learning system that was mainly a teacher-centric style, students interact with instructors directly by F2F interaction. Distance education and online learning
environments caused a big shift in learning decentralization and provided more online learners. Nowadays e-learning technologies have brought about many fundamental changes in learning styles and focuses more on students “by enabling multiple interactions among all the different agents involved – learners, instructors and course designers, tutors, contents, interfaces, administrative staff, code, environments, etc.” (Agudo-Peregrina et al., 2014, p. 542).

According to the literature, developing and promoting online interaction is vital in online learning and there are different studies regarding this issue. Some of them apply a specific technology such as social media to increase interaction and create an interactive environment in their online courses (Bubas et al., 2010; Cardona-Divale, 2012). Other studies uses various Learning Management Systems (Carrick-Simpson & Armatas, 2003; Kang & Im, 2013; Ke & Kwak, 2013; Sargeant et al., 2006), Web 2.0 technologies (Purarjomandlangrudi, Chen, & Nguyen, 2015; Torun, 2013), video teleconferencing (Kirby, 1999) etc. In addition to technologies and administrative features, individual and behavioural factors of students that significantly influence online interaction and engagements of students have been considered. These factors contain students’ self-efficacy (Y.-C. Kuo, Walker, Belland, et al., 2014), levels of readiness and computer literacy (Kaymak & Horzum, 2013), interaction behaviours (Daradoumis et al., 2003), age and ethnicity (Ke & Kwak, 2013), learning styles
(Hao, 2006), cultural diversity (Bing & Ping, 2008), attitude toward distance and online learning (Brooks et al., 2004) and etc.

Despite all the merits mentioned in last section for online learning, there are major concerns with it that needs to be brought to light. One of the biggest drawbacks of online learning is the lack of physical presence and interaction, particularly for students of special learning style like those that learn via tactile or kinaesthetic modality and used to move, touch and being active when learning. Learning through online classes and not having physical presence on campus make students suffer from lack of social interaction, belonging, and adequate support and guidelines for their study as they are supposed to do their assignment and exams on their own. According to Sims (1999), interaction in electronic learning processes has many educational functions, related to learner control over system responses, adaptation to user’s input, allowing for participation and communication and helping to provide meaningful learning (Sims, 1999).

Given the importance of interaction in online learning, the objective of this study is to have a deeper insight to the literature to extract and explore different factors that contribute to the student online interaction. It aims to provide a better understanding of the impact of various characteristics and elements on doing interaction and engagement of students in an online learning environment. To do so, this study provides a literature review on online
interaction in education. It proposes a classification for the main factors impact students’ online interaction and also highlights some of their applications by learners and instructors to improve online interaction in online learning settings. In section 2, the research methodology, the review steps and criteria are discussed and study process is explained. Section 3 contains the results of analysing the selected data set and proposes the factors’ categorization. Section 4 discusses the importance of implementing these results for both researchers and university course design departments. And finally the study ends with a conclusion in section 5.

Research Methodology

This systematic literature review was conducted on studies done regarding online interaction in online learning in higher education entities to identify what factors influencing online interaction and engagement of students. As mentioned before, a systematic literature review as a research methodology aims to address research questions by elaborating and interpreting existing research and propose a big picture of the area. The steps of the review are planning, conducting and reporting the review. Next steps are carried out to meet these purposes.
Study Selection Process and Criteria

A comprehensive study has been done in this literature review. There are no excluding or including criteria about sources and we searched in different databases such as: “Google Scholar”, “Taylor & Francis”, “Elsevier”, “Wiley”, “Editlib”, “Springer”, “Eric”, and etc. that the exact details of each database and the number of research we have found in them are indicated in figure 1. It shows that Taylor & Francis” has constituted the most percentage of the total, 24% and then “Elsevier” is the second databases by 13%. Research terms includes: “online interaction and engagement in education”, “online interaction and engagement in learning”, “factors influencing online interaction”, and “online interaction parameters”. Then to present a state-of-the-art analysis of recent studies about online interaction and engagement, the review has been focused on research done after 2000. Another excluding criteria is applied regarding research has been done on higher education entities including colleges and universities.
Reviewing studies that have been carried out after 2000 and using the above mentioned search terms, the total number of studies found was about 362. Afterward, the titles of the papers were considered and those that are not related to the area were excluded, this resulted in 156 studies remaining. In next step, the studies were reduced to 74 once their abstracts were studied carefully. Finally after reading the full remain studies, I have come out with 66 research to be included in this literature review. Figure 2 indicates the study process and the final set of papers and a summary of their research objectives are in appendix A.
This review has verified factors that impact online interaction and engagement in online education systems. The outcomes of this review regarding research trends and frequency in different geographical locations are displayed in figures below. Figure 3 illustrates the trend between 2000 up to current time, which is 2015. It shows a steady increase in research activities within 2000 and 2009, but it experienced a dramatic upward trend in 2010. However, there is
sharp reduction in 2011. So, it can be concluded that this is a very open area of research and attractive topic in the recent years.

Figure 3. Trend of research

Figure 4 displays the frequency of the studies authored in different countries. The results show that USA has surpassed others by publishing 40 publications in this period. Other countries are substantially in the lower rate, which researchers have paid less attention to this area. They include: Spain and Turkey with 4 each, Australia and Taiwan contains 3 each, Hong Kong, Croatia, China, and Malaysia are at 2 each, and finally Korea, UAE, Canada, and Finland that have 1 each.
Type of participants and research methodology

This literature review is conducted on higher education organisations. We have classified the participants of the reviewed research to five main categories: university graduate, undergraduate and postgraduate, college graduate and undergraduate students. Figure 5 shows the bar chart of these categories and the number of studies for each one. It can be implied that most of the studies have been conducted on university undergraduate students.
Different research approaches and methodologies have been employed in reviewed literature. Some studies applied quantitative methods, which is an objective and systematic process where numerical data are used to obtain information about the research objectives. As figure 6 shows, it dominants the other methods and contains 61% of the total percentage. Some authors have selected qualitative approach to find out underlying reasons, opinions, and motivations and provide a deeper insight into the issues or help to develop ideas or hypotheses for potential quantitative research, which is 14%. The last approach applied in the reviewed studies is mixed-method that means their research contains both quantitative and qualitative methodology and it contains 25% of the total amount.
As figure 6 shows, most of past studies used quantitative research methodology. For instance, authors in (Kang & Im, 2013) have investigated factors in learner–instructor interaction that can predict the learner’s outcomes in the online learning environment. Agudo et. al. have defined three system-independent classifications of interactions and evaluated the relation of their components with academic performance across two different learning modalities: virtual learning environment (VLE) supported face-to-face (F2F) and online learning (Agudo-Peregrina et al., 2014).

Pure qualitative research method is adopted the lowest amount of previous studies of literature. Some examples such research are: Wang in (M.-j. Wang, 2010) has conducted research to find out students’ online utterances and offline interactions, to determine the extent of collaborative learning among students,
Sargeant et al. have explored instructor roles in enhancing online learning through interpersonal interaction (Sargeant et al., 2006).

Mixed method that contains both quantitative and qualitative methodology are used in some authors’ research such as F. Ke and D. Kwak (Ke & Kwak, 2013) that claims online learning interaction participation, perception, and learning satisfaction would be consistent across varied age and ethnicity groups. Also authors in (Nor et al., 2012) have attempted to realize how the students interact and collaborate in the process of online learning topics that had previously been discussed in a face-to-face mode. Other samples of these research are: different aspects of the online courses impact the way students enter into discussions online, and consequently, what they have opportunities to learn (McCrorry et al., 2008), how instructors and students perceive the importance of online interaction and which instructional techniques enhance those interactions (Su et al., 2005), Focusing on e-connectivity, instructor presence and positive communication in online courses (Cheng & Suan). Appendix B contains more details about all investigated studies in literature of this review.

Students’ Positive Outcomes
Past research has shown that online interaction and engagement have a large impact on different student positive outcomes such as student satisfaction and motivation (Y.-C. Kuo et al., 2010; Y.-C. Kuo, Walker, Belland, et al., 2014; Moallem et al., 2013; Shank & Doughty, 2002), active learning (Y.-C. Kuo et al., 2010), learning outcomes, prospects, and performance (Beatty, 2002; Daradoumis et al., 2003; Heinemann, 2007; Kang & Im, 2013; Y.-C. Kuo et al., 2010; Okonta, 2010; Tatar et al., 2002). Some researchers introduced new ways to improve online interaction and engagement within online courses. For instance, Kang, M. and T. Im (2013) tried to identify what factors in online interaction can predict the learner’s outcomes. They have concluded that “factors related to instructional interaction predicted perceived learning achievement and satisfaction better than factors related to social interaction. However, it was revealed that social interaction such as social intimacy could negatively affect perceived learning achievement and satisfaction” (Kang & Im, 2013) (p. 292). Abrami, P. C., et al. (2011) discuss about different types of online interactions and suggest how these results may foster instructional improvement. They also highlight several evidence-based approaches that may be useful in the next generation of distance and online learning (Abrami et al., 2011; Bing & Ping, 2008; Brooks et al., 2004).

On the other hand, there are some studies that experienced failure in adopting some techniques for stimulating online interaction and engagements. To give an example Okonta (Beatty, 2002; Okonta, 2010)(2010) investigated the effect of
parallel use of Facebook and Twitter for increasing online interaction among the college undergraduate students and the results indicated that there was interaction between learners and other learners but it was minimally used in their courses and academic purposes (Okonta, 2010). Belinda Carrick-Simpson and Christine Armatas from Deakin University, Australia, explore the factors that influence online interaction and better engagement because the results of their study has proven that designing online learning activities with opportunities for interactivity is not sufficient to engage students’ interest (Carrick-Simpson & Armatas, 2003).

Figure 7 displays all positive outcome factors extracted from literature and its subcategories. There are three main factors categories including 1-psychological factors, 2-learning factors, and 3-behavioural factors. The first one contains variables such as student motivation, student self-regulation, student appreciation, and student problem solving. The second category includes learning outcome/performance, student learning style, learning quality, learning effectiveness, academic achievement, and student success. The last one comprises student interaction, student collaboration, student engagement, student attrition, and student perception.
Factors Impacting on Online Interaction

As mentioned before, there are several factors contributing to online interaction and engagement improvement and development. The main contribution of this review is to identify and classify these factors. This literature review proposes four main groups for these influencing factors: 1- Student’s Individual characteristics, 2- Student’s Behavioural factors, 3- Course design factors, and 4- Administrative factors. Figure 7 shows the details of classifications and all contributing factors categories.

Individual characteristics can be identified as having originated with a particular person or source with a high degree of certainty. In this study they refer to traits that are instinctively institutionalized in each individual. The characteristics that have extracted from the literature has been done in the area of online interaction and engagement in higher education entities include student expectation, self-expression, interest, cognitive abilities, leadership, self-efficacy, creative thinking, confidence, learning flexibility, and knowledge sharing (Hao, 2006; Ke & Kwak, 2013; Y.-C. Kuo, Walker, Belland, et al., 2014). Behavioural factors are traits that are done by an individual. The behavioural factors that are identified so far in literature, which effect online interaction and engagement are social intimacy, attitude, readiness, interaction, content understanding,
group functioning, collaboration, cooperation, and participation (Kaymak & Horzum, 2013; Sher, 2009).

Course design factors are explained as factors in relation to instructing and developing course materials and contents and refer to the traits that are directly contributed to presenting a course. Those that are found in literature that impact online interaction and engagement in online learning are course clarity, task design, and academic integrity (Bubas et al., 2010; Lamy & Hassan, 2003; Karen Swan, 2002; Torun, 2013). Administrative factors are pointed out to parameters that are related to administration of the course such as active discussion, feedback, technical support, academic support, and pedagogical support (Mohamad et al., 2014; Nor et al., 2012; Swanson, 2010).

According to the literature regarding course design and administrative factors, various parameters have been considered such as focusing on e-connectivity and instructor presence (Swanson, 2010) which used a mixed method of a qualitative study with a quantitative component in the affective domain emphasizing on e-connectivity, instructor presence, and positive communication. Instructors’ role and course content to enhance online learning through interpersonal interactions is other interest of researchers of this area in this area (Cheng & Suan). Authors in (Lamy & Hassan, 2003) presented the relationship between changing task designs and learner behaviour in online
course and their results showed that task type is the main predictor of the volume of reflective interaction.

In terms of individual and behavioural traits, there are some research conducted in regard with students characteristics that have an impact on their online interactions. Some examples of them are: the effect of interactions and Internet self-efficacy on student satisfaction (Y.-C. Kuo, Walker, Belland, et al., 2014), students’ readiness levels of the online learning (Kaymak & Horzum, 2013), interaction behaviours of different collaborative group types (Daradoumis et al., 2003), age and ethnicity of students (Ke & Kwak, 2013), learners’ learning styles (Hao, 2006), cultural diversity (Bing & Ping, 2008), students’ attitude toward distance and online learning (Brooks et al., 2004) and etc.

Discussion

Moving to the new millennium and with the emergence of the Internet, it provides the opportunity to stimulate participation and interaction within a technologically mainstream and cost-effective learning environment. Beside various interactive opportunities that are available in the online environment, this improvement can achieve in the light of the fact that high levels of interaction have positive effects on the learning experience (Y.-J. Chen & Chen, 2007; J. Richardson et al., 2000; Sher, 2009; Wilson, 2007). Failure to adequate consideration to the relational dynamics in OLEs may incur feelings of isolation in online courses, decrease students’ satisfaction, deficient learning outcome
and performance, and high attrition rate. Given the current condition, online interaction is one of the most important components of online learning setting, therefore, it is needed to explore and elaborate different parameters and factors that contributing to higher and more effective interaction.

This review study represents significant findings for research and practice. The potential implications of categorizing contributing students’ interaction factors for the potential implications for instructors, university faculties, students and learners, course designers and conveners is that it provides a big picture of several factors that are influencing learners online interaction and engagement. Therefore, they can take into account these factors when designing an online course to promote and cultivate the online interaction to attain better student academic performance and satisfaction. In addition to having several practical implications, it could help researchers, particularly new researchers, to inform about these factors in a very convenient way.

Moreover, getting to know that what specific students’ individual, behavioural, course design, and administrative factors could participate in improving and enhancing students’ online interaction and engagement, they can achieve better result and outcome of online learning by manipulating and controlling these traits. For instance, if learners’ attitude toward OLEs is one of these factors that have a positive impact online interaction, educational expertise and instructors will be able to increase online interaction in their courses by working in this
specification and try to give accurate and aggregate perspectives to learners. On top of that, the students can be aware of these characteristics and try to improve them. Additionally, investigating these aspects will enrich the literature and provide a clearer realization of different elements that could help interaction improvement in online learning systems and could assist researchers to contribute a better understanding of these fields and give directions to them to form the future of their research, as well as identifying gaps in the body of knowledge in this area.
Individual Characteristics:
- Expectation
- Self-expression
- Interest
- Cognitive Abilities
- Leadership
- Self-efficacy
- Creative Thinking
- Confidence
- Learning Flexibility
- Knowledge Sharing

Behavioural Factors:
- Social Intimacy
- Attitude
- Readiness
- Interaction
- Content Understanding
- Group Functioning
- Collaboration
- Cooperation
- Participation

Positive Outcome Factors

Psychological Factors:
- Student Motivation
- Student Self-regulation
- Student Appreciation
- Student Problem solving

Learning Factors:
- Learning Outcome / Performance
- Student learning style
- Learning Quality
- Learning Effectiveness
- Academic achievement
- Student Success

Behavioural Factors:
- Student Interaction
- Student Collaboration
- Student Engagement
- Student Attrition
- Student Perception

Course Designe Factors:
- Course Clarity
- Task Design
- Academic Integrity

Administrative Factors:
- Active Discussion
- Feedback
- Technical Support
- Academic Support
- Pedagogical Support
- E-connectivity
Conclusion

The emergence of technology has made a huge shift in educational systems and created a variety of opportunities and facilities for today’s learners and has been expanded by the development of the Internet worldwide. Online learning is a new way of learning that is employed nowadays with many educational providers throughout the world particularly in higher education entities. However, there are some barriers and obstacles with this way of learning which lack of interaction is the most important of them. To fulfill this objective and provide a comprehensive view of the contributing factors in learners’ online interaction and give a big picture of them to educators, this study has conducted an in-depth review of current literature to elaborate and explore different factors that have influence on students’ online interaction. The results show that they typically can be divided into four major categories: individual, behavioural, course design, and administrative factors. Providing all these factors and their sub categories that contain different traits could help researchers and instructors and gives them an entire perspective to improve online interaction in their educational settings and lead to a better and higher result in student’s outcomes and increase level of cognition.
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Appendix F: SUBMITTED PAPERS

UNDER REVIEW IN: Research in Learning Technology Journal

A Causal Loop Approach to Uncover Interrelationship of Student Online Interaction and Engagement and their Contributing Factors
Abstract

With the expansion of online learning, students’ online interaction and engagement have become increasingly important for educators. Advances in technology reinforce the imperative to obtain further insight into the factors that impact online interaction in online environments. Even though past researchers have extracted factors impacting student online interaction and engagement, there is a lack of research that uncovers the dynamics of these relationships and investigating the impact of comprehensive set of factors on student online interaction at the same time. Thus, this paper seeks to fill this gap by utilizing a causal loop approach to uncover the interrelationships of these contributing factors. To this end, a rich qualitative data set was obtained from an online focus group consisting of students from a large online course, and a thematic analysis was conducted resulting in identifying different factors playing role in the topic under study. More importantly, causal loop modelling was used to model the factors playing role and their causal interrelationships.

Keywords: Online learning; Online interaction; Online engagement; Qualitative approach;

INTRODUCTION
Online education is an educational medium that has enabled communities of learners and their teachers to interact with one another even while located indifferent geographical locations. An essential aspect of online learning environment is active and communicative interactions among learners, course contents, and instructors (C. Kuo, A. Walker, & K. Schroder, 2010; Nor et al., 2012). Common methods employed to foster such interactions include sharing opinions with others asking questions, and arguing about different subjects. In fact, the success of many online courses relies on effective online interactions.

Past studies have shown the importance of online interaction in student learning outcomes and satisfaction (Y.-J. Chen & Chen, 2007; J. Richardson et al., 2000; Wilson, 2007). In addition to technologies and administrative features, there are different drivers and factors that significantly influence students’ online interaction and engagement. Different studies have been conducted on these factors, including students’ self-efficacy, (Y.-C. Kuo, Walker, Belland, et al., 2014; Y.-C. Kuo, Walker, Schroder, et al., 2014), levels of readiness and computer literacy (Kaymak & Horzum, 2013), interaction behaviours (Dadaroumis et al., 2003), age and ethnicity (Ke & Kwak, 2013), learning styles (Hao, 2006), cultural diversity (Bing & Ping, 2008), and attitude toward distance and online learning (Brooks et al., 2004), however there is a lack of research that uncovers the dynamics of these relationships and analyzes relatively
comprehensive set of factors that play role in student online interaction and engagement at the same time.

This study focuses on generating a comprehensive picture of the different contributing factors and their causal relationships, which is an important gap in the literature. To address this gap, a qualitative research design has been employed to investigate factors that contribute to a positive impact on students’ learning outcomes, and to evaluate satisfaction and engagement in online courses by focusing on students’ online interaction. It has been conducted by posing open-ended questions to students of an undergraduate e-commerce online course, which were then thematically analyzed to extract the fundamental factors and their internal relationships. Then a series of Causal Loop Diagrams (CLD) has been generated to clearly indicate the result.

This paper is organized as follow: section 1 is an introduction that explains the concept of online learning, the important role that online interaction plays, and the research gap. Section 2 contains a literature review of studies conducted on online interaction and elaborates the research importance. Section 3 presents the research methodology including participants, data collection, and data analysis. The results section contains the final data analysis, a discussion of the factors, which contribute to a positive outcome of student online interaction and involvement in online courses, and CLDs that display the causal
relationships among these drivers. The discussion section examines the implications of this research for researchers and practitioners. Next, the study’s conclusions are presented.

RESEARCH BACKGROUND

The percentage of students who are not successful in completing their online courses varies from 10% to 50% (Carr, 2000; Jun, 2005). These attrition rates result in increased costs and expenses for institutions and universities, and are likely to decrease student satisfaction and outcomes. Investigating the factors that can cause dropouts in online courses is an essential task and thus deserves special attention from educational organisation management and course designers (Cheawjindakarn, Suwannatthachote, & Theeraroungchaisri, 2013; F.-Y. Kuo et al., 2013; Prougestaporn, Visansakon, & Saowapakpongchai, 2015; Wu, Low, Liu, Pienaar, & Xia, 2014).

One of the key elements of effective teaching and high quality online learning is providing ways for students to exchange their ideas with teachers and among themselves (Kuo, Walker, Schroder, & Belland, 2014). Interaction has been identified as an essential component of online learning and a major key to increasing student learning outcomes, satisfaction and engagement (Kang & Im, 2013; Yoo, Jeong Kim, & Young Kwon, 2014). It has been demonstrated that higher levels of interaction between teachers and learners leads to more
satisfaction, greater engagement with course content and better outcomes (Veletsianos, 2010).

Different solutions have been developed to improve online interaction and engagement and a vast number of technologies have been employed to cater to the need for interaction and engagement in online learning classes. For instance, Torun (2013) applied Adobe Connect Pro and investigated its effect on the synchronous interaction of students in online courses. Authors (Bubas, Coric, & Orehovački, 2010) have also investigated the potential uses of the online community tool “Ning” in a hybrid university course for part-time students.

Apart from different technologies and interventions, there are different drivers and factors that have a significant direct impact on students’ online interaction and engagement. Identifying and improving these factors can highly influence online interaction among learners, and consequently, their learning outcomes.

Many researchers have worked on online interaction and its effectiveness in online learning. They have applied various research methods, including quantitative (Y.-J. Chen & Chen, 2007; Sher, 2009; Tatar, Gray, & Fusco, 2002), qualitative (Hammer, 2002; H. Wang, 2005; York & Richardson, 2012), and mixed methods (Ellis & Romano, 2008; Su et al., 2005; Wilson, 2007). Different elements of online learning and interactions have been described in the literature. Generally, these studies can be described as investigations of personal and psychological factors, studies of course-related and technology design.
factors that impact online interaction, and studies of engagement in online education systems.

Despite the attempts of course instructors and researchers to increase and cultivate students’ online interaction and engagement through different elements, this issue still remains as a major concern. Many students complain about a lack of interaction and engagement in their feedback and online educational systems. It is thus essential for e-learning course instructors, university faculties, and researchers to investigate and explore factors that influence student online interaction and engagement in online learning systems and generating a comprehensive picture of different contributing factors and their causal relationships.

**METHODOLOGY**

Even though several relevant studies have been reported, the current literature still does not provide sufficient insight into the factors that influence student online interaction and engagement in online learning environments. The goal of our research is to gain an in-depth understanding of the factors and drivers that contribute to student online interaction, participation and involvement with an online course and their causal relationships. To achieve this goal, we applied an exploratory case study approach to identify different factors and parameters.
Previous research revealed that case studies can be employed to explore, elaborate, or describe events or phenomena in the everyday contexts in which they occur (Yin, 2013). It proves that an important strength of case studies is the ability to conduct an investigation of a phenomenon in its context, and that replicating the phenomenon in a laboratory or experimental setting does not necessarily provide a better understanding. As a result, case studies are very valuable for exploring environments (William Lawrence Neuman, 2005). That is, exploratory case studies are generally a suitable approach for addressing “what”, “how”, and “why” type questions, as this research approach explores a contemporary phenomenon (Rowley, 2002).

In this research, the underlying factors and parameters that have positive and negative impacts on learners’ interactions and connectedness to the course contents and other learners in online education are investigated by addressing these research questions that what factors contribute to student online interaction, participation and engagement? What is their causal and interrelationships with students’ involvement, satisfaction, and learning outcomes? An exploratory case study approach is suitable for this purpose because it asks “what” and “how” questions and is based on a key assumption that the phenomena are inherent in the context in which they exist.

To achieve in-depth insight and investigate the research problem, qualitative data have been collected from undergraduate students enrolled in an e-
commerce online course offered by an Australian university. The course contained more than 100 students and an online group discussion was conducted at the end of the semester, in May 2015 where the qualitative data were collected. An online focus group approach was adopted and populated with open-ended questions that provided the opportunities for students to express their points of view regarding their online interaction in their online course, as well as their opinions about the pros and cons of their experience with the course and its impact on their academic prospects (Gaiser, 2008). This approach of collecting text data from online forums in the form of online focus groups is a practical method for online courses because their students are mostly off campus and distant students.

Students have been asked to answer and discuss open-ended questions about the online interaction they had in the course. Potential participants were asked to sign a consent form indicating their voluntary participation and their participatory status will not be concealed to the teaching team until after the grades for a semester have been issued. They also were assured that participating in the study would not affect their course grade in any way.

From a demographical perspective, the total participation rate of students was 43% of which 86% were males and 14% were females. The age of the participants varied significantly: 11 (16%) participants were under 20 years of
age, 25 (37%) were between 21 and 30 years of age, 18 (27%) were between 31 and 40 years of age, and 13 (20%) were over 40 years of age.

Thematic analysis is prevalent among researchers in qualitative research approach studies (Boyatzis, 1998; Braun & Clarke, 2006). Analytic themes in this concept involve identifying the patterns in datasets, which are most important to explaining, and describing particular events or areas associated with a specific research objective. It is therefore a very effective method for compiling and analysing focus group data. There are six main steps required to conduct a thematic analysis: familiarising the analyst with the data, coding data, searching for themes, reviewing themes, defining and naming extracted themes, and presenting the results. The entire data set was read very carefully several times to get familiar with it (Braun & Clarke, 2006). Themes in this concept involve patterns in datasets that are more important and critical in order to explain and describe particular events or areas associated with a specific research objective. It is therefore a very effective method to compile and analyse focus group data analysis.

Then, with the help of NVivo software (Gibbs, 2002), the data was coded and themes are extracted, reviewed, named and the results presented through a causal loop diagram (CLD). After analysing the data and creating the output of the thematic analysis, the findings are used to generate a list of potentially important variables associated with online interaction and engagement in an
online course. These variables were then used to develop descriptive CLDs through the employment of Vensim Software (6.3D, 2013). Traditionally, causal modelling results in a developed network of variables and the explicit delineation of their internal relationships. The main purpose of CLD is to display causal hypotheses in order to present the structure of the system in an aggregate illustration. This structure helps the user discuss the feedback structure and underlying presumption (Sushil, 1993). It contains parameters or variables connected by arrows indicating the causal relationship or influences among them. A positive mark on the link indicates a positive relation and means that the two variables change in the same direction. When one increases the other also starts to increase; similarly, if the node in which the link starts decreases the other node decreases as well. A negative mark shows a negative influence and means the two nodes change in opposite directions (G. P. Richardson, 1986).

Coding is an explicit and iterative process in which the researchers will alter and modify the analysis as reflected by the data and as ideas emerge. To ensure the integrity of the codes, they are developed and reviewed by all people in the research team. The researchers read and re-read the data, double-checked the codes for consistency and validation. Assessment of course, communication skills, course engagement, learning improvement, assignment and quizzes, knowledge sharing, discussion, feedback, learning skills, personal characteristics, motivation, medium features, and course administration are some of the nodes
created. Then, themes and sub-themes are identified, finalized and named from the coded data in the result part. The following figure is an example of word tree created by NVivo to visualize some nodes exists in the data.

![Word tree for node “learning”](image)

Figure 1. Word tree for node “learning”

**RESULTS**

When coding the entire dataset was completed, reviewed and labelled, themes were extracted, finalized and labelled by researchers. Table 1 indicates the final result of thematic analysis. There are seven main themes: participation, adoption, involvement, interaction, learning outcome, engagement, and satisfaction. Each theme has been labelled based on coding the data. For instance, in the learning outcome theme there are six sub-themes including post-lectures links and videos, self-paced learning, knowledge acquisition,
interact with other students, give directions for assignments, and improve learning and giving feedback.

Table 1. Thematic analysis themes and sub-themes

<table>
<thead>
<tr>
<th>Major Theme</th>
<th>Categories of sub-theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation</td>
<td>Organizing information</td>
</tr>
<tr>
<td></td>
<td>Individual motivation</td>
</tr>
<tr>
<td></td>
<td>Lack of participation</td>
</tr>
<tr>
<td></td>
<td>Polls &amp; quizzes</td>
</tr>
<tr>
<td></td>
<td>1-to-1 and group discussion</td>
</tr>
<tr>
<td></td>
<td>Easy to use, up to date, and fast to access medium</td>
</tr>
<tr>
<td>Adoption</td>
<td>Picture display ability</td>
</tr>
<tr>
<td></td>
<td>Organizing information</td>
</tr>
<tr>
<td></td>
<td>Get into it everyday</td>
</tr>
<tr>
<td></td>
<td>Time consuming to read all comments</td>
</tr>
<tr>
<td>Involvement</td>
<td>Good commenting and alert system</td>
</tr>
<tr>
<td></td>
<td>Keep connected via frequent notification</td>
</tr>
<tr>
<td></td>
<td>Live update</td>
</tr>
<tr>
<td></td>
<td>Distracted by other notifications</td>
</tr>
<tr>
<td></td>
<td>Easy to access and notify</td>
</tr>
<tr>
<td>Interaction</td>
<td>Easy to use, discuss, and focus</td>
</tr>
<tr>
<td></td>
<td>More interaction with visual representation</td>
</tr>
<tr>
<td></td>
<td>Group discussion and live chat</td>
</tr>
<tr>
<td></td>
<td>Involve with course content</td>
</tr>
</tbody>
</table>
### Learning outcome
- Post lectures link and videos
- Self-pace learning
- Knowledge acquisition
- Interact with other students
- Give directions for assignments
- Improve learning and giving feedback

### Engagement
- Increase sense of presence
- Keep connected to other students and course content
- Easy to follow comments
- Increase individual motivation
- Allow every student to involve

### Satisfaction
- Allow students to participate
- Easy to get involve and connect with course
- Share ideas and other experiences
- Increase sense of presence

After analysing the data and creating the thematic analysis, the findings were used to generate a list of potentially important variables associated with online interaction and engagement in an online course, and used to develop descriptive CLDs. At the first level all variables and potential relations and causes have been extracted. At each stage, separated causal diagrams were generated to document different factors and their influences on students’ positive outcomes features such as learning outcome, satisfaction and engagement in online course. An example of such a causal model can be found in.
Figure 2 indicates that factors including: accessibility, organizing information, functionality, group discussion, individual motivation, polls and quizzes, communicationality, and technology aptitude have a positive impact on participation. These factors also generate positive feedback on students’ learning outcome, satisfaction, and engagement. The term technology aptitude in this study means abilities to use navigate electronics and technology as intended by the designers (Olaniran & Rodriguez). These can include a wide range of tools such as discussion board, email, blog, Facebook, Twitter, Google Plus, 3D virtual worlds, etc., that are adopted as tools to enhance learning and education (Bowman & Akcaoglu, 2014; Z. Merchant et al., 2013).
Past research has shown that online interaction has a strong impact on various positive student outcomes, such as student satisfaction and motivation (Y.-C. Kuo et al., 2010; Y.-C. Kuo, Walker, Belland, et al., 2014; Moallem et al., 2013; Shank & Doughty, 2002), learning outcomes, prospects, and performance (Beatty, 2002; Daradoumis et al., 2003; Heinemann, 2007; Kang & Im, 2013; Y.-C. Kuo et al., 2010; Okonta, 2010; Tatar et al., 2002). Figure 3 illustrates the same relationship among communicationality, technology aptitude, sociability, and live updates in that they have a positive effect on involvement. In the same way, involvement has a direct positive relationship with students’ learning outcomes, satisfaction and engagement. However, in figure 4, the factor “time consumption” has been connected to an adoption feature with a negative sign, meaning this factor has a reverse effect on social media adoption. Some students noted that it takes time to read all the comments and messages to keep up to date with the discussion.
Figure 4. CLD for Adoption

Figure 5 is the final CLD generated from the qualitative data analysis and includes all of the extracted and contributing factors in students’ online interaction. It depicts all elements and their causal relationships simultaneously. There are different loops, negative and positive relationships, to interpret this diagram. It can easily convey important information and help the reader understand the impact and correlation of different factors affecting students’ online interaction and engagement in an online learning environment.
DISCUSSION

Given the importance of online interaction and engagement in online courses and their role on student’s satisfaction and learning outcomes, in this research, data from an online forum have been collected in online courses and the results of this data analysis, displayed in the form of a CLD, reveals the causal relationships of different factors influencing online interaction in online
courses. In this study, a thorough thematic analysis has been conducted to extract different elements and features of online learning which have a direct impact on students’ online interaction and engagement from a rich set of qualitative data. The contributing factors of the findings of this study can be divided into two main categories: individual and behavioural characteristics, and course related and technology design factors. This grouping indicates that different aspects of educational drivers influence online interaction and involvement in an online course. Only applying an interesting medium or technology in the course does not guarantee a high level of interaction among students. There are also some personal and psychological elements that influence student online interaction.

For instance, one of the issues seemingly impacting online interaction is quick feedback. Students believed that the lack of immediate feedback was a discouraging driver and contributed to their limited engagement and participation in online discussion. They argue that when there is no in-time feedback, they are less motivated to continue posting comments and they feel they are posting to a nonresponsive network. Therefore, providing timely feedback could have improved student participation in all aspects of the course.

The characteristics studied in the literature on student online interaction and engagement includes student expectation, self-expression, leadership, self-efficacy, creative thinking, confidence, learning flexibility, and knowledge sharing (Hao, 2006; Ke & Kwak, 2013; Y.-C. Kuo, Walker, Belland, et al.,
The factors that are assessed in the literature for course related and technology design are course clarity, task design, academic integrity (Bubas et al., 2010; Lamy & Hassan, 2003; Karen Swan, 2002; Torun, 2013), active discussion, feedback, technical support, and academic support, (Mohamad et al., 2014; Nor et al., 2012; Swanson, 2010). This study examined a sense of presence, technology aptitude, individual motivation and communicationality for the individual and behavioural characteristics category. Also included were organizing information, accessibility, functionality, polls and quizzes, visualizing ability, live updates and quick feedback for course related and technology design factors. For better understanding, the result of this research and finding are depicted through the creation of CLDs.

The main purpose of CLD is to display causal hypotheses in the form of a system aggregate illustration in order to help the user discuss the feedback structure and underlying assumptions (Sushil, 1993). This diagram illustrates relationships and connections that are difficult to explain verbally. This is because normal language represents interrelations in linear cause-and-effect chains, while the diagram indicates circular chains of cause-and-effect in an actual system. (Kirkwood, 1998). Figure 10 illustrates all the different contributing factors and drivers and their causal relationships in a single picture.

This research results in significant findings for theory and practice. The potential implication of CLD representations for instructors, university
faculties, students and learners, course designers and conveners is that they provide an overall picture of the various factors influencing online interaction and engagement in online learning. This allows educators to take into account these factors when designing an online course in order to promote and cultivate online interaction and engagement, thus facilitating better student academic performance and satisfaction. In addition to having several practical implications, these results could also assist researchers, particularly new researchers, understand these factors in a very convenient way. More importantly, CLD representation can depict the causes and effects of all important parameters of online learning as well as their internal relations and interplay, the knowledge of which is essential for conducting comprehensive research, and which enables instructors and researchers to select the factors most relevant to their work.

By gaining knowledge of which factors influence students’ online interaction and engagement, practitioners are better positioned to improve and enhance students’ online interaction and engagement, and to achieve better results and outcomes in online learning environments by effectively manipulating and controlling these traits. For instance, if a learner’s communicational ability is a factor which has a positive impact on online interaction, instructors using this educational expertise will be able to increase online interaction in their courses by working in this specification or try to improve the functionality and visual ability of the medium they use. In addition, the students can be made aware of
those features which depend on their own characteristics and encouraged try to improve on them. Investigating the aspects of online education that have not been considered in past research will enrich the literature and enhance the impact of existing works. This contribution will further assist researchers, provide a better understanding of these fields and give direction to their future, as well as to identify gaps in the body of knowledge in this area.

**Research Limitation**

There were several limitations to our study, the first of which was the sample composition. The data were derived from students who fell into an age group of young people, which is unsurprising given that young people are in fact dominant on the Internet. This may affect the result of the study when its results are applied to other age groups. Second, the data were collected from one online course on the subject of e-commerce. Drivers that influence online interaction may differ from other students’ perspectives. Third, we conducted research in a course in which SM was used as a tool for promoting interactions and engagement; this context may limit their students’ opinions regarding online interaction.

**CONCLUSION**

With the emergence of the Internet, online learning has expanded rapidly. In addition to various interactive opportunities available in the online
environment, opportunities for improvements in online education, particularly in the areas of interaction are possible and necessary given that high levels of interaction have positive effects on the learning experience. Failure to adequately consider the relational dynamics in Online Learning Environment (OLE) may incur feelings of isolation in online courses, decrease student satisfaction, cause deficient learning outcomes and performance, and result in high attrition rates. Therefore, exploring and elaborating the different parameters and factors contributing to higher and more effective interaction in online courses was the main subject of this discussion. Rich qualitative data have been collected and thematic analysis was conducted. The results illustrated by CLD diagrams indicate that various factors including accessibility, functionality, group discussion, students’ communicationality, technology aptitude, etc. have direct positive impacts on students’ engagement and satisfaction. Conversely, time consumption and distraction have negative influences. All the factors and features with their causal relationships are illustrated in a comprehensive CLD. This illustration can help researchers, course conveners, and students improve online interaction and engagement in online learning courses.

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Swanson, A. C. (2010). Establishing the best practices for social interaction and e-connectivity in online higher education classes.

Computer Support for Collaborative Learning: Foundations for a CSCL Community.


Exploring the Influence of Learners’ Personal Traits and Perceived Course Characteristics on Online Interaction and Engagement

Abstract

One of the most pressing issues in online learning systems that has contributed to the failure of online education and student dropout is the lack of interaction. Hence, investigating and exploring the different factors that influence learners’ online interaction and engagement are crucial for e-
learning success. This study proposes a research model to assess the possible impact of the student’s personal attributes and perceived course characteristics on their online interaction and engagement. The data of this study were collected by survey from 246 students who participated in online courses in one of Australia universities. Partial Least Squares (PLS) was then used as a method to test the research model and hypotheses. The findings suggest that personal characteristics of self-regulated learning and communication competencies have a positive substantial effect on students’ engagement with online courses, and attitude towards online learning is also found to have a significant impact on learners’ online interactions. The findings also reveal that perceived course characteristics of sense of identity, presence, and purpose significantly influence student’s online interaction and engagement.

**Keywords:** Online education; online interaction and engagement; student characteristics; quantitative research; research model

**INTRODUCTION**

Online learning has become a common method to provide learning at different levels of education. It uses a new form of technology in the field of education to improve classroom activities, overcome the limitations of traditional learning methods, and attract more learners around the world.
Online learning facilitates learning in many ways. It makes learning more flexible and available compared to the traditional methods (Finegold & Cooke, 2006). According to the 2010 Sloan Survey of Online Learning, approximately 30% of university and college students take at least one course online (Allen & Seaman, 2010). Web-based learning provides students with increased opportunities to obtain information; it offers them greater access to different learning resources, and it allows them to collaborate more easily than in the context of traditional pedagogical learning (Means et al., 2009b). In spite of these benefits and the rapid growth of online education, the success of online courses is one of the important aspects of online learning that relies on a variety of factors that will be discussed more in this study (Carr, 2000; Cheawjindakarn et al., 2013; F.-Y. Kuo et al., 2013; Prougestaporn et al., 2015; Rochester & Pradel, 2008; Wu et al., 2014).

One of the most important problems in online learning systems that play a big role in the failure of online education and student dropout is a lack of interaction (Banna et al., 2015; Kyei-Blankson et al., 2016). In learning, engagement and interaction between the students themselves, with the course content, and course instructors, is important for conveying information, enhancing teaching quality, giving direction, and many other functions (Kang & Im, 2013; Yoo et al., 2014). Given the importance of online
interaction in e-learning environments, the investigation and exploration of the different contributing factors are essential for attain considerable improvements in this area.

This study is focused on the individual and behavioural factors of students that significantly influence their online interaction and engagement. Some of these factors, which contain various traits and characteristics, are considered in the past studies such as student self-efficacy (Y.-C. Kuo, Walker, Belland, et al., 2014), levels of readiness and computer literacy (Kaymak & Horzum, 2013), interaction behaviours (Daradoumis et al., 2003), age and ethnicity (Ke & Kwak, 2013), learning styles (Hao, 2006), cultural diversity (Bing & Ping, 2008), and attitude toward distance and online learning (Brooks et al., 2004). However, there are still some important characteristics that are not considered in the literature and affect student’s online interaction and engagement in different ways.

The objective of this research is to investigate and emphasize individual and behavioural traits, which are labelled in this study as student’s personal characteristics and student’s perceived course characteristics. The first category contains student’s communication competencies, self-regulated learning, and attitudes towards online education. The reason for this labelling is that they are traced back to the student’s personal characteristics, which are external to the type of online course they experience. The second
category includes student’s sense of presence, sense of identity, and sense of purpose towards online interaction. These characteristics depend on the specific online course that is attended by the student. To achieve the study’s research aims and objectives, we pose the following research questions:

**RQ1** - What are the impacts of student’s personal characteristics on student’s online interaction and engagement?

**RQ2** - What are the impacts of student’s perceived course characteristics on student’s online interaction and engagement?

To address these research questions, this study develops a research model of the effects of student’s personal characteristics and perceived course characteristics on student online interaction and engagement. The next section describes the details of developing this research model. The model is tested using data collected from an Australian Universities’ online courses. The results of our study shed light for researchers and e-learning developers on the perceptions and attitudes of student’s individual and behavioural characteristics and traits in online interaction and engagement. In the next section, the conceptual background and proposed research model are presented, and the prior research is reviewed. Next, the research methodology and the approach are outlined. The paper concludes with research results, discussion and implications.
CONCEPTUAL BACKGROUND

The research model in this study contains six specific student personal and perceived course characteristics that affect student’s online interaction and engagement:

Self-regulated learning,

Communication competencies,

Attitude towards online education,

Sense of presence in Online Learning Environment (OLE),

Sense of identity in OLE, and

Sense of purpose towards online interaction.

These latent variables are selected based on a previous qualitative study that was conducted in an online course by the research team. To this end, rich qualitative data were obtained from an online focus group that consists of students from an online course, and a thematic analysis was conducted that resulted in the identification of the different factors that play a role in student online interaction and engagement. In the literature, there are also variables of other learning concepts that are employed in the past studies in different areas of learning research that are of great importance from the perspective of online
interaction and should be considered in this study, such as self-regulated learning. The section below examines each of the six characteristics.

Self-regulated learning (or self-regulation) refers to learning that is the outcome of a student’s self-generated thoughts and behaviours that are oriented towards the achievement of their goals (B. Zimmerman & Schunk, 2001). The authors in (McGhee, 2010) investigated how asynchronous interaction, online technology self-efficacy, and self-regulated learning influence academic achievements. The results of their study found that there were statistically significant relationships between asynchronous interaction, online technologies’ self-efficacy, self-regulated learning and academic achievement. However, there is no investigation on the impact of self-regulated learning on students’ online interaction and engagement.

Definitions of communication competence vary widely, and it is difficult to propose a comprehensive definition of the term. Some researchers have defined communication competence as the extent to which people acquire their desired objectives through communication (Morreale, Staley, Stavrositu, & Krakowiak, 2015). Communication competence is also considered to be a person’s ability to choose communication behaviour, which is suitable to achieve the aim of the social relationship (Spitzberg & Cupach, 2012). This characteristic is essential for both students and teachers in all learning concepts. However, there is not
adequate research that considers the influence of students’ communication competencies with regard to their online interaction and engagement.

There is research that addresses student attitudes towards online learning and online distance education. Watson (Watson, 2010a) worked on the attitudes of students who were enrolled in a distance education MBA programme with the goal of identifying alternative modes of interaction and design strategies to encourage greater interaction. Different technologies such as *Skype* were utilized in his research to examine the tendency of students to engage in online interaction. Moreover, race and cultural differences are considered in the author’s research, and the results showed a sharp division in the satisfaction levels of respondents from different cultural backgrounds with regard to the quantity and quality of asynchronous online discussion forum posts. Still, there is a lack of research that investigates the influence of students’ attitudes towards conducting online programs and experiencing distance learning in terms of their interaction and engagement with online courses.

The second category, student’s perceived course characteristics, includes a sense of presence and a sense of identity in the specific online learning environment that is used in their course and a sense of purpose toward the online interaction in that course. These traits have previously been associated with education; however, they have not been specifically related to e-learning and students’ online interaction. The sense of presence, or virtual
co-presence, in an online learning environment is a social feature that shows student perceptions of their availability and enthusiasm to engage and connect with other learners (Bulu, 2012). The sense of identity refers to an individual’s personal trait that is derived from the individual’s perceived membership, which described as being identified or recognized in a society (Moon, Li, Jo, & Sanders, 2006). Finally, the sense of purpose in online interaction means the purposefulness of online interaction and engagement, from the student’s perspective, in the specific course in which the student is enrolled (Farahani, 2003). Addressing the gaps and research questions that are discussed above, this section seeks to postulate the potential interrelationships between these traits and online interaction and engagement. These interrelationships are hypothesized below.

**RESEARCH MODEL**

Figure 1 summarizes the hypotheses that are proposed in this study. As is shown in this figure, the dependent variables of our research model are student learning outcomes and satisfaction. There are six independent variables: self-regulated learning, communication competencies, attitude towards online education, sense of presence, sense of identity, and sense of purpose towards online interaction. There are also two dependent variables in our research model, student’s online interaction and engagement. The past studies have shown the importance of online interaction in student learning
outcomes and satisfaction, and they have proven that investigating the different elements and factors that lead to stimulating online interaction in online learning is of great importance for researchers and learning system designers (Y.-J. Chen & Chen, 2007; J. Richardson et al., 2000; Wilson, 2007). Therefore, because a direct positive impact of student’s online interaction and engagement on student’s learning outcomes and satisfaction has been demonstrated by the past studies (the dotted line in Figure 1), in this research we address the other parts of this model.
Theoretical Background and Hypotheses

As discussed in the previous section, this study employs six specific student personal characteristics and perceived course characteristics that affect online interaction and engagement including: communication competencies, self-regulated learning, attitude towards online education, sense of presence in OLE, sense of identity and belonging, and sense of purpose towards online interaction. Addressing the gap that is discussed above, this section seeks to postulate the potential interrelationships between these traits and online interaction and engagement. In the following section, these interrelationships are hypothesized.

The Impact of Communication Competencies on Student’s Online Interaction and Engagement

According to Social Cognitive Theory (SCT), there is a reciprocal interaction between human behaviours, cognitive personal factors and environmental variables (Bandura, 1977, 1986). This theory, which is used in psychology, education, and communication, states that human cognitive personal factors can influence external environmental variables. Figure 2 (Schunk, 1989) is a schematic of this theory. According to SCT, which states that human cognitive personal factors affect external environmental variables, and if
online interaction and engagement are identified as external environment variables, communication competencies as a human behaviour could have a positive impact on student’s online interaction and engagement. Therefore, hypothesis 1 can be formulated as follows:

**H1. Communication competencies are positively associated with: a student’s (a) online interaction and (b) engagement.**

![Diagram of Social Cognitive Theory](image)

**Figure 2. Social Cognitive Theory**

The Impact of Self-Regulated Learning on Student Online Interaction and Engagement

Generally, self-regulating students are described as being learners who are metacognitive, motivational and have the ability to learn independently (M. G. Moore, 1989; B. J. Zimmerman, 1989), and self-regulation is considered to be a personal cognition factor. However, Connectivism theory (Siemens, 2014), is a relatively new learning theory, which implies that online
interaction, engagement and connection with different ideas are core variables in the online learning environment. Based on SCT, the self-regulated learning trait, which is a cognitive personal factor, influences online learning environment variables. Referring to SCT and Connectivism theory, we hypothesize that self-regulated learning traits could have a positive impact on a student’s online interaction and engagement in online educational systems. In light of this, we formulate hypothesis 2 as follows:

**H2.** Self-regulated learning is positively associated with: a student’s (a) online interaction and (b) engagement.

The Impact of Attitude Toward Online Education on a Student’s Online Interaction and Engagement

In this study, the attitude toward online education refers to the sum of a student’s beliefs and insights about adopting online learning in their educational process and the way in which they think about its usefulness. The Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1988), is a theory for predicting behavioural intention, extending predictions of attitude and predictions of behaviour (Figure 3). TRA states that a person's behavioural intention depends on the person's attitude toward a behaviour and subjective norms. Simply put, behavioural intention is directly affected by the attitude of a person toward a behaviour. Therefore, student’s attitude towards online
education directly influences their behavioural intention to use it in their learning systems. Based on TAM theory as discussed above, the behavioural intention to use a system affects the actual use of the system, which in the context of the current study is online interaction and engagement in OLE. Combining these two theories, one could hypothesize that a student’s attitude toward online learning can influence their online interaction and engagement in online education settings.

**H3.** *Attitude towards online learning is positively associated with: a student’s (a) online interaction and (b) engagement.*

![Diagram of Theory of Reasoned Action (TRA)](image)

**Figure 3.** Theory of Reasoned Action (TRA)

The Impact of Sense of Presence in OLE on Student’s Online Interaction and Engagement
A sense of presence or virtual co-presence in an online learning environment has emerged as a computer-mediated interaction and as an evolved mode of communication. These technologies help individuals to represent themselves in their online environment. The sense of presence is represented by the way in which communication is undertaken and messages are posted and interpreted by other participants. Sense of presence is derived from the social presence ability of an individual. Social presence theory, which was developed by Short, Williams and Christie (Short, 1976), states that the degree of social presence is equated to the degree of an individual’s sense of awareness and presence in their communications in a community.

According to social presence theory, communication is effective if the communication medium has the appropriate social presence level of interpersonal involvement that is required for a task (Sallnäs et al., 2000). Considering sense of presence as one of the fundamental components of social presence, a higher level of sense of presence and awareness leads to a higher social presence and more effective communication and interaction in a specific community. Therefore, in a specific online learning environment, and based on the argument that is mentioned above, we hypothesize that sense of presence could have a direct impact on a student’s online interaction and engagement in the particular online environment that they use for their online course.
**H4.** Sense of presence is positively associated with: a student’s (a) online interaction and (b) engagement.

The Impact of Sense of Identity on a Student’s Online Interaction and Engagement

The word “identity” is ubiquitous in different concepts of social science, psychology, sociology, and history; however, the common usage of the term identity is very different from its conceptual meanings and its theoretical role (Tajfel & Turner, 1979). In this study, “sense of identity” refers to the personal characteristics that are defined as being identified or recognized in a society. Henri Tajfel and John Turner (Tajfel & Turner, 1979) introduced a theory called ‘social identity theory’. It explains that an individual's self-concept is extracted from their perceived membership in a relevant group, and it introduces the concept of a social identity as a way in which to explain intergroup behaviours.

Social identity theory focuses on the connection between self, role, and society, and in this concept, the self is made up of multiple selves or a community (Stryker, 1980). It states that interpersonal behaviours shape the social behaviours and, in turn, the interpersonal relationships that exist between two or more people in a group. Sense of identity in a society or community can be attributed as an interpersonal characteristic. Based on
social identity theory, this trait can shape an individual’s social behaviour and affect their interpersonal relationships, including their connections, engagements and interactions. Hence, students have different levels of online experiences that will cause different levels of sense of identity, which influences their online interaction and engagement with a course.

**H5. Sense of identity is positively associated with: a student’s (a) online interaction and (b) engagement.**

The Impact of Sense of Purpose Toward Online Interaction on a Student’s Online Interaction and Engagement

In general, a sense of purpose in any system means that the people in that system believe and experience the usefulness and purposefulness of that system. It has been shown that a sense of purpose in an educational system is important and essential for the growth and development of that system (Chickering & Reisser, 1993; Frankl, 1985). From another perspective, the past research has shown that having a sense of purpose toward technologies will lead to the greater use and adoption of that technology (Hanson, 2006). According to the technology acceptance theory (TAM) (Davis, 1989), the sense of purpose of a system as an external variable that positively affects perceived usefulness, which in turn affects the actual use of that system. By combining sense of purpose theories in education and in technology, we
believe that in an online course if students are informed about the usefulness and purposefulness of online the interactions that are undertaken through that course, their actual use of online media in that course will be increased. As a result, it can be hypothesized that a sense of purpose towards online interaction in an online learning environment can positively influence a student’s online interaction and engagement in an online course.

**H6. Sense of purpose toward online interaction is positively associated with:**

*a student’s (a) online interaction and (b) engagement.*

The Impact of a Student’s Online Interaction on their Engagement

In this section, an IS success model is used to predict the impact of online interaction on student engagement. To provide a comprehensive and general definition of the IS success, DeLone and McLean introduced an integrated view of the concept of information systems success (Figure 4). The interpretation of the model is that “a system can be evaluated in terms of information, system, and service quality; these characteristics affect the subsequent use or intention to use and user satisfaction. As a result of using the system, certain benefits will be achieved. The net benefits will (positively or negatively) influence user satisfaction and the further use of the information system” (Delone, 2003).
In this study, student’s online interaction through an online interaction tool in an online learning environment can be attributed to the use of that online interaction tool, because when they interact in an online environment, they are in fact using an online interaction tool to connect with course conveners, course content, and other students. Based on the IS success model and considering student online interaction through a specific online interaction tool as system use and student engagement with a course and online learning as system benefits, we can hypothesize that student online interaction in an online environment can have a direct impact on student engagement with that online course. This hypothesis is also supported by engagement theory. The fundamental idea that underlies engagement theory is that students must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks (Kearsley & Schneiderman, 1999).

**H7. Student online interaction is positively associated with student engagement.**
Figure 4. Updated Information Systems Success Model (Delone, 2003)

Research Methodology

This section contains details about the research participants, the instrument that is used for data collection, research methodology, some demographic information about the participants, and the procedure of conducting data analysis.

Participants and Demographic Information

The main objective of the quantitative research method in this study is to mathematically measure and investigate the research hypotheses that are proposed in the section above. The quantitative research method is described by the collection of information that can be analysed numerically, the results
of which are typically presented using statistics, tables and graphs. To validate the research model, a survey was conducted and distributed to students who were enrolled in university online courses.

To fulfil our research objective through the quantitative approach, the data were collected through a questionnaire that was conducted in the context of that university online courses. There are several studies in the literature that have employed surveys to conduct research and obtain results. Neuman (2006) noted that surveys are useful for questions that address self-reported perceptions and beliefs (W. Neuman, 2006). An online questionnaire was distributed through the Health, Business, Sciences and Arts, Education and Law faculties to students who were enrolled in online courses. The questions that were used in the survey were concept-based, using student personal and perceived course variables that are introduced in the proposed research model (Figure 1). The survey analysed participant levels of agreement with various questions based on the Likert scale approach (Matell & Jacoby, 1971). There were 246 completed surveys.

The majority of the participants are from the school of Health with 108 students. They are composed of 84% female and 16% male, of which 119 of them are full-time students and 127 are part-time students. The results show that 81% of them are 25 years old and older. Approximately 13% are between 21 and 25. Among all participants 43% are employed full-time,
39% have part-time jobs and 18% are not employed. The year of their study is different; 37% are in their first year, 22% are in their second year, 12% are in their third year, and 29% are in their fourth year and higher. It is the first online course experience for 92 students, 37 of them had taken one online course excluding the current course, and 116 students had taken more than two online courses.

Data Analysis

To address the research questions that are proposed in this study, Partial Least Squares (PLS), which is a statistical method that bears some relationship to principal components regression and could model latent constructs under conditions of non-normality, was employed to analyse the research model and hypotheses. PLS is a component-based technique that “focuses on maximizing the variance of the dependent variables explained by the independent ones instead of reproducing the empirical covariance matrix” (Haenlein & Kaplan, 2004, p. 290). The main objective of PLS is to explain the variances of factors and to show significant t-values (Gefen et al., 2000), and it is more suitable for exploratory studies and for the purpose of theory building (Chin et al., 2003).

The reason for choosing this method is its ability to predict the variability of the dependent construct and to manage reflective measures (Eikebrokk &
Olsen, 2007). This selection was made based on the fact that this method can predict the interrelationship between multiple independent and dependant variables while supporting unobserved or undefined variables (Gefen et al., 2000). In this study, Smart PLS 2.0 M3 (http://www.smartpls.de) was used to estimate the parameters of the inner and outer model with the minimum number of bootstrap samples of 5,000, and the number of cases 246, which is equal to the number of observations (Hair et al., 2011).

Measurement Model

To analyse the collected data, the Structural Equation Modelling (SEM) technique is employed. SEM is a quantitative research technique that is used to show the causal relationships between variables. SEM is mostly applied to confirm a research design rather than exploring or explaining a phenomenon. In other words, it helps researchers to examine the strength of the relationships between variables in a hypothesis. SEM has two basic parts: a measurement model and a structural model. The first model shows the relationships between the variables (both measured and latent), and the second model only shows the relationships between the latent variables.

To develop a PLS model, in the first stage, the measurement model (outer model) is examined by conducting reliability and discriminative validity analyses on each of the measures to ensure that all of the measures of the
constructs are reliable and valid. It determines the relationships between the independent and dependent latent variables. In the next stage, to test the structural model (inner model), the paths between the constructs, their significance, and the predictive ability of the model, are estimated. The model defines the relationships between the latent variables and their observed indicators (Figure 5) (Wong, 2013).

Fig 5. Inner vs. Outer Model in an SEM Diagram
A measurement model addresses the loadings of the indicators on their associated latent constructs, and PLS tests the significance of such loadings (Chin, 1998b). As Figure 5 shows, there are three latent constructs (independent variables) for student personal characteristics, communication competencies, self-regulated learning, and attitude toward online learning and three for perceived course characteristics, sense of presence, sense of identity, and sense of purpose. There are also two dependant variables, student engagement and online interaction. The indicators of these variables are coded as CC_1, CC_2, CC_3 for communication competencies, SRL_6, SLR_7 for self-regulated learning, ATOE_8, ATOE_9, ATOE_10 for attitude toward online education, SPR_11, SPR_12, SPR_13 for sense of presence, SID_14, SID_15, SID_16 for sense of identity, SPUR_17, SPUR_18, SPUR_19 for sense of purpose, ENG_20, ENG_21 for engagement, and INT_22, INT_23 for online interaction. Table 1 indicates the measurement model.

Table 1. Measurement Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication competencies</td>
<td>CC_1, CC_2, CC_3</td>
</tr>
<tr>
<td>Self-regulated learning</td>
<td>SRL_6, SLR_7</td>
</tr>
</tbody>
</table>
### Structural Model

A structural model determines the relationship between latent variables through path coefficients and examines the strength of coefficients as well as the R-square and t-values of the model. The main reason to assess the structural model is to examine the interrelationships of the constructs and to rectify the research hypotheses. To do so, the dependent and independent variables are linked together in a diagram as is shown in Figure 6. This diagram is a path model that indicates the theoretical relationship between the variables.
In this study, Confirmatory Factor Analysis (CFA) was employed to analyse measurement models. In statistical analysis, CFA is a special form of factor analysis that is used to test whether the measures of a construct or factor are consistent with the understanding of the nature of that construct. CFA assesses a model to confirm the factor loadings and seeks to determine to what extent a structure of items load on their corresponding factors (Fabrigar

**Figure 6** Structural model

**RESULT**

In this study, Confirmatory Factor Analysis (CFA) was employed to analyse measurement models. In statistical analysis, CFA is a special form of factor analysis that is used to test whether the measures of a construct or factor are consistent with the understanding of the nature of that construct. CFA assesses a model to confirm the factor loadings and seeks to determine to what extent a structure of items load on their corresponding factors (Fabrigar
et al., 1999). Thus, the objective of confirmatory factor analysis is to examine whether the data fit a hypothesized measurement model through factor loading.

**Measurement Model Results**

The first criterion to include or to exclude an indicator in the CFA analysis is the assessment of the factor loadings. According to (Chin, 1998a) and (Hulland & Business, 1999), indicators’ loading on their associated factor should be higher than 0.60 or preferably 0.70 or above, which shows that each indicator explains at least 50% of the variance of the corresponding latent variable. Table 2 indicates the results of CFA for the proposed model. All of the variables have loading factors above 0.7, which means that all of them are accepted at this stage. In next step, the t-values for each indicator are also computed. The above authors also stressed that the generated t-values must be equal to or greater than 1.96 and are significant at the level of Alpha 0.001 to confirm the presence of statistically significant loadings. Therefore, all of the factors are accepted in the model.

**Table 2.** The results of the confirmatory factor analysis

<table>
<thead>
<tr>
<th>Variable/indicator</th>
<th>Loading</th>
<th>T-values*</th>
</tr>
</thead>
</table>

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Communication competencies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC_1</td>
<td>0.86</td>
<td>39.249</td>
<td></td>
</tr>
<tr>
<td>CC_2</td>
<td>0.74</td>
<td>13.680</td>
<td></td>
</tr>
<tr>
<td>CC_3</td>
<td>0.84</td>
<td>33.003</td>
<td></td>
</tr>
<tr>
<td><strong>Self-regulated learning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRL_6</td>
<td>0.85</td>
<td>20.634</td>
<td></td>
</tr>
<tr>
<td>SLR_7</td>
<td>0.80</td>
<td>14.234</td>
<td></td>
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<tr>
<td><strong>Attitude toward online education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATOE_8</td>
<td>0.85</td>
<td>31.251</td>
<td></td>
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<tr>
<td>ATOE_9</td>
<td>0.81</td>
<td>18.448</td>
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<tr>
<td>ATOE_10</td>
<td>0.89</td>
<td>41.707</td>
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<tr>
<td><strong>Sense of presence</strong></td>
<td></td>
<td></td>
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<tr>
<td>SPR_11</td>
<td>0.84</td>
<td>25.979</td>
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<td>SPR_12</td>
<td>0.85</td>
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<tr>
<td><strong>Sense of identity</strong></td>
<td></td>
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<tr>
<td><strong>SID_14</strong></td>
<td>0.77</td>
<td>20.244</td>
<td></td>
</tr>
<tr>
<td><strong>SID_15</strong></td>
<td>0.90</td>
<td>68.316</td>
<td></td>
</tr>
<tr>
<td><strong>SID_16</strong></td>
<td>0.85</td>
<td>35.799</td>
<td></td>
</tr>
<tr>
<td><strong>Sense of purpose</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SPUR_17</strong></td>
<td>0.87</td>
<td>45.424</td>
<td></td>
</tr>
<tr>
<td><strong>SPUR_18</strong></td>
<td>0.88</td>
<td>40.814</td>
<td></td>
</tr>
<tr>
<td><strong>SPUR_19</strong></td>
<td>0.85</td>
<td>32.877</td>
<td></td>
</tr>
<tr>
<td><strong>Engagement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ENG_20</strong></td>
<td>0.91</td>
<td>70.530</td>
<td></td>
</tr>
<tr>
<td><strong>ENG_21</strong></td>
<td>0.71</td>
<td>11.359</td>
<td></td>
</tr>
<tr>
<td><strong>Online interaction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>INT_22</strong></td>
<td>0.86</td>
<td>29.097</td>
<td></td>
</tr>
</tbody>
</table>
Structural Model Result

Figure 7 indicates the results of the structural analysis. In a structural model, the first element to evaluate is the predictive power of the research model. This quantity is measured by variance explanation power ($R^2$). This evaluation is consistent with the PLS objective to maximize the variance that is explained in the endogenous variables. The recommended values for $R^2$ are categorized as 0.67 for substantial, 0.33 for moderate, and 0.19 for weak (Chin, 1998b). Table 3 shows that the $R^2$ values for the proposed research model and based on above-mentioned details, the variance explanation power for this model is considered to be substantial.

Table 3. Variance explanation power ($R^2$)

<table>
<thead>
<tr>
<th>Latent variables</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement</td>
<td>0.6529</td>
</tr>
<tr>
<td>Online Interaction</td>
<td>0.617</td>
</tr>
</tbody>
</table>
Table 4 shows the results of the structural analysis and summarizes the hypothesis verification. For each hypothesis path coefficient, which is produced to show the interrelationships between the independent and dependent latent variables, the sample mean, standard deviation and t-values.
are represented. The number of bootstrap “samples” is 5000 and the number of bootstrap “cases” is the same as the number of valid observations, 246 (Hair et al., 2011). Based on these measurements, a decision is made for each hypothesis.

_Hypothesis 1:_ the results show that “communication competencies” has a positive effect on “student engagement”, and the path coefficient between “communication competencies” and “engagement” is 0.197 (t-value=2.98), which is supported by the significance level of 0.01. Therefore, hypothesis 1a is confirmed. However, the path coefficient for the effect of “communication competencies” on “online interaction” is 0.024 (t-value=0.37, less than 1.65) (Gefen et al., 2000), which is not supported by the significance level of 0.1. Therefore, based on this research hypothesis 1b is not confirmed.

_Hypothesis 2:_ table 6 indicates that “self-regulated learning” has a significant positive effect on engagement with the path coefficient 0.189 (t-value=3.28), which is significant at a level of 0.01. Thus, hypothesis 2a is supported and confirmed. While “self-regulated learning” does not have a significant impact on “online interaction”, the path coefficient is 0.054, and the t-value is 1.49. As a result, hypothesis 2b is also not confirmed in this study.
Hypothesis 3: the results from the hypothesis verified that “attitude toward online education” has a highly substantial effect on student engagement (path coefficient 0.270, t-value 5.18), and it is supported at a significance level of 0.001. It also has a significant effect on “online interaction” (path coefficient 0.220, t-value 3.56), and hypothesis 2b is strongly supported at a level of 0.001 and thus it is confirmed.

Hypothesis 4: the results represent that the same story applies for the independent construct of “sense of presence”. It has a highly significant effect on student engagement (path coefficient 0.358, t-value 4.67) at a level of 0.0001, and it has a positive impact on student “online interaction” (path coefficient 0.170, t-value 1.96) at level of 0.1. Therefore, hypothesis 4a and hypothesis 4b are confirmed.

Hypothesis 5: according to table 4, “sense of identity” has a positive direct impact on “engagement” at a 0.01 significance level and a path coefficient of 0.194 (t-value=2.75). It also has a high positive effect on “online interaction” at a significance level of 0.001 (path coefficient 0.314, t-value 4.21). Consequently, both hypotheses 5a and 5b are confirmed.

Hypothesis 6: the results reveal that “sense of purpose” has a considerable positive effect on both students “engagement” and “online interaction”, and it is significant at a level of 0.001. The path coefficients and the t-values are
(0.336, 7.09) and (0.708, 11.01), respectively. Thus, hypotheses 6a and 6b are confirmed.

Hypothesis 7: the results from the hypothesis specified that the student “online interaction” has a positive effect on student “engagement”. It has a high significance level of 0.001 with a path coefficient of 0.326 and a t-value of 7.2. Hence, hypothesis 7 is also confirmed.

Table 4. Summarized Results of the Hypotheses Verified

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path Coefficient</th>
<th>Sample Mean (M)</th>
<th>Standard Deviation (STDEV)</th>
<th>T Statistics</th>
<th>Confirmed/Not confirmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1a Communication competencies =&gt; Engagement</td>
<td>0.197***</td>
<td>0.1279</td>
<td>0.0634</td>
<td>2.9856</td>
<td>Confirmed</td>
</tr>
<tr>
<td>H1b Communication competencies =&gt; Online interaction</td>
<td>0.024</td>
<td>0.0145</td>
<td>0.0438</td>
<td>0.3709</td>
<td>Not confirmed</td>
</tr>
<tr>
<td>H2a Self-regulated learning =&gt; Engagement</td>
<td>0.189***</td>
<td>0.1681</td>
<td>0.0359</td>
<td>3.2862</td>
<td>Confirmed</td>
</tr>
<tr>
<td>H2b Self-regulated learning =&gt; Online interaction</td>
<td>0.054</td>
<td>0.0459</td>
<td>0.0305</td>
<td>1.4972</td>
<td>Not confirmed</td>
</tr>
<tr>
<td>H3a Attitude toward online education =&gt; Engagement</td>
<td>0.270****</td>
<td>0.1732</td>
<td>0.0331</td>
<td>5.1846</td>
<td>Confirmed</td>
</tr>
<tr>
<td>H3b Attitude toward online education =&gt; Online interaction</td>
<td>0.220****</td>
<td>0.1135</td>
<td>0.0319</td>
<td>3.569</td>
<td>Confirmed</td>
</tr>
<tr>
<td>H&lt;sub&gt;4a&lt;/sub&gt;</td>
<td>Sense of presence =&gt; Engagement</td>
<td>0.358****</td>
<td>0.263</td>
<td>0.0564</td>
<td>4.6778</td>
</tr>
<tr>
<td>H&lt;sub&gt;4b&lt;/sub&gt;</td>
<td>Sense of presence =&gt; Online interaction</td>
<td>0.170**</td>
<td>0.1121</td>
<td>0.0569</td>
<td>1.9659</td>
</tr>
<tr>
<td>H&lt;sub&gt;5a&lt;/sub&gt;</td>
<td>Sense of identity =&gt; Engagement</td>
<td>0.194***</td>
<td>0.1398</td>
<td>0.0509</td>
<td>2.7559</td>
</tr>
<tr>
<td>H&lt;sub&gt;5b&lt;/sub&gt;</td>
<td>Sense of identity =&gt; Online interaction</td>
<td>0.314****</td>
<td>0.2087</td>
<td>0.0497</td>
<td>4.2182</td>
</tr>
<tr>
<td>H&lt;sub&gt;6a&lt;/sub&gt;</td>
<td>Sense of purpose =&gt; Engagement</td>
<td>0.336****</td>
<td>0.3643</td>
<td>0.0516</td>
<td>7.0978</td>
</tr>
<tr>
<td>H&lt;sub&gt;6b&lt;/sub&gt;</td>
<td>Sense of purpose =&gt; Online interaction</td>
<td>0.708****</td>
<td>0.4708</td>
<td>0.0427</td>
<td>11.016</td>
</tr>
<tr>
<td>H&lt;sub&gt;7&lt;/sub&gt;</td>
<td>Online interaction =&gt; Engagement</td>
<td>0.326****</td>
<td>0.3156</td>
<td>0.044</td>
<td>7.2085</td>
</tr>
</tbody>
</table>

* Significant at 0.1 level; **significant at 0.05 level; ***significant at 0.01 level; ****significant at 0.001 level

Considering the importance of the hypotheses, the results indicate that the relationship between sense of purpose and online interaction has the highest path coefficient among the others of 0.708. The finding means that this variable has the strongest impact on online interaction in comparison with the other variables. Then, the impact of sense of presence and sense of purpose on engagement and sense of identity on online interaction are very strong with the path coefficients of 0.358, 0.336 and 0.314, respectively.
Attitude towards online education is at the next level of importance with the path coefficient of 0.27 on engagement and 0.22 on online interaction. Among the confirmed hypotheses, sense of presence has the lowest impact on student online interaction with a path coefficient of 0.17. Researchers and course designers can improve their course engagement and online interaction by considering the level of importance of these factors.

**Reliability and Validity**

The following section is about testing the different levels of validity and reliability of the proposed model, and it investigates the indicators and latent variables of reliability and validity.

**Indicator Reliability and Validity**

The other results of the outer models are shown in table 5. To ensure that all of the indicators are reliable in this model, the “Indicator Reliability” was checked. Table 5 indicates that all of the indicators have individual indicator reliability values that should not be less than the minimum acceptable level of 0.4 and preferably close to level 0.7 (Wong, 2013). The results show that all of the indicators in this model meet the requirement and are reliable.
**Internal Consistency Reliability**

Generally, the internal consistency reliability describes the consistency of the results that are delivered in a test, which ensures that the various items that measure the different constructs deliver consistent scores. The prior literature has suggested the use of “Composite Reliability” (CR) to measure internal consistency reliability (Bagozzi & Yi, 1988). Table 5 illustrate that all of the reflective variables have high levels of internal consistency reliability due to CR values that are above 0.6 or preferably 0.7.

**Table 5. Results Summary for Outer Models**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Indicator</th>
<th>Indicator Reliability</th>
<th>Composite Reliability</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication competencies</td>
<td>CC_1</td>
<td>0.740</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CC_2</td>
<td>0.624</td>
<td>0.856</td>
<td>0.665</td>
</tr>
<tr>
<td></td>
<td>CC_3</td>
<td>0.722</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude toward online education</td>
<td>ATOE_8</td>
<td>0.722</td>
<td>0.8935</td>
<td>0.733</td>
</tr>
<tr>
<td></td>
<td>ATOE_9</td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Variable</td>
<td>Value 1</td>
<td>Value 2</td>
<td>Value 3</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Self-regulated learning</td>
<td>SRL_6</td>
<td>0.689</td>
<td>0.8197</td>
<td>0.695</td>
</tr>
<tr>
<td></td>
<td>SLR_7</td>
<td>0.656</td>
<td>0.8834</td>
<td>0.717</td>
</tr>
<tr>
<td>Sense of identity</td>
<td>SID_14</td>
<td>0.593</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SID_15</td>
<td>0.81</td>
<td>0.9023</td>
<td>0.755</td>
</tr>
<tr>
<td></td>
<td>SID_16</td>
<td>0.706</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sense of presence</td>
<td>SPR_11</td>
<td>0.706</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SPR_12</td>
<td>0.722</td>
<td>0.8684</td>
<td>0.687</td>
</tr>
<tr>
<td></td>
<td>SPR_13</td>
<td>0.608</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sense of purpose</td>
<td>SPUR_17</td>
<td>0.757</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SPUR_18</td>
<td>0.774</td>
<td>0.9023</td>
<td>0.755</td>
</tr>
<tr>
<td></td>
<td>SPUR_19</td>
<td>0.706</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement</td>
<td>ENG_20</td>
<td>0.828</td>
<td>0.7928</td>
<td>0.66</td>
</tr>
<tr>
<td></td>
<td>ENG_21</td>
<td>0.504</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online interaction</td>
<td>INT_22</td>
<td>0.74</td>
<td>0.8651</td>
<td>0.762</td>
</tr>
</tbody>
</table>
Convergent validity

To evaluate convergent validity, each latent variable’s Average Variance Extracted (AVE) was considered. Again, from table 5, it is found that all of the AVE values exceed the acceptable threshold of 0.5, which secures the convergent validity (Hair et al., 2011).

Discriminant validity

Discriminant validity is applied to investigate whether the indicators that represent a latent variable are different from those that are not supposed to be related to that latent construct in the research model. It confirms that the square root of AVE in each latent variable is higher than the other correlation values of that latent construct (Fornell & Larcker, 1981). For this purpose, table 6 was created, and the square root of AVE was manually calculated (written in bold). The numbers under each square root of AVE are the correlations between the latent variables. To confirm discriminant validity, the diagonal elements should be larger than the off-diagonal elements in the same row and column (F.-Y. Kuo et al., 2013).

Table 6. Results of Discriminant Validity of Latent Variable

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>INT_23</td>
<td>0.792</td>
</tr>
</tbody>
</table>


### APPENDIXES

<table>
<thead>
<tr>
<th>Variables</th>
<th>Attitude</th>
<th>Communication competencies</th>
<th>Engagement</th>
<th>Online interaction</th>
<th>Self-regulated learning</th>
<th>Sense of identity</th>
<th>Sense of presence</th>
<th>Sense of purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td>0.858</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication competencies</td>
<td>0.330</td>
<td>0.816</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement</td>
<td>0.499</td>
<td>0.455</td>
<td>0.813</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online interaction</td>
<td>0.421</td>
<td>0.503</td>
<td>0.717</td>
<td>0.873</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-regulated learning</td>
<td>0.429</td>
<td>0.403</td>
<td>0.405</td>
<td>0.301</td>
<td>0.833</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sense of identity</td>
<td>0.278</td>
<td>0.550</td>
<td>0.605</td>
<td>0.652</td>
<td>0.265</td>
<td>0.846</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sense of presence</td>
<td>0.437</td>
<td>0.634</td>
<td>0.682</td>
<td>0.666</td>
<td>0.317</td>
<td>0.720</td>
<td>0.829</td>
<td></td>
</tr>
<tr>
<td>Sense of purpose</td>
<td>0.396</td>
<td>0.586</td>
<td>0.695</td>
<td>0.743</td>
<td>0.259</td>
<td>0.695</td>
<td>0.743</td>
<td>0.868</td>
</tr>
</tbody>
</table>

### DISCUSSION

The exploration and investigation of different elements and characteristics of students is necessary to determine the prerequisites for an effective e-
learning system in higher education settings. It can help educational designers, instructors, and students to achieve better online interaction and engagement. The goal of this research is to investigate the role of student’s personal characteristics and perceived course characteristics on their online interaction and engagement in online educational systems. This study focused on three types of personal characteristics: communication competencies, self-regulated learning, and attitude towards online learning, which are the student’s personal characteristics, apart from the type of online course in which they participate. In the second category, there are three types of perceived course characteristics: sense of presence, sense of identity, and sense of purpose, which are dependent upon the specific online course that is being taken and the online interaction tool that is used in that course.

Implications in Theory

One of the contributions of this study is the result of the structural model and the research hypotheses. This study distinguishes the impact of personal traits and perceived course characteristics on student online interaction and engagement. To address the research questions and gaps, the findings prove that all three of the personal characteristics that we have examined have a positive and direct impact on students’ engagement with online courses. However, this study can only confirm the positive impact of attitude towards online learning on online interaction. The positive impact of communication
competency and self-regulated learning on online interaction remains unconfirmed.

This research also investigates the effects of the perceived course characteristics, which are dependent on the structure and design of each course, on student online interaction and engagement. The results show that “sense of identity”, “sense of purpose”, and “sense of presence” have a substantial positive and direct impact on both student engagement and online interaction. This means that a student’s perception of being identified among other learners and educators and having more of a sense of presence can directly improve that student’s engagement and online interaction in an online learning environment. Moreover, when they have a better realization of the purposefulness of an online course, students will become more engaged with it; this is also true when students are encouraged to engage in increased online interaction.

The theoretical findings of this study propose that most of these personal and perceived course characteristics have a significant direct impact on their online interaction, and all of them strongly influence student engagement, which is the goal of every online learning developer. The previous research has proven that the more online interaction and engagement that students have, the higher satisfaction and learning outcomes they will obtain. Therefore, the results of the current study are valuable for increasing student’s satisfaction, and they substantially contribute to student’s academic achievements and outcomes.
This research also opens new avenues for researchers’ future work such as investigating the impact of certain administrative and course design factors. Moreover, they can verify the influence of the proposed characteristics on other positive student outcomes such as motivation, attrition, and problem solving. There are some unconfirmed hypotheses in this study that can be addressed in future research, which can be investigated with different data sets and examined with other research participants to add value to the recent findings.

**Implication for Practice**

The most important practical achievement and contribution of the present research is the development and validation of a research model and its instrument for measuring the dependent and independent constructs of the research model. This instrument has been tested with a large sample, and it has reflected a high level of validity and reliability. By providing an explicit list of indicators, this instrument can help online learning instructors and educators to measure proposed constructs and stimulate the online interaction and engagement of learners. Furthermore, the research model and instrument guides the required changes in online learning environments to acquire higher student online interaction and engagement.

The results of this research can help online course developers and teachers to produce better online courses by improving personal and course characteristics. The three personal characteristics are as follows:
Student’s self-regulated learning can be improved through online or in-person training sessions or workshops to teach them how to manage their time and schedules and provide comprehensive guidelines and instructions for how to more effectively study the course material.

Although communication skills are somewhat determined by student’s culture and background, institutions and online educators can supply a preparation course for learners before engaging in an online course to train them how to communicate online and to improve their communication competencies.

Attitude toward online learning can highly influence students’ online interaction. Educators can directly improve student online interaction through this attitude. This means that having a positive viewpoint towards the educational setting of online learning can contribute to a higher online interaction of learners. To positively influence student’s attitude, teachers can offer course briefing sessions during the first week of class to elaborate and explain the pedagogical advantages of online courses. Furthermore, teachers should make it clear what they expect of the students in the online setting.

This research distinguishes the effect of “sense of presence” and “sense of identity” on student engagement and online interaction. This can help course conveners and educators in designing the entire structure of online courses. The platform that they use and the media that they employ to communicate and connect to the learners should be selected on a basis that can create an
atmosphere in which learners can be better identified and in which they can represent themselves in the online environment. By asking students to use their real names, having orientation sessions and running activities such as online icebreaking games, instructors can help students to be better identified in their group. To enhance the sense of presence of the learners, instructors can employ platforms such as 3D virtual worlds that help students to feel greater presence in the online environment.

The findings of the current study indicate that a sense of purpose in an online educational system is essential for the progress of online learning systems, and it can directly affect online student interaction and engagement. The more that students understand the purposefulness and usefulness of online interaction in an online course, the more they will feel connected to and engaged by that course. Therefore, online learning developer can take advantage of this result and promote learners’ understanding and realization of the critical role of online interaction and its usefulness in their learning quality in different ways. For instance, they can incorporate information about the benefits and advantages of engaging in online interaction with other students and educators for learners in a video or emphasize this concept in their lecture materials to help learners to be more motivated to engage with the course by elaborating the different privileges and rewards of engaging in online interaction.

Research limitations
One of the limitations of this study is that we only focused on certain personal and perceived course characteristics. Important psychological factors, such as motivation, problem solving, and self-efficacy or administrative factors such as technical support, e-connectivity, and pedagogical support were not included. In fact, as suggested by the existing research regarding online interaction, these factors may interact with student online interaction and engagement and collectively with student learning outcomes. Another limitation of this research is the data collection, which was constrained to one Australian higher education institution and therefore could not embrace other online learning settings. Although the sample size of this study was sufficiently large for statistical analysis, including more institutions could improve the findings of the research.

CONCLUSION

Student online interaction and engagement is essential for stimulating and improving student learning outcomes and satisfaction. This study indicates that personal and course perceived characteristics can affect student online interaction and engagement in online learning settings. It made several important contributions to this area through a validated research model, and it deepened our understanding of the factors and traits that contribute to student online interaction. It used different theories and models to provide a solid theoretical foundation for its research hypotheses. The proposed
research model and validated hypotheses benefit online learners and educators by introducing some important and effective factors that affect student online interaction and engagement. Moreover, the study’s instrument provides a precise list of indicators that can help online learning developers and educators to measure the personal and course perceived characteristics of learners. The results of this research propose that learners who are more self-regulated, have a better attitude toward online education and an understanding of its purposefulness, who are able to present themselves in the online environment and are identified by other learners and educators can have better online interaction and engagement in online courses.

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