TOWARDS THE SITUATED ENGAGEMENT EVALUATION MODEL (SEEM): MAKING THE INVISIBLE VISIBLE

A Thesis submitted for the degree of Doctor of Philosophy

By
Karen Stepanyan

School of Applied Production & New Media,
Faculty of Design, Media & Management,

Buckinghamshire New University
Brunel University

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Abstract

This thesis explores the multifaceted concept of engagement within online learning environments. Key research aims are to suggest approaches and an extendable model for evaluating, monitoring and developing understanding of online learner engagement. The overall intention is to offer educators insight, practical guidance and tools for supporting timely intervention in fostering learner engagement.

This thesis reviews the major theoretical perspectives on learning and highlights the role of student engagement in relation to the research literature. It discusses the limitations of the methods applied in current research and attempts to address this problem by crossing the disciplinary boundaries to draw together a range of perspectives and methodologies. A review of the literature provides a foundation for a learner engagement evaluation model that employs a variety of evaluation methods and accommodates the possible diversity of learning experiences.

The proposed 'Situated Engagement Evaluation Model' (SEEM) is positioned to reflect the wide theoretical perspective of social learning. It constitutes a comprehensive system of intertwined components (Learning Content; Pedagogical Design Elements; Learning Profiles; and Dialogue and Communication) that learners may interact with, and integrates dynamically changing preferences and predispositions (e.g. cultural, emotional, cognitive) potentially informative in engagement studies.

Prior to (and independently of) the development of SEEM, four empirical studies were conducted and reported here. These explored patterns of online engagement with respect to learning content, learning profiles, patterns of communication and elements of pedagogical design. Studies were then revisited to evaluate the usefulness of SEEM for monitoring and evaluating student engagement, and to discuss its potential for guiding intervention to improve learning experiences. The practical relevance for integrated and automated implementation of SEEM in online learning is considered further.

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Declaration

I, Karen Stepanyan, declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own research. This thesis has not been submitted for any other degree.

To grandmother Norah - the first and dearest mentor of mine…

May, 2010

List of Publications

Stepanyan, K., Borau, K. & Ullrich, C. (Upcoming). Social Network Analysis Perspective on Student Interaction Within the Twitter Microblogging Environment. *ICALT 2010,* IEEE Computer Society, Sousse, Tunisia.

Stepanyan, K, R Mather, C Hamilton-Jones and C Lusuardi. 2009a. "Avoiding Pitfalls of Peer Assessment." *The 9th IEEE International Conference on Advanced Learning Technologies*:186-188. IEEE Computer Society.

Stepanyan, K, R Mather, H Jones and C Lusuardi. 2009b. "Student Engagement with Peer Assessment: A Review of Pedagogical Design and Technologies." *Advances in Web Based Learning – ICWL 2009* 5686/2009:367-375. Springer Berlin / Heidelberg.

Stepanyan, K., R. Mather and J. Payne. 2007a. "Integrating Social Software into Course Design and Tracking Student Engagement: Early Results and Research Perspectives." *E-LEARN 2006 - World Conference on E-Learning in Corporate, Government, Healthcare & Higher Education*.AACE. Quebec, Canada.

Stepanyan, Karen, Richard Mather and Janet Payne. 2007b. "Awareness of the Capabilities and Use of Social Software Attributes within and Outside the Educational Context: Moving Towards Collaborative Learning with Web 2.0." *ICL2007 - Interactive Computer Aided Learning* Villach, Austria.

Table of Content

List of Illustrations

List of Tables

The organism acts in accordance with its own structure, simple or complex, upon its surroundings. As a consequence the changes produced in the environment react upon the organism and its activities. The living creature undergoes, suffers, the consequences of its own behaviour.
(Dewey 1920, p.129)

1. Introduction

This chapter introduces the research problem and the motivation for the research undertaken. It sets the scope of study and states the research questions addressed. The chapter also provides a map of thesis structure to guide the reader.

1.1. Background

Educational institutions face great challenges for ensuring effective teaching and learning in a globalizing and rapidly changing world. The increasing diversity of cultural, social and educational backgrounds of student bodies requires the providers of formal education to frequently adapt teaching approaches and strategies for meeting the requirements of students and other stakeholders (1996; Panitz, 1996; Warschauer, 1997). Teaching staff, however, are mainly responsible for identifying and advocating the needs for pedagogical modification, and then for ensuring a timely and appropriate intervention. These raises questions as to how might a need for change be identified?; what means are available for guiding educators towards informed decisions?; and, more widely, how may current educational challenges be met? Such questions provide a general context for research reported in this thesis. These broad questions, that underpin the research summarised in this thesis, are approached from the perspective of e-learning (Electronic Learning). The specific concern of this thesis is how educational technologies may contribute to improving learning experiences and addressing the challenges that Higher Education institutions are facing today.

Before proceeding any further it is useful to consider the diverse interpretations of 'E-learning' and to state a working definition for the purposes of this thesis.

'E-learning' (also eLearning, Online Learning or Technology Enhanced Learning[1]) – a term that is constantly changing and evolving (Rosenberg, 2000) – varies widely in all the pursuits of defining it. Heery and Noon (2001) define it as: *"The acquisition of competencies, knowledge, and skills through electronic media, such as the Internet or a company Intranet".* Rather than stressing the outcome (i.e. knowledge 'acquisition') as the focal point of e-learning, Risenberg (2000) highlights the process behind this term and defines e-learning as: *"the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance"*. Others focus on educational technologies and their application when referring to e-learning. Garrison and co-workers define educational technologies (an inseparable part of e-learning) as: *"[the] tools used in formal educational practice to disseminate, illustrate, communicate, or immerse learning and teachers in activities purposively designed to induce learning"* (Garrison *et al.*, 2003, p. 34). However, regardless of any differences in details of interpretation, it is widely agreed that e-learning aims to improve learning experiences and teaching practices through the use information and communication technologies.

For the purpose of this research a working definition is adopted that:
"E-learning constitutes a set of teaching and learning practices conducted solely or partially via institutional educational Web based systems and integrated Web-based tools.". This definition confines the conducted research to limited use of web based technologies and less restricting mode of e-learning practice.

1.2. Research in the Cross-Disciplinary Area of E-Learning

The rapid development of information and communication technologies fosters the use of technological innovations for training, teaching, and learning over the Internet (Liao and Lu, 2008). Online teaching and learning receives considerable attention from educational institutions as an alternative or a supplement to traditional face-to-face, instructor-led education (Smart and Cappel, 2006). Information technology market analysts report the total global 'self-paced' e-learning market reaching $5.8 billion in 2007 and estimate its growth to $13.6 billion by 2012 (Adkins, 2008). Classroom instruction though, still dominates the preferred

[1] *"Technology Enhanced Learning [(TEL)] leverages technology to maximize learning within an environment of sound course design that can offer students the options of time, place, and pace and emphasizes different learning styles."* (TEL Committee, 2004, p. 6)

method for delivery of teaching and training in primary, secondary and tertiary educational sectors. However, Clark and Mayer (2007) citing the Training Industry Report of 2006, find that the use of e-learning in the US, in the forms of virtual instruction and online self-study, increased by 19% between 2000 and 2005 (see Figure 1-1).

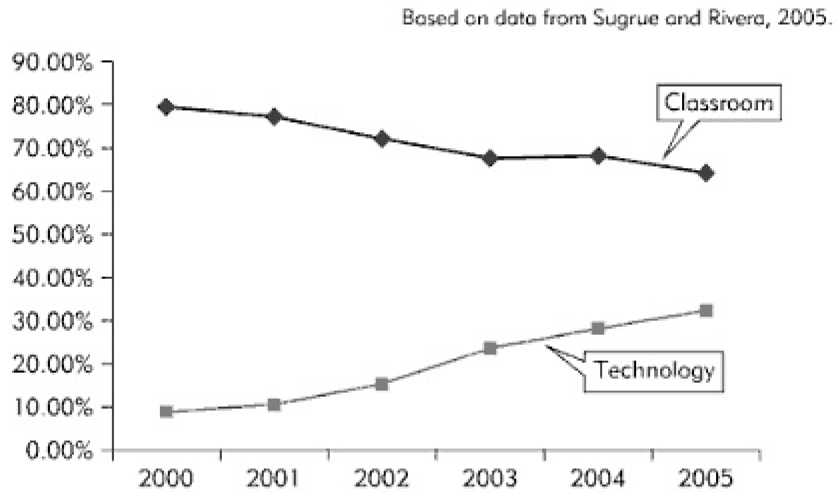

Figure 1-1: Percentage of teaching hours delivered in classroom and online modes (Clark and Mayer, 2007).

It is evident that research and practice of e-learning, alongside the growth of the e-learning industry, has grown in influence and complexity over recent years (Garrison *et al.*, 2003; Oliver, 2002b). Yet, the area of e-learning as a coherent body of knowledge is relatively new and is still developing despite increasing demand for its practices (Lisewski and Joyce, 2003). The demand for e-learning attracts numerous researchers from many disciplines including psychology, education and computer science. There has also been much recent growth in the numbers of centres of excellence, e-learning conferences and journals representing e-learning researchers and practitioners. However, the field of e-learning according to Conole (2004), is not rigorously defined. Conole *(op. cit.)* furthermore identifies that a tension exists in "the struggle for recognition along other established areas, issues of shared dialogue and understanding for the area [of e-learning], and articulation of the different schools of thought" (p. 3). The further establishment of e-learning as a research discipline requires that research is methodologically rigorous and that it is informed by the existing work in related disciplines. E-learning research emerging from a number of related disciplines is believed to remain diversified, although major foci of interest are likely to emerge (Conole, 2004).

E-learning research, spanning the areas of education, psychology, communication and information sciences, is truly inter- and multi-disciplinary. Variations in perspectives and views on e-learning issues are common at both theoretical and practical levels. For instance, applications of e-learning may be approached differently in the corporate and academic spheres. A teacher or a lecturer may refer to e-learning as a set of courses or learning materials towards achieving teaching programme objectives. On the other hand, a corporate trainer may view e-learning as a combination of knowledge management and a set of practical courses (Siemens, 2004). Besides differences in perceptions of e-learning, the application of e-learning is of multiform and can be differentiated into Blended Learning[2], Informal Learning[3], Networked Learning[4], Computer Supported Cooperative Learning (CSCL)[5], Computer Supported Collaborative Work (CSCW) [6]and many others. Any one category of e-learning is very rarely functionally isolated or completely distinct from other categories. Siemens believes that these categories often intersect, and sometimes are required to be practised interchangeably for achieving effective learning outcomes (Siemens, 2004). The great variations in practices and conceptual differences that underpin the application of e-learning significantly increase the complexity of this research area.

Due to the complexity and diversity of the area, the conduct of e-learning inquiry that rigorously investigates all the dimensions of its multidisciplinary scope is considered to be challenging. However, authors such as Andrews and Haythornthwaite (2007) believe that the objects of e-learning research are often

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[2] *"Blended learning is increasingly used to describe a hybrid model of e-learning that allows coexistence of conventional face-to-face teaching methods and newer e-learning activities and resources in a single course." (Littlejohn and Pegler, 2007, p. 26)*

[3] *"Informal learning is any activity involving the pursuit of understanding, knowledge or skill which occurs without the presence of externally imposed curricular criteria. Informal learning may occur in any context outside the pre-established curricula of educative institutions." (Livingstone, 2001, p. 4)*

[4] *"Networked Learning is learning in which information and communications technology (ICT) is used to promote connections: between one learner and other learners, between learners and tutors; between a learning community and its learning resources." (Goodyear, 2001, p. 9)*

[5] *"CSCL is an interdisciplinary research field focused on how collaborative learning, supported by technology, can enhance peer interaction and work in groups, and how collaboration and technology facilitate sharing and distributing knowledge and expertise among community members." (Lipponen et al., 2004)*

[6] *"CSCW is a generic term, which combines the understanding of the way people work in groups with the enabling technologies of computer networking, and associated hardware, software, services and techniques." (Wilson, 1991)*

framed too simply and the dominant models of e-learning research are narrowly conceived and comprise a one-way model. The authors find this approach too limited for the demands and purposes of the present day – suggesting alternatives that derive from rhetorical, communication, and social informatics theories. One such alternative, for instance, is the co-evolutionary (Andrews, 2005) model, that also takes into account the societal context, in which e-learning is practised, and the longitudinal attributes that the practices are bounded to.

To avoid framing research problems too simply the cross-disciplinary nature of e-learning needs to be represented. While research in multi[7]-/inter[8]-/trans[9]-disciplinary area (Stokols *et al.*, 2003) is undeniably more demanding (Leydesdorff and Wagner, 2008), it allows the researchers to address the complexity of scientific problems under study thereby improve the likelihood that studies make valuable contributions to scientific and societal knowledge (National Academies, 2005; Rosenfield, 1992).

Sections below first position the work of this thesis within the wider cross-disciplinary area of e-learning before expressing research questions to be addressed and discussing the rationale for studies reported in this thesis.

1.3. Subjects of Interest in E-learning Research

A review of the literature, conducted by Tallent-Runnels and co-workers (2006), considers quantitative, qualitative and mixed-method approaches to studying e-learning. The review includes a wide selection on empirical research of online teaching and learning, excluding the conceptual papers and programme descriptions from consideration. The review identifies research subjects of key importance and discusses directions for future study.

[7] *Multidisciplinarity refers to a process whereby researchers in different disciplines work independently or sequentially, each from his or her own discipline-specific perspective, to address a common problem.*

[8] *Interdisciplinarity is a process in which researchers work jointly, but from each of their respective disciplinary perspectives, to address a common problem.*

[9] *Transdisciplinarity is a process by which researchers work jointly to develop and use a shared conceptual framework that draws together discipline-specific theories, concepts, and methods to address a common problem. As defined by Stokols (2005).*

The authors categorise the publications according to the theories and processes of traditional curriculum and instructional design; the reader is referred to Anderson and co-workers (2001) for further information concerning the relationship between publication categories and established views of learning taxonomy. Papers were grouped into the four following categories: [a] course environment; [b] learner outcomes; [c] learner characteristics; and [d] institutional and administrative factors. The graphical representation of the categories, along with pedagogical characteristics, considered in relation to each of the categories, is presented in Figure 1-2.

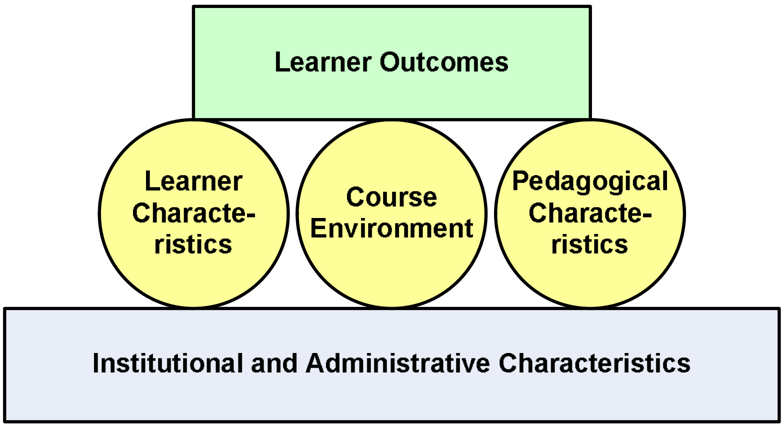

Figure 1-2: Subjects ares of research interest to the e-learning community as identified by Tallent-Runnels and co-workers (2006).

In the context of Tallent-Runnels *et al.* (2006)The study summarised in this thesis focuses on the subjects of interest that are directly related to pedagogical practices. For instance, issues that influence administrative decisions surrounding technological solutions on an institutional level are not considered, while guidance on using institutional resources is not eliminated for its potential to influence pedagogical design elements. Institutional factors that influence the learning environment are not treated separately by this thesis but are considered in the context of the affected learning category. The intention was that this approach would narrow this thesis on those factors over which educational practitioners have direct control.

A more detailed overview of the thesis rationale, literature base and scope of research concern is presented in the context of the key subject-areas as introduced above.

Theories of Learning and Pedagogy – represent a subject of interest that attempts to describe and conceptualise the ways people learn, while pedagogy consists of teaching strategies informed by theories of learning. Theories of learning should underpin the technologies, course design and practice of online learning.

Course Environment – refers to an overarching term that includes classroom culture, online interaction, evaluation and success factors (Tallent-Runnels *et al.*, 2006). Research on 'course environment' highlights the values associated with each of the factors of: student use of educational materials, online communication, development of learning communities and participation. The term *engagement*, which encompasses the processes that are mediated by online environments, is considered more appropriate for denoting this category widely.

Learner Characteristics – are associated with studies that focus on student goals, needs and motivations. This subject considers individual differences and psychological characteristics of learners (i.e. personality profiles) or learning preferences (i.e. learning/reading styles). Better understanding of the relationships between teaching practices and learner characteristics are necessary for improving online learning practices (McManus, 2000). In this thesis the terms 'Learner Characteristics', 'Personal Characteristics' and 'Individual Differences' are used interchangeably.

Learner Outcomes – are widely regarded to be reliable and comparable measures in e-learning research. Learning outcomes attract attention and debate on strategies of learning improvement in online and more traditional settings. In this thesis learner outcomes are considered from cognitive and affective perspectives. The former relates to cognitive achievements, while the latter are concerned with student perceptions and attitudes towards personal progress and learning (Tallent-Runnels *et al.*, 2006).

In summary, the subjects of interest which were identified as being of primary importance towards understanding engagement and experience in on-line learning environments (the concern of this research) are: [a] Theories of Learning and Pedagogy; [b] Engagement; [c] Personal Characteristics and Individual Differences; and [d] Learner Outcomes. Learner outcomes are considered in the context of the three other and 'underpinning' subject areas (see Figure 1-3). The four subject areas are considered in the literature review and are referenced in later chapters that report on results of studies and on models for engagement with on-line learning.

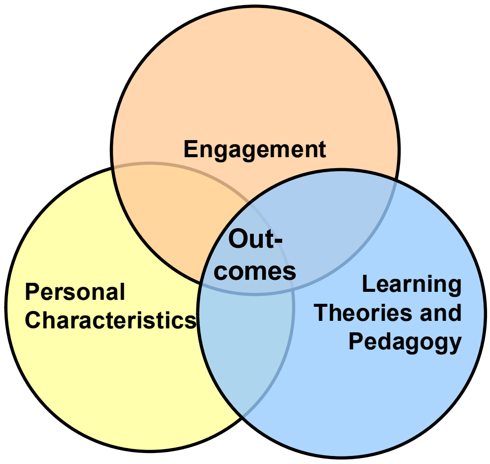

Figure 1-3: Subjects of interest of e-learning research as considered in this study.

1.4. Rationale and Position of Research Reported in the Thesis

The number of educational institutions that integrate e-learning practices into their teaching routine has risen sharply within the last twenty years. Higher education institutions in particular are leading the trend of employing information technologies for enhancing their services (Fry *et al.*, 2009; Littlejohn *et al.*, 2006). The supportive role of virtual/personal learning environments (VLE/PLE), online group-work facilities, synchronous and asynchronous communication technologies adopted by universities is becoming increasingly common if not central to the teaching process. Students and teachers are equally reliant on some of the facilities provided by these information technologies. Yet, it appears that much remains unknown concerning: (i) how online educational systems are used; (ii) which pedagogical practices are effective; (iii) whether or not technologies may deliver more equitable learning environments; and (iv) if the use of online learning influences levels of student achievement. The literature is equivocal in answering these questions (Tallent-Runnels *et al.*, 2006). Convincing answers to these general and widely positioned questions are unlikely to be given by individual e-learning research.

Given the breadth, complexity, diversity and cross-disciplinary nature of e-learning contexts and issues, it is essential that the scope of research reported here is clearly stated. Rather than attempting to answer the raised questions, this study aim to contribute towards identifying and proposing mechanisms that can help researchers and teaching practitioners to evaluate and develop greater understanding of online learning, and identify the factors that affect learning experiences. By doing so, the research will establish grounds that will allow identification of necessary directions for enhancing pedagogical practices and online student support. This research will therefore, indirectly contribute to the development of effective pedagogical practices that lead to higher levels of student learning. The arena for enquiry is Higher Education pedagogy and practice, though as we shall see, the findings may to some extent be generalised to other educational sectors as principles of e-learning engagement.

E-learning researchers strive to understand what the effects of online teaching and learning have on learners, teachers and support staff. They also seek to inform the design and practice of online learning. Anderson and co-workers articulate the necessity for informed educational practice (2000, p. 11): *"Educational innovations should be informed by the available scientific knowledge base and should be evaluated and analyzed with rigorous research methods."*. To achieve such research and practice goals for the multidisciplinary area of e-learning, researchers must cross disciplinary boundaries and draw upon new areas of knowledge, research method and practice (Levy *et al.*, 2003). The overlapping and mutually-dependent subject interests of e-learning research require a similar approach for exploring the affecting factors and the outcomes of online learning and teaching. The decisions on e-learning practice may be shown to be deficient when limited by the scope and the methods of the research.

Other researchers support the idea of research-informed educational practice. The meta-analysis performed by Clark (2001) demonstrates significant learning benefits when using information technologies, as opposed to traditional ways of learning. However, Clark *(op. cit.)* attributes the reason for the reported benefits not to the medium of instruction, but the instructional strategies built into the learning materials and course structure, thus demonstrating the importance of selecting appropriate teaching methods. However, increasing cultural diversity and widening participation in higher education presents significant challenges for pedagogy, teaching practice and course design. Cultural and social variables may have complex interactions with teaching practices and learning environments, thereby influencing patterns of engagement and learning outcomes. Such factors are therefore deserving of greater research attention with respect to understanding the continuing impacts of cultural and social diversification in the higher education sector (Markus *et al.*, 1997). However, are the research methods and techniques used in e-learning studies sufficient for addressing the challenges that the contemporary e-learning research is facing. Alternative methods are needed to improve understanding of the factors and interpretations that influence online teaching and learning experiences (Aviv *et al.*, 2003; de Laat *et al.*, 2007; Reffay and Chanier, 2003).

In summary, the essential problem in the area of online learning research is defined by: [a] the variety of contextual and cultural variables that influence online learning experiences; [b] the necessity to employ research methods that may supplement conventional techniques; and [c] the necessity to avoid reductionist approaches for understanding complex phenomena (Andrews and Haythornthwaite, 2007). This problem can be addressed by identification, development, improvement and validation of mechanisms for conducting holistic and comprehensive studies. Justified by the literature review (Chapters 2, 3 and 4), this research focuses on the phenomenon of online learner engagement.

1.5. Research Aim and Objectives

The aim of the research is to: [1] identify, review and suggest an alternative approach to comprehensive evaluation of online learner engagement; [2] provide educational practitioners and researchers with a general and extendable model/mechanism to guide evaluations of engagement; [3] discuss further practical application of the model/mechanism and its integration into e-learning systems and environments.

A set of objectives towards achieving the aims of this research has been set as follows:

Objective 1: Establish theoretical foundation towards the review and development of an adequate model/mechanism. The objective can be actualized by conducting a systematic literature review in identified subjects of interest.

Objective/Action 1.1: Review learning theories and frameworks that underpin pedagogical practices in e-learning (Chapter 2).

Objective/Action 1.2: Review the current research on engagement and participation, in relation to student achievement and online learning experience (Chapter 3).

Objective/Action 1.3: Review the literature on learner individual differences and personal characteristics, and their influences on learning experience (Chapter 4).

Objective 2: Identify and review models and frameworks used for evaluation, analysis and understanding of online learner engagement (Section 6.4).

Objective 3: Propose modifications to the reviewed models/frameworks or develop a new one in line with the research problem (Section 6.5).

Objective 4: Position the modified or new model/framework using revisiting earlier conducted empirical studies. Highlight potential benefits and limitations of model/framework (Chapters 7, 8, 9, and 10).

Objective 5: Suggest potential for further developing research outcomes, particularly concerning the development of computer-based instruments and systems for automatic monitoring and evaluation of learner engagement (Sections 11.3).

Setting the focus of the thesis, it is essential to explicate what the study summarised in this thesis does *not* aim to achieve. The research conducted as part of this study does not focus on empirically testing learning theories or comparing the effectiveness of suggested pedagogical practices. The argument held here does *not* certify any of the learning theories or pedagogical perspectives to be in any way superior. Hence, it does *not* advocate the use of any specific theory or practice nor does it, focus on experimentally testing the effectiveness of certain educational practices or serve as a "best-practice" guide. Yet, the pedagogical endeavours taken for achieving the main objectives of the thesis may still inform educators and researchers by extended discussions around the employment of certain teaching and learning techniques.

1.6. Brief Overview of the Research Methodology

The research inquiry summarised in this thesis can be positioned within the realms of exploratory research. The exploratory approach was found plausible for addressing the research problem and achieving research aims and objectives. The research subscribes to multi-paradigm principles of engaged scholarship (Van de Ven, 2007). This form of research is believed to extend the capability of researchers who study complex problems and advance the knowledge in both science and practice *(ibid.)*. The conducted empirical studies, employed mainly quantitative techniques that are justified for their potential for automation. The research inquiry can therefore be described as quantitative-exploratory. This strategy enabled surpassing the simplistic notions of one way causality models of confirmatory research and addressing the research problem. The detailed account of research methodologies is presented in Chapter 5.

1.7. A Retrospect: Initial Texts and Positions that Shaped this Research

This journey, as much as any other learning experience, was not entirely linear or sequential, but rather circular and iterative. The argument of this thesis is shaped by a retrospective and a holistic view on the iterative literature review and empirical studies. The initial boundaries for conducting the literature review were extended to develop a wider understanding of the e-learning field and for familiarization with the knowledge available in the related disciplines such as pedagogy, technology, psychology and philosophy. To avoid concealing a possible bias, it is necessary to state that the initial studies were inspired by the innovative social technologies and pedagogies that strived to utilize the technological developments available at hand. The literature review was therefore initiated in a 'bottom up' approach from educational technologies, to pedagogies and teaching methods, to learning and education theories, and finally towards reaching educational philosophies. This sequence is not preserved when presenting the overview of the conducted literature review.

The initial ideas that inspired the study were powered by the development of communication and collaboration technologies that fueled the evolution of the contemporary Internet (Chone, 2005). The so called Web2.0 (O'Reilly, 2005), as a technological advance, that promotes greater user-control over content and connection was believed to be particularly promising. The adoption of these innovative means of communication and collaboration for teaching purposes - raising a number of the pedagogical questions - justified the starting point of the conducted literature review. In other words, the review commenced with the study of prominent online pedagogical approaches, that focused on the case of social and communication tools. First, drawing from Johnson and Johnson (1991), competitive, individualistic or cooperative categories of learning were studied. Second, to understand the reported significant effects that selected pedagogical techniques can have on the learner outcomes (Kohn, 1986; Slavin, 1980, 1996), the reading was further extended to cover learning theories and educational philosophies. The most prominent current theories appeared to support the important role of social practices for learning, hence, encouraging collaborative pedagogical practices and effective use of communication and collaboration means. This initial inquiry set the scene for the literature review and the conducted exploratory studies.

1.8. Methods of Literature Review

The e-learning literature is scattered throughout a range of sources targeted primarily to education, psychology, communications, computer and information sciences. The boundaries of knowledge repositories that provide relevant information are usually less extended – providing specialised knowledge services. Hence, a strategic approach was adopted for performing a literature review, particularly searching and locating earlier published papers, articles and other resources. The search of the literature was performed broadly. No limitations were set for the date, publishing house or journal when conducting the search. This measure was taken intentionally to avoid overlooking key papers and articles published at a specific time period or in journals that differ in their focus.

Search for literature was performed mainly via the Education Resources Information Centre (ERIC), an online digital database of education research and information. The ERIC database indexes papers from journals published by houses such as Elsevier, Sage and Routledge and resources that appear in various conference proceedings. ERIC is considered to be the most important database for searching and browsing educational literature (Hertzberg and Rudner, 1999). Additionally, publicly available search tools such as Google Scholar were used extensively for performing broad searches on various topics and the general inquiry field.

The access to knowledge repositories, such as journal publications and electronic books, was made possible via the Institutional Athens accounts of Brunel University of West London and Buckinghamshire New University. The subscription of those institutions provides full-text access to a variety of journals, publishing houses and indexes that cover areas directly or indirectly related to e-learning.

1.9. Structure of the Thesis

The thesis comprises eleven chapters which form the structure shown in Figure 1-4. Chapter outlines follow.

Chapter 1 introduces the context and presents the research domain, aim, objectives, the rationale and learning journey underpinning research and the methods.

Chapter 2 provides a chronological overview of educational philosophies and learning theories relevant to the area of research. It covers the underpinning factors that lead to the development of various theories for understanding human learning. The chapter covers most prominent and debated learning theories attempting to establish necessary grounds for conducting further research in relation to educational practices that are informed by the discussed theories.

Chapter 3 reviews previous studies related to one of the identified subjects of interest in e-learning research – that is engagement and participation. This chapter offers an overview of the various perspectives of student engagement. It reviews and discusses the learner outcomes that are associated and studied in relation to student engagement and participation. Finally, the study proposes and discusses the gaps to be addressed by e-learning research.

Chapter 4 summarises the literature review on another subject of interest – learner characteristics. This chapter discusses the personal preferences and individual differences that learners may have and their relation to the ways they use the information technology tools and interact with learning materials and with other participants.

Chapter 5 discusses the methodological approach employed for conducting this research.

Chapter 6 reviews the models and frameworks that are available for evaluating student engagement with educational resources and environments; it overviews the mechanisms for evaluating learning participation and interaction. Consequently, it summarises the results discussing the benefits and disadvantages of the models and proposing an improved model - introduced as the Situated Engagement Evaluation Model (SEEM) - by building on the available knowledge and earlier developed frameworks.

Chapters 7-10 summarise the conducted empirical studies according to the methodology introduced and discussed in Chapters 5 and 6. The chapters discuss the benefits and disadvantages of the SEEM model identified as a result of empirical studies.

The final *Chapter 11* summarises the research by highlighting the findings and contributions to the area. These chapters revisit the objectives that were met and those that require further work due to limitations. The potential application of research findings and prospects for future research are discussed.

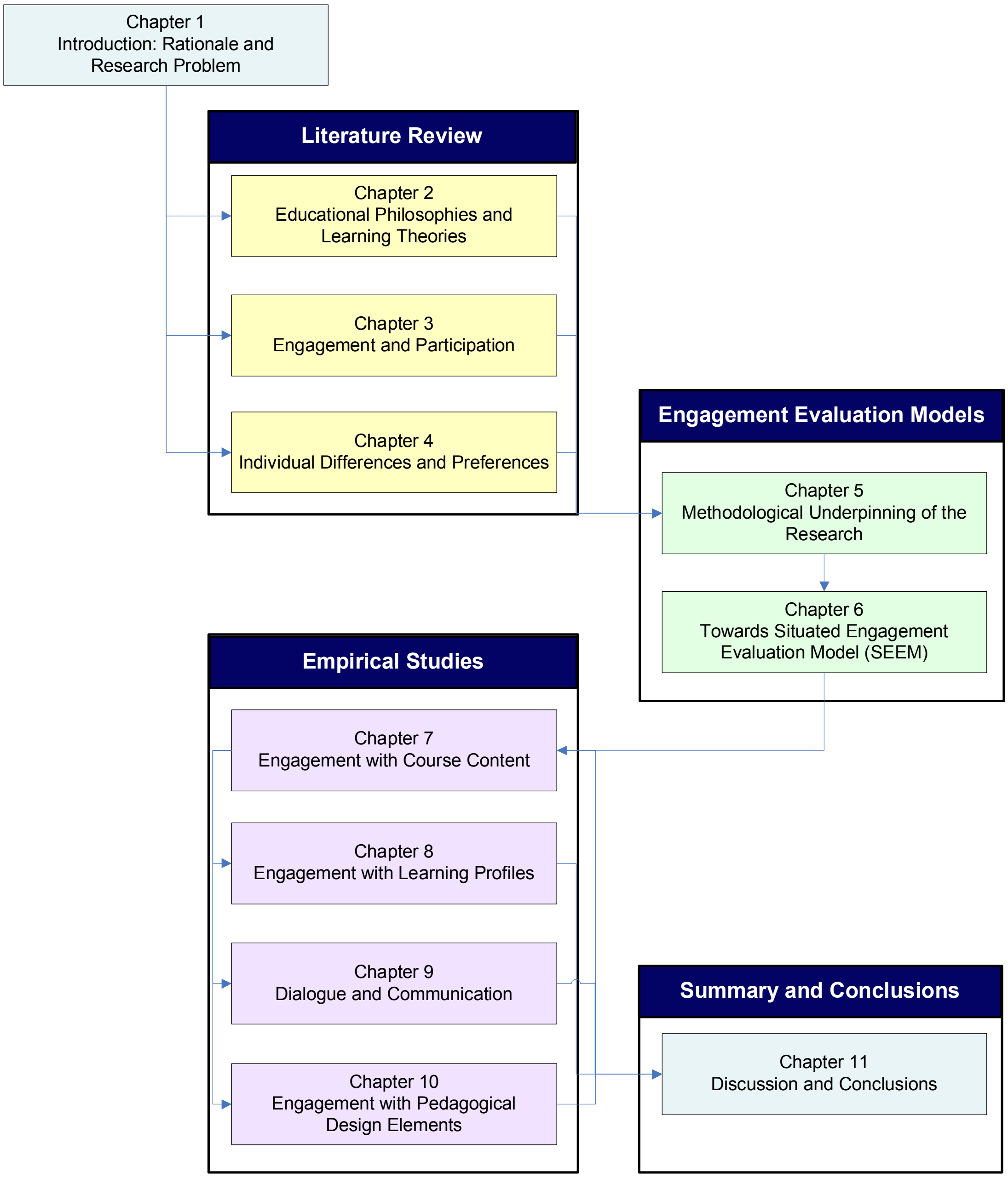

Figure 1-4: Flow diagram depicting the structure of this thesis.

2. A Chronological Overview of Educational Philosophies and Learning Theories

2.1. Introduction

Regardless of novelty of technological advance that powers the development of e-learning, the issue of educational and social development has been discussed by philosophers since ancient times. Some of the educational questions that occupied great minds are still of current interest and are now being revisited by educational researchers in the e-learning context. To elaborate on the current research problems a quick retrospective of educational schools of thought is presented here.

The concept of knowledge and its acquisition, the role of teachers and their contribution to a learning process are an integral part of cognitive psychology and the theory of education (Frawley, 1997). The documented roots of these fields of enquiry go far back to ancient times when discussions on knowledge and cognition were raised by Greek philosophers and were formalised in the works of Plato and Aristotle (White, 1999). While concentrating on politics, mind, reality and logic these earliest philosophers thought about education in a systematic way (White, 1999) highlighting its important role for socio-economic development (Carr, 1991). Over time, various philosophical traditions aiming to understand and transform human endeavour were naturally driven to discussing the role of education. Some of those schools of thought attempt explanations of a number of issues - such as pedagogical practice, policy and ethics - that are still of present concern in education. Descartes, Locke, Rousseau, Spinoza are among those philosophers who contributed to shaping the field of education as a nascent discipline and directed its development (Rorty, 1998). With the rise of the idealist tradition developed by Kant, Fichte and Hegel, moral and cognitive aspects of education were increasingly recognised as essential parts of educational process. The legacy of the idealist tradition, encompass later reforms for inclusive education and the emergence of a more cohesive educational system (Lawton and Gordon, 2002). Much later, the importance of education was stressed by John Dewey, the most influential educational thinker of the twentieth century, who approached education as a bridge from knowledge to modern, liberal and democratic society (White, 1999). By considering educational questions in a wider scope, educational philosophers laid a foundation for further pedagogical and psychological research – inspiring the work of educationists.

Empirical psychological research challenging earlier philosophical ideas became the cornerstone in the development of modern theories of education and learning. The latter theories (theories of learning) are elaborated in this section to explain the theoretical foundations of the studies described in this thesis.

Learning theories are critical links for understanding the relationship between teaching design and theories of human learning. They underpin the process of acquiring a research-informed vision of good teaching practice. The call for 'linking science' or a 'combined view' – aimed at bridging research and teaching practice – appeared early in the works of Dewey and Thorndike (Glaser, 1976). This call is still apparent today. Within recent years, however, there has been significant progress on creating knowledge repositories, adjusting teacher education programmes and introducing educational policies based on the outcomes of educational research. An important part of this advance is attributed to the development of learning theories that serve as a foundation for many of the applied teaching design principles and practices.

How may a learning theory be defined and what distinguishes a pedagogic theory from a mere instructional approach or educational method? Ertmer and Newby (1993) emphasise four distinctive dimensions that they perceive as germane to all learning theories. They identify the learning theories to be: [a] a source of verified instructional strategies, tactics and techniques; [b] foundations for intelligent and reasoned strategy selection; [c] basis for integrating context into selected instruction strategy; [d] fundamental systems for allowing reliable predictions of outcomes. Therefore, the identification and informed selection of learning theories are crucial for addressing practical learning problems and achieving the desired outcomes. Accordingly, this chapter reviews and classifies some of the learning theories that have attracted the attention of modern educational researchers and practitioners. Subsequently, it identifies and discusses those learning theories found to be most relevant for consideration in the context of e-learning and, particularly, for the studies summarised in this thesis.

There is a diverse array of learning theories proposed and studied to date. Some of the proposed theories (to name a few) are: Leont'ev's Activity Theory (Engeström, 1999), Communities of Practice (Lave and Wenger, 1991), Social Learning Theory (Bandura, 1986) or Attribution Theory (Weiner, 1972). In the given variety, attempts at characterising, categorising and mapping the learning theories are aimed at providing 'structured foundations' for practitioners, designers and researchers (Ertmer and Newby, 1993). Categorising and mapping learning theories makes the link between the theory and practice more explicit and scaffolds researchers' and practitioners' engagement with theories of learning (Conole *et al.*, 2004). The categorisations of learning theories are discussed in the following section.

2.2. Categorisation of Learning Theories

The documented learning theories and models vary widely in their focus, emphasis and theoretical perspective. Despite these variations, however, it is apparent that many of the theories share common characteristics and justified pedagogical approaches. It is therefore possible to categorise, combine and classify some of these theories and to ally them with theoretical perspectives and positions with wider boundaries. A number of scholars have attempted such a classification with varying degrees of success. Some of the prominent perspectives are reviewed below and discussed in the context of this study.

Previous attempts to schematize and categorise learning theories have varied considerably from author to author. Some scholars are content with identifying the characteristics that are closely associated with learning perspectives, while others trace the roots of theories back to dominant educational and philosophical schools of thought. As the concepts of learning and knowledge acquisition (as mentioned earlier in Section 2.1) are rooted in a number of philosophical positions of epistemology and ontology (Allert, 2004), tracing the development of learning theories to their philosophical roots can extend understanding of the conceptual underpinnings of various theories. The following sections (2.3 and 2.4) overview two perspectives on the classification of learning theories.

2.3. Individualistic and Social Perspectives

Stahl (2003) categorises philosophical traditions that discriminate learning, teaching and the educational process into two dominant perspectives: individualistic and social. He summarises this clear division between the two categories and the schools that support one perspective or the other in a diagram presented in Figure 2-1. The diagram shows the division of views and the initial stages of emergent learning theories from Descartes' times up to contemporary learning theorists.

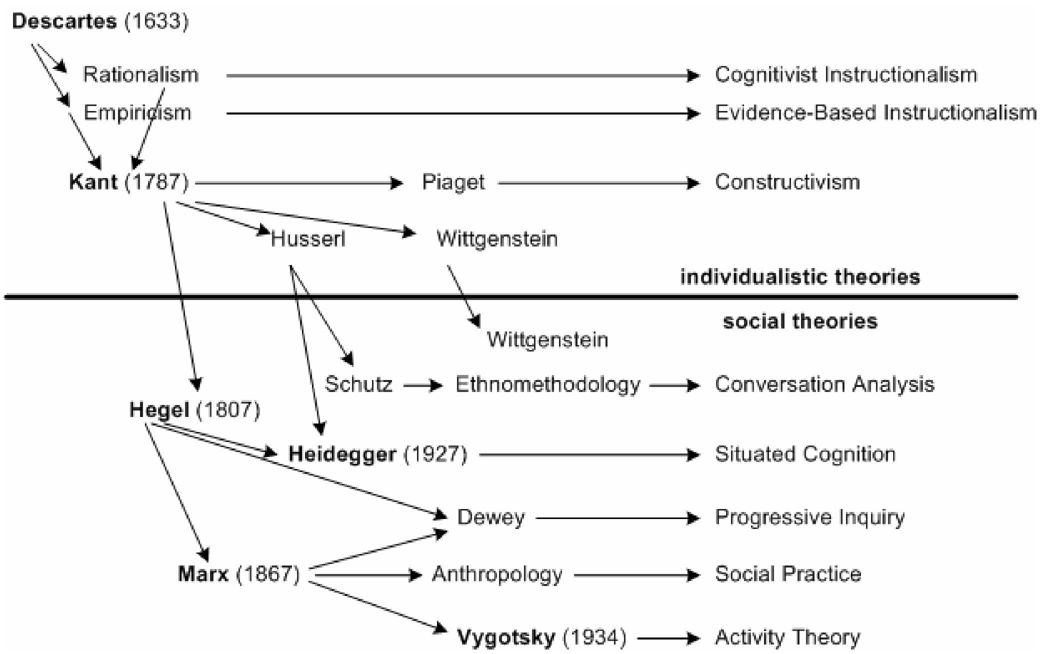

Figure 2-1: Philosophical influences on individual and social theories of learning (Stahl, 2003)

In framing this twofold division, Stahl (2003), focuses on 'meaning-making' (an essential part of learning) when tracing back the development of learning theories. He himself believes that meaning-making is an essentially social activity that is conducted collaboratively. While the role of social activity has acquired greater attention fairly recently, Stahl demonstrates that social learning theories have recurrently been evolved in dialogue or in contrast with individualistic learning theories. His discussion charts the earliest full articulation of this individual-social dichotomy in early philosophical ideas. Stahl's codification of these two traditions is persuasive and clarifies and exemplifies how the majority of learning theories can indeed be allied to either the individualistic or the social perspective. The next two sections discuss the differences between these two perspectives in more detail.

2.3.1. Individualistic Learning Theories

In categorising one tradition of learning theories as individualistic, Stahl (2005, p. 79) refers to a range of theories that 'focus on the mind of the individual student as the unit of analysis when looking for instructional outcomes, learning, meaning-making or cognition'. These learning theories are rooted in the philosophical tradition that originates Descartes' enstatement of a mind-body dualism. An attendant philosophical tradition, established by the followers of Descartes, focused on understanding *one* of the elements of Cartesian dualism in isolation– the mind. Researchers in this tradition took the workings of the mind as the central focus of educational research, interpreting cognition, learning and development as a psychological matter only. They therefore adopted traditional methods of psychological experimentation in researching the educational process.

Understanding the mind and behaviour of individuals dominated the psychological researcher of the early twentieth century. Many researchers, among them, Pavlov Watson, Thorndike and Skinner, studied conditioning, stimulus-reward/punishment contingency and emotional reactions in their experiments (Mergel, 1998; Mills, 2000). Later in the twentieth century, when researchers exposed limitations in the behaviourist approach to understanding learning, new ideas such as learning by repetition and association were introduced to educational research. These catalysed the development of cognitivist and constructivist approaches in educational research. It is here that arguably Stahl's stark division between individualistic and social learning theories can be challenged somewhat since many constructivist and cognitivist researchers acknowledged the importance of social environment and communication in the learning process. Jean Piaget (1896-1980) was one of them. Piaget, most widely known for his theory of cognitive development, made a significant and enduring contribution in the field of education, his influence persisting to the present day. Focusing on the cognitive development of the child, he demonstrated that communication, interaction and discussion plays a key role in the learning and development of individuals. Unlike other social theorists however, he did not consider the social environment to be essential for learning (Tudge and Rogoff, 1999) – aligning his work to the individualistic tradition. In more recent times, theories that emerged from individualistic tradition increasingly started taking into account social and contextual factors that affect human development. These factors are ascribed much greater importance in social learning theories.

2.3.2. Social Learning Theories

In the individualistic traditions reviewed above, the social environment of the learner was rarely taken into consideration in educational studies (Gardner, 1987). This was to change when the work of Russian scholar Lev Vygotsky (1896-1934) pointed out the importance of interaction for human learning and development. Vygotsky's ideas are in the roots of many contemporary social learning theories including those bearing on technology-enhanced or e-learning. He studied and highlighted in many of his works that biological and cultural development do not occur in isolation (Driscoll, 1994). In contrast to other educational thinkers including Piaget, Vygotsky focused on the connections between people and the cultural context in which they act and interact in shared experiences thus constituting meanings, significances and understandings in a collaborative process (Riddle and Dabbagh, 1999).

Vygotsky's ideas inspired many educational researchers and practitioners. His ideas have been developed further by his colleagues Luria and Leont'ev in the Soviet Union and much later by western educators and psychologists (Lindblom and Ziemke, 2003). For instance, Leont'ev, building on the ideas of Vygotsky, established the foundations of what would later be know as Activity Theory (Engestrom, 2001) while Lave and Wenger (1991) referred to the ideas of Vygostsky as their basis for developing and introducing the concept of situated learning. Stahl (2003), however, goes still further back when mapping the genesis of social learning theories to philosophers that influenced social theorists – the works of Marx and Hegel.

Compared to the category of individualistic learning theories, the social category is larger, as many contemporary theories attach much greater importance to the social environment. Hence, this category represents a generic perspective that views learning as "participation in social processes, emphasizing both the issues of knowing, and issues of being and becoming" (Elkjaer, 2003, p. 39). In social learning theories, development and learning are considered as indivisible processes. This leads the social learning theories to explore beyond the narrow views that focus on individuals' minds – towards understanding the process of socialisation and the centrality of context in all learning experiences. In other words, the main difference between the individualistic and social learning perspectives is that the former one neglects the ontological dimension of learning and focuses only on the epistemological dimension (Elkjaer, 2003).

2.4. Behaviourist, Cognitivist, Constructivist and Social Constructionist Perspectives

Another common approach to classifying learning theories is based on differentiating them into learning positions (or perspectives): behaviourist, cognitivist and constructivist. These three perspectives have common characteristics, which sometimes blur the boundaries between the three; however, the perspectives are distinctive enough to be treated as discrete positions (Ertmer and Newby, 1993). This section discusses each of the perspectives contrasting their characteristics and positioning them in relation to e-learning research.

Behaviourism studies learning by observing changes in frequency and form of observed learning performance. In other words, the behaviourist approach acknowledges learning as being accomplished when an appropriate response is demonstrated by a learner. The key elements in the behaviourist account of learning and development are the stimulus and response (Mills, 2000). A typical behaviourist study can constitute, for instance, giving a mathematical task to calculate the sum of two numbers (i.e. stimulus) and observing the answer (i.e. response) given by a learner. The key components of behaviourist study involve identifying the association between the stimulus and the response. Focusing on the desired outcome and the likelihood of observing similar outcomes in the future, the learner is viewed as reactive to certain conditions and those reactions are in turn viewed as predictable and measurable (Ertmer and Newby, 1993). Behaviourism does not consider the structure of student knowledge, nor the active role the student takes in learning. Although considered simplistic, and often travestied in accounts of

Pavlov's canine subjects, behaviourism is often accredited as an important influence when considering the influence of assessment on learning (Biggs, 2003b).

Cognitivism emerged in the late 1950s when learning research started to deviate from behavioural techniques and models. Rather than focusing on observable behaviour, cognitivism emphasised the complex cognitive processes such as concept formation, thinking, problem solving and information processing. Learning theories that are based on the cognitivist perspective focus on the concepts of knowledge acquisition and internal mental structures. These theories conceptualise the processes of student learning and particularly, the ways information is stored, organized, received and retrieved by the mind (Ertmer and Newby, 1993). Hence, cognitivism represents a progressive shift from behaviourist views and represents a further stage of complexity in pedagogic research and in the evolution of instructional technologies in particular (Cooper, 1993).

While the conceptual approaches of cognitivism significantly deviate from the behaviourist school, the studied factors often overlap with those studied by behaviourists. Cognitivists, in similar fashion to behaviourists, focus on the role of practice, illustrative explanations and examples, and other similar techniques. In contrast to behaviourists, however, cognitivists attach greater importance to understanding the role of memory in the learning process, the functions of information transfer, and the processes that activate transferred and stored knowledge. As a result, cognitivist theories propose methods to encourage learners to take appropriate learning strategies and to structure teaching practices for helping learners to make knowledge meaningful (Ertmer and Newby, 1993).

Constructivism has acquired increased attention in recent decades, and is considered to be the most widely recognised perspective in modern e-learning research (Thorpe, 2001). It defines learning as the creation of meaning from experience. The fact that constructivism considers learning to be a mental activity, makes this perspective a branch of cognitivism. However, the concepts of constructivism significantly deviate from those of cognitivism, which justifies a separate positioning in this classification. The main difference between the two perspectives is in their approach towards conceptualising the ways in which knowledge is conceived. Unlike cognitivists and behaviourists who believe that knowledge exists independently of the mind and can be mapped upon the learner, constructivists consider knowledge and the mind to be inseparable. In other words, constructivists conceive knowledge to be *constructed* from interpretations of personal experiences, rather than *acquired* from the external world (Jonassen, 1991). As knowledge constitutes internal interpretations of the external world, the achievement of a predetermined correct meaning is impossible. Hence, the internally constructed knowledge undergoes constant change. This change of the flexible structure of knowledge is argued to be the result of personal experiences (Bednar *et al.*, 1992; Ertmer and Newby, 1993).

The socio-cultural environment is considered one of the most influential factors that affects learning. Constructivists consider behaviour as 'situationally determined'. For example in language learning, acquisition of new vocabulary can be enhanced by the use of the words in context (in contrast to learning these words from a dictionary). Brown *et al.* (1989) and later (Brown, 2001), argue that the content knowledge must be embedded in situations in which learning is planned to take place. This requires the practitioners to design learning tasks according to the lived experiences of students. Constructivists do not perceive the memory to be a container with crystallized information. The memory itself is considered to be in constant flux – evolving with new situations, interactions and activities (Ertmer and Newby, 1993). Constructivists therefore advocate the propagation of available knowledge flexibly, rather than in 'packaged schemas'.

Social Constructionism (Social Constructivism) is part of the wider constructivism family and has the same roots. Despite distancing itself from behavioural and cognitive approaches, constructivism is still based on an individualistic approach (even when discussing the role of interaction in learning). However, some scientists, such as Damasio, perceived this as a dualist assumption (Young and Collin, 2004). Martin and Sugarman state that the constructivism perspective failed due to its individualistic approach and questioning, "how human beings are able to share so much socially, to interpret, understand, influence their activities with one another" without reference to "social interaction, context and discourses that make self-reflection" (p. 9). The dual assumptions of constructivism challenged the explanation of the approach and fostered the development of models which moved increasingly towards a social constructionism perspective (Young and Collin, 2004).

Hence, social constructionism involves a social rather than individual focus – attaching a greater importance to social interaction (Young and Collin, 2004). To quote Gasper, knowledge, consequently, is "the product of our social practices and institutions and the interactions and negotiations between relevant social groups" (Gasper, 1999, p. 855). In other words, social constructionism perceives knowledge to be inseparable from social processes (Young and Collin, 2004). Among the scholars who can be categorized as constructivists are Piaget and Kelly. They perceived knowledge construction as mainly an individual activity – a process that is connected to the external world but not necessarily to social interaction (Smith, 1998; Young and Collin, 2004). In contrast to constructivists, those who base their work on Vygotskian tradition and emphasized the importance of social interaction in knowledge construction are usually categorized as social constructionists (Pear and Crone-Todd, 2002; Smith, 1998; Young and Collin, 2004).

2.5. Review of Related Learning Theories

Learning theories attempt to explain the variations in learning outcomes and effectiveness of certain pedagogical practices by looking at psychological and physiological factors that affect learning (Illeris, 2009). This section presents an overview of some of the contemporary learning theories that are currently being debated and discussed. A great number of learning theories are emerging constantly and are being developed. Some of those are referring to more traditional concepts of learning, while others are trying to explore new opportunities and introduce new ways of thinking (Illeris, 2009). The variations in the learning theories emphasize different aspects of learning and hence are useful for different purposes. These variations in emphasis are driven by the differences in the approaches that the theorists are applying to the problem of learning (Wenger, 1999). The focus of this section however, is placed on theories that conceptualize learning from the 'prominent' (Young and Collin, 2004) social constructionist perspective.

2.5.1. Situated Learning Theory

The situated learning theory, introduced by Lave and Wenger (1991), has become a significant and influential body of work. The concepts that Lave and Wenger discuss in their work on situated learning are consistent with the current body of knowledge, which is developing as a result of research in learning, education and cognitive sciences since the 1980s. The theory of situated learning was based on a long-term examination and study of learning processes that take place within and beyond the context of formal education. The main focus of Lave and Wenger was, however, primarily on learning within occupational communities and in a workplace (Fox, 2000).

Situated Learning theory highlights the relationship between learning and the social situations in which it takes place. Rather than focusing on the mechanisms of acquiring knowledge, Lave and Wenger proposed the concepts of identifying learning within certain forms of social interaction and participation. Without making an attempt to explain the nature of cognitive processes that accompany learning, the authors discussed the types of social engagements and appropriate context for the learning to take place (Hanks, 1991).

One of the essential elements in situated learning theory is the engagement of a learner as a participant within a community – initially to a limited degree and later on becoming a more intensive participant. This concept is introduced by the authors with the notion of 'legitimate peripheral participation' (Hanks, 1991). Lave and Wenger (1991, p. 35) argue that legitimate peripheral participation is not limited to a situated practice. It is in contrast, "a descriptor of engagement in social practice that entails learning as an integral constituent". Hence, the authors argue that the learning process, rather than occurring within isolated individuals, is inseparable from ongoing activities and practices that occur in communities and via social interaction. The importance of social interaction leads to discussion of another critical element of the situated learning theory – the influential notion of 'communities of practice'.

The concept of a community of practice constitutes a group of people who are involved in a shared practice. Lave and Wenger (1991) elaborate the concept by discussing the triadic group relations, between 'old-timers', 'journeymen' and 'newcomers'. The newcomers usually learn from old-timers however, at the same time, they also contribute to the work of the group, which exemplifies the notion of legitimate peripheral participation. Additionally the members of the group can have different interests and viewpoints, hence contributing to the shared practice differently. The levels of participation and diversity of contributions are used for explicating the notion of communities of practice. Subsequently, the authors explain the concept of the community of practice by the multiple levels of member participation. They do not imply the existence of identifiable groups or activity systems within the community (Lave and Wenger, 1991).

In summary, situated learning theory emphasises the importance of communities of practice and the legitimate periphery as a site for participation in the learning practice. The theory views the transformation of members within the community of practitioners and social organization to be essential for learning. However, some scholars (Anderson *et al.*, 1996) criticise situated learning theory for its lightweight consideration of known facts from the area of cognitive psychology – claiming that Lave and Wenger selectively focus, for instance, on some of the cognitive phenomena while ignoring others. Yet the same authors acknowledge the value of situated learning theory in raising the awareness about certain aspects of learning that were previously unappreciated.

2.5.2. (Cultural-Historical) Activity Theory

The cultural-historic activity theory emerged as a result of the work of a Soviet psychologist Lev Vygotsky in 1920s. This work was later developed by his colleagues Alexei Leont'ev and Luria gaining the attention of the Western world after the late translations of their work into English. At the same time, some Anglo-American research has also been following similar lines of thought. Hence, it is possible to recognise similarities between the activity theory and the perspectives that are in line with Dewey's pragmatism and Mead's symbolic interactionism (Kuutti, 1996).

According to Engestrom (2009), the paradigm behind activity theory has undergone significant changes as a result of three generations of research. The first generation, led by Vygotsky, proposed the idea of cultural mediation – a notion that revolutionised the approach for understanding individuals, which now requires consideration of an agency of individuals who used and produced mediating artefacts. In other words, this idea led to an argument that the individual could only be understood with consideration of his/her cultural means (Vygotsky, 1978). Hence, the unit of analysis was changed and had to contain also the objects and materials that were considered as cultural entities (see Figure 2-2). The mediated artefacts can vary widely from instruments, signs, procedures machines and methods. The common feature between the artefacts is their mediating role between the subject and the object. However revolutionary the idea may be, this unit of analysis, throughout the first generation, is believed to be individually focused which was considered the main limitation of the approach. This was to be overcome by Leont'ev, who initiated the second generation of research.

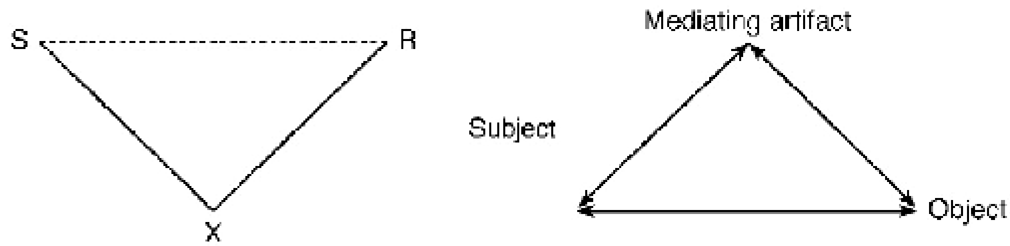

Figure 2-2: Vygotsky's model of a mediated act.

Leont'ev (1981), developed the initial paradigm further by introducing the notation of activity. Rather than focusing on individual subjects and individual actions, he proposed consideration of complex interrelation between the subjects and their communities. Building upon Vygotsky's initial model he introduced the structure of activity system (Figure 2-3) that extended the earlier triangular model.

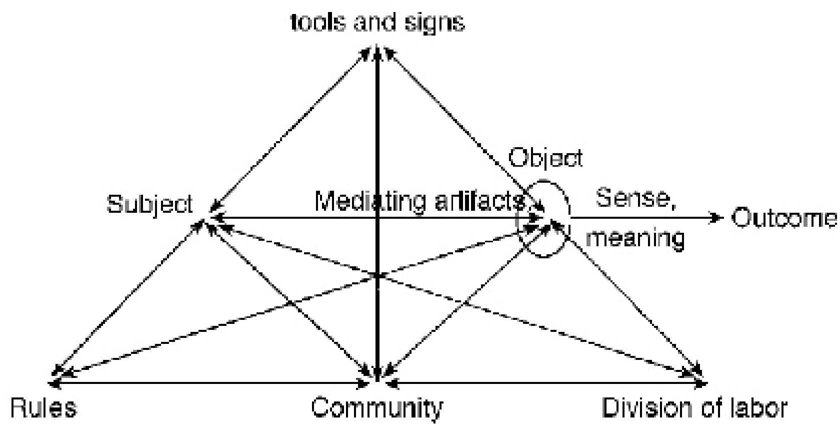

Figure 2-3: Human Activity system, proposed by Leont'ev.

Unlike earlier psychological theories, which focused on a single human action as a unit of analysis, Leont'ev's activity system includes the minimal meaningful context as part of the unit (this unit is later referred to as activity). He defines activity as: "a nonadditive, molar unit of life for the material corporeal subject" (Leont'ev, 1981, p. 67). Hence, activities are under constant non-linear and discontinuous change and development. The constantly changing activity that includes consideration of the context makes the object of the research essentially collective, even if individual actions are to be studied (Engestrom, 2009).

The third generation activity theory is still considered to be in the process of development. The challenge of the activity theory in this stage is to offer conceptual tools for understanding dialogue, multiple perspectives and networks of interacting activity systems. It is at this stage that various learning theories and frameworks overlap with the concepts of activity theory. Latour's actor-network theory and Bakhtin's concepts of dialogicality are some of the theoretical concepts that, according to Engestrom (2009), overlap with the activity theory. At this stage of development the complexity of activity theory increases due to broader consideration of the concepts. There are a large number of conceptually interrelated elements that constitute and explain activity theory – these are objects, actors, rules, tools, identities and levels of activities. Elaborating each of those elements is outside the scope of this thesis. However, the most important concept that needs to be specified in the brief overview of the theory is the following: the third generation activity theory includes at least two interacting activity systems, as shown in Figure 2-4. In this model the objects (Object 1&2) of the interrelating activity systems are moving targets that jointly construct the third object (Object 3). However, activity theory suggests that all the activity systems comprise a network of activity systems. This network constitutes the human society as a whole.

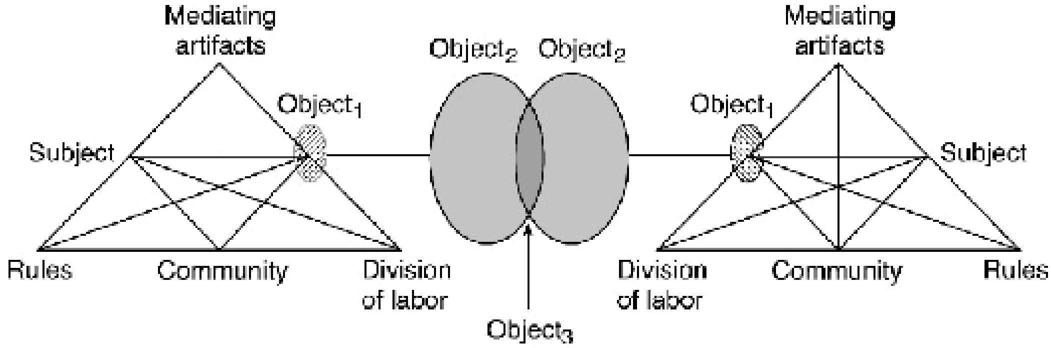

Figure 2-4: A model for the third generation of activity theory that includes two interacting activity systems

Activity theory is of great interest to contemporary educational research. Various citation-related factors constitute the evidence of an exponential increase in the attention being drawn towards activity theory. The trend is clearly visible from Figure 2-5 which depicts the growth in the numbers of the citations and the use of search terms associated with the theory – indicating the penetration of the concepts into the Anglo-Saxon literature (Roth and Lee, 2007). The fairly recent discovery of this research tradition (and the activity theory itself) and the observed exponential growth of attention to their work, gave birth to statements that attributed activity theory to be "one of the best-kept secrets of academia" (Engeström, 1993, p. 64).

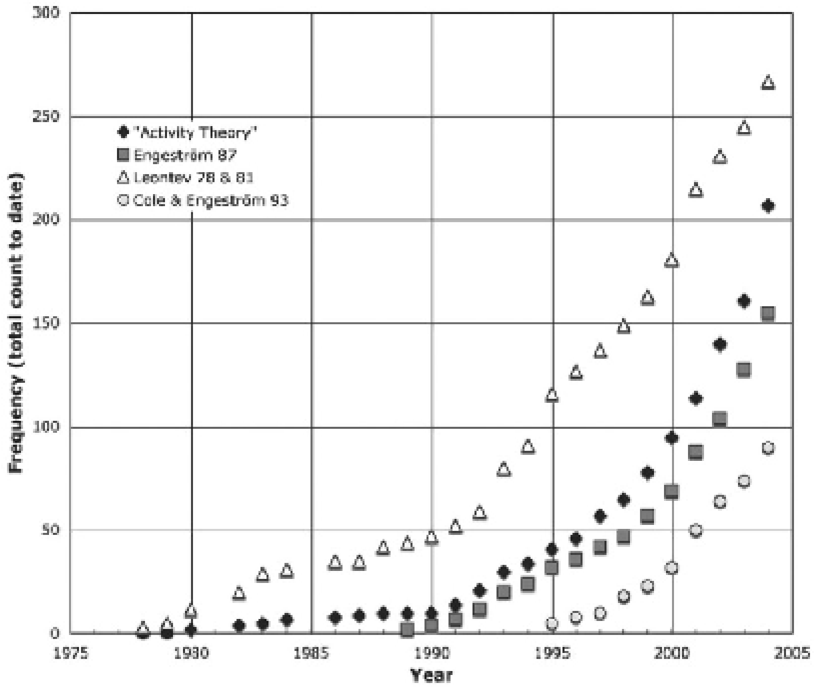

Figure 2-5: Frequency of citations on cultural-historical activity theory during the last three decades (Roth and Lee, 2007)

Activity theory is believed to carry significant potential for educational practitioners. Its main focus is development and learning that encompass the system as a whole – combining various subjects and communities that constitute it. Adopting activity theory as a framework for designing educational practice offers a number of benefits. For instance a practice based on activity theory allows the learners and other stakeholders to have opportunities to participate in forming and controlling their teaching and learning environment. It also allows learners to retain greater control over aspects of their experiences and to expand the actions in personalized ways (Engestrom, 2009). Yet, Roth and Lee (2007) indicate, that activity theory cannot be viewed as a master theory or offer a quick fix. By its origin and ideology, activity theory compels researchers to update, transform, develop and renew the theory continuously – that reflects the nature of the theory itself.

2.5.3. Social Learning Theory

The social theory of learning was proposed by Wenger (1999) by developing his earlier work published jointly with Lave (1991), and building on the concept of Communities of Practice. Wenger's social learning theory contains four main components: practice, meaning, community, and identity. Subsequently, these four components constitute the central element of learning. Wenger argues that these components (see Figure 2-6) are tightly interconnected and are mutually defining. He even suggests a possibility of swapping any of the four components with the central element – learning itself – without disturbing the integrity of the diagram and the system it represents. Hence, Wenger broadens the conceptual framework of communities of practice, offering many points of entry for researchers, academics and practitioners. At the same time he leaves the concept of communities of practice as the constitutive element of the theory.

Figure 2-6: Components of a social theory of learning (Wenger, 1999)

While the notion of communities of practice was introduced in section 2.5.1, this section further elaborates this essential element of the theory. Wenger loosely refers to communities of practice as groups of people who share an interest, craft or a profession, or who have common interests in the field. He considers communities of practice an integral part of people's daily lives – informal and lacking explicit focus due to their pervasive nature (Wenger, 2009). The author believes however that the communities of practice encompass and reflect human learning.

The social theory of learning does not necessarily associate learning with classroom, or training sessions but rather makes it inseparable from daily experiences. It considers learning to be an essential part of peoples' participation in the communities and organizations. Hence, this theory is based on assumptions that:

a. Humans are social beings and this fact is a central aspect of learning. Based on this assumption, Wenger bounds social participation to [i] *practices* of social communities and [ii] construction of *identities* – referring to these concepts as the essential elements of the theory (Figure 2-6).
b. Knowledge is a matter of competence in a valued activity (i.e. singing in tune or writing poetry).
c. Learning is a matter of participating in such activities.
d. Meaning is the ultimate by-product of learning that allows experiencing the engagement as meaningful (Wenger, 2009).

While Wenger considers learning a ubiquitous process that cannot be stopped or separated from experiences, he stresses the natural desire for accelerating learning, directing it and taking charge of it. Yet, the theory of learning that Wenger proposes is not prescriptive and is rather general. His theory is proposed as a guide on what educational researchers and practitioners should pay attention to, what pitfalls should be expected and how the problems should be approached. Hence, Wenger, calls for continuous reflection on the fundamental assumptions about the nature of learning (Wenger, 2009).

The major criticism to the social theory of learning is noted by Wenger himself. He particularly admits taking the biological, neuropsychological and cultural and linguistic developments for granted and admits possible overlaps with other theories of learning. However, by focusing on the concept of communities of practice, the social theory of learning distinguishes itself from other conceptual views and frameworks that describe learning.

The research on the social theory of learning has acquired considerable attention; however, this area of research is still relatively new (Johnson, 2001). It is particularly true with respect to the use of the theory in online learning. The social interaction that became possible with the advance of information technologies fosters the research in so called virtual communities of practice. This leads to studies of social theory of learning within the context of online learning. The research, which looks into the use of conceptual contracts of social theory of learning, reports benefits as well as disadvantages associated with the application of the theory in e-learning. Particularly, for instance, text-based communication tools are reported to encourage introverted people interacting with the extroverted cohort on equal terms. At the same time, the studies report an increase of student withdrawal or attrition from virtual communities of practice and stress the need adequate facilitation techniques and appropriate scaffolding for enhancing virtual communities in the context of online learning (Johnson, 2001).

2.5.4. Distributed Cognition

The theory of distributed cognition was developed by Edward Hutchins in the late 1980s. Considered a branch of cognitive science, according to Flor and Hutchins (1991, p. 37), distributed cognition is "*the study of: the representation of knowledge both inside the heads of individuals and in the world; the propagation of knowledge between different individuals and artifacts; and the transformations which external structures undergo when operated on by individuals and artifacts*". It is widely perceived as a theoretical approach that recognizes human cognition as a socially distributed phenomenon. This approach views human cognition as distributed across individuals, artefacts and a multitude of interactional mediators (Nasir and Hand, 2006).

Distributed cognition is not limited to explaining human learning, but rather encompasses learning as part of a wider consideration of the nature and function of cognitive and physical activities. Distributed cognition however, tries to address how knowledge emerges and work is accomplished as a result of the complex interaction of system components. According to this theory, individual learning cannot be explained without the consideration of the overall system in which the learner is located (Hutchins and Lintern, 1996). Similar to situated learning and cultural-historical activity theory, distributed cognition moves the focus of analysis away from the individual towards the 'real world' in which the learning takes place. This 'real world', often referred to as context, is usually a highly complex social and technological environment that is dispersed throughout time and space. Hence the analysis of learning within the theory of distributed cognition moves toward studies of multiple, co-dependent learners and their social organization of tools and artefacts that constitute a cognitive system (Perry, 2003).

These cognitive systems are very similar to the concept of *activities* (from cultural historical activity theory that was discussed in section 2.5.2). For instance, successful flight of a plane cannot be explained without understanding the unity of interacting people and artefacts, regardless of the depth and breadth of the pilot's knowledge. Successful flight, in this example, becomes a unit of analysis and is viewed as a cognitive system. Some practitioners refer to the cognitive system as a 'functional system', which suggests an even greater dispersion of the focus from studying a sole individual. However, distributed cognition does not disregard the processes inside the head. It considers both – trying to understand the mutually affecting transformations that occur inside and outside the brain. This fact differentiates distributed cognition from the traditional cognitive sciences (Nardi, 1996).

The analysis of cognitive systems is not limited to the study of its components. Another major emphasis of distributed cognition is on understanding the mechanisms that coordinate relations among individuals and artefacts. In other words, how individual components align and act within a distributed process (Flor and Hutchins, 1991). From the perspective of distributed cognition, the analysis of the teamwork of a group of software programmers, for instance, can focus on understanding the coordination of their efforts: distribution of information, exchange of knowledge, and the common ways of using tools. Hence, distributed cognition perspective encompasses studies of collaboration and interaction within the system – addressing the quality of interaction and the determinant characteristics of interrelated artefacts (Nardi, 1996).

It is apparent that distributed cognition shares some of its concepts with activity theory and situated learning. For example, the similarity between the units of analysis, as defined in distributed cognition and activity theory (cognitive system versus activity), has already been mentioned. However, the main association of distributed cognition to other theories is defined by the central role that is given to understanding the context. All of the covered theories emphasise the need to look at the intertwined processes that originate and constitute human thought. These theories however, suggest approaches that differentiate them from one another.

Nardi (1996) compares the theories from various perspectives: [a] the structuring of the activity by its goals and motives; [b] the role of artefacts in learning; and [c] the distinction between people and non-human artefacts. The following concise overview of Nardi's comparison can clarify theoretical concepts and amplify the distinctive characteristics of distributed cognition. The practice that adopts distributed cognition begins with positioning a system goal. A rather similar concept to a system goal is used in activity theory, which shapes the activity by its object. The object-goal is the beginning point of analysis in both activity theory and distributed cognition, which sets them apart from situated learning theory. In situated theory the goals and motives are believed to be "post-hoc rationalisations whose meaning can arise only within the immediacy of a given situation" (Nardi, 1996, p. 79). Hence, the idea of the object-generated processes is rejected in the situated perspective.

Another important distinction emerges from the distinct conceptual approaches to the role of persistent structures, such as artefacts, institutions and cultural values. The extent to which persistent structures shape a learning activity differs from one theory to another. Nardi (1996) argues that of all the reviewed theories, distributed cognition takes the study of persistent structures most seriously. The practice behind distributed cognition provides detailed analysis of artefacts, such as navigation tools, airline cockpits, spreadsheets and computer-aided designs. The use of artefacts in real situations is studied in detail. It is believed that the artefacts can be designed and redesigned in respect to the situation. For example, the analysis of the cockpit devices can inform on the imposed memory requirements.

The last distinction that Nardi (1996) explicates is the variation in the approaches for analysing human and non-human artefacts. The fundamental difference of the notion of distributed cognition is in its view of people and things (non-human artefacts) as conceptually equivalent. Hence distributed cognition remains in line with traditional cognitive science and only widens it by including interrelated artefacts. In contrast to this, activity theory rejects the idea that humans are equivalent to non-human agents. This is due to the emphasis on the motive and consciousness that can only be attributed to humans. In activity theory, artefacts can only serve a mediating role in the process of human thought and activity. The situated learning theory is less explicit and more abstract on the specificities between the human and non-human artefacts, yet they generally portray people and non-human artefacts as qualitatively different.

In summary, distributed cognition studies cognitive systems whose structures and processes are distributed across individuals, between groups of individuals and their external environments, dispersed though space and time. The analysis of distributed cognition is centred on studies of interaction between the components of the system rather than the components themselves. The theory of distributed cognition is perceived as promising for understanding interactions between people and the mediated artefacts. Casting a holistic view on the environment and the people who are part of it, the concepts of distributed cognition are being adopted in various disciplines. For instance, the central role of the context in distributed cognition makes it widely applicable in human computer interaction studies (Hollan *et al.*, 2000). Distributed cognition can also be informative for Computer Supported Collaborative Learning (CSCL), Computer Supported Collaborative Work (CSCW), distance and online learning fields, as it can address the issues of collaborative problem solving and understanding of the role of mediating technology. Hence, the application of distribution theory can lead to contributions for stronger and clearer designs of mediating technology (Perry, 2003).

2.5.5. Connectivism

Learning theories such as constructivism have been developed at a time when teaching and learning was not influenced by information technology. Today, technologies are widely used at educational institutions and in teaching practices. The available technology reduces the cost of processing, storing, and transmitting data and information. Existing knowledge gets out of date much sooner than was previously the case and currency of information is central to the learning experience. As a result concepts like the 'half-life of knowledge' are being introduced that define "the time interval over which half of any body of knowledge becomes obsolete and no longer relevant" (Karash, 2001). The half-life of knowledge in the area of technology and some other scientific fields is as short as few months (AlBanna, 2000).

These changes have a significant impact on the method of instruction and process of learning. Some of the changes are well depicted by Karen Stephenson who argues that experience had been considered to be the best way of learning, but at the same time highlights that people are unable to experience everything. She believes that it is possible to use other people's experiences and make them become the surrogate for knowledge. "I store my knowledge in my friends is an axiom for collecting knowledge through collecting people" (Stephenson, 1998, p. 1). These ideas are in the roots of connectivism.

George Siemens argues that the available behaviourist, cognitivist, and constructivist perspectives have limitations and do not comply with the requirements of the digital era. The connectivism learning theory, proposed by Siemens, defines learning as "…a process that occurs within nebulous environments of shifting core elements – not entirely under the control of the individual" (p. 4). He states that knowledge can reside outside of individuals, i.e. within organizations or databases. Consolidating this notion, he further suggests that "…connecting specialized information sets, and the connections that enable us to learn more, are more important than our current state of knowing" (Siemens, 2005, p. 4).

Connectivism aims to take cognizance of the process of decision-making based on rapidly changing foundations and constant emergence and acquisition of information. As the amount of information continues to grow and evolve, access to what is needed is more important than what the learner possesses at that moment in time. When information, however, is needed, but not known, the ability to plug into sources to meet the requirements becomes a vital skill.

Some of the principles of connectivism encompass the following:

- Learning and knowledge rests in diversity of opinions.
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in non-human appliances.
- Capacity to know more is more critical than what is currently known
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Ability to see connections between fields, ideas, and concepts is a core skill.

Furthermore, connectivism is believed to address the challenges associated with knowledge management. Information, often referred to by the author as the basis of knowledge, resides in a database. For learning to take place the information needs to be connected with the right people in the right context. The author argues, that connectivism addresses the challenges of organizational knowledge – placing the theory outside the established categories of learning theories and perspectives (Siemens, 2005).

One of the opponents of Siemens, Verhagen, argues that the proposed concepts of connectivism cannot be considered to cohere into a tenable learning theory. He continues saying: "connectivism is not a learning theory, but a pedagogical view on education with the apparent underlying philosophy that pupils from an early age need to create connections with the world beyond the school in order to develop the networking skills that will allow them to manage their knowledge effectively and efficiently in the information society" (Verhagen, 2006, p. 1). He states that ideas of Siemens do not explain verifiable learning phenomena and do not contain a link to arguments and examples. Kerr (2007), intrigued by Siemens' ideas, says in his blog: "something interesting is definitely happening". He continues however, saying that nothing radically new is there for proposing a new learning theory. He argues that other theories, particularly distributed cognition, already encompass the concepts of connectivism. Quoting Kerr from his blogpost, "I think the new territory which George Siemens connectivism and Stephen Downes connective knowledge seeks to claim has either already been claimed by others or has been better done by others" (Kerr, 2007).

However, connectivism has also got its supporters and co-developers of the concept such as Stephen Downes. He shares the views of Siemens that knowledge is distributed across a network of connections and that learning consists of the ability to construct and harness those networks. He disagrees with the giants of educational philosophy opposing the major concept of learning. He argues that there is no real concept of transferring knowledge, making knowledge, or building knowledge. Downes states that knowledge is distributed across a network of connections; hence learning constitutes an ability to construct and traverse those networks (Downes, 2007).

The idea of connectivism has gained considerable attention and acquired many followers in recent years. The educational blogosphere extensively discussed the concepts of distributed learning and the proposed 'theory for the digital age' (Kop and Hill, 2008). The first Conference (Connectivism 2006) solely dedicated to the theory of connectivism gathered more than 300 delegates – illustrating the increasing attention the proposed concepts have recently generated.

There is no doubt that the concepts of connectivism are still being developed and that the notion is in a raw stage. However, according to Kerr (2007), radical changes are apparent in the educational domain: a multitude of web applications that enhance learner collaboration and communication are in use; new learning environments have emerged aimed at supporting educators and students; global networks and communities of interest are constantly being formed. A paradigm shift, indeed, may be occurring in educational theory, which may indeed lead to the growth of connectivist ideas into a new epistemology (Kop and Hill, 2008). This thesis, as elaborated further down, attempts to accommodate the ideas behind the notion of connectivism. It openly welcomes and explores the new perspectives of learning research that focuses on networks of connected individuals and communities. This thesis builds its argument by incorporating ideas influenced by the notion of connectivism and attempts to contribute to the academic debate on the actual and potential benefits of understanding the capability of inter-related social networks.

2.6. Summary and Conclusion

This chapter summarises the development of educational schools and theoretical foundations that underpin the multifarious pedagogical and technological designs of the present day. The main goal of this chapter is to cast a retrospective view on the development of human learning theories and briefly to overview the major conceptual perspectives and frameworks that inform modern initiatives in education theory. By doing so, it highlights the momentous developments that altered the conceptual approaches to learning and suggested changes to educational practitioners. Having outlined the historical developments, this chapter also encompasses more recent lines of thought within the permissible limits of this thesis. It selectively summarises some of the contemporary learning theories that attracted greater attention in recent years and comments on their potential to inform the practice of online learning. Hence, this chapter prepares the reader for further and more detailed review of the learning literature. Following from this chapter, the further review (Chapter 3) addresses the pedagogical designs and characteristics that are aligned with the concepts, which are believed to be essential in contemporary learning theories.

This chapter starts by setting the stage for unfolding the history of ontological and epistemological developments. It briefly introduces the reader to philosophical ideas that stand in the sources of development of educational theories. It then introduces the major categories of individualistic and social perspectives in relation to their philosophical roots. The chapter extends introducing the behaviourist, cognitivist, constructivist and social constructionist traditions in line with the growth of educational literature. It finally overviews some of the theories within the social constructionist tradition and highlights their potential for praxis in the field of online learning.

3. Defining Engagement and Participation within the Boundaries of the Study

3.1. Introduction

The words engagement, participation, action and interaction have already been used as metaphors in the early chapters of this thesis without a clear-cut definition or sufficient explanation. As these metaphors encompass the main subject of the study, it is necessary to make the definition of the terms explicit. This chapter defines and discusses these terms within the boundaries of this study – aiming to frame the research and eliminate possible misconceptions.

This chapter overviews the pedagogical value of student engagement and participation. It discusses the prevailing views in the educational literature that addresses the benefits associated with student engagement, participation and interaction. The chapter also discusses the niches that require further research and the benefits that may be acquired from their practical application. It finally discusses the methods used in the literature and sets out the methodological map for minimising possible limitations of future studies.

3.2. Student Engagement: Concepts, Benefits and Prospects

Student engagement is suggested to be an important precursor of learning. Student engagement or the lack of it (also referred to as disengagement or alienation) has been of interest to many researchers (Carini *et al.*, 2006; Cumming, 1996; Newmann, 1992; Vibert and Shields, 2003). The challenge of student disengagement and the consequences that follow have been recognized as a serious issue, especially in the middle years of schooling. Disengaged students fail to complete assignments, disrupt the classes or skip them altogether. In less obvious cases of disengagement, students indicate little excitement, commitment or pride in the mastery of the studied subject. Engaged students, in contrast, are associated with psychological investment in learning and hard work. Similarly, in higher education, student engagement is found to be a reliable predictor of college success: academic achievement measured by GPA and retention or persistence toward a degree (Robbins *et al.*, 2004). In addition to achievement, studies report qualitative differences in student behaviour such as attending classes, reading or reviewing materials (Svanum *et al.*, 2009). Yet, operational definition of engagement is not a straightforward task (Newmann, 1992). An epistemological view on engagement, which questions the purposes, benefits and perception on engagement, can provide the necessary foundation for defining the term within the boundaries of this study.

Dictionary references define engagement as *commitment* (Corréard *et al.*, 1997), *pledge* (Hoad, 1993), *official/social obligation* (Chalmers and Pierquin, 2002), a process of *involvement or attraction* (Jewell *et al.*, 2001). These definitions can be associated to mechanistic and behavioural, as well as emotional and motivational aspects of engagement. The literature on engagement reflects the diversity of approaches taken to study the various aspects of engagement. The following section reviews the literature that attempts to conceptualise engagement - elaborating on the perspectives of engagement studies.

There has been considerable research on student engagement since the mid-1990s. The research is usually focusing on the retention rates, level of participation and achievement data, reporting correlations associated with engagement and even positing causal relationships. Yet, reports stress lack of engagement of students in schools and with their communities (Carini *et al.*, 2006; Kovacs, 1998) and make suggestions on the ways of improving student engagement (Little *et al.*, 2009). Student engagement is commonly considered to be one of the better predictors of student achievement (Carini *et al.*, 2006). Hence, student engagement is placed high on the agenda of governmental organizations and schools. Nation-wide policies and guidelines (NEALS, 2009), especially in Australia and Canada, are being introduced to improve the levels of student engagement and reduce student alienation. Pedagogies that encourage student engagement are being developed and encouraged by educational bodies.

The Higher Education Academy (HEA), an independent organisation in the UK that supports higher education institutions, identified student engagement as one of the three priorities for the academic year 2008-9. They propose a view on student engagement as a multi-dimensional concept that encompasses a wide range of activities (HEA, 2009). The diagram that captures this view is presented in Figure 3-1.

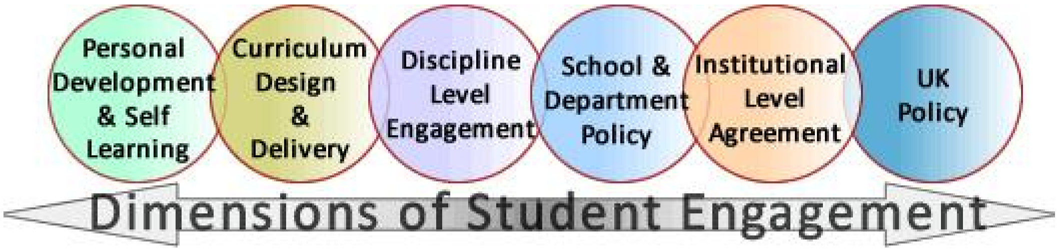

Figure 3-1: Dimensions of Student Engagement – from A Student Engagement strategy for the Higher Education Academy (HEA, 2009)

3.2.1. Approaches to Student Engagement

The variety of elements that constitute the multi-dimensional view of engagement, indicate that defining engagement may require taking a broader perspective and conducting a wider literature review. The literature on student engagement discusses various perspectives and pursues different aims in the studies of the subject. Some researchers, for instance, consider engagement from the perspective of social justice, others take an instrumentalist approach to study student participation (Zyngier, 2008). Hence, the definitions of the term vary in relation to the context and focus of a study.

Newmann (1992, p. 12) defines engagement as "…student's psychological investment in and effort directed toward learning, understanding or mastering the knowledge, skills or crafts that academic work is intended to promote". He identifies characteristics, such as active involvement, commitment and considered attention, to be closely associated with engagement. He contrasts these characteristics with superficial participation, apathy or lack of interest that attribute disengagement.

Newmann (1986) attempts to conceptualise student engagement by proposing a typology that categorises engagement into either of those domains: [a] conventional or professional technological; [b] developmental; and [c] cultural emancipatory. Building on Newmann's work and similar to concepts of Vibert and Shields (2003), Zyngier (2008) alters this typology by offering the three main perspectives on engagement: [a] instrumentalist or rational technical; [b] social constructivist or individualist; and [c] critical transformative. The review of these perspectives underpins the selection of engagement perspectives aligned to the theories of learning and pedagogies that are relevant to this study. It is therefore, necessary to review and understand the epistemology of those perspectives for conducting this study. The following section briefly summarises the perspectives and draws parallels with the learning theories reviewed in Chapter 2.

Instrumentalist or rational technical perspectives on engagement:
Viewed through the instrumentalist or rational technical lenses, engagement is considered on a technical level of achieving pragmatic educational results. Grounded in the objectivist understanding (Burrell and Morgan, 1979), the instrumentalist perspective on engagement constitutes: counting the number of participants, calculating task completion rates, monitoring student grades. Instrumentalist or rational technical studies of engagement are most usually conducted using surveys and analysis of examination/text performance data (Zyngier, 2008). Hence, these studies only 'scratch the surface' in an attempt to understand the factors behind student engagement. This 'deficit view', as Zyngier (2008) refers to the instrumentalist perspective, is the most prevalent in the studies of - and the pedagogies associated with - engagement (Vibert and Shields, 2003).

The social constructivist or individualist perspective on engagement:
The social constructivist or individualist perspective is built around student-centred pedagogy, where "student choice are located in the lived experiences of the students" (Zyngier, 2008, p. 1772). This pedagogy gives students greater control over the selection of topics, materials or ways of learning. It involves students who work individually, in self-directed pairs or small groups on a variety of tasks and projects. The social constructivist perspective considers engagement in relation to values, aims and responsibilities. Engagement is identified in the ways students learn to make individual choices, take individual responsibilities and adapt to collaborative work and management. Although student-centred pedagogy produces a more 'dignified' and 'interesting' classroom, it may sometimes conceal practices that are the cause of inequality. Vibert and Shields (2003) argue that pedagogies that are failing to encourage students to question and critique their actions and teachers who are focusing on task-oriented behaviours may reduce the social constructivist view to a more friendly version of the deficit instrumentalist or rational technical perspective.

Critical transformative perspective on engagement:

The critical transformative perspective interprets engagement in communal and social terms. This perspective focuses on experiences of collaborative and individual discoveries of knowledge in their communal and social interests (Vibert and Shields, 2003). Engagement, viewed through this lens, takes into account experiences that go beyond the traditional concepts of schooling and curriculum. The most crucial difference from other perspectives, is that the critical transformative view considers the curriculum to be explicit, negotiated and more dynamic and the experiences of students more diverse and extended (Zyngier, 2008). This view is firmly associated with the so called 'curriculum of life' (Portelli and Vilbert, 2001), an approach to pedagogy that gives coherence to disparate aspects of schooling. "The curriculum of life is grounded in the immediate daily worlds of students as well as in the larger social and political contexts of their lives. As such students' worlds and lives are not addressed as factors that need to be excused, pitied, mediated, or fixed in order to get on with the curriculum, but as the vital ground of/for learning" (Portelli and Vilbert, 2001, p. 15). It is *this* broad perspective that enables the studies of engagement to address the complexity of factors that are embedded in experienced social reality and learning.

The significant challenge of defining the term engagement is shaped not only by the ideological views, but also the divisions of approaches that researchers and educators take. Many studies that dominate the research agenda (Zyngier, 2008) are based on participatory components of attending classes, completing teacher-initiated tasks, responding to questions or participating in extracurricular activities. These studies can be categorised as behavioural and fit into the instrumentalist or rational technical perspective of engagement. Other studies take into account affective components. These components may include student perceptions on their roles at school and values embedded within a particular school. With consideration of socio-cultural, economic and ethnic status of students, a study might better fit the social constructivist or individualist perspective on engagement. Yet, research on engagement may attempt to combine numerous components (i.e. behavioural, affective, socio-cultural) that are related to more than one perspective increasing the complexity in drawing the boundaries when referring to the term engagement (Finn, 1989). This may explain why many studies (Emmer and Gerwels, 2002; Quinn, 2002) do not explicitly define the term.

3.2.2. Engagement as a Meta-Construct: Components of Engagement

The multifaceted nature of engagement leads to "proliferation of constructs, definitions, and measures of concepts that differ slightly" (Fredricks *et al.*, 2004, p. 60). Conducting a review of student engagement literature, Fredricks *et al.* deduce that the multiplicity of constructs and concepts that emerge as a result of miscellaneous (concerned with diverse subjects or aspects of engagement) studies do not improve the conceptual clarity of the term 'engagement'. They argue however, that the term engagement has a considerable potential when considered as a multidimensional or 'meta' construct. Echoing Guthrie and Wigfield (2000), the authors (Fredricks *et al.*, 2004) argue that the term engagement should be used when multiple components are present. They believe that consideration of engagement as a multifaceted concept can enrich the studies of engagement and reduce the limitations posed by research constraints that exclude the consideration of intertwined factors of behavioural, affective and cognitive effects.

Research literature, reviewed and categorised by Fredricks *et al.* (2004) defines engagement in three ways: [a] behavioural engagement – that constitutes student involvement and participation in academic and extra-curricular activities; [b] emotional engagement – that draws upon positive and negative feelings of students towards their classes, teachers, classmates and the learning environment in general; [c] cognitive engagement – that is drawn from the concept of investment and incorporates willingness to make efforts for excelling in acquiring comprehensive knowledge and skills. While categorising the studies of engagement, the authors acknowledge the dynamic interrelation between behavioural, emotional and cognitive components. They endorse studies of individual components of engagement as part of a multidimensional construct for the purpose of identifying the effects for each of the components.

Behavioural Engagement

The studies of behavioural engagement usually focus on student participation in academic and extracurricular activities. The definitions of engagement however, differ from one study to another. Fredricks *et al.* (2004) identify three main approaches that researchers take to define and study behavioural engagement.

These approaches view behavioural engagement as: [a] positive conduct – following the rules and accepted norms, avoiding disruptive behaviour (Finn and Rock, 1997); [b] involvement in learning – making an effort to learn, concentrating and contributing to the class (Birch and Ladd, 1997); and finally, [c] participation in extracurricular activities – joining sports clubs, contributing to the local community (Finn, 1993).

The literature on behavioural engagement not only caries different definitions but also highlights qualitative differences of student engagement. Finn (1989) classifies the levels of student behavioural engagement that distinguishes the levels of student commitment from variations of their participatory behaviour. Others (Carini *et al.*, 2006) advance further by comparing the levels of student engagement and learning outcomes. While the studies that associate qualitative aspects of behavioural engagement with academic progress can be informative and beneficial for many stakeholders, it is recommended to resist deducing research to a mere search for a threshold below which academic performance of students is unlikely to reach satisfactory levels (Finn, 1989).

Emotional Engagement

Unlike behavioural engagement, emotional engagement does not take into account the participatory activities of students. Emotional engagement focuses on affective elements of engagement that include: interest, boredom, happiness or anxiety. Emotional engagement also considers student attitudes towards the learning environment, school, teachers and peers. In higher education settings, teaching that encourages positive feelings, i.e. curiosity, empathy, security, are believed to be "the keys that unlock the intellect for many students" (Camfield, 2009, p. 53). The studies of emotional engagement overlap with other studies that investigate: [a] student attitudes towards school (Epstein and McPartland, 1976); [b] student motivation (Guthrie and Wigfield, 2000); [c] student belongingness and value, or in other words 'identification with school' (Finn, 1989). Unlike other studies (e.g. motivation or attitude studies) however, the literature tends to define emotional engagement more loosely. Hence, it leads sometimes to lack of clarity in the subject or the source of emotion. Additionally, the studies of emotional engagement are usually: [a] limited to self-reported measures; [b] constrained to the context of the class and learning activities; and finally, [c] relate to studies of other concepts, such as interests and values. Thus, maintaining precision and reliability in studies of emotional engagement is considered more challenging compared to studies of behavioural engagement (Fredricks *et al.*, 2004).

Cognitive Engagement

Cognitive engagement is usually associated with psychological investment in learning that goes beyond the requirements set by the course structure or the curriculum. Cognitively engaged students exhibit a preference for challenge, self-regulation and an ambitious desire to progress (Connell and Wellborn, 1991). The studies of cognitive engagement are interrelated with the literature on motivation and learning. Student 'psychological investment' (Newmann *et al.*, 1992) can be qualitatively differentiated by consideration of attributes associated with intrinsic or extrinsic motivation. Variations in the ways students value and persevere in their learning (as highlighted in the studies on motivation) can adequately reflect the levels of student cognitive engagement. In addition to motivation, learning studies can make valuable contributions for gaining insight on cognitive engagement. A qualitative distinction of student deep or surface approaches to learning can equally well reflect the levels of cognitive engagement. The levels of self-regulation and use of meta-cognitive skills and the methods for identifying them can inform the studies of student cognitive engagement (Fredricks *et al.*, 2004).

The measurement of engagement is considered challenging in each of the categories (i.e. behavioural, emotional or cognitive). The most common problems can be associated with blurred distinctions between similar items that are used to assess different types of engagement. An attempt to propose a taxonomy of engagement (Bangert-Drowns and Pyke, 2001, 2002), for instance, identifies seven levels of student engagement: disengagement, unsystematic engagement, frustrated engagement, structure-dependent engagement, self-regulated interest, critical engagement, and literate thinking. Yet, clear cut boundaries are not specified in this particular categorisation.

Additionally, the paying of insufficient attention to the source or the target of engagement is another common problem limiting the studies of engagement. Hence, the precise measurement of each engagement construct is resource-expensive. Inclusive studies of engagement - that span all the three constructs according to some researchers (Fredricks *et al.*, 2004) may be deficient in their depth or not be fully informative. Yet, fairly rigorous studies that consider more than one category of engagement are being published. Some of the studies already include elements of e-learning and use of technology as part of their research (Barkatsas *et al.*, 2009). The next section represents an attempt to summarise the epistemological views on and the empirical studies of engagement within the context of e-learning.

3.3. Student Engagement within an E-Learning Context

With the increasing presence of online learning and education, student engagement attracts the attention of researchers and practitioners who are willing to study student actions that are mediated via information technologies. The questions that were once considered in the 'traditional' context of engagement are now being raised within the context of e-learning. Before focusing on the issues such as learning outcomes, dropout rates, inclusiveness and marginalisation, that are frequently associated with discussions of engagement in a higher education context, it is necessary to highlight what the benefits of analysing student online actions are. This section is an attempt to stress the potential of analysing student online engagement and advantages that information technologies provide over the 'traditional' techniques used in studies of student engagement.

Online educational environments and platforms are integrated in a great number of universities and schools. Teachers and students are using these systems to access learning materials, interact with peers, and acquire administrative information, among other tasks. Can these online actions reflect the levels and types of student engagement? Can educational practitioners extract meaningful information about student engagement by observing the patterns of participant online actions?

The provision of services offered via educational environments evolved dramatically over the last decade. Most of the environments extend beyond their early-day role of serving as electronic content repositories. Contemporary educational environments have grown into a complex system of communication, course management and personal development tools. They provide platforms that enable participants to maintain engagement in a community of learners *when* and *where* they want (Garrison and Cleveland-Innes, 2005). These environments bring another social world into the offline lives of students (Strauss, 1978). Online environments add a new domain to the existing worlds of students. As a result, students develop new norms and conventions for interaction, expand their networks of friends and peers, adapt to the constraints posed by the systems and adopt new ways of operating within these environments (Kazmer and Haythornthwaite, 2001). The communication tools that are part of educational systems deserve greater attention for their potential of stretching beyond the classroom. They can be used for both, capturing the essence of academic development and fostering complementary social activities - encouraging openness to diversity, personal and interpersonal development (Zhao and Kuh, 2004). Student activities within the educational environment can therefore be analysed from the various conceptual perspectives of student engagement (as covered in Section 3.2.1) and with regards to various components of student engagement (as discussed in Section 3.2.2).

Hence, analysis of the ways in which students use online systems can identify and convey prominent patterns and characteristics of student engagement – mirroring the traits of campus-based student engagement and learning in general. It can therefore, supplement the traditional techniques of student engagement studies and inform practitioners on the levels and types of student engagement. At the same time however, analysis of online activities should not be substituted to 'traditional' methods that include observations and surveys on campus-based activities. Due to differences in student abilities and confidence levels in using information technologies, the results of student online engagement may be deceptive yet the benefits and disadvantages identified in studies of online student engagement are patent. Some of the benefits include consistent records of access logs, availability of longitudinal records and potential for automation. A more detailed overview benefits and pitfalls that e-learning can offer for engagement studies is provided in Section 3.5. Prior to discussing the advantages and disadvantages, the concepts of online participation, action and interaction, which are closely associated to the studies of online engagement, are needed.

3.4. Participation: Concepts and Measures

The 'learning as participation' metaphor has already appeared in Chapter 2 in relation to some of the reviewed learning theories, particularly Situated Learning theory. The literature is mainly unilateral in acknowledging the central role of participation in a learning process. But what is participation? Participation is considered an essential and indivisible component of student engagement (Chen *et al.*, 2008; Taylor, 2002). In fact, Taylor (2002) recommends identification of varying degrees of engagement by rigorous and systematic analysis of student participation. Some authors even use the terms ‘engagement’ and ‘participation’ interchangeably. This section aims to: [a] overview the literature that focuses on the concept of participation; and [b] set the boundaries for the term within the context of this study.

The American Heritage Dictionary of English Language (Pickett, 2000) defines participation as “the act of *taking part* or *sharing* in something”. A similar definition of participation is given by the Oxford English Dictionary (Simpson and Weiner, 1989) as “the action or fact of partaking, having or *forming a part* of”. The word ‘participation’ is considered a stereotype word that is free of context (Rahnema, 1992). According to Sfard (1998, p. 4), “the special power [of these words] stems from the fact that they often cross the borders between the spontaneous and the scientific, between the intuitive and the formal”. Hence, the concept of participation can be moulded into shapes that define the meaning of the word in relation to the specified context.

3.4.1. Philosophical Perspective on Participation

In educational contexts, the term participation frequently appears as part of the discourse on philosophy and policy of education. Participation has been placed high on the agenda of politicians and educational organizations since the 1980s. It is viewed mainly as the active involvement of children, students, teachers and parents in the activities that concern their lives. As a multifaceted concept, participation can be viewed from a number of different perspectives. For politicians, participation is seen as a right that is linked to freedom – something to be promoted and secured for every citizen (Masschelein and Quaghebeur, 2005). Advocating the necessity to nurture and develop the abilities of young people to participate, the topic frequently appears in the agendas of educational institutions and organizations. UNICEF, for instance, is trying to draw public attention to the topic of child participation:

> *Child participation involves encouraging and enabling children to make their views known on the issues that affect them. It ensures their freedom to express*

themselves and takes their views into account when coming to decisions that affect them. Engaging children in dialogue and exchange allows them to learn constructive ways of influencing the world around them (Bellamy, 2002).

These organizations promote action by providing practical guidelines and manuals on how to achieve higher levels of participation. The rationale for greater participation is given in relation to the capacities that students develop: [a] perspective-taking; [b] social and communicative skills; [c] abilities to construct and negotiate meanings; [d] abilities to influence their own and others behaviours (Masschelein and Quaghebeur, 2005).

Apart from political and philosophical perspectives, the term participation is frequently used in a pedagogical perspective. Learning as participation was considered as part of a long Marxist tradition that was later reflected in the works of learning theorists such as Vygotsky and Luria. The Marxist tradition viewed the development of human knowing and personal development through *participation* (Lave and Wenger, 1991).

3.4.2. Pedagogical Perspective on Participation

The concept of participation as learning attracted greater attention of educationists after the publication of Lave's and Wenger's book – 'Situated Learning: Legitimate Peripheral Participation'. In this work, the authors claimed that many social learning theories do not capture the real nature of learning due to reducing the social aspect of learning to work in small groups or pairs. Building on Vygotsky's historical-cultural paradigms Lave and Wenger argued that learning is a much more complex social phenomenon that embraces every aspect of human life; hence, should be viewed with a broader perspective. The concept of participation is central to the situated learning paradigm, as it emphasises the importance of the community and learner's role in it for the learning process (Lave and Wenger, 1991). Hence, the learning process cannot be considered a one-person act. It is, in contrast, the by-product of a participation in many communities – within or outside the educational context. Participation, from this perspective, encompasses the practices and development of identities within the communities (Wenger, 2009).

Learning, as a social process that occurs within communities, challenges the traditional view of learning. Rather than considering an individual to be essential for learning, this perspective takes the communities as the key element for learning. The classroom or lecture hall, as a form of community, is viewed as a complex social setting in which the learning is being collaboratively constructed (Leach *et al.*, 2008). This changes the notion of participation from individual actions to an interrelated complex system of communicating individuals and dynamic environment. As a result of participation, individuals are being positioned either centrally or marginally in the specified community. Thereby, a question may come to mind on whether the position (central/peripheral) of individuals within the community is in some way related to their learning outcomes? The academic discourse on this issue requires greater attention and is subsequently elaborated further in this thesis.

3.4.3. Participation versus Acquisition

While the participation metaphor acquired greater attention in the discourse on learning, it is not the only metaphor frequently appearing in the learning literature. Anna Sfard (1998) highlights *participation* and *acquisition* as the two dominating, yet polar perspectives on learning.

Both of these metaphors are indeed present in the learning literature. However, the acquisition metaphor is more frequently considered in older writings. Since ancient times, the dominating view of learning was conceived as the acquisition of something. This perspective described learning as the accumulation of knowledge and its further refinement and combination into richer cognitive structures. It is clear that this perspective implies the human mind to be a container, and the materials that are filled in the mind to be the possession/commodity of a learner. Acquisition is considered in relation to its end-point – the concept development and knowledge gain (Sfard, 1998).

A prominent deviation from the deeply rooted acquisition metaphor is embodied in the aforementioned works of Lave and Wenger (1991) and Rogoff (1990). The notions of commodity associated with the acquisition metaphor were no longer present in these works. Knowledge was considered not from the perspective of *having* but from the constant process of *doing*. Commonly referred to as a participation metaphor, this perspective did not focus on the end-point of learning, but rather on an ongoing process of engaging with learning activities. Additionally, the participation metaphor attached great importance to the context in which the learning took place (Lave and Wenger, 1991). The context, being a multifarious construct, is usually referred to as a community or culturally-bounded environment. Thus, learning, under the participation metaphor, is viewed as a process of becoming a member in a certain community or taking a position within a delimited environment.

The main difference between the acquisition and participation metaphors is that the former focuses on the individual mind, while the latter emphasises the dynamically changing and mutually influencing bonds among the individuals within a certain community – the process of becoming a part of a whole. Hence, the participation metaphor views identity as a function of being part of the community and an integral part of the whole, while the acquisition metaphor determines the identity by the standalone/individual possessions (Sfard, 1998).

Despite the major conceptual differences in these two perspectives, Sfard argues that it is impossible to establish a clear dichotomy between acquisition and participation paradigms. In fact, acquisition can be considered to be a by-product of participation – making it impossible to consider the two metaphors as mutually exclusive. Sfard, continues her argument advocating the necessity of considering both of the metaphors in combination for revealing the strengths of each of the metaphors. She continues saying that: "…too great a devotion to one particular metaphor and rejection of the others can lead to theoretical distortions and to undesirable practical consequences" (Sfard, 1998, p. 5). Anderson and his colleagues (2000) concur with Sfard's work arguing that consideration of each of the metaphors can cast light on different aspects of the educational process; hence both perspectives should be pursued vigorously.

The acquisition and participation metaphors - that are considered dominant in the learning literature - are however, neither unrivalled by other metaphors nor undisputed by criticism. Paavola (2004), in his recent work, highlights the disadvantages of each of the metaphors and proposes another metaphor – 'knowledge-creation' – as an alternative that extends the notions of acquisition and participation. He argues that neither the acquisition nor participation metaphor is able to capture the "radical advancement of knowledge or practices" (Paavola *et al.*, 2004, p. 569). Rather than considering knowledge as an individual commodity or focusing on situated practices, the knowledge-creation metaphor is believed to encompass the *collaborative* and *evolving* development of *shared* artefacts that include knowledge, ideas and practices. The concepts associated with knowledge creation do not deviate from the participation/acquisition metaphors, but rather build on both of them.

3.4.4. Online Learner Participation

The concept of participation, studied within the boundaries of e-learning, is usually referred to as online participation (or online learner participation). Hrastinski (2008), in his recent work, reviews the literature on online participation. He observes great diversity in the ways online participation is being studied; it ranges from quantifying student access of online environments, to qualitative studies of student online interaction. Hence, the methods of analysing online participation vary according to the adopted approach of each study. This diversity of approaches predisposes the multiplicity in which the notion of online participation is being conceptualised.

Some studies consider student access to the online educational environment as a measure of participation. The possible units of analysis in these studies are the number of logins, access records or the amount of time spent online. Often, student online actions, which do not lead to contributions via available communications tools are referred to as lurking (or passive participation).This phenomenon, is widely present in virtual communities and, therefore, requires greater attention for understanding it (Lee *et al.*, 2006). Yet, Hrastinski (Hrastinski, 2008, 2009) refers to studies that are limited to analysis of lurking behaviour as ‘simple’ or ‘low-level’, due to their limits of capturing the essence of student actions. The studies of passive participation though, can be greatly extended by evaluation of student active contributions made through the use of synchronous and asynchronous communication tools (Davies and Graff, 2005).

Moore (1993a), for instance, views student interaction as an element of online practice. He proposes three types of interaction: [a] learner–instructor; [b] learner–content; and [c] learner–learner interaction. Many studies (Brower, 2003; Rovai, 2002) consider online participation from this ‘interaction perspective’. In fact, Wresch, Arbaugh et all (2005) report interaction in group discussion forums to be the ‘most telling description of student participation’. Internal dialogue - in addition to more obvious modes of interaction - is also considered in studies of online participation. Thinking and reflecting as part of online interaction is highlighted in some of the studies (Bullen, 1998; Macdonald, 2003) that focus on qualitative variations/measures of learning - advocating the importance of practices that are enriched with elements of internal dialogue.

Participation, considered from the perspective of social learning theories and particularly the communities of practice, involves more than accessing learning environments or posting messages. It is considered a complex process that involves 'doing, talking, thinking, feeling and belonging' (Wenger, 1999). The process of learning as participation continues even outside of educational settings or online environments (Haythornthwaite and Kazmer, 2002; Ramsden, 1992). It is therefore, virtually impossible to capture participation in its entirety by studying online participation records only. However, online participation records can be used for acquiring an insight into the patters of online behaviour and the factors that affect them (Beaudoin, 2002; Lee *et al.*, 2006).

The conceptual differences of participation are reported by Hrastinski (2008), who reviews the previously conducted studies and categorisations of online participation. He discusses the identified six 'levels' of online participation. These categories include participation as: [i] accessing e-learning environments; [ii] writing; [iii] quality writing; [iv] writing and reading; [v] actual perceived writing; and finally, [vi] taking part and joining in a dialogue. The methods of analysing participation on the aforementioned levels may therefore, employ a comprehensive set of quantitative and qualitative techniques. The following section (Active versus Passive Participation) argues that the lower (i) level of participation may be equally informative as the higher (vi) level of participation. Thus, consideration of online participation in this thesis is not bounded by a single level of participation, but rather across all of the six. Within the scope of this thesis, online participation is viewed as qualitatively or quantitatively measurable online actions and interactions of participants. When necessary (i.e. due to restrictions of the design of this research) the definitions are narrowed down according to specificity of single studies. Before elaborating the methods of studying online participation, it is important to discuss the dichotomy of 'active' and 'passive' participation in greater detail.

3.4.5. Active Participation versus Passive Participation

The study of characteristics and quality of student participation gives rise to the dichotomy of 'active' and 'passive' participation. There are frequent reports, in the participation literature, that discuss the silent or less active participants and members of the learning community. For instance, Zhang and Stork (2001) report great asymmetry in the patterns of posting messages and initiating threads on a discussion board. They find that in the sample studied, almost half of all the postings were made by less than 8% of the community members. They classify the other 92% of less active participants as 'peripheral' members. Other studies discuss similar observations of having a 'silent majority' in an online communities such as email based discussion lists (Katz, 1998; Nonnecke and Preece, 2000) and discussion boards (Preece *et al.*, 2004; Rafaeli *et al.*, 2004). This pattern of peripheral participation is commonly referred to as *lurking*.

A lurker is widely described as 'someone who reads messages posted to a public forum such as a newsgroup but does not respond to the group' (Hine, 2000). Taylor (2002), in his study of student participation patterns, categorises the participants into three groups: [a] workers; [b] lurkers; and [c] shirkers. Workers are defined as active participants who visit the educational environment frequently and contribute to discussions. Lurkers are viewed as occasional, mostly 'read-only' participants, while shirkers are identified as parsimonious individuals whose participation is close to the minimum. Proposing this categorisation, Taylor steps away from the established dichotomy of 'lurking versus non-lurking' behaviour, by adding an extra dimension for studying the factors that affect the observed participation patterns. Most of the studies of online participation however, classify participants into two groups: more and less active.

The less active lurking behaviour is often viewed in a negative light, and the lurkers are considered free-riders (Nonnecke and Preece, 2001). Yet, lurking behaviour - when viewed from the perspective of situated learning theories – can comprise an essential part of learning. Learning, as described by the concept of 'Legitimate Peripheral Participation' (Lave and Wenger, 1991) involves the process of entering, observing and gradually becoming an active member of a community. Lurking behaviour can therefore, be ascribed to difficulties and lack of confidence in becoming part of a community. In fact, some researchers consider lurking to be a significant form of learning, arguing that lurkers progress over time by achieving levels of participation similar to the postings of active participants (Nonnecke *et al.*, 2004; Taylor, 2002).

Likewise, in their study Lee *et al.* (2006) argue that lurking should not necessarily be viewed as a negative behaviour. It may result from the sets of tension and negotiation that are encountered by less confident participants in the process of becoming more active members of the learning community. Their 'silent' participation may be accompanied by a more frequent access/reading pattern than that of the active participants – revealing their salient engagement and commitment. To avoid the negative connotations associated with the word 'lurking' an alternative, oxymoronic term – 'passive participation' – will be used to denote the contrasting concept of active participation. Taking into account the prevalence of passive participation, it is important to study and understand the patterns and determinant factors of this phenomenon. Acquiring insights on the reasons behind the exhibit of certain behaviour patterns can help educators adjust their practices to ensure the so called 'de-lurking' of less active participants earlier in the process of learning.

3.4.6. Measuring Participation

Clear definitions of measures are essential for any research. This section attempts to summarise the techniques and measures used for evaluating *online* participation. Before that however, it discusses the classification of online participation in relation to the measures as it appears in the literature.

The studies of campus-based student participation are often conducted by measuring: [a] student attendance and [b] student initiative undertaking (Voelkl, 1995). These two measures were proposed as part of the participation taxonomy proposed by Finn (1989). While constituting the lower two of the four levels of participation, they are frequently used in studies of participation (in relation to student achievement) (Cohn and Johnson, 2006; Rodgers, 2001), possibly due to their relatively simple and easily quantifiable nature.

The search of educational literature did not reveal any taxonomy that could rigorously conceptualise and offer measures of online participation. However, the review of the online participation literature, performed by Hrastinski (2008), provides an insight on the units of analysis and techniques used by researchers to study online participation. Hrastinski however, devotes little attention to the participation that is not directly related to student interaction. Measures of student access, in his work are deficient. For instance, access to learning materials or profile views, are not highlighted in his review. Hence, the measures proposed by Hrastinski are not exhaustive. Some units of analysis that were identified as a result of the literature review were added to the table; these are: [a] number of clicks; [b] number of profile views; and [c] amount of learning content downloaded or accessed. Hrastinki's table is extended further to include network-based measures that are drawn from the social network analysis domain. While acquiring greater attention in the recent studies on participation (Haythornthwaite, 2005), these measures were missing from the original table. The six categories of online participation identified by Hrastinski along with the extended list of units of analysis are shown in Table 3-1.

The units of analysis can refer to both asynchronous and synchronous modes of participation as well as employing qualitative and quantitative methods of analysis. Hrastinski reports however, that only a small fraction (8%) of research use solely qualitative methods; the majority of studies (56%) apply a combination of qualitative and quantitative methods, in contrast to 36% of purely quantitative studies.

Unit of analysis	*Level 1*	*Level 2*	*Level 3*	*Level 4*	*Level 5*	*Level 6*
Quantity of messages or units		ü	ü	ü	ü	ü
Message or unit quality			ü	ü	ü	ü
Learner perceptions			ü		ü	ü
Message lengths		ü	ü	ü	ü	ü
System accesses or logins	ü	ü	ü	ü	ü	ü
Read messages				ü		ü
Time spent					ü	ü
Table Extension: Explicit Access Units	*Level 1*	*Level 2*	*Level 3*	*Level 4*	*Level 5*	*Level 6*
Participant clicks	ü			ü	ü	
Content access	ü		ü	ü	ü	
Profile records/access	ü			ü	ü	ü

Table Extension: Network Measures	*Level 1*	*Level 2*	*Level 3*	*Level 4*	*Level 5*	*Level 6*
Participant centrality	ü	ü		ü	ü	ü
Similarity and structural equivalence	ü	ü		ü	ü	ü
Cohesion	ü	ü		ü	ü	ü

Table 3-1: Units of analysis and levels of online learner participation; Level 1: Accessing e-learning environments; Level 2: Writing; Level 3: Quality writing; Level 4: Writing and reading; Level 5: Actual perceived writing; Level 6: Taking part and joining in a dialogue.

The identified units of analysis, as shown in Table 3-1, can largely be categorised into two main groups – units that are used to measure *access* and *interaction*. The following two sections summarise the practices and trends of measuring and analyzing *access* and *interaction* as discussed in the student participation literature.

3.4.6.1. Access Records: Measures, Units and Analysis of Participation

Most of the modern virtual learning environments that are used in educational institutions provide a mechanism for tracking access. Information about participant logins and access of certain material can be recorded and stored in the system and used by teachers and administrators thereafter. This data is relatively easy to quantify and analyse – becoming an accessible resource for participation analysis. Examples of units of analysis extracted from the access records are, for instance: [a] number of logins; [b] time spent within the online environment; [c] number of resources accessed; or [d] total number of clicks.

Studies that summarise the number of student logins appear frequently in online participation literature. A few of the studies are summarised here to provide an overview of techniques used to study participant access. For instance, Kuboni and Martin (2004) analysed the number of student logins to suggest institutional strategies that could encourage student participation. Others (Douglas and Alemanne, 2007) analyse student access for the purpose of enhancing analysis tools incorporated in the virtual learning environment. Yet, studies that focus only on the number of student logins are rare. Being a crude measure of online participation, this unit of participation analysis is usually considered along with other measures such as number of postings made or read by the participant (Caspi *et al.*, 2008).

Participation literature contains frequent studies that are aimed at identifying the relation between certain online behavioural patterns and student characteristics. These multifarious relational studies consider additional variables such as gender (Caspi *et al*., 2008), personality types (Ellis, 2003), and grades (Davies and Graff, 2005). However, regardless of the multiple variables considered in the participation research, studies of access contribute to revealing the participation that usually remains unnoticed; it helps to identify shirkers, passive participants and peripheral members who are not just the majority but an integral part of any learning environment (Zhang and Storck, 2001).

3.4.6.2. Interaction: Measures, Units and Analysis of Participation

The studies of communication and interaction in online learning environments dominate the participation literature and e-learning research in general (Wallace, 2003). Studies of asynchronous interaction that focus on discussion boards or email lists are especially frequent (Hammond, 2005). A similar view is saliently evident in Hrastinski's (2008) review, where the great majority of papers (about 96%) discuss online interaction in relation to participation.

The review of the participation and interaction literature, conducted by Wallace (2003), identifies a number of theoretical constructs and frameworks for analysing online teaching and learning by looking at the online interaction records. While some of the frameworks are aimed at identifying student development/progression to higher levels of thinking, others target constructs that define interaction as an integral part of a learning community. Wallace categories the constructs that are discussed in the literature from the perspective of: [a] transactional distance; [b] interaction; and [c] social presence.

Transactional distance: the construct of transitional distance, introduced by Moore (2007) and investigated by others (Chen, 2001; Swan, 2002), is introduced as a means of understanding student engagement with distance learning. The concept is based on the amount of interaction between the online student and a teacher. The more intense interaction between the two would indicate a shorter transactional distance. Wallace (2003) indicates the studies of transactional distance to be more descriptive rather than predictive.

Interaction: Pinpointing the construct of interaction, Wallace (2003) is aiming to highlight the means of knowledge creation in online educational environments and the importance of interaction in this process. He adds to his review the models of student engagement in online environments (Gunawardena *et al.*, 1998), framework for analysing student discourse (Harasim, 2000) and studies that show the value added to learning in association with interaction (Wang *et al.*, 2001).

Social presence: The construct of social presence was available since 1976, when it was introduced as "the degree of salience of another person in an interaction and the consequent salience of an interpersonal relationship" (Short *et al.*, 1976, p. 65). Rourke, Aderson *et al.* (1999) extended this definition by adding a new dimension to it – affective characteristics. Garrison (2001), building on the concept of social presence, proposes a new concept – cognitive presence. The cognitive presence indicates the extent of student engagement in the inquiry. The studies of social and cognitive presence focus on analysis of discussion boards and other interactions within the learning environment. This construct provides great possibilities to extend the studies of participation by looking at the affective and cognitive elements of interaction that can shed light on the more general and comprehensive patterns of student engagement (Wallace, 2003).

All three of the above mentioned constructs employ measures that are derived from online communication records and scripts. The number of measures that can be extracted from interaction records reflect the variations in the types of communication and the perspectives (transactional distance, interaction, social presence) taken for analysing the interaction records.

Going back to Hrastinski's review of participation literature, it becomes apparent that many of the measures are derived from interaction records. These measures are: [a] quantity of messages or units; [b] message length; and [c] message or unit quality. All those measures are defining the extent of student interaction. All those different measures can be used to analyse one of the three dimensions identified by Wallace (i.e. transactional distance, interaction and social presence). They can come from asynchronous resources, such as discussion boards or electronic mailing lists, or from synchronous sources such as instant messaging logs or chat rooms. Yet, regardless of the source of the records they can be equally informative.

Quantitative Measures: The number of postings – being used in 75% of all the papers reviewed by Hrastinski (2008) – is the most frequently used measure of participation analysis. Using this measure of interaction researchers usually categorise the participants into groups. The categorisation however, varies from one study to another, which suggests that researchers tend to approach the task of classification according to the aims of the study they conduct. For instance, Mason, using this unit of analysis, argues that learners fall into three distinct groups in their online interaction: [a] active participants, [b] lurkers (defined as 'those who read messages but do not post messages'), and [b] those who do not participate at all (Mason, 1994). In a similar study however, Taylor (2002) investigated student participation patterns in contributing to an online discussions area. He, similarly to Mason, categorises the participants into three groups. Yet, he codes, names and defines the three groups differently. The groups identified by Taylor as noted earlier in this chapter are: [a] workers - group of proactive participants; [b] lurkers – group of peripheral participants; and [c] shirkers – group of parsimonious participants. This example is a vivid illustration of the use of the same measure for analysis and interpretation of different tasks. The data, its measures and analysis considered in this thesis are viewed, firstly, in relation to the earlier conducted studies and, secondly, in accordance with the research questions pursued.

Virtual learning environments, such as Moodle and Blackboard, that are available in the mainstream market, are equipped with readily integrated modules that make feasible both recording student access and reporting its summary. However, the studies report the modules to have limited capability of analysing the participation and suggest improvements to the tools that track and analyse student access. Combined and comprehensive measures of participation (including both active and passive participation) are necessary to improve the ways of informing practitioners about certain participation measures. There is a scope for researching and further refining the abilities to identify student online participation patterns in relation to their performance (Douglas and Alemanne, 2007).

Qualitative Measures: While the quantitative measures – such as the aforementioned number of postings – are the most prevalent in the participation literature, qualitative measures become more frequent in the recent studies. The qualitative measures of student interaction are referred to in Harstinki's (2008) review as: 'message or unit quality'. Almost half (47%) of all the reviewed papers addressed the 'quality' of student interaction in one way or another. The literature is not unilateral on the ways to address the issue of measuring the quality of posted messages. This is not surprising, taking into account the subjective nature of this unit of analysis. Davidson-Shivers *et al.* (2002), for example, employ a message coding scheme to define the so called 'substantive' versus 'non-substantive' posts in the discussions. The posts are later categorised according to their content (substance) of the message. The substantive category contains messages that show evidence of: structuring, soliciting, responding or reacting. On the contrary, the non-substantive posts exhibit: procedural, technical, chatting or supportive nature of the message.

The value of employing qualitative analysis of discussion boards cannot be underestimated. The use of qualitative lenses to view the studies of student interaction can shed light on participant cognitive and meta-cognitive skills. The use of qualitative analysis can open new insights, knowledge, perspectives, and understandings on qualitative differences in learning (Garrison and Cleveland-Innes, 2005). Researchers argue that structured and cohesive discourse of participants indicates high levels of critical thinking and knowledge construction (Aviv *et al*., 2003; Pawan *et al*., 2003). Understanding the mechanisms and structures that increase the quality of online discourse (fostering critical thinking and knowledge construction) are important for designing successful courses. Taking into account the important role of tutors and facilitators in leading and developing rich discussion, qualitative analysis of student interaction can contribute to understanding the methods that can be used by practitioners for "triggering discussion and facilitating high levels of thinking and knowledge construction" (Garrison and Cleveland-Innes, 2005, p. 137).

While quantitative studies are based on relatively easy and sometimes automated data collection, they rarely indicate qualitative differences in learning. In contrast, qualitative analysis can indicate the 'approach to learning' that students take. The concept (approach to learning) was derived from empirical studies and introduced by Marton and Saljo (1976). The two distinct approaches that students take – *deep* and *surface* – were identified in relation to the qualitative differences in students' undertaking of their learning. Those adopting deep approach tend to understand the whole picture and try to comprehend the academic work. The surface learners are focused on remembering mere facts, employing strategic techniques (i.e.

memorizing material) for the purpose of successfully completing assessments. Hence, teachers should strive to encourage students taking a deep learning approach that can itself lead to development of critical thought, generalisable skills and understanding of the subject they studied (Ramsden, 1992). Garrison (2005) argues that use of qualitative measures can contribute to understanding the underpinning factors that drive students to adopt deep and meaningful approaches to learning.

The automation of qualitative analysis of interaction, in contrast to quantitative analysis, is more demanding. Considered largely subjective, qualitative analysis of the content of interaction raises issues related to reliability (Rattleff, 2007), objectivity and systematic consistency (Rourke *et al.*, 2001). The literature on content analysis agrees on the necessity of filtrating the subjectivity and addressing the reliability of message coding. Rourke, Anderson *et al.* (2001) believe that objectivity and reliability are the important criteria of research and should not be taken as an accidental feature of a conducted study. In fact, Riffe, Lacy, and Fico (2005) reiterate that "failure to report reliability virtually invalidates whatever usefulness a content study may have" (p.159).

3.4.6.3. Social Network Analysis for Measuring Participation

Social Network Analysis (SNA) is a technique that allows analysis of human interaction and relationships between individuals, groups and communities (Wasserman and Faust, 1994; Wellman and Berkowitz, 1997). It provides a number of benefits for studying online engagement and participation. It can be employed for the studies of participant interaction (i.e. email, discussion board communication) and access (i.e. educational systems or materials)(Park, 2003), as well as, analysis of group and community development (Monge and Contractor, 2003).

The increasing availability of computer resources and the creation of standardized SNA software packages, such as UCINET or Siena, bundled with a variety of graphical visualisation tools, make SNA accessible and valuable for researchers in a number of disciplines – including education. The evaluation and monitoring of student communication using SNA techniques can reveal the level of cohesion within the group of learners and identify disadvantaged participants (Haythornthwaite, 2005; Reffay and Chanier, 2003). The application of SNA can shed light on the hidden factors that may affect student participation, open collaboration and personal development. Thus, the use of SNA in educational research can become a valuable and a fundamental resource for understanding student engagement and participation. Richly informing the studies of online participation, SNA can extend the researcher's understanding of online engagement and participation patterns, subsequently leading to improvement of teaching techniques and methodologies (Martínez *et al.*, 2003). An extended overview of SNA is presented further down the thesis in relation to the reviewed models of engagement and participation analysis.

3.4.6.4. Variables Considered for Participation Analysis

The review of the literature of online participation (Hrastinski, 2008) and online learning in general (Tallent-Runnels *et al.*, 2006), provides an insight on the multiplicity of variables used in the educational research. The earlier sections of this chapter discussed the measures and units of participation analysis in both quantitative and qualitative methods. These measures and units are however, considered in relation to other variables, both dependent and independent. An overview of the variables used in the studies can provide an insight on the methods used in studies of online learning and widen the perspective of the research subject.

Tallent-Runnels (2006), categorises the literature of online learning into themes by the aspects of the studies that were included in his literature review. These broad categories are: [a] Course Environment; [b] Learners' Outcomes; [c] Learners' Characteristics; and [d] Institutional and Administrative Aspects. Within these categories he then discusses the variables considered in the studies in relation to the research goals. Hrastinski (2008), similarly to Tallent-Runnels, indirectly refers to the variables used in the studies by summarising the outcomes of the studies as discussed in the literature. While the rationale for using certain variables may only be explained in relation to research objectives, it would be helpful to discuss the value that some of the variables can add to a study.

Course Environment Variables: Variables, that were considered in this theme, mainly relate to the measures that quantify student participation, its qualitative differences and perceptions. Other variables appear to identify the effects of course structure and teacher support and teaching mode (Tallent-Runnels *et al.*, 2006). From the engagement and participation perspective, they are therefore considered mainly as independent variables. Their consideration in qualitative and quantitative studies is discussed in sections 3.4.6.1 and 3.4.6.2.

Learner Outcome Variables: The majority of research conducted in the area of e-learning addresses learner outcomes in one way or another. Variables that denote learning outcomes can be derived from a *cognitive* and/or *affective* domain. Marks, grades, completion records and learning artefacts are some of the variables that form part of the cognitive domain. Student attitudes, satisfaction, and perceptions of the online environment are variables that are derived from the affective domain. These variables frequently appear in relational studies (Tallent-Runnels *et al.*, 2006).

Learner Characteristic Variables: The advance of research in the area of e-learning leads to consideration of more sophisticated and complex questions related to student motivation, learning styles and demographics. The focus of studies is shifting from simply investigating the effect of different delivery systems and methods to understanding a more complex and synergistic relationships among students, teachers, course structure and constraints of the learning environments (Tallent-Runnels *et al.*, 2006). Learner characteristic variables can include learning styles, personality traits, gender or age. The learning characteristics are discussed in detail in Chapter 4.

Other Variables: The timestamp, in studies of student engagement and participation, may become one of the most informative variables to consider. It denotes the date and time at which a particular event occurred; hence, becoming a precondition for conducting longitudinal studies. Learning perspectives that view human development in a situated or a historical context employ the use of timestamp variables and value longitudinal studies particularly highly.

3.5. Prospects and Caveats of Online Engagement Studies

The technology used for online learning is equipped with facilities and communication tools that ensure a permanent record of exchanged messages and discussion threads. Not only they are considered helpful for students – who use the communication tools for reflection and debate – but also for practitioners and researchers interested in analysing the recorded communication. At the same time, the logging records of student access, in addition to dialogue transcripts, provide researchers with useful data that allows student tracking, monitoring their development over time and during a single online session. These records can also shed light on the factors that determine and influence the development of learning communities (Hara *et al.*, 2000). The availability of online participation and access records carries a potential for automating the process of analysis and evaluation. Some research suggests however, that not enough attention is given to research and development of automated analysis tools. While measures of online participation can serve as a good predictor of achievement, virtual learning environments provide only limited features for analysis of the interaction and access records. (Douglas, 2008)

Amongst the potential caveats – behind the benefits of analysing the online participation data – is the issue of reliability related to the analysis and interpretation of online participation (Rattleff, 2007). The most common shortcoming, not addressed by researchers and data analysts, particularly in conducting content analysis, is the failure to employ the principles of quantitative and qualitative research and address the limitations before eliciting the conclusions (Rourke *et al.*, 2001). A rigorous research methodology that encompasses the issues of reliability is therefore essential for conducting engagement and participation research.

Last, but not least, it is necessary to highlight the ethical issues related to online learning research. The ethical conduct of researchers and most importantly the informed consent of the subjects are of great importance regardless of research area. In addition to the issue of informed consent, identifiable private information should also be avoided from the earliest possible stages of research. The researchers are therefore expected to put some considerable effort into obtaining consent and omitting any personal identification information from the transcripts (Rourke *et al.*, 2001).

3.6. Summary and Conclusion

This chapter reviewed the literature and discussed the engagement research aiming to gain insight on a number of questions. What are the outcomes of student online engagement or disengagement? What can the studies of student online engagement contribute to enhancing the effectiveness of teaching and learning?

In summary, the development of understanding learner online engagement and participation is becoming increasingly important. Chen et al. in their discussion on engagement studies say: "Student engagement takes many forms—intellectual challenge, active and collaborative learning, meaningful interactions with faculty, and the perception that the learning environment is supportive of the student's efforts to overcome obstacles to learning" (Chen *et al.*, 2008, p. 4). Hence, the outcomes of engagement research can be applied to online teaching practice and the support of educational practitioners and learners. Summarising the value of engagement studies to the school sector, Fredricks et al. accentuate it thus: "The study of engagement as multidimensional and as an interaction between the individual and the environment promises to help us to better understand the complexity of children's experiences in school and to design more specifically targeted and nuanced interventions." (Fredricks *et al.*, 2004, p. 61)

The studies of engagement are especially gaining momentum due to the increasing diversification of students in higher education. The increasing commonality of courses with demographically diverse, multi-cultural and cross-disciplinary student enrolment requires frequent adaptation of teaching and facilitation processes as well as the reorganization of course structure in order to engage students in the learning process (Gunawardena and Zittle, 1996; Panitz, 1996; Warschauer, 1997). Identification of engagement and participation patterns within a diverse online educational environment can become highly valuable to the tutors striving to address the diverse needs of students.

Despite the substantial amount of research in the area of e-learning conducted during the last decade, there is little research that focuses on activities, pedagogical methods and other factors that can affect student engagement patterns. The models used in studies of engagement and participation are usually more narrow than the overarching definitions of the term. Most importantly, however, there is little research that adopts innovative methods that could richly inform practitioners' understanding of engagement. There is a demonstrable need for methods and measures that can ensure greater understanding of the driving mechanisms of student engagement.

"Share our similarities, celebrate our differences."
(M. Scott Peck)

4. Learner Personal Characteristics and Learning Styles

4.1. Introduction

Learner engagement, participation and interaction are the main points discussed so far. Yet, little has been said about the individual differences that may be associated with learner engagement. This chapter initiates the review of the literature that highlights student differences and their role in learning. It focuses however, on learning styles – general preferences to learning approaches.

4.2. Individuals, Differences and Learning

The question, why some students find it easy to learn and others difficult, often appears on the agenda of educational researchers (Jonassen and Grabowski, 1993). To answer this question a number of learner ability and non-ability (preference) tests have been developed over a number of decades. They usually identify individual differences defined as crystalised intelligence, personality traits and learning styles. These differences often used as predictors of test grades or academic performance in general (Furnham *et al.*, 2009). Furthermore, the consideration of individual differences may be used for adjusting the teaching design and maximising learning outcomes. Yet, is there any relationship between individual differences and student engagement? Should individual differences be taken into account when evaluating student engagement? This chapter attempts to address these questions.

Jonassen and Grabowski (1993) identify nine broad categories that define individual traits and differences. Some of those categories include: General/Primary Mental Abilities; Cognitive Controls; Cognitive Styles in Information Gathering; Cognitive Styles in Information Processing; and Personality. Cognitive controls, for instance, define how the person interacts with the environment, organises and applies knowledge. Personalities, identified as a separate category, describe: how a learner communicates with other people or behaves in a certain situation, and how this may affect learning. The large number and wide span of learner traits speak for the complexity of individuals and the area of research in particular. In order to manage the volume of material addressing the question of individual learning differences in empirical studies, only learning styles were considered in this thesis.

4.3. Learning Styles

Learning styles, both the theory and practice, have attracted significant interest over the last 20 years. The review of the literature conducted by Coffield *et al.* (2004) identified 71 models of learning styles and critically reviews 13 of them. The models of learning styles are widely applied to teaching and learning, particularly, by researchers in sociology, psychology, business and education. Many practitioners use the available instruments for identifying and measuring learning styles preferences. Reflecting the abundance of the theoretical models, there are many inventories developed for different purposes – some of those aimed at contributing to the theoretical constructs, others are intended for educational practice.

Reflecting these numerous research directions, the definitions of the term 'Learning Styles' varies widely in the literature. James and Gardner however, define learning styles broadly as the "complex manner in which, and conditions under which, learners most efficiently and mosteffectively perceive, process, store, and recall what they are attempting to learn" (1995, p. 20). This definition does not explicate the underlying psychological processes that are affecting or defining the traits, nor does it exclude the 'conditions' under which the trait is observed – highlighting the contributing role of the context in which the learning style is being defined. While embracing the complexity of learning styles, this definition characterizes the variations in the preferences in individual approaches to learning.

The preferences in approaches to learning are considered to be an important factor in designing learning. Educational researchers and practitioners take learning style preferences into account aiming to improve learning or its efficiency for learners. They do so by adjusting the teaching techniques and resources to learner preferences. Alternatively, they try to raise student awareness about the personal strengths and weaknesses the students exhibit. Either of these two techniques is believed to improve student performance (Graf, 2007; Popescu, 2009).

The consideration of the arguments that designing teaching to suit learner preferences can improve learning outcomes raises a question: can similar adjustments affect learner engagement? In fact, are learning styles in any ways associated with or correlated to student engagement? Some studies attempt to address the relationships between the learning styles and the ways learners interact with learning resources or learning environment (García *et al.*, 2007). Many universities are already aiming to improve student engagement by taking actions in designing courses that meet a variety of learning styles (Chickering, 2006). Hence, the study of individual differences has a great potential in understanding engagement. Consideration of learning styles can help in developing strategies and techniques for enhancing student participation. While this thesis does not focus on investigating the relationships of student learning styles and to their engagement, it does integrate and consider learning style information. The model of engagement proposed in Chapter 6, does highlight the importance of considering individual differences. The following sections briefly overview the development of the learning style research and explain the rationale behind the selection of certain learning style instruments employed in the present research.

4.3.1. Experiential Learning Theory

In the early 1980's, psychologists stressed that the concept of learning lies in the way we process experience, particularly, critical reflection of experience (Kelly, 1997b). They described the process of learning starting from experience that continues to reflection and leads to action, which itself becomes an experience again (Rogers, 2002). The concept was described as a three-step learning cycle.

Later, the educational theorist David Kolb, inspired by the work of Kurt Lewin (Atherton, 2005) extended the concept by adding another process to the cycle. This process divided the reflection into perceiving and processing (Kelly, 1997b). He called the step, which was added to the cycle, Abstract Conceptualization – describing it as a process of finding answers and drawing conclusions. This stage appeared after the reflection stage, which described the process of asking questions based on the previous experience. The next stage of Kolb’s cycle, which fosters the testing of a hypothesis in a set of actions, was referred to as Active Experimentation

(Kolb, 1984). The diagram presented below represents the described cycle, known also as Lewin's Cycle.

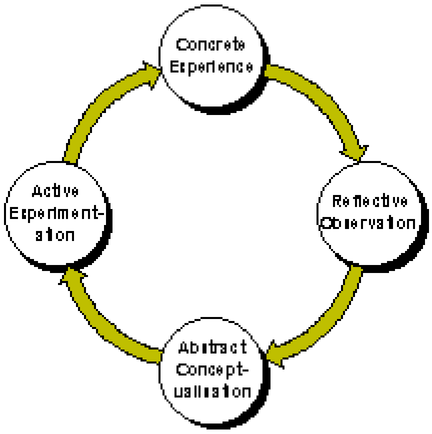

Figure 4-1: Lewin's Cycle

This theory published in Kolb's work "Experiential Learning: Experience as the Source of Learning and Development" in 1984 generated considerable attention and significantly influenced the development of some learning models (Greenaway, 2006). Building on the concept of the learning cycle he explains his Experiential Learning Theory (ELT) describing four learning styles and four learning environments that are most conducive for accommodating the learning styles and learning modes. Each of the learning styles: *accommodative, assimilative, divergent,* and *convergent*, is a combination of two of the four learning modes: *concrete experiences, reflective observation, abstract conceptualization,* and *active experimentation*. These learning modes and learning styles are supported by the learning environments known as: *affective, symbolic, perceptual* and *behavioral* learning environments (Richmond and Cummings, 2005).

Kolb describes the Experiential Learning Theory with a conical diagram presented as Figure 4-2: Kolb's experiential learning theory of development. He illustrates the lower levels of learning at the basement of the cone, whereas the higher levels of development, which assume increased integration of the four learning environments as the peak of the cone (Pedrosa de Jesus *et al.*, 2004).

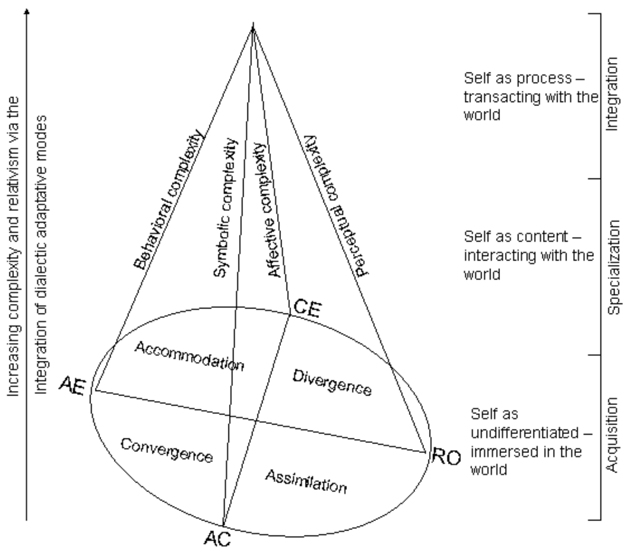

Figure 4-2: Kolb's experiential learning theory of development
Adapted from (Pedrosa de Jesus *et al.*, 2004)

4.3.2. Kolb's Learning Styles and Learning Environments

Most of the research on Experiential Learning Theory considered the concepts of learning styles and their assessment to be central (Kolb and Kolb, 2005). The individual learning styles were proposed to be assessed by means of the Learning Style Inventory (LSI). This inventory identified four different learning styles as summarised below:

Assimilative Style: The assimilative learning style is characterized by the ability to reason inductively. Assimilators concern themselves with ideas and abstract concepts rather than with people and social interactions and are concerned with abstract, logical rather than practical aspects of theories.

Accommodative Style: As opposed to the assimilative style, accommodative learners excel at accomplishing tasks by following directions, meticulously planning, and ultimately seeking new experiences. They are characterized as being opportunistic, action driven, and risk takers.

Convergent Style: Kolb suggests that the convergent learner's greatest strength is the ability to efficiently solve problems, make decisions and apply practical ideas to solve problems. Generally, these people do well on standard conventional intelligence tests because they can organize knowledge by hypothetical deductive reasoning and thus are able to converge to one given answer.

Divergent Style: The divergent learner is best at tasks that require "imaginative ability and awareness of meaning and value" (Kolb, 1984, p. 77). Individuals with this learning style have the ability to identify concrete examples of a concept and to generate numerous qualities about this concept from many perspectives.

Kolb's learning styles and learning environment are illustrated below in Figure 4-3.

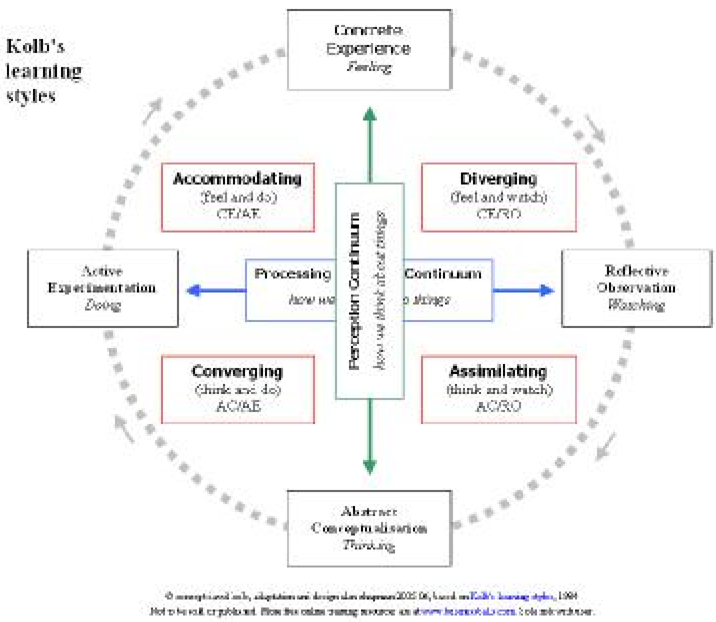

Figure 4-3: Kolb's Learning Cycle Diagram

As mentioned earlier, along with the concept of learning styles Kolb has introduced four learning environments: affective, symbolic, perceptual, and behavioral learning environments. However, he does not make a direct correlation or casual relationship between the learning styles and learning environments (Kolb, 1984).

Affective Learning Environment: the affective learning environment emphasizes concrete experiences so that students actually experience what it might be like to be a professional in a given field of study. Affective learning tasks include activities such as practical exercises, simulations, or field experiences.

Symbolic Learning Environment: the symbolic learning environment is one in which learners are involved in trying to solve problems for which there is usually a right answer or a best solution. Information is abstract and usually presented in readings, data, pictures, and lecture formats. Characteristic activities may include lecture, homework, and theory readings.

Perceptual Learning Environment: the perceptual learning environment is one in which the main goal is to identify and understand relationships among concepts. Unlike activities in the symbolic environment, the perceptual environment emphasizes the process of problem solving rather than coming up with the best solution. Learners are required to collect relevant information for researching questions and are expected to attack a problem situation through different perspectives (own opinion, expert opinion and literature) by listening, observing, writing, discussing and personal pondering.

Behavioral Learning Environment: the behavioral learning environment emphasizes actively applying knowledge or skills to a practical problem. Although correct answers for activities are not necessary for success in this environment, activities should be structured so that learners gain intrinsic rewards and values. The teacher acts as a coach or guide but only when the student initiates or solicits help.

Since the first publication of Kolb's experiential learning theory in 1984, extensive research has been conducted to further develop the ideas. Google Scholar reports 8500 citations to Kolb's initial work. More than 1800 papers are listed to discuss Kolb's experiential theory and the learning style model (Kolb and Kolb, 2005). Yet, despite the high number of adherents, there are skeptics such as Rogers (2002), who argues that Kolb's learning cycle does not include concepts such as goals, purposes, intentions, choices or decision making, which are an indivisible part of the learning process. Nevertheless, the development of the Experiential Learning Theory and the learning cycle is considered to be an important contribution to the area. The concepts proposed by Kolb generated a healthy debate and allowed an advance in educational research and thought. The development of the experiential theory shifted the focus of education from teacher and teaching techniques to learner and learner differences. Kolb's work re-introduced the discussion of the experience in educational research (Kelly, 1997a).

4.4. Learning Styles Models and Instruments

4.4.1. Honey and Mumford Learning Styles

Based on Kolb's experiential learning model, Honey and Mumford proposed a similar categorization of individual learning styles by adopting Kolb's learning cycle. The four learning styles proposed by them are: *activist, reflector, theorist* and *pragmatist.* The proposed categories can be summarised as follows:

Activists prefer to act and are ready to experiment – *experiencing* (Mobbs, 2003). They are enthusiastic and open-minded people; they tend to act first and think about the consequences later. Activists enjoy the challenge and like new experiences but are bored with implementation and longer-term consolidation. They seek to centre activities around themselves but at the same time they are gregarious individuals (Duff, 2000).

Reflectors prefer to study data and are ready to analyze it – *reviewing* (Mobbs, 2003). They prefer to reflect on experiences and analyze them from different perspectives. They tend to postpone drawing a conclusion for as long as possible while collecting and analyzing data about experiences and events. They are cautious and thoughtful people who like to "… consider all possible implications before making a decision" (Duff, 2001, p. 187).

Theorists need to understand the theory behind the actions and are well equipped for concluding – *concluding (Mobbs, 2003).* They try to integrate experiences and adapt them into logical, complex theories and models. They tend to be analytical and detached, feeling uncomfortable with ambiguity or subjectivity (Duff, 2000).

Pragmatists like practical things and are ready for planning – *planning* (Mobbs, 2003). They are believed to enjoy trying out new ideas, theories, and techniques to see if they work in practice. Pragmatists are practical and down-to-earth people who like solving problems and make practical decisions (Duff, 2000).

The categories of learning styles are, arguably, resembling the learning styles proposed by Kolb, where Activist is similar to Accommodating; Reflector to Diverging; Theorist to Assimilating; and finally, Pragmatist is similar to Converging style (Chapman, 2006). The model proposed by Honey and Mumford is accompanied with a self-report questionnaire that has been used for over 20 years in various organizations and educational institutions. There are two versions of the Learning Styles Questionnaire. The 80-item questionnaire is the original inventory. The 40-item inventory, was developed in 2000 and has a concise wording and is better suited to a more diverse audience (Honey, 2000). The review of the instrument (Duff and Duffy, 2002), which combined a wide range of studies that employed the instrument, suggested internal consistency reliability of the learning style questionnaire. However, the psychometric robustness of the instrument as well as its ability to predict performance remains contested (Coffield *et al.*, 2004).

4.4.2. Felder Silverman Instrument

The Felder-Silverman learning style model (FSLSM) offers an alternative view on learning preferences. The FSLSM categorises learners into four dimensions based on their preferences to process, perceive, receive and understand information. The model is believed to be particularly applicable to engineering education and has evolved from the teaching and learning experiences of students in engineering (Felder and Silverman, 1988).

The FSLSM classifies the learning preferences into four dimensions: active/reflective; sensing/intuitive; verbal/visual; and sequential/global. The following sections position and describe these dimensions.

Active and Reflective learners are categorised according to their preferences towards active experimentation or reflective observation – complex mental processes for converting information into knowledge. Active learners prefer actively engaging with the learning material, practicing and 'trying things out'. They tend to communicate with others and prefer to work in groups. On the opposite scale to active learners are the reflectors. Reflective learners prefer to think and work on their own or in smaller groups – usually a close friend. Reflectors are considered as theoreticians, mathematical modellers, those who define and solve problems.

Sensing and Intuitive learners are defined in accordance to psychological type indicator of Myers-Briggs, that describes differences in the ways people tend to perceive the world (Felder and Silverman, 1988). This dimension has also similarities to the sensing/intuitive one of Kolb's model. Students with preferences in sensing tend to work with facts, data and experimentation. They prefer learning concrete material by using their sensory experiences. Sensing students like working on problems by applying standard approaches. They are usually more patient with detail and do not like complicated scenarios. Sensing students are considered to be more practical and realistic. Intuitive students, in contrast to sensing, prefer learning abstract learning material. They are usually bored by detail and welcome complications. Intuitive learners prefer general principles to concrete instances – grasping new concepts easily. Intuitive students score better at tests that contain open ended rather than multiple choice questions.

Visual and Virbal learners are defined by their preferences in processing visual and auditory modalities of information. The learners are categorised as visual if they have preferences in working with visual data such as pictures, diagrams, charts, films or demonstrations. In contrast, verbal learners are those who are most comfortable working with auditory data. They prefer discussions and verbal explanations to visual demonstrations.

Sequential and Global learners are defined by the ways in which students approach the task of learning and understanding. Some students prefer to learn sequentially, understanding the material as it is presented. Others may be more comfortable learning by absorbing the material randomly and then, suddenly, joining it into a holistic image. Global learners learn in fits and starts, but are able to solve complex problems and are more innovative in finding possible solutions. Yet, they tend to have difficulties in explaining their experience. Sequential learners, on the other hand, tend to follow linearreasoning processes in the attempts of problem solving.

The summary of FSLSM, presented above, may suggest little differences from other learning style models. In fact, the proposed dimensions are similar to (or can be derived from) other models. However, the FSLSM differs in its mechanisms for identifying and describing learning styles. More specifically, while other multi-dimensional models describe learner preferences from the dimensions that are statistically prevalent, FSLSM scales the learner preferences from -11 to +11 (odd numbers only). The resulting learning styles are being described by four different values in accordance with the considered dimensions.

The FSLSM learning style preferences are identified by an instrument called Index of Learning Styles (ILS) (Felder and Soloman, 1997). ILS is a 44 item instrument that allows the respondent to choose from the given two options. The instrument identifies student preferences scaling the responses on each of the four dimensions. An empirical study conducted and presented as part of this thesis (see Chapter 10) employs and demonstrates the use of learning styles in the discussed context. The selection of the model was justified by the specialised scope of the model that targets students in engineering schools in higher education. The relatively short and concise ILS questionnaire was considered to be another benefit for employing the model. Finally, the multi-dimensional structure of the model and the ability to measure the results without categorising respondents into a single group was considered. The capability of the model to highlight the strengths and weaknesses of respondents were used to justify the selection of the model.

4.5. Implications, Challenges and Criticism of Learning Styles

It is widely believed that incorporating nuanced consideration of learning styles into teaching practice can increase student learning efficacy. Learning styles are considered an important factor in enhancing the learning process (Felder and Silverman, 1988; Graf, 2007). Furthermore, teaching process that does not take into account student strengths and weaknesses may especially become problematic to those with strong preferences for one learning style or another. Hence, consideration of student learning styles in pedagogical design can make learning easier for students. Yet, adjusting pedagogical design to fit learning styles is considered to be a short-term goal for immediate improvement of learning outcomes. Some educational theorists, including Kolb (1984) himself, suggest encouraging students to develop a range of learning skills. Hence, teaching techniques that are tailored in dissonance with student learning styles may encourage students to practice and improve the learning skills they are less comfortable. While Kolb argued that a mismatch in teaching and learning styles can support personal growth and encourage creative thinking, others (Gregorc, 2002), in contrast, believe that teaching approaches that are not aligned with student learning preferences are not desirable. The mismatch is not encouraged by Gregorc due to supposed stability of learning styles.

As reviewed in Graf's (2007) work, Felder stresses the issue of unintentional mismatch between teaching and learning styles. He argues that teachers, who are unaware of their own learning styles may (subconsciously) use only their preferred teaching styles. Teaching predominantly with one style may, as he argues, favour some students and disadvantage others. Suggestions to avoid permanent mismatch in teaching and learning are voiced by Felder. Hence, it is advised to practice teaching mismatched with learning styles in a strategic and controlled way – avoiding permanent misalignment or single-style designs.

The issue of mismatch between teaching and learning styles is not the only controversy in learning style research. The complexity of the research area and the limitation of conducted studies hinder the deduction of definitive conclusions. A number of issues are still being debated. Discussions that arise from the large number of available learning style models are frequent. Even though the learning style models often overlap in many dimensions, the selection of the appropriate model is widely debated. The proposition of a model that integrates the multitude of the existing models and dimensions is considered to be the dominant challenge of the learning style research area (Graf, 2007).

The validity of instruments for identifying and measuring learning styles is another topic that is being frequently discussed. Most instruments are based on self-reported questionnaires. Hence, it is argued, that the answers given by the respondents may not match their actual behaviour or may not be applicable to contexts and learning environments different from the one in which the self-report was undertaken. This argument is true for self-reported questionnaires in general. Therefore, the obtained results can be considered biased or subject to the following two assumptions: [a] the respondents are motivated to fill out the questionnaire accurately; and [b] the respondents are aware of their preferences in learning. Most importantly, however, as in any other psychometric tests, the learning style instruments should comply with the requirements of validity. While most of the instruments are validated, some of them are inconsistent across various criteria (Coffield *et al.*, 2004). Hence, the area of learning style research still needs critical and independent empirical studies. This thesis does not attempt to conduct an independent study of using student learning styles in online education. Yet, it uses a learning style model as an example to highlight the potential benefits of considering individual differences in online learning. The following chapter discusses in greater detail the consideration of learning styles and individual differences in e-learning practice and research.

4.6. Summary

This chapter has presented a concise rationalisation of considering individual differences in education, particularly focusing on the use of learning style models. The chapter has overviewed the narrative of development of learning style research and has discussed the development of experiential learning theory and its contribution to the proliferation of the learning style models available to date. Referring to earlier literature, this chapter has highlighted the prospects and challenges of using learning styles in education while stressing the critical elements frequently brought up in this research area and re-affirming the need for further research. The concepts that encourage further research and conduct of empirical studies are revisited in Chapter 6 of this thesis. Moreover, an empirical study that involves consideration of learning styles is discussed in Chapter 10. The study adopts the Felder-Silverman learning style model and the Index of Learning Styles inventory. This section, however, presents the argument in an attempt to justify the selection of the learning style model and the measurement instrument.

"What, I wondered, was the right way to use theory here?
Should we believe in them, live them, and risk being dogmatic —
or should we be pluralistic, tied to none, and risk being superficial?"
In Special Issue on Theories on Learning Technologies
Martin Oliver (2002a)

5. Methodological Background

5.1. Introduction

This chapter acknowledges the theoretical perspectives and outlines the roadmap for developing and positioning a mechanism for evaluating learning engagement. This mechanism is introduced as Situated Engagement Evaluation Model (SEEM) in Chapter 6. Prior to introducing the model, this chapter overviews and justifies the adopted exploratory approach in conducting this research. Consecutively, it discusses the stance of this thesis in relation to widely accepted positions in theory development.

5.2. Methodological Approach

The argument developed in this thesis attempts to communicate the background, reasons, qualifiers and reservations in proposing a conceptual model as presented in Chapter 6. While developing an argument may become an opportunity for learning, revisiting and improving the proposed model, the argument itself, should not necessarily reflect the journey of learning and conceptual development (Van de Ven, 2007). Giere and colleagues (1985) suggest that the process of illustrating the discovery is very different from the process of discovery itself. This is due to multitude of activities and independent thoughts that may go into development of a conceptual model. This section however, attempts to explain the philosophical and methodological grounds of the study, frame the development of the model and describe the inquiry summarised in this thesis.

5.2.1. The Process of Exploration in Social Sciences

"A theory can be proven by experiment; but no path leads from experiment to the birth of a theory." Albert Einstein (1879-1955)

Earlier in this thesis (see section 1.4), the reductionist approaches in e-learning were discussed as being one of the problems in the field of online learning. Referring to Andrews and Haythornthwaite (2007), the thesis elaborated the need for developing alternative perspectives on theory and practice of online learning, that can accommodate the complexity of the field. These authors suggest identification, development, improvement and validation of mechanisms for conducting practice-based e-learning research. They call for a *"theoretical base that informs evolving processes in a rapidly advancing technological environment, yet also addresses the kind of transformative activity that is entailed in e-learning and e-learning communities"* (Andrews and Haythornthwaite, 2007, p. 23). The proposition of the SEEM model constitutes an attempt to address this need. The development of the model encompassed cyclic and diverse approaches in referring to learning literature and conducting empirical studies. The scope of the research therefore, was kept wide and open, to facilitate going beyond the simplistic notions of one way causality models of confirmatory research.

The research initiative described in this thesis can be positioned within the realms of exploratory research. David, in the Sage Dictionary of Social Research Methods (Jupp, 2006, p.110), defines exploratory research as *"a methodological approach that is primarily concerned with discovery and with generating or building theory"*. Unlike confirmatory research that requires a fixed theoretical model or a formula to approach the study, according to Davis *(op. cit.)*, exploratory approach allows flexibility and enables a form of research that is broad and thorough. Hence, exploratory research allows avoiding the constraints of the theoretical models that were developed earlier. Given the less constrained situation, the researchers who employ an exploratory approach are suggested to study the data with an open mind and acquire an intimate and first-hand understanding of what is being observed (Stebbins, 2001).

Stebbins *(op. cit.)* identifies four variations of the meaning of the word 'exploration' and discusses variations of the term that infer: "*broad and thorough exploration for discovery*"; *"inquisitive processes for examining and investigating*"; or "*systematic search for something in particular*" (p. 3). Stebbins acknowledges the wide scope of the term and adopts the definition proposed by Vogt:

> *Social science exploration is a broad-ranging, purposive, systematic, prearranged, undertaking designed to maximise the discovery of generalisations leading to descriptions and understanding of an area of social or psychological life. Such exploration is, depending on the standpoint taken, a descriptive way of conducting science – a scientific process – a special methodological approach (as contrasted with confirmation), and a pervasive personal orientation of the explorer. The emergent generalisations are many and varied; they include the descriptive facts, folk concepts, cultural artifacts, structural arrangements, social processes, and beliefs and belief systems normally found there. (Stebbins, 2001, p. 3)*

Stebbins *(op. cit.)* continues contrasting exploration to serendipity – accidental discovery and spontaneous invention – emphasizing distinguishing characteristics of exploration such as broad-ranging, purposive and systematic. More generally, Davies, in (Jupp, 2006), describes exploration as a process that constitutes a "distinct form of discovery" (p. 110). She continues, pointing to fundamental misinterpretation of exploratory research of being described as simply an initial developmental process for normative research. Davies *(op. cit.)* encourages to perceiving exploratory research as a distinct methodological approach of systematic research inquiry. Exploratory research is acknowledged to underpin grounded theory – where the theory is conceived and developed by grounding the collected data (Stebbins, 2001). Yet, due to multiple meanings attributed to the term 'grounded theory', unless the approach of Glaser and Strauss (1967) is employed, it is suggested to avoid ascribing exploratory research to grounded theory (Eisenhardt and Graebner, 2007).

The practice of exploratory research, for instance as described by Routio (2004), usually starts by observing the object of research from multiple perspectives, ensuring the collected data to be rich and broad. At this stage, the clarification of the essence or the definition of the object is not expected. In fact, Routio *(op. cit.)* suggests 'contemplating' and developing a way to 'seeing' the object. At this stage, the observation of the object of study remains in a continuous flux, being affected by the theoretical, methodological or subject perspectives. As a result, it enables deepening of the researcher's understanding and provides opportunities for revealing new and valuable aspects to the object of study. A deepening, cyclic method of alternating point, is depicted Routio *(op. cit.)* in a diagrammatic way (see Figure 5-1) closely resembles the general method for theory-building research as discussed in the following section 5.2.7. Alternating point of view or continuous refinement as part of exploratory research are considered common practice for individual research projects (Klein and Myers, 1999; Stebbins, 2001).

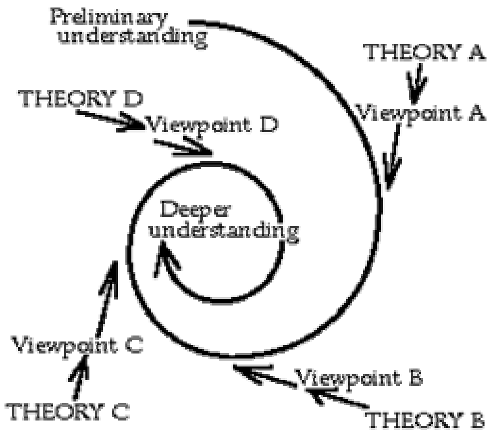

Figure 5-1: Alternating point of view in exploratory studies.

The need for exploratory studies and the benefits they offer have been demonstrated decades ago (Husen, 1988). Since then, a number of methodological and wider paradigmatic approaches have been developed and established in the area of education (Van de Ven, 2007). Prior to explicating the methodologies underpinning this research, a brief overview of contrasting paradigms of thought and research is necessary.

5.2.2. Philosophies of Science and Multiple Paradigms

A paradigm is a set of fundamental beliefs and assumptions that constitute a perspective on reality (Kuhn, 1970). Paradigms are originating in philosophies of science and attempt to inform researchers approach to the nature of the studied phenomena (ontology) and the ways for understanding them (epistemology). There are four major philosophies of science: positivism, relativism, pragmatism and realism (Van de Ven, 2007). Positivism, the 'traditional' approach, views the reality as objectively present and attempts to explain it and produce value free laws and models. Pragmatism adopts objective views of ontology, but is subjective in the choice of epistemological constructs. Relativism is a subjective philosophy that views scientific knowledge as socially constructed collective interpretations, rather than as being absolute 'truth' (Suppe, 1977). Within the realms of relativism, there exists a variety of alternative philosophies, among which are: *critical theory, historical relativism, interpretivism, social constructivism* or *hermeneutics* (Schwandt, 1994; Van de

Ven, 2007). Constructivism is believed to be the most widely recognised position in e-learning research (Oliver *et al.*, 2006). This thesis, attempting to address the complex social phenomenon of learner engagement, can be ascribed to operating mainly from the relativist stand. However, this research maintains a pluralist approach in coordinating multiple perspectives – a plausible approach for advancing the understanding of a complex phenomenon under study (Azevedo, 1997). The empirical studies conducted and summarised in the following sections (see chapters 7, 8, 9 and 10) vary in the adopted methodological approaches. By doing so, this thesis attempts to follow the multi-paradigm principles of *scholarship discovery* or *engaged scholarship* (Van de Ven, 2007): *"a participative form of research for obtaining the different perspectives of key stakeholders in studying complex problems"* (p. 9). This form of research is believed to extend the capability of researchers who study complex problems and advance the knowledge in both science and practice *(ibid.)*.

5.2.3. Qualitative versus Quantitative

Exploratory research is widely associated with the adjectives 'qualitative' and 'interpretive'. Despite the fact that the exploratory researchers may collect both qualitative and quantitative data, they are commonly addressed as qualitative researchers. This misleading association may be interpreted in a way that quantitative data has no place in exploratory research (Stebbins, 2001). The philosophical positions, indeed, acknowledge the possibilities of using qualitative data in a positivistic way, as well as interpretation of quantitative data in a relativist approach (Oliver *et al.*, 2006). Hence, exploratory studies are best described by both their methodologies (the epistemological stance) and the methods (data collection and analysis techniques) they employ. This study therefore, can be generally described as quantitative-exploratory, due to subscribing to relativist traditions and employing mainly quantitative measures (Klein and Myers, 1999; Stebbins, 2001).

5.2.4. Hermeneutics: Methodology for Textual Analysis?

Hermeneutics, derived from the Greek *'hermeneuein'* (*v.*, to interpret, to understand) or *'hermeneia'* (*n.*, interpretation) can be defined as textual interpretation.

Historically, hermeneutics was associated with interpretation of biblical texts. Religious leaders and clergymen adopted hermeneutics to find authentic meaning and build new perspectives by revealing original meaning of biblical scriptures (Byrne, 2001). Modern hermeneutics evolved beyond biblical interpretation into a broad philosophy to illuminate understanding of human practices, events and situations (Crotty, 1998). Positioned among alternative philosophies within the relativist paradigm, hermeneutics views reality as socially constructed and subscribes to understand the meaning that people give to reality and not only the mechanisms the reality operates with (Van de Ven, 2007).

Central to hermeneutics, is the concept of *'hermeneutic circle'* – a process that implies that *"the part can only be understood from the whole and the whole from the inner harmony of its parts"* (Palmer, 1969, p. 77). The development of understanding, according to the hermeneutic circle, is explained by alternating views between considering the whole and the parts it is composed of. In other words, the meaning of the individual parts can only be understood within the context of the entire experience. At the same time, viewing the phenomenon as a whole is understood by reference to its integral parts. The continuous and circular interchange of views of the studied phenomenon - as a whole and as a sum of the whole - gradually leads to greater understanding. Hence, hermeneutic researchers, and those engaged in multi-paradigmatic or engaged research, are required to be more reflexive going through recursive turns, providing different insights and perspectives (Van de Ven, 2007).

5.2.5. Hermeneutics in Education Research

Hermeneutics, and the concepts of hermeneutic refinement in particular, have been previously studied in applied and operational sciences such as information systems, artificial intelligence, neural networks, machine learning and design. Hermeneutics was considered plausible in applied sciences for enabling iterative refinement of empirical insight and understanding of the studied phenomenon (Klein and Myers, 1999). The use of hermeneutics in education research has been advocated due to complexity of the field, which is tightly bound to contextual and cultural dimensions (Husen, 1988; Soltis, 1984). In order to address the diversity of education Gordon (Gordon, 1984; Gordon *et al.*, 1990) made a plea for hermeneutical approaches in research in order to prevent researchers rushing from *description* to *analysis*. Hermeneutics is frequently used in qualitative research and is often being allied with interpretation. Depending on the way it is being used in qualitative research hermeneutics can be considered a philosophy ('strong' sense), when used for interpretation of texts, or a set of methodological protocols ('weak' sense), when used for qualitative interpretive inquiry (Prasad, 2005). The fundamental principles and assumptions of hermeneutics can be found in practice of action research (Baskerville, 1999) and design-based research (Barab and Squire, 2004). The concepts of hermeneutics are present in ethnographic (Atkinson and Hammersley, 1994; Lambropoulos, 2007; Nocera, 2002), anthropological (Wortham, 2008) and phenomenographic (Dahlin, 2007) research conducted within educational context.

5.2.6. The Twofold Goal of Educational Research: Knowledge and Practice

In addition to acknowledging the postulates of scientific inquiry that this research subscribes to, it is necessary to acknowledge its place and the outcomes it produces in addressing the twofold goals of educational research. Educational research is not only research *on* education, but also research *for* education (Biesta, 2007). In regards of this classical dualism of 'basic' and 'applied' research, education, as an established discipline, is aiming at both (Bauer and Fischer, 2007). The main goal of basic research is to seek fundamental understanding of the phenomena under study. While, applied research aims to producing technical or instrumental knowledge (Stokes, 1997). For instance, the instrumental or technical knowledge in the area of education, as an outcome of applied research, may result in proposal of effective teaching strategies, assessment practices and other guidelines for supporting learning. Less prescriptive (or so called 'cultural') role of research, on the other hand, can inform educational practice, as argued by Biesta (2007, p. 298), by *"the provision of different interpretations and understanding of educational practice"*. Biesta *(ibid.)* continues however, stressing (ironically) that significant impact on educational practice has historically been made possible only after considering the cultural role of research. The following quote demonstrates it vividly.

> *While there is an important task for research in finding, testing, and evaluating different ways of educational action, research can also have a practical impact if it helps practitioners to acquire a different understanding of their practice. To see a*

> *classroom through the lens of behavioral objectives or through the lens of legitimate peripheral participation can make a huge difference, not only in that we can see things differently but also in that we may be able to see problems where we did not see them before. As a result, we may see opportunities for action and improvement where we did not see them before. The cultural role of educational research is thus no less practical than the technical role; it is just a different way in which research can be useful for educational practice (Biesta, 2007, pp.296-297).*

Given the tension between the perceived dichotomy of basic and applied research, it might be useful to explicate the position of *this* research in relation to the dualist aspect of educational research. Can the conducted research, which led to the proposal of the SEEM model, be ascribed to either basic or applied research traditions? Avoiding prescriptive recommendations for achieving, for instance, higher levels of engagement or more effective learning, the SEEM model suggests an alternative, holistic view on participant engagement. This research can therefore, be referenced to exerting a cultural, rather than a technical role. At the same time however, the possibilities of applying and implementing the model, developed as part of this research, attributes the outcome to the technical realm of educational research. Playing a dual role of developing an alternative perspective and proposing a tool for experiencing that view, this research attempts to avoid taking a segregating perspective on educational research and practice. At this stage however, the further understanding of the learner engagement phenomenon depends essentially on the application and implementation of the proposed SEEM model.

5.2.7. General Method of Theory-Building Research

The word theory (from Greek *'theoria'* – viewing, beholding) is defined by Gioia and Pitre (1990, p. 587) as a *"coherent description of observed or experienced phenomena"*. Unlike idealistic theories that attempt to describe the phenomena in the world, the theories in applied disciplines, such as business, engineering, information technologies or education, contribute to both the advance of scientific discipline and the enlightenment of practice. Hence, the research and the theories it generates are to contain practical value that enables not only describing but also informing practice in a professional domain (Van de Ven, 2007). From the perspectives of pedagogical design and e-learning systems engineering, the development of the SEEM model can be related to theory-building in applied disciplines.

Building a theory is referred to a process by which descriptions of the studied phenomenon are generated, tested and refined. Lynham (2002a, p. 222) defines theory building as an *"ongoing process of producing, confirming, applying and adapting theory"*. As with any research activity - that varies in relation to its goal, influences and requirements - theory building can embrace a number of strategies and methods. These approaches are grounded in relevant philosophical traditions that are better suited to understand and describe the studied phenomenon. As reviewed in section 5.2.2, paradigms, as a set of beliefs and assumptions about the nature of phenomena that constitute the four main categorical dimensions (i.e. positivism, relativism, pragmatism and realism) are unlikely to be synthesised due to existing contradictions among them. However, multi-paradigm theory building models have been demonstrated to be legitimate (Holton and Lowe, 2007; Lynham, 2002a; Van de Ven, 2007), given the theorist operates from only one of the given paradigms. The selection of methods, employed as part of the theory building process, should be driven by the nature of the phenomenon to be studied and described.

Regardless of the employed methods, theorists can consider deductive and inductive strategies for a theory development. These strategies are also referred to as theory-to-research and research-to-theory. Each of those strategies, inheriting a set of benefits and disadvantages from inductive/deductive reasoning, may be more/less suitable depending on the nature of research and theory development itself. However, Lynham (2002a) argues that the importance of theory building lies not in the prioritising one over the over, but rather understanding the interrelation between their components that are critical to theory development. These components (i.e. theory, research and practice) constitute the so called growth or virtuous cycle (see Figure 5-2).

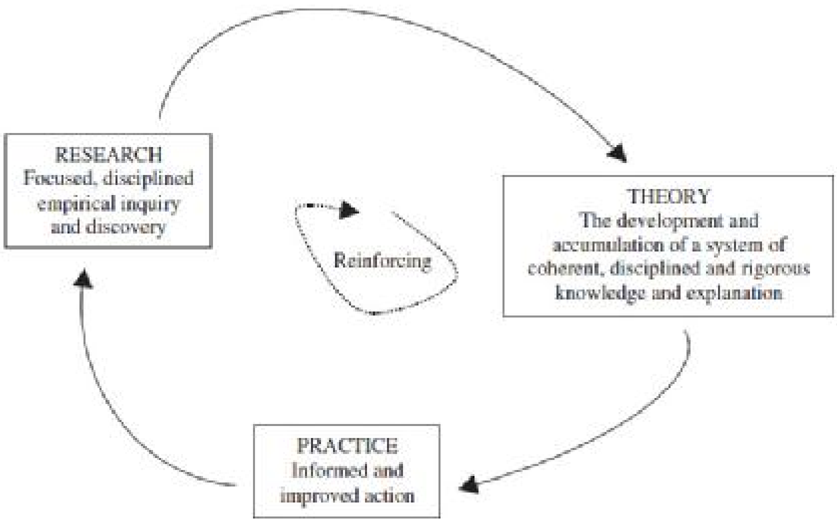

Figure 5-2: Growth cycle of theory-building.

The interdependence of the three components of the growth cycle underpins the development of a rigorous theory (Dubin, 1978). Building on the growth cycle, Lynham *(op. cit.)* proposes a general method for theory development that suits applied research better.

Referring to the literature, Lynham (2002a) stresses - given the applied nature of the research - the importance of developing expertise by employing both inductive and deductive processes. She explicates this idea by saying: *"Applied theory-building methods … require the theorist to interact with and be influenced and informed by both her or his experience of the phenomenon in practice and her or his acquired knowledge/mastery of the phenomenon in theory."*(p. 228).

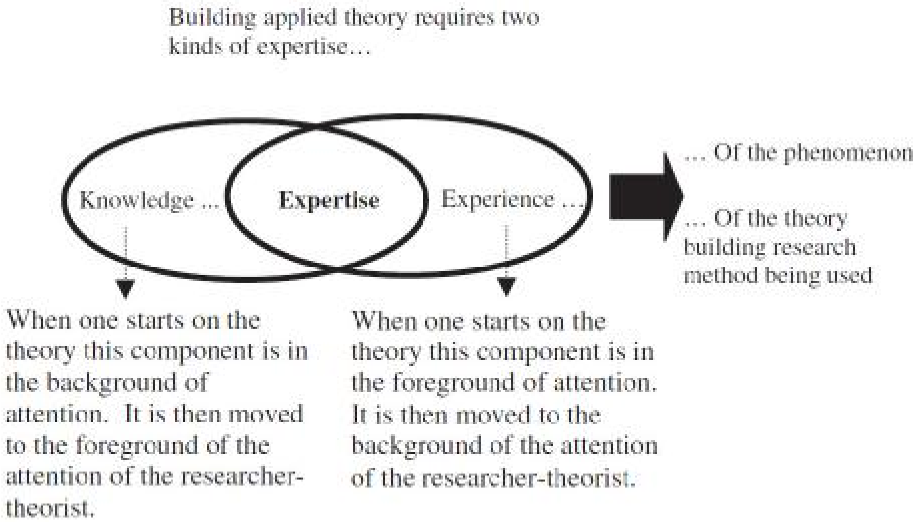

Figure 5-3: Recursive nature of practical and theoretical expertise.

Informed by the growth cycle and acknowledging the recursive nature of practical and theoretical expertise, Lynham *(ibid.)* introduces five distinct phases, namely: conceptual development, operationalisation, application, confirmation or disconfirmation and continuous refinement. She argues that a theory-building process can have multiple entry points with no priorities among the proposed phases. The General Method, presented in Figure 5-4, demonstrates the sequencing of the phases in relation to employed deductive and inductive practices. Referring to Cohen, Dubin and Kaplan, Lynham *(ibid.)* stresses that the development of the theory is never complete and is continuously in the state of development and refinement. This continuous progress further increases the overlap between the theorising and practice.

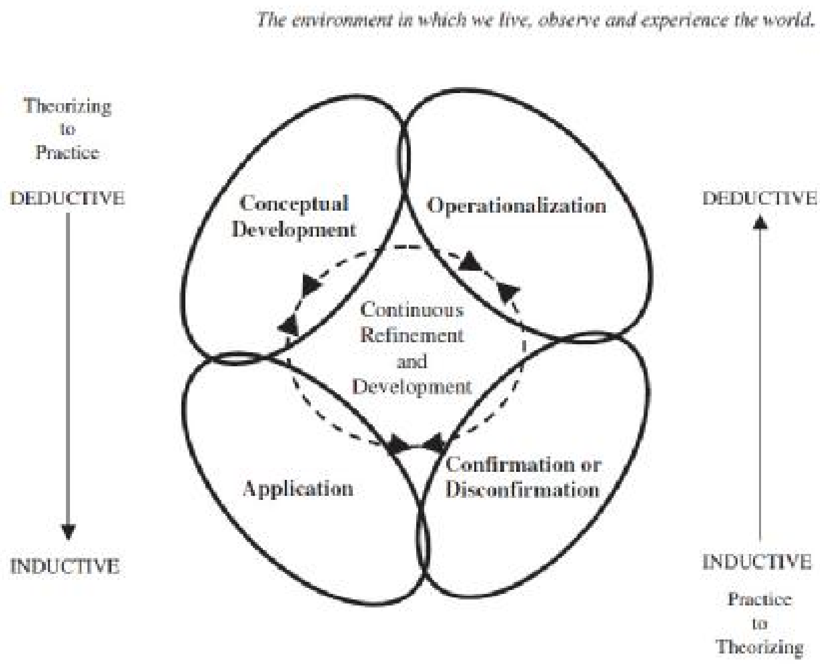

Figure 5-4: General method of theory-building research.

The general method of theory-building (Lynham, 2002a), demonstrates the systematic nature of the theory development process that can be described as an *"ongoing conversation between the research and practice, between concept development and concept verification, through research in the real world"* (Lynham, 2002b, p. 270). The proposed method embraces variations in the approaches of theory-building. Quoting Lynham (2002a, p. 237), *"multiple methods of theory building can and should be used to develop a theory in fields of the applied nature"*. She concludes by stressing the importance of developing integrated, inclusive, and multiple-methods perspective and approaches to building theories aiming to improve the rigour and relevance of the developed theories.

5.2.8. Design Research

The dominant approach in research and practice of education has been strongly influenced by an empiricist approach working within a positivist paradigm. The intellectual frameworks, within which most of the research in social sciences operates, remain undiminished. This claim is supported by the fact that most of the research literature on education remains empiricist in orientation (Gliner and Morgan, 2000; Smith and Blase, 1991). It is believed however, as illustrated in section 5.2.2, that the understanding of complex phenomenon can be extended by considering relevant contributions from different paradigms. While adopting a multi-paradigmatic approach to understand the phenomena of engagement, this research mainly operates from the relativist paradigm. Hermeneutics, the scientific tradition specifically concerned with interpretation (Gummesson, 2003), seems to be particularly relevant in the endeavour of this exploratory research. The use of hermeneutics was found particularly plausible for conducing research in applied disciplines and interdisciplinary areas such as information systems (Walsham, 2006), organizational studies (Lee and Location, 1994), design of information technologies (Coyne, 1995) and, more recently, design in computer supported collaborative work (CSCW) (Chalmers, 2004), computer supported collaborative learning (CSCL) (Hoadley, 2004) and pattern mining processes (Linden and Cybulski, 2009).

Researchers working in the field of education and online learning in particular, find themselves developing tools, frameworks and pedagogical models that may help systematically understand emerging pedagogical theories and learning experiences. In these contexts, the educational research moves beyond describing and starts systematically engineering these tools and models. The commitment to embracing the complexity of learning leads researchers to development of methodological toolkits to support deriving evidence-based claims in educational contexts (Barab and Squire, 2004; Reeves *et al.*, 2005). Design research, also known as design experimentation or design-based research (Brown, 1992; Collins, 1992), constitutes a set of approaches prescribed to producing new theories, artifacts, and practices that account for and potentially impact learning and teaching within the studied environment (Barab and Squire, 2004, p. 2).

> *Prototypically, design experiments entail both "engineering" particular forms of learning and systematically studying those forms of learning within the context defined by the means of supporting them. This designed context is subject to test and revision, and the successive iterations that result play a role similar to that of systematic variation in experiment. (Cobb et al., 2003, p. 9)*

Design research is considered suitable for addressing the need for 'evidence-based' models of practice (Van de Ven, 2007) as it is characterised as naturalistic, process-oriented, iterative measures that involve involves development of tangible designs that work in complex social settings. It operationalises measures, examines a phenomenon and understands the consequences of its use. The design is constantly revisited, progressively refined and systemically adjusted for further understanding of the studied phenomenon, which may in turn lead to: connecting design interventions with existing theory or generating new theories (Barab and Squire, 2004). The generation of new theories or further generalisation from the studied phenomenon, however, remains unlikely in design research until *"many designs and enactments are allowed to occur and to be studied formally"* (Hoadley, 2004). The SEEM model, in this case, may lead to generalised description of learner engagement or, ideally, to the theory of engagement only when sufficient number of evaluations and collation of these evaluations are made. Not less important than further generalisation, design research may address the local emerging needs and warrant for local gains (Barab and Squire, 2004). It is by the local gains, as argued by Brown (1992), that important theoretical insights into the observed phenomena and learning in general can be developed.

Design research, as any other research methodology or approach, is challenged to address the issues of rigour. Approaches in addressing research rigour vary according to the paradigm, due to their fundamental assumptions. Design research, embracing situation-specific contextual factors and focusing on development and refinement of understanding, may largely constitute inductive practices and be prone to interpretation (Hoadley, 2004). Some design researchers (Collective, 2003; Sandoval, 2004), rather than subscribing to one of the widely known paradigms, are claiming the design research to be an *"emerging paradigm for the study of learning in context through the systematic design and study of instructional strategies and tools"* (2003, p. 5). Accepting the reliance on techniques used in other paradigms, they attempt to illustrate the differences that set design research aside from other paradigms. Sandoval *(op.cit.)*, for instance, demonstrates a concrete example of theorising based on a historical empirical refinement of the design. In his argument, where Sandoval *(op.cit.)* describes the shift in the views on understanding the observed phenomenon, he emphasises the central role of refinement and the resulting change of conceptualisations and conjectures. Puntambekar (2002) refers to this post hoc change as *"informing cycles"*. Furthermore, it becomes apparent that design-based research integrates a collaborative effort of both educational researchers and practitioners, inferring that goals and design constraints are drawn from both the local contexts and researchers' agenda (Collective, 2003). The change in perspective and the intervention of researchers and practitioners in as part of the design research adds extra strain on the credibility of this developing approach.

One of the critics of design research is Kelly (2004). He argues that design research must grow from *"loose set of methods to a methodology"* (p. 118). Acknowledging this novel forms of design research Kelly *(op. cit.)* suggest rethinking the standards and characteristics of this approach. Referring to Shavelson and colleagues (2003) and highlighting the descriptors of design studies, such as, interventionist, iterative, multileveled, utility oriented and theory driven, he stresses the need to overcome the complexities of scientific problems that may be attributed to the common descriptors of design research. Kelly *(op. cit.)* suggests collaborating with other methodologists and methodologically 'borrowing' from other disciplines. In unison to Kelly, Bell (2004) emphasises the need to continue the discussion on methodological and epistemological issues of design research. At the same time however, he suggests that *"greater attention should be given to the pluralistic nature of learning theory, to the relation between theory and method, and to working across theoretical and methodological boundaries through the use of mixed methods"* (Bell, 2004, p. 243). Indeed, validity, utility and reliability are important factors, when for instance, cause-effect studies are conducted to inform policymaking (Shavelson *et al.*, 2003). However, the discourse on validity varies for different types and stages of design research. For instance, validity of model formulation may be viewed differently from that of model testing (Kelly, 2004). The academic community is still debating the issue of scientific validity in design research (Barab and Squire, 2004; Cobb *et al.*, 2003; Collins *et al.*, 2004; Shavelson *et al.*, 2003). There appears to be no single approach or solution for addressing the issue of scientific credibility. Bell (2004), argues that similar to the arguments surrounding the nature of science there will hardly be any unity around the diverse approaches in design research. He suggests however, addressing the issues of validity from specific lines of theoretical inquiry and within the boundaries of a particular study.

5.2.9. Model Validity and Utility in Exploratory Research

Development of a theoretical model, as part of this thesis, raises an issue of credibility and validity. Credibility of a theory, referred to at times as validity, indicates whether it can withstand the satisfaction of a critical reader and the canons of the discipline (Kvale, 1995). Validity represents a firm boundary segregating the truth from non-truth. From the subjectivist, postmodern stand, therefore, the issues of validity are sometimes overlooked or even discarded as irrelevant *(ibid.)*. On the contrary, validity is considered central in a positivist inquiry. However, both confirmatory and exploratory researchers alike are concerned with the questions of validity (Stebbins, 2001). Broadly framed, validity - in the positivist tradition - is most commonly referred to the extent at which the researcher measures what he/she intends to measure. Researchers pursuing validation operating in subjective, postmodern paradigms, are expected to demonstrate that they investigate what they intend to investigate (Kvale, 1995). The typology of validation (Campbell, 1957) however, which includes statistical conclusion validity, internal validity, construct validity and external validity, illustrates the variety of ways in which the credibility of a theory or a model can be questioned. Each of those criteria, whether more or less relevant to exploratory research, should be a concern of a researcher regardless of the paradigms he/she operates from. When reminded by Cronbach (Bell, 2004, p. 250) however, validity still remains to be *"subjective rather than objective: the plausibility of the conclusion is what counts. And plausibility, to twist a cliché, lies in the ear of the beholder"*. In the context of complexity that is associated with learning, Bell *(op. cit.)* suggests *"exploring how far theoretical and methodological pluralism will carry us in better understanding, promoting, and sustaining innovation in education"* (p. 251).

Therefore, the strength of the argument on validity may vary from one philosophical perspective to the other. For instance, the positivist tradition would require validation across the categories of Campbell's *(op. cit.)* typology, with empirical tests that ensure representative samples, confirmatory design and statistical power. Hence, the full testing of the proposed model from the positivist perspective is likely to fall beyond the scope of a single PhD study. Despite operating from a relativist stand, this thesis avoids developing an argument in support of the validity of the proposed model. In fact, the philosophical underpinning of the thesis would encourage the opposite, i.e. subsequent attempts to apply, test and improve the model by researchers that adopt alternative philosophical perspectives. Therefore, rather than conducting an argument towards the validity of the model, this thesis attempts to demonstrate the potential utility and applicability of the proposed model by referring to earlier conducted empirical studies. To achieve this aim, the retrospective consideration of the empirical studies intends to:

- demonstrate the value of model components
- identify patterns of engagement that may inform practitioners on further actions

- identify variables that are associated with certain engagement patterns, or to recognise the possibility of an association with variables that can be considered in future evaluations
- demonstrate the value and the potential of the integrated methods
- demonstrate the potential for automation and development of engagement evaluation tools

5.3. Chronological Account of the Conducted Inquiry

The general methodological constructs presented in this chapter underpin the conducted research. Attributed broadly to exploratory research, therefore, this research deviates from a linear, hypothetico-deductive and confirmatory line of inquiry. More specifically, it constitutes a set of empirical studies, subsequent iterative reflections and continuous referrals to the literature. The empirical studies were conducted sequentially and focused on various elements of student engagement. The reflective account of conducted studies and further review of the literature enabled theorising and reifying a mechanism for comprehensive evaluation of online learner engagement. The mechanism, introduced here as the Situated Engagement Evaluation Model (SEEM), is presented in the following chapter. The empirical work, which predicates the argument of this thesis, was largely conducted prior the proposition of the model. Framed by the proposed model, the empirical studies are revisited and presented in this thesis to demonstrate the potential of the proposed model and support the main argument.

To illustrate the line of thought and explicate the process of deriving the model a chronological account of the conducted empirical work is presented here. Table Table 5-1 indicates the data collection and analysis stages of the four empirical studies that are discussed in this thesis.

Empirical Study	*Discussed In*	*Data Collection*	*Analysis*
Learning Content and Log Analysis	Chapter 7	09-12.2006	01-04.2007
Learning Profiles and Content Analysis	Chapter 8	02-05.2007	06-07.2007

Empirical Study	*Discussed In*	*Data Collection*	*Analysis*
Social Network Analysis of Discussion Forums	Chapter 9	09-12.2006	01-05.2008
Participation in Peer Assessment	Chapter 10	09.2008-12.2009	01.2009-01.2010

Table 5-1: Chronological account for data collection and analysis of empirical studies as discussed in this thesis.

The further development of the argument is conducted linearly towards: [a] introduction of the proposed engagement evaluation model (Chapter 6) and [b] discussion of the empirical studies for explicating the potential utility and applicability of the proposed model (Chapters 7, 8, 9 and 10).

5.4. Methodological Limitations

The need for testing and validating the SEEM model from various paradigmatic perspectives constitutes the main limitation of this research. This limitation can be addressed by conducting a comprehensive validation, which integrates consideration of all the four of its main components along with a greater number of variables drawn from the inducing layers. The process of illustrating the potential utility and applicability of the model is reduced here to considering the earlier conducted studies in retrospect that may serve as an example for future validation endeavours. This thesis therefore opens a debate on the plausibility of the model and invites further inquires on validation of the model.

Additionally, the empirical studies as discussed in the following chapters were conducted with various cohorts of participants. Some of the data, considered in the evaluation of student engagement, was acquired from external sources, i.e. collaboration data from the externally run course. Future analysis that could eliminate these weaknesses may be considered necessary. Furthermore, the holistic evaluation practices may not be considered fully feasible unless automated tools are developed. Finally, alternative roadmaps, which employ different routes and methods, may subsequently be developed to address further development and validation of the model as widely as possible.

"There is nothing so practical as a good theory"
(Lewin, 1951, p. 169)

"The purpose of science is not to analyze or describe but to make useful models of the world. A model is useful if it allows us to get use out of it."
(Edward de Bono)

6. Models for Evaluating Engagement and Participation: A Context for the Situated Engagement Evaluation Model (SEEM)

This chapter refers to the earlier reviewed literature on learning theories, engagement and individual differences. It highlights a requirement for understanding learner engagement in relation to their personal characteristics and the employed pedagogical methods. The chapter then discusses the need for a model for guiding evaluations of the quality and level of engagement and participation. It critically evaluates available models referring to appropriate theoretical work where necessary. The chapter proceeds by describing the Situated Engagement Evaluation Model (SEEM) that attempts to address some of the gaps not covered by existing models. It then elaborates on the structural components and mechanisms of the proposed SEEM model and sets a context for demonstrating the potential benefits and applicability of the model in online educational settings.

6.1. The Rationale for Continuous Evaluation of Online Learning Practice

In line with social and participatory perspectives, student engagement and interaction are considered to be essential components of learning. Within the context of e-learning, evaluation of engagement is equally important. Student engagement with the VLE and learning resources, participation in learning activities, and interaction with others are imperative elements that can inform improvement to online learning practice. However, are researchers and practitioners equipped to evaluate learner engagement? This chapter aims to answer a number of important questions, including: [1] do research-based models for evaluating student engagement and participation already exist?; [2] how relevant are available models to the current educational demands?; [3] are applied models fully informative and what are their limitations? Before addressing these questions however, this chapter reinstates why it is important to evaluate learner engagement and how online learning practice can benefit from it.

The evaluation of online learning can be justified by the necessity of adapting, customising and refining educational practices. The technological advance and the affordances it offer for enhancing learning, drives the necessity to understand the ways students use and expect to benefit from using educational technologies (Littlejohn *et al.*, 2010). The continuous evaluation of teaching and learning practices can improve the learning environment and individual learning experiences – leading to greater developmental outcomes. Hence, the evaluation is suggested to be based on "…a dynamic, continuous, ever-emerging assessment of the learning process, the learner's progress, the instructional strategies deployed, and the learning environment" (McLellan, 1996, p. 101).

Researchers and practitioners are generally encouraged to approach the task of evaluation in conjunction with learning. Knowledge, from the social perspectives, is believed to be the product of activity, context and culture in which it is developed. It is therefore essential to approach the task of evaluation without separating it from these essential elements of learning. This means that a wide array of components that constitute the design of online courses and teaching strategies need to be taken into consideration. These components can be enclosed in the notable vignettes (Leach *et al.*, 2009) of contemporary online learning practices:

- Learners take charge of their own learning
- Teachers are model learners
- Collaborative and group work practices are embraced
- Curriculum builds on diversity
- Community resources of learning are being utilised

Constituting the social and participatory views of learning, these components of pedagogical design are aimed at improving learning outcomes. Yet, the effects of these elements on learning and student experiences need to be studied and understood. The results of continuous monitoring of pedagogical practice can enable better-informed refinements to course design and teaching practice (McLellan, 1996).

6.2. The Need to Evaluate Engagement and Interaction in an Online Environment

E-learning initiatives are employed to improve education and open new teaching and learning possibilities. The field of e-learning offers a great variety of online learning environments and an array of experiences. The evaluation of e-learning practices and the discovery and refinement of effective online pedagogies require continuous research. It is therefore important that instruments are developed for guiding researchers and practitioners and to support the development of systematic views on educational practices. Such instruments can then support the development of systematic views on the variety of educational practices and form part of a framework for evaluating the quality of learning experiences and informing further development of online technologies and practices.

Understanding Engagement in Relation to Learning and Learner Diversity: The review of the literature conducted by Tallent-Runnels et al.(2006) suggests that further research is needed to qualitatively distinguish pedagogical methods that lead to improved learning outcomes. In line with the earlier reviewed (Section 2.5) learning theories, Tallent-Runnels *et al. (op. cit.)* highlight the need for continuing to research those pedagogies that have a strong reliance on interaction and social activities. While interaction, centrally, underpins many pedagogies, it is unclear how to develop and maintain the levels of interaction that can ensure effective learning. Moreover, Tallent-Runnels *et al. (op. cit.)* recommend further research alongside student diversity for identifying and understanding the variations in the ways that students interact. Other authors (Strijbos *et al.*, 2004) argue that educational research is unnecessarily restricted to the studies of quality of collaborative products or individual learning results. They continue their argument suggesting that current design of online courses is usually based on subjective decisions regarding tasks, pedagogies and employed tools. Because the concepts that underpin pedagogical designs are insufficiently substantial, they call for conceptual clarifications and explanations of relationships between learner interaction and learning outcomes.

Avoiding Oversimplification of Engagement and Interaction Research: Larreamendy-Joerns and Leinhardt (2006, p. 592) maintain that the design of online environments should be primarily guided by "…an understanding of the epistemic and discursive practices that constitute disciplinary communities, and not by pedagogical considerations and technologies that short-circuit the engagement of students".

They argue that literature undermines the complexity of interaction and its relationship with learning outcomes. The authors warn about the tendency in the literature to consider interaction as a guaranteed path to learning. The view that learning is not a necessary consequence of student interaction alone is supported by others (Hiltz and Goldman, 2005; Picciano, 2002). While some authors welcome the wider acceptance that social interaction makes a valuable contribution to educational design, they believe that much further work is required to understand how to design online educational practices so that they successfully integrate and orchestrate epistemic practices (Larreamendy-Joerns and Leinhardt, 2006).

6.3. Evaluation Instruments and their Potential Benefits

As demonstrated in the previous section, the need for further research in evaluating engagement and interaction is justified by the potential implications that may lead to understanding of epistemic constructs of online learning and foster improvements in e-learning design and practice. However, the growing range of new media such as streaming video, weblogs, wikis and virtual worlds, combined with the diversity of disciplines, educational goals and environments present significant challenges for researchers and practitioners. Furthermore, additional strain is placed by the increasing diversity of students' cultural, social and educational backgrounds in higher education. The practitioners are often unsure how the new technologies can be integrated to ensure higher levels of student engagement regardless of their background. It is often unclear how to use the new media and technologies to encourage greater levels of interaction rather than distance students from one another. However, given an instrument or guiding principles for evaluating teaching and learning experiences, the practitioners will be able to continuously analyze and refine the employed pedagogical design - revisiting and adjusting the learning activities and tasks. In addition to practitioners, a precise instrument can also benefit educational researchers. Equipped with common principles or automated mechanisms, researchers will be enabled to expand continuous monitoring, and periodic data-collection and analysis. In addition to furthering the understanding of educational practice, such instruments and guiding principles can, therefore, catalyze the development of research and knowledge in the area of online learning.

Other potential benefits of such evaluation instruments include: informing the future development of learning technologies; and greater and more sophisticated automation of evaluation and analysis towards more timely and personalized intervention by practitioners. While potential for automation can promise teachers and researchers a reduced evaluation time, the students can benefit from an automated process too. Given access to the evaluation results, students can take more active roles in shaping their own learning experiences and directing the learning process. When student-centred approaches are introduced, the learners can take grater responsibility for determining their goals and monitoring learning progress (Hannafin and Hannafin, 2008). Therefore, automated evaluation instruments that provide descriptive feedback or prescriptive guidance may be beneficial for self-monitoring of learning progress and empowering a self-regulated learner.

6.4. Review of Engagement Evaluation Models and Frameworks

To address the need for evaluating student engagement in e-learning environments, a number of models have been developed in recent years. A selection of more widely accepted models are reviewed and summarised below. The review considers the strengths and limitations of models from the perspective of social learning theories. Evidence emerging from this review suggests a need to develop a new model or to extend existing ones, to fulfill the emerging needs for evaluating learner engagement.

In the following review, four questions are applied to each model for addressing the key issues that distinguish the models from each other or highlight their commonalities.

1. What are the main model components?
2. Are the evaluation methods explicit?
3. Can the model be extended if needed?
4. Does the model have a potential for automation?

6.4.1. Community of Inquiry Framework

The Community of Inquiry (CoI) was developed by Garrison *et al.* (1999) and introduced as a generic model and a tool for "supporting an educational experience". Educational experience is therefore central to the CoI model. It assumes that the process of learning is the result of a combination of three essential elements: social presence, teaching presence and cognitive presence. The CoI framework attempts to conceptualize the social, technological and pedagogical processes that lead to collaborative learning. Hence, the framework incorporates and promotes theoretical concepts of learning. It represents and attempts to theorize and address the issues of online learning through 'dialogic pedagogy' (Shea and Bidjerano, 2009) These issues align with concepts of epistemic engagement (Larreamendy-Joerns and Leinhardt, 2006).

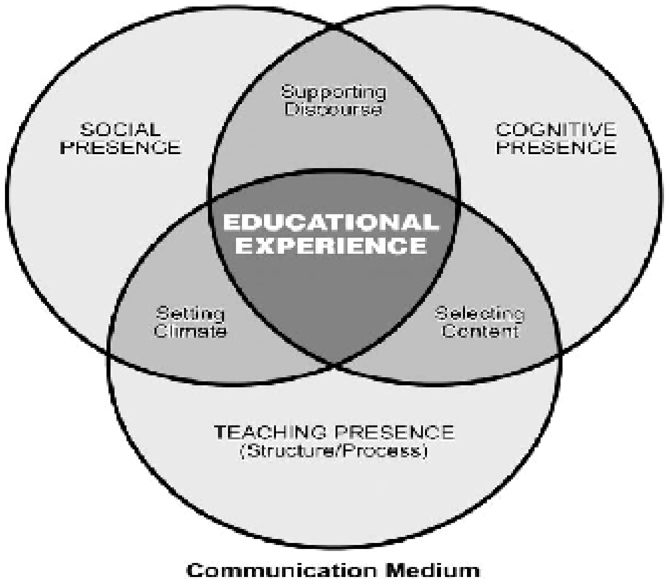

Figure 6-1: Community of Inquiry Framework (Garrison *et al.*, 2000)

One of the central concepts of the CoI is the development of online learning communities by instructional conversations that lead to epistemic engagement. The development of online communities is fostered by the three forms of presence (i.e. cognitive, teaching and social), which constitute the activities that support, nurture and cultivate the construction of knowledge. The authors (Garrison *et al.*, 2000) argue that productive online learning environments can be developed by careful combination of these three forms of presence. Cognitive presence is the vital element of the framework and is equated to the processes related to critical thinking. Social presence is characterized by the ability of participants to project themselves as 'real people' to the community. Its primary function is to support cognitive presence by facilitating the process of critical thinking. Garrison et al. argue that online instructors should take the responsibility of fostering social presence within the learning environment. Teaching presence completes the CoI framework. It constitutes two general functions: organization, selection and presentation of learning content; and facilitation of the social and cognitive presence aimed at actualization of learning outcomes.

The components of the CoI framework are seen as a set of overlapping lenses. While the interrelation between the three components is still open for discussion, Garrison *et al.* (2000) argue that the cognitive, social and teaching presence are interrelated and do not exist in isolation. Hence, the authors call for more research in understanding the optimal design and delivery in an educational environment, which can lead to a development of a functional CoI and therefore a desirable educational experience.

The CoI framework can also be adopted as a tool for evaluating asynchronous networks and text-based online environments. The CoI is in fact largely concerned with analysis of the text-based content of participant interaction. The framework therefore highlights the importance of objective coding of the information into one of the three presence categories. For instance, critical assessment, identification of problems, proposals and discussion of resolutions can be categorized as cognitive presence. Expressions of emotion, acknowledgment of others and group support can, for instance, indicate social presence. Lastly, teaching presence can be indicated by instructional and guiding messages; group management strategies; summaries of learning outcomes. The techniques for ensuring objectivity, reliability and validity of categorization are not elaborated further; they are left to the discretion of the researcher or practitioner.

While the CoI framework received great attention in the online learning literature (Arbaugh, 2008), a number of issues in relation to the components and methods of the framework have been raised.

Earlier research highlights the importance of elaboration of the teaching presence component. Potentially a two-dimensional construct, the teaching presence can constitute more than one function: course design and directed facilitation (Arbaugh, 2007; Jefferies *et al.*, 2003). Additionally, the teaching presence component indirectly affects the participatory roles within learning communities. Some may argue that the role of a teacher within the framework is delineated in a more traditional context. Representing the teacher as a model learner is discussed by the Grodzinsky and co-workers *op.cit.*, yet, the differentiation between the two participants (i.e. the teacher and the student) seems to be apparent.

Furthermore, focusing on asynchronous text-based interaction, the CoI framework accentuates the participants' contribution to the interaction and mitigates passive participation. As discussed earlier (see section 3.4.5) passive participation, when viewed from the perspective of situated learning theories (Lave and Wenger, 1991), can comprise an essential part of learning, when a learner enters, observes and gradually becomes an active member of a community. One study reports that almost half of all the postings were made by less than 8% of the community members (Zhang and Storck, 2001) - highlighting a great asymmetry in participation. The text-based indicators of the CoI framework would therefore be insensitive to this passive but important aspect of engagement; in Zhang and Storcks study, representing 92% of activity.

It should be noted that the three presence components of the CoI framework are not independent categories. Stodel *et al.* (2006) highlight the importance of carefully examining each of the categories towards developing a deeper understanding of their interrelationships. Stodel *et al.* (*op.cit.)* summarise studies that take into account participant demographic variables in relation to the level of participant presence. The framework itself however, does not have any mechanism for expressing or commenting on the relationship between individual characteristics and online engagement. The CoI framework therefore, does not appear to explicitly address the diversity of participants and the issues of personalization.

In summary, CoI represents a solid framework that focuses on the development of learning communities that exhibit epistemic engagement through meaningful participant interaction. The CoI framework can be used as an evaluation tool for content analysis of text-based asynchronous communication. The emphasis on content analysis however, undermines the contribution of passive participation (lurking) to the processes associated with social and cognitive presence components. The components of the framework are clearly defined, but there are interactions between components; most importantly, the teaching presence component is believed to influence social and cognitive processes. The framework is discussed within the boundaries of content analysis as its main method that limits its potential application. Furthermore, the lack of commentary on personal preferences and characteristics of participants may mislead less experienced researchers or practitioners in their assessments of participant engagement and progress. For these reasons, an alternative and/or modified version is considered (see below) to address the limitations of CoI framework and towards developing a more 'rounded' and sensitive tool for evaluating student engagement and progress in learning environments.

6.4.2. Cybergogy: Instructional Design Model

Cybergogy is another framework developed to accommodate strategies for creating engaged learning online. The developers of Cybergogy highlight the need for addressing participant diversity in online learning and claim to offer a framework that guides the methods for "…generating meaningful and engaging learning experiences for distance students with diverse cultural and linguistic backgrounds" (Wang and Kang, 2006, p. 225). The authors review literature on engagement and highlight indicators, measures and strategies that support engaged learning practice. The Cybergogy framework comprises three intersecting domains/factors: cognitive, emotive, and social (see Figure 6-2). Wang and Kang *(op. cit.)* believe that engaged learning is possible when critical factors are well attended by the learners – creating cognitive, emotive and social presence.

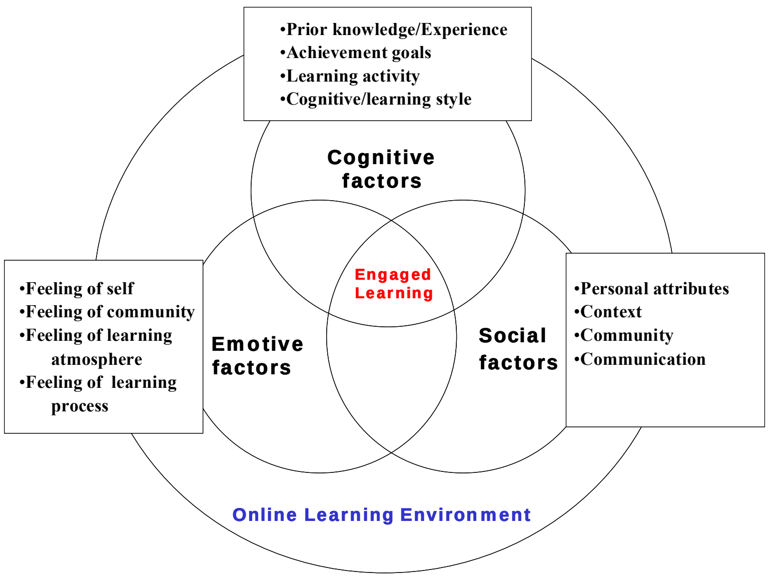

Figure 6-2: Cybergogy for Engaged Learning.

Although very similar to the Community of Inquiry (CoI) framework (as reviewed in section 6.4.1), Cybergogy appears to substitute CoI 'teaching presence' with 'emotive factors' and leave the other two conceptual elements of the CoI diagram intact. However, covering a comprehensive review of the engagement literature, Cybergogy elaborates on the diagrammatic structure attempting to offer an insight onto online engagement. With respect to the change in emphasis away from teaching towards emotive factors, the authors propose that these form an integral part of the process of adult learning. Wang and Kang *(op. cit.)* identify four types of 'feeling' that make up the emotive domain. These are: [a] feelings of self; [b] feelings of interpersonal connection/community; [c] feelings of learning atmosphere; and [d] feelings emerging from the learning process. Wang and Kang *(op. cit.)* expand on each category and propose pedagogical techniques for ensuring higher levels of learner engagement.

While teaching factors are not made explicit in the diagram, Cybergogy does discuss and highlight the central role of facilitators and teachers in supporting emotive, social and cognitive development. Hence, teaching factors underpin all three domains of the framework. The framework is, in fact, targeted at teaching practitioners with the purpose of suggesting the design of generative and constructive learning activities and evaluation techniques. Furthermore, the framework proposes a taxonomy of engagement and assessment strategies in online learning with categories for indicators of engagement and common measurement techniques.

Some of the measurement methods used by the Cybergogy framework raise questions of subjectivity and reliability, particularly surrounding the measurement of emotional factors. While 'emoticons' may indicate personal perceptions of possible cognitive-emotive state, such reductions of complex psychological processes may constrain the reliability of the analysis. Furthermore, it is unclear how the other emotional factors, identified by the authors, can be measured. The Cybergogy framework inherits some of the disadvantages of the CoI model. Arguably the most vulnerable element of the framework is the way in which linguistic and cultural diversity is addressed. Wang and Kang *(op. cit.)* derive a taxonomy of student engagement and assessment, which, however, does not accommodate the factors, measures or strategies for considering diversity of cultural background and addressing equality within online learning environments. Most importantly though, it is necessary to note here, that the framework has not yet been empirically tested and validated. However, Cycbergogy's recognition of the emotive domain as being an important factor in online engagement may yet invigorate and inspire further development of online engagement research. This alone justifies Cybergogy's inclusion for review.

6.4.3. Actors, Assets and Activities: 3A Model

The Actors, Assets and Activities - also known as the 3A Model (Bogdanov *et al.*, 2008) was introduced to generalize the visual and functional properties of Web-based applications. This model demonstrates potential for practical application in representing and analyzing the interrelated components that play a central role in online learning practice. Although a general model, 3A refers to learning theories and is therefore relevant to an online learning context. The authors of the 3A model draw on activity, distributed cognition and actor network theories. They also aim to include the model technology in a personal learning environment (eLogbook), which is under development as part of the European PALLETTE project. The model therefore expresses concepts that are widely accepted to be part of learning processes. For example, the essence of the model is expressed in the statement that 'An Actor is producing an Asset within an Activity' (Bogdanov *et al.*, 2008).

The three components of the 3A model are therefore activities, actors and assets (see Figure 6-3). An actor may be a human or non-human agent, such as a student, a teacher, an intelligent object, a remote device or a software agent. Assets are "content repositories" such as document collections, discussion threads, wikis or image albums. Activities are defined as "…formalization of a common objective to be achieved by a group of actors" (Bogdanov *et al.*, 2008, p. 43). The authors associate activities to a classroom or a project management environment that can for instance contain a set of learning tasks. The three elements of the model are connected by directed or undirected ties and held together by a central 'events action'.

Figure 6-3: The eLogbook 3A interaction model.

When used for evaluating student engagement, the 3A model may shed light on patterns of participant behaviour. More precisely, the model may guide practitioners in identifying and monitoring participant interaction with components depicted by the model, towards a greater understanding of engagement and learning processes. However, although the 'protocols' layer has potential for explaining relationships between components, the authors do not provide further explanation on the nature of protocols beyond describing these as organizational or operational governing factors.

While innovative and inspiring in some respects, the 3A model misrepresents certain areas of established theory and has other limitations. The authors claim that 3A is rooted in activity theory. However, if this were the case one would expect 3A to differentiate the three dialectically related levels of analysis: activities, actions and operations (Roth and Lee, 2007). The hierarchical structure of these major elements for analysis (i.e. activities, actions and operations) is unclear, which can subsequently affect the evaluation of learner engagement. Furthermore, the association of actors with non-human agents such as computer software or remote devices widens the conceptual gap between this model and activity theory. Activity theory considers non-human artifacts as unambiguously asymmetrical to people (Nardi, 1996). While explicitly defining its components, the 3A model does not elaborate on methods and protocols for understanding and measuring the interrelationship among the components. Although the model is claimed to be simple and extendable, the direct application of the model in evaluating participant engagement or interaction may not be comprehensive.

6.4.4. Theory of Online Learning

The Theory of Online Learning, introduced and developed by Anderson (2008) attempts to provide a framework to support the development and practice of online learning. This framework is informed and guided by theoretical constructs of learning and recent empirical research. The core of Anderson's theoretical framework lies in the Model of Educational Interaction (MoEI) (see Figure 6-4). The MoEI combines components that are believed to be essential for effective learning in general and learning online in particular. The model is mainly concerned with interactions between the three key components; teacher, student and content. Anderson highlights that benefits of interaction include meaningful learning, enhanced learner-control and creation of learning communities. The MoEI therefore emphasizes that interaction has a critical role in supporting learning and education.

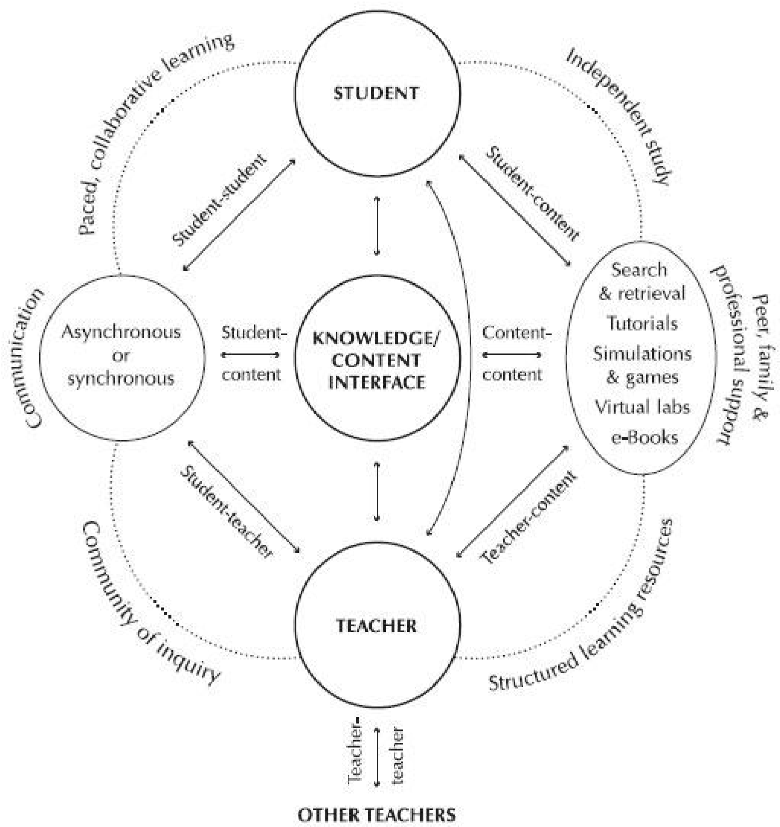

Figure 6-4: Anderson's (2008) model of online learning

Anderson adopts the wider definition of Wagner (1994, p. 8) that interactions are "reciprocal events that require at least two objects and two actions", thus recognizing that interaction takes place between both human and non-human agents. Correspondingly, the MoEI accommodates cross-component interaction between learners, teachers and educational content. Believing that interaction underpins learning, Anderson suggests that the proposed model can inform practitioners by: [a] allowing planning and tracing the interaction of learners; [b] monitoring the balance of interaction between the various components of the model; and [c] monitoring learner progress and the achievement of learning outcomes.

It is relevant to note that Anderson was a long-time colleague and co-worker with Garrison (Anderson, 2009), with whom he co-developed the CoI framework (see section 6.4.1). Despite the apparent differences between the joint effort of CoI and the later developed MoEI, the two models share some underpinning elements. One of those elements is based on Moore's (1993b) concepts of interaction. The main difference between the two models is that content is a prominent component of MoEI. Anderson highlights the general importance of student-content interaction, for instance, independent study in the library. By including content as a system component, Anderson *(op. cit.)* provides a means for addressing student passive participation, thereby addressing one of the key limitations of CoI.

Nonetheless, the MoEI does not describe the methods and techniques for tracking, monitoring, analyzing and evaluating the most essential element of the model – interaction. The lack of explicitly defined methods may hinder the practical application of the model and its technological implementation. Similarly to the CoI framework, the MoEI does not discuss mechanisms for addressing diversity in student demographics, culture and socio-economic status. Hence, the application of the MoEI may require additional structural elements for accommodating learner diversity, and most importantly, informing the educational practice that aims to embrace the challenge of the diversifying Higher Education sector.

In fairness to Anderson *(op. cit.)*, the author recognizes the necessity to measure the direction and the degree of the effects that the components of the model can have on learning and satisfaction. He restrains from further conceptualization and highlights the necessity to conjecture and test hypotheses for explaining educational experiences.

6.4.5. Other models

Three further models considered but not reviewed in detail were: [1] the Participation-Identification Model, developed by Finn (1989). This is mainly concerned with generic aspects of institutional or behavioural engagement (see section 3.2.1). Because the techniques and measures of this model have not been developed for application to online learning, this model is not considered further; [2] the Collins (1990) framework provides guidelines surrounding the use of summary statistics, diagnostics and portfolios. While considered potentially informative for evaluating engagement (McLellan, 1996) this framework is intended largely for student assessment, rather than for informing pedagogical practice that is the concern of this thesis; and [3] the Student Engagement Review Cycle (Little *et al.*, 2009) was developed as part of the HEFCE report on student engagement. The report highlights a necessity for constant evaluation, monitoring and adjustment of practice towards improving student engagement. However, the HEFCE model was excluded from the review due to its broad perspective and aims of institutional engagement.

6.5. Towards the Situated Engagement Evaluation Model (SEEM)

The literature on online learning contains much evidence of serious endeavours to understand, model and enhance processes of online learning. The theoretical models, reviewed in this chapter, reflect the variety of conceptual work that attempts to shed light on some aspects of e-learning. In addition to conceptual works, the literature of online learning contains numerous empirical studies, evaluation reports and systematic meta-analysis that attempt to inform online learning practice and advance the development of the field (Tallent-Runnels *et al.*, 2006). However, as raised earlier in Chapter 1, the theory and practice of online learning can be understood when research initiatives embrace the complexity of the process and constitute holistic studies (Dyke *et al.*, 2006). As stressed by some authors (Andrews and Haythornthwaite, 2007) the e-learning research often exhibits [a] lack methodological rigour and [b] limited flexibility for accommodating the multifarious approaches and pedagogical needs. Although many of the models reviewed are useful for defining approaches for studying online educational practice, none of these models are at a stage of development capable of providing conclusive answers to the questions posed in section 6.4. The models are still to demonstrate their relevance to the requirements of a practical and widely applicable model capable of addressing the diversity of pedagogical design.

This section, and the thesis as a whole, therefore draws on literature and exploratory studies to develop a model for monitoring and evaluating online engagement. The model is intended to be useful for educational practitioners and researchers. It aims: [1] to address limitations of earlier models focusing on potentially automatable and comprehensive evaluations of online engagement; [2] to offer an evaluation instrument for informing and supporting practitioners towards improving online learning experiences; and [3] to guide researchers towards enhancing theoretical models of online learning.

6.5.1. The Scope of the SEEM Model

The proposed SEEM model represents a comprehensive mechanism that aims to integrate a variety of instrumental components and methods to allow a holistic, comprehensive and rigorous evaluation and monitoring of online learner engagement. The proposed model does not intend to be a comprehensive theory of online learning but rather offers a conceptual model for evaluating how participant engage with the elements of online learning. The model does not therefore offer a single solution for enhancing student engagement, but aims to support identification, understanding and changing patterns of student engagement. The development of the model can characterised as evolving the in dialogue with the literature and the findings of the empirical studies. The outcome of the development represents a conceptual model for evaluating participant engagement. It is based on a theoretical domain that encompasses the social theoretical perspectives on learning as discussed in Chapter 2 and attempts to accommodate the concepts of situated learning, activity theory and distributed cognition. The model focuses on a key element of learning - engagement and interaction – and offers a comprehensive framework that constitutes a set of the components, variables and interrelations that bind into a single comprehensive system for evaluating learner engagement.

A working name is adopted of "Situated Engagement Evaluation Model" (SEEM). The model is inspired by the reviewed learning theories and examined online learning models. It represents an amalgamation of various models and conceptual frameworks. The word 'situated' is not an exclusive reference to Situated Learning or the concept of Community of Practice (Lave and Wenger, 1991), but indicates the 'situatedness' of learners and teaching practitioners within an online learning environment. Yet, teaching and learning experiences based on the concepts of situated learning may employ this model.

SEEM is not a recipe for successful online teaching or learning practice. In its current stage of development it is a descriptive and exploratory instrument for evaluating practice. It may however, alert educators to: areas requiring attention; the breadth of learner needs and responses to teaching approaches; and the impacts of changes in teaching approaches. By answering these questions educators may develop strategies, structures and designs for effective practice. The intention is that SEEM should be used progressively towards a deeper understanding of online educational practice and more refined theories of learning.

6.5.2. The Rationale, Potential Use and Users of the SEEM Model

It is accepted that the design of e-learning environments and the structure of teaching and learning practices should primarily be dictated by clear understanding of the epistemic constructs (Larreamendy-Joerns and Leinhardt, 2006). Larreamendy-Joerns and co-workers *(op. cit.)* argue that at times of continuous socio-economic changes, cultural diversification and technological advances, epistemic constructs can be understood by repeated analysis and constant monitoring of teaching and learning. The need for continuous evaluation shapes the rationale for proposing the SEEM model. The use of the model as an instrument or a guide for evaluating student engagement in relation to pedagogical structures can shed light on our understanding of the epistemological structures and inform the refinement of the teaching and learning strategies. Hence there is a rationale and a great potential for the development of a practical and rigorous model that can become a valuable instrument in the area of e-learning. The introduction of the SEEM model in this work is an attempt to start the development of this practical instrument.

The SEEM model can be adopted by practitioners who are willing to monitor student interaction or levels of engagement with educational activities and resources. Evaluating student engagement, the teachers can then adjust the learning resources and re-structure the learning activities. Revealing the patterns of student interaction, the SEEM model can help practitioners adjust the facilitation techniques for encouraging closer interaction, wider participation or greater cohesion where necessary. The SEEM model can also be adopted by educational researchers. The evaluation of engagement in relation to the embedded variables can shed light and enhance the understanding of online learning. Last, but not least, the SEEM model can also be used by students themselves, when the results of the evaluation are made available for self-assessment and self-regulation purposes.

6.5.3. Framing and Defining the Components of the SEEM Model

SEEM aims to provide comprehensive information about online learner engagement. The concept of engagement here represents a meta-construct to emphasise the multitude of components that comprise the online learning environment and experience.

Referring to earlier literature (see section 3.2) and building on the definitions of Fredricks *et al.* (2004) and Newmann (1992) engagement is defined here as: *participant's behavioural, emotional and cognitive investment as participatory interaction directed towards learning within an online environment.* A working definition of 'participatory interaction', informed by Wagner (1994) and Lee's (2006) concepts of active/passive participation (as discussed in section 3.4.5), is adopted that this is: *directed action that involves at least two objects and causes unidirectional or reciprocated after-effects*.

6.5.3.1. Engagement Components of the SEEM Model

The main components of SEEM are informed by literature reviewed earlier and are: Participant; Learning Content; Pedagogical Design Elements; Learning Profiles; and Dialogue and Communication (see Figure 6-5).

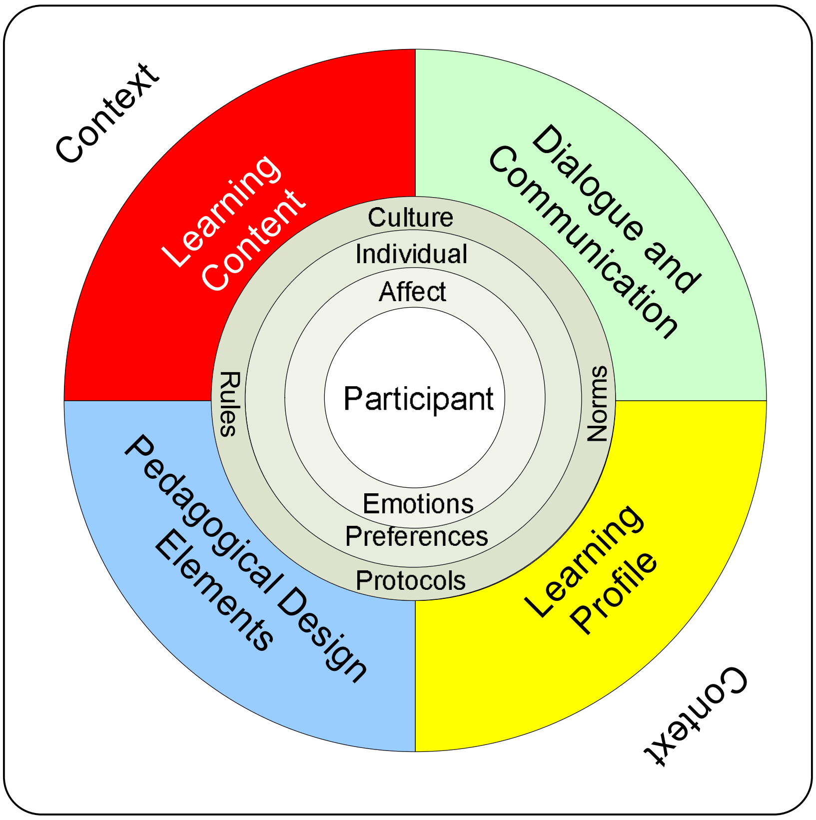

Figure 6-5: Components of the Situated Engagement Evaluation Model.

At the heart of SEEM is **'Participant'.** Participants are human actors (students, teachers and facilitators) using an online learning environment, therefore engaging behaviourally, emotionally or cognitively by interacting with other components of the SEEM model.

Participants may interact with one or more of the four major model components. Evaluations of engagement are based on observing and analysing interactions of participants with compounding elements in each of the components. Components are interrelated and interactions with one component may lead to changes of interaction in others. Components are as follows:

Learning Content: is usually a combination of learning resources, such as lecture notes, videos, textual or other materials. Learning content may be made available via an online environment and may be accessed by participants throughout the learning process, typically bounded by a formal course structure. The patterns of student interaction with the elements of learning content may contribute to understanding aspects of student engagement behaviour. Student access logs (automatically recorded by many VLE/PLEs), may be used diagnostically and evaluatively by teachers and facilitators. The direction of interaction of the participant with content can be either unidirectional or bidirectional. For instance, as part of the interaction: [a] the student can access the materials provided by the teacher; [b] the student can contribute to the development of learning materials; or [c] the material can be automatically sent out to the student by the e-learning system (i.e. [a] unidirectional; [b]&[c] bidirectional).

Pedagogical Design Elements (PDEs): define the structure of the teaching and learning process. The pedagogical design elements represent the tasks and educational activities embedded in the structure of the course. One example might be a peer assessment exercise or a group-work activity. The compounding elements of the component, integrated as part of the pedagogical design, may vary in complexity. When the structures are complex, they may and often should contribute to other areas of the model; for instance, a peer assessment exercise may integrate student interaction and discussion. Evaluation of student engagement with PDEs therefore, may require a careful consideration of comprehensive learner interaction. The identification of student interaction patterns with PDEs may provide useful information on enhancing their design and integration. Consideration of PDEs as a separate component is intended for analysing the relationship between the pedagogical design learner engagement that may feed the reflection upon and the refinement of pedagogical designs. Separate consideration of the differences between student engagement and various pedagogical structures may also shed light on the issues of personalisation, learner preferences and traits (Graf, 2007).

Dialogue and Communication: social learning theories stress the central role of dialogue and communication in learning. This component emphasises identification of communication patterns and roles of participants within the online environment. This may help practitioners understand the social dynamics of the class and inform intervention or modification when necessary. While dialogue and conversation may presume active contribution, this component includes passive participation of learners who do not reply to or initiate communications. The model, therefore, may alert practitioners: to silent or peripheral learners; to investigate reasons for communication patterns; and introduce strategies for more fully engaging participants. The analysis of communication may contribute to understanding engagement at participatory, emotional and cognitive levels. Potential measures and methods for doing so are discussed in section 6.5.4.

Learning Profile: refers to tangible, socio-historic artefacts accumulated by the participant over time. Examples include grades, certificates, accomplishments or experience and other evidence of acquired skills and experience. As learning profiles may include unassessed artefacts, consideration of the learning profiles as a separate component may also provide further information on levels of student cognitive investment into the learning process. The development of learning profiles may help practitioners identify where student support is needed. Conversely, practitioners may also identify factors that lead to improving learning profiles. Hence, learning profiles here are considered to be an extension or projection of student personal development. Learning profiles are therefore regarded here to be expressions of student personal development.

Context: forms more widely used notions of culture and community experiences. The concept of context, as a component of SEEM, represents and constitutes the virtual environment employed for educational purposes. This component is described by the variables that reflect the technological characteristics of the learning environment such as, usability, accessibility, response time and security.

6.5.3.2. Inducing Components and Descriptive Variables of the SEEM Model

The central participant component of the model is surrounded by three layers: [a] an affective layer that includes emotional factors; [b] an attunement layer that combines personal preferences and individual differences; and [c] a socio-historical layer that encompasses the culture, norms, codes of conduct and rules. The interaction of the participant with the main components of the model is being induced by these three dynamically changing layers. The engagement of the participant with various components of SEEM may, in its turn, alter the three layers too. These layers denote complex systems that differ in their interrelation to the participant and vary in their potential for change. Each of the layers encompasses a number of variables that carry a potential for describing or explaining participant learning experiences in relation to his/her engagement. These layers should be seen as a set of lenses that deflect and reflect participant interaction. An alternative metaphor – engagement filters – can be used to denote the role of these layers in the model. The layers therefore, are considered to be the inducing and descriptive components of the model that affect participant engagement. However, the layers represent a flexible structure that may dynamically undergo adjustments as a result of participant interaction with other components of the model (as discussed below for each of the layer).

A number of variables and more complex structures can be identified and studied as part of the three layers. For instance, cultural tools, such as language, can be studied as a complex mediator of participant engagement. However, the main purpose for incorporating these three layers is to enrich the model with a set of variables that can help practitioners and researchers understand the nature of participant engagement. The studies of engagement in tight relationship with the three intervening layers can also contribute to understanding the dynamic properties of the layers and shed light on the conditions that alter personal preferences, culture and norms.

The three layers of the model are positioned hierarchically. The closer the layer is to the central component (the person) the less dynamic the changes of the layer may appear to be. This may be explained by: [a] the deep evolutionary structure of human emotions (affective layer) (LeDoux, 1995); [b] early brain wiring that structures personal preferences and differences, but is susceptible to change (attunement layer); [c] the social nature of culture and norms that are adjusted over time according to the environment (socio-historical layer). Hence, for instance, personal preferences, as part of the attunement layer, are considered relatively more stable than the codes of conduct that are part of the socio-cultural layer. The explication of the variable and further elaboration of the layers is presented below.

Affective Layer: Emotive Factors

Much educational research exhibits a tendency to focus on the role of cognitive rather than affective processes of learning. Considering human thinking and learning as akin to computer-like information-processing marginalises or ignores the role of affect. Yet, research conducted in the last decade suggests that affect is intertwined with cognition in a complex way. Affect influences or even guides rational behaviour, memory retrieval, decision-making and creativity. The imbalance of research between cognitive and affective factors in human learning needs to be addressed especially in relation to the developing theories of online learning (Picard *et al.*, 2004). Calls for the application of relevant theoretical models that support affective learning outcomes are increasingly being made (Shephard, 2008).

The process of learning and learning outcomes can be directly affected by the range of emotions exhibited by learners and teachers. Kort, *et al.* (2001) argue that the affective state that a learner experiences may change significantly throughout the learning journey across a spectrum of various emotions. The emotional state of the learner may influence the efficiency and effectiveness of the learning process. The authors propose a model for the generic learning process predicated upon a set of meta-cognitive processes. However, more research is needed to elaborate the methodological aspects of emotional factors that affect teaching and learning. A need for research has been particularly identified to study the emotional aspects of a discourse to understand the role it plays in online learning (Zembylas, 2008).

In a face-to-face setting, participants can pick up emotional cues from a number of gestures, facial expressions, tone and style of speech. By contrast, in an e-learning environment, the identification of a participant's emotional status is more challenging due to constraints imposed by internet technologies. The dominating form of interaction – the asynchronous textual communication – is limited to the use of text. However, emotional cues in the context of online learning can still be identified through the use of emoticons and the styles of the exchanged messages. A content analysis that takes into account the use of emoticons in online discussions can go some way to reflect the affective state the learner is in. Considerable progress in identifying the affective factors has been achieved lately. A number of approaches have been developed to mine and analyse textual content exploring the emotion in the exhibited communication (Gregory *et al.*, 2006). The affective layer of the SEEM model is integrated to allow consideration of affective factors in the process of engagement and learning in general.

Attunement Layer: Individual Preferences, Differences and Traits

Individual Preferences, Differences and Traits delineate the second layer that encircles the participant on the SEEM diagram. This layer represents the participant's personal preferences and individual characteristics that may affect his/her mode of interaction with other components and the levels of engagement in general. Individual differences and personal traits can include attitudes, general skills, or preferences for processing information and constructing meaning. These traits can be categorised into general abilities and cognitive controls. The categorisation can also be based on more complex psychological dispositions such as cognitive styles, learning styles or personality differences. Jonassen and Grabowski (1993) studied student interaction with various forms of learning activities and pedagogical structures comparing it to students' individual traits and learning outcomes. The authors argue that traits and individual differences can affect the way students respond to various forms of instruction. The authors call for additional research in understanding the effects that personal traits may have on learning, highlight the necessity for raising awareness about the differences, and suggest grounding the teaching and learning practices in the models that are informed by the research of individual differences.

It is widely accepted (as discussed in Chapter 2) that effective learning requires the student to be in a social and academic environment. It is however, necessary to consider that student motivation and ability to learn are also important to foster learning. The concept of ability is multifaceted, which makes the general distinction of the "more/less able" student increasingly irrelevant (Armstrong, 2009; Gardner, 1993). However, it is necessary to stress here, that a single teaching technique can be approached differently by students with different traits and, therefore, can lead to different learning outcomes. The awareness of teachers concerning individual traits can help structuring and refining the design and pedagogical practice. Being aware of the traits, the teacher can then decide to either ensure the educational experience to meet the student's individual preferences or challenge the student to learn methods that are less preferred or less efficient. As Säljö (2009, p. 205) eloquently said: "…we can imagine settings where individual differences are critical, but we can also imagine settings where the learning situation can be organized in such a manner that these differences do not appear as fundamental". It is therefore important to include the layer into the SEEM model for monitoring student engagement in relation to their personal traits and differences. The inclusion of the attunement layers may be informative and potentially useful for improving learning experiences.

The literature contains a great variety of units of analysis and psychometric tools for identifying and measuring personal traits and preferences. Some of the variables may include personality traits such as introversion/extraversion, anxiety levels or ambiguity tolerance. Other traits that can be of interest to educators and the users of the SEEM model in particular are: cognitive styles, learning styles or cognitive controls as reviewed in Chapter 4. Learning styles are used in this thesis for illustrative purposes and as part of the attempts to demonstrate the potential insight that can be acquired by applying the SEEM model.

Socio-historical Layer: Culture, Norms, Rules and Protocols

This layer represents a complex combination of socio-cultural factors that may affect participant interaction with the main components of the model. This layer is socially constructed and is constantly in a dynamic stage. The dynamism of the layer inflicts additional complexity on measuring and analysing the effect that the culture, norms, rules and protocols can have on participant engagement. Due to the complexity of this layer, many practitioners may think that they have limited or no control over the dynamic variables associated with the layer. Some methods for evaluating the change and the effect of the layer are proposed in the following section. Prior to that however, some of the research approaches that study the constituting elements of this layer are elaborated.

There is a tendency in scientific research to employ reductionism. Questions in biology can be explained by understanding cell structures and complex organisms can be represented as an interacting system of their cell components. The reductionism works, which justifies the reasons for employing reductionist approaches in scientific research (Gallagher and Appenzeller, 1999). Reductionist techniques allow researchers to control and deal with complexities of the world. However, application of the reductionist approaches in social psychological and educational studies may diminish cognitive complexities. The studies of culture, role and other social dimensions have tendencies to over-simplify these complex categories by undermining variations among their elements.

Orellana and Bowman (2003) highlight that current research on cultural diversity carries two major conceptual and methodological limitations. First, is the focus of research on single levels of analysis that undermines the interrelation of individual with community-based experiences and second, the tendency to treat the variables such as ethnicity, culture, class or race as fixed rather than socially constructed processes. They suggest studying culture as a dynamic construct that people cultivate through various sets of experiences. Hence, the evaluation of participant interaction with the components of the model should be considered in relation to possible changes of perceptions, views and attitudes. This perpetually dynamic layer not only affects student engagement but also brings additional challenges to understanding and evaluating the pedagogical practices. Yet, careful consideration of variables and methods may eliminate some of these challenges.

The literature on culture in educational research often points to 'pan-ethnic' labels (e.g. Asians) that categorises individuals and communities of a wide variety. The internal subdivision of categories by differentiation along cultural dimensions, such as languages, immigration status, cultural practices, political or religious affiliations, can significantly affect the outcomes of studies (Orellana and Bowman, 2003). Hence, careful consideration of cultural variables is necessary for understanding the interrelated engagement patterns and the dynamism of this socio-historical layer. Variables such as race, for instance, may be substituted by: [a] countries of origin (regions, i.e. rural or urban); [b] language preferences and multilingual fluency; [c] social class positioning; [d] immigration status; [e] parents' countries of origin; [f] frequency of contact with home/other countries.

In addition to the necessity of scrupulous categorisation of diversity, Lee (2003) suggests understanding individuals within their cultural practices and roles they play in broader institutional, economic and political relationships. The socio-historical layer of the model should therefore accommodate additional structures to capture the change and to understand the causality of the effects in relation to the considered factors.

Similarly to the culture, the roles that participants play can shed light on understanding the social structure within the larger group of participants. The social structure of the group can be defined by role hierarchy or dependency and can be viewed from the community/group and individual perspective. From the community perspective, the role descriptions should be justified by the activities and services to achieve common objectives, while from the individual views the roles should specify the expectations of the society with respect to the participant's activity (Dignum *et al.*, 2004).

While the use of norms and rules in the social environment predate computer mediated communication, they are frequently established and introduced within virtual communication and learning spaces. The norms and rules can be negotiated and revisited by the learners. Learning communities may exhibit norm-less/negative behaviour. Yet, it is usually anticipated that such norm-less behaviour will decrease when learners perceive the environment as a long-term community. Identifying norm-less behaviour and participants who do not comply with the established rules of the community may shed light on understanding the community dynamics and its evolution.

In summary, the socio-historical layer of the SEEM model is introduced to allow understanding of the evolution of participant experiences and socio-cultural elements on both an individual and collective level. To manage the analysis of this dynamic layer some reductionist approaches may be necessary. Yet over-simplification and over-generalisation of variables and factors should be avoided for ensuring higher levels of precision and rigour.

6.5.4. Adding Rigour to the SEEM Model: Measures and Methods of Evaluation and Analysis

"We're rapidly entering a world where everything can be monitored and measured. But the big problem is going to be the ability of humans to use, analyze and make sense of the data."
(Brynjolfsson, 2009)

The SEEM model encompasses a number of intertwined components and variables that form an integral part of an online learning experience. Yet to understand participant interaction with these components and identify the factors that affect student engagement, rigorous measuring and monitoring methods are necessary for ensuring higher levels of reliability. The integration of the methods into the SEEM model is informed by a theoretical overview of the available techniques and methods adopted or potentially useful for evaluation of interaction and engagement. Given the diversity of instrumental approaches the SEEM model allows integration of a set of techniques that can be applied interchangeably or jointly.

The complexity and diversity of the components integrated into the system cannot be thoroughly studied and understood by the affordances of a single method. It is impossible to cover the entirety of student engagement studies within the multifarious scope of the SEEM model by using a distinct method. Furthermore, as Andrews and Haythornthwaite (2007) stress, the models of research should not be shaped too simply but should rather stretch beyond a one-way (or causal) approach. Hence, the SEEM model not only integrates a set of methods that address the demands of the present day, but also provides a capability of extending the methodological basis of interaction and engagement studies. The application of methodological techniques can therefore be dynamically switched in and out when necessary. The extensibility and methodological efficacy of the model ensure higher levels of precision and practical applicability.

Referring to the literature, the SEEM model does not directly prioritise between the qualitative and quantitative techniques. However, focusing on the potential of automating the process of evaluation, the methods that are described here as part of the SEEM model, constitute mainly quantitative techniques. Qualitative techniques however, are briefly overviewed to demonstrate the possibility and to highlight the potential of employing a qualitative approach. The methods that are included for discussion in this thesis are grouped into four main categories: Social Network Analysis, Content Analysis, Log Analysis and Qualitative Techniques (see Figure 6-6).

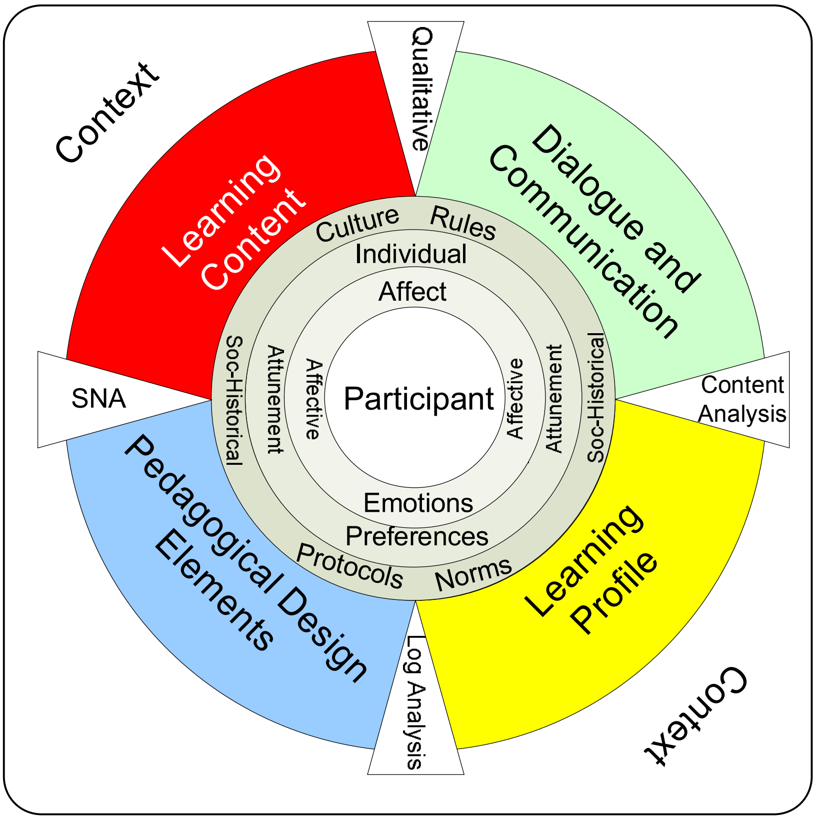

Figure 6-6: SEEM model and evaluation methods.

6.5.4.1. Social Network Analysis and Field Theory

Social Network Analysis (SNA) is a technique that allows analysis of human interaction and relationships between individuals, groups and communities (Wasserman and Faust, 1994; Wellman and Berkowitz, 1997). It provides a number of benefits for studying online engagement and participation. It can be employed for the studies of participant interaction (i.e. email, discussion board communication) and access (i.e. educational systems, materials and the like) (Park, 2003), as well as analysis of group and community development (Monge and Contractor, 2003).

The increasing availability of computer resources and the creation of standardized SNA software packages, such as UCINET and Siena , bundled with a variety of graphical visualisation tools, make SNA accessible to and valuable for researchers in a number of disciplines – including education. The evaluation and monitoring of student communication using SNA techniques can reveal the level of cohesion within the group of learners and identify disadvantaged participants (Haythornthwaite, 2005; Reffay and Chanier, 2003). The application of SNA can shed light on the hidden factors that may affect student participation, open collaboration and personal development. Thus, the use of SNA in educational research can become a valuable and a fundamental resource for understanding student interaction and engagement, subsequently leading to improvement of teaching techniques and methodologies (Martínez *et al.*, 2003).

The review of the literature of online participation (Hrastinski, 2008) and online learning (Tallent-Runnels *et al.*, 2006), provides an insight on the multiplicity of variables used in educational research. In addition to quantitative measures, such as number of access records, posted messages and time spent online, the SNA domain can extend the quantitative measures that indicate the direction of posted messages and the individuals they are posted to/from. Furthermore, the timestamp – an attribute of a message that denotes the date and time at which the posting was made, allows researchers to conduct longitudinal studies for analysing observed changes over time. The longitudinal analysis can identify most prominent trends within the dynamics of learner interaction and provide a foundation for predictive and explanatory research.

The research methods incorporated into the SEEM model can include descriptive and probabilistic SNA techniques. The use of descriptive techniques focuses on providing a general overview of network states and structures. Descriptive SNA is usually conducted in retrospect – often considering a static snapshot of the network at a specific time. Descriptive SNA includes structural and positional analysis that identifies clusters and reports general network measures of cohesion. On the contrary, the probabilistic and longitudinal analysis allows identification of the trends of network dynamics and empowers reporting with statistical precision. The employment of longitudinal probabilistic methods in the SEEM model can ensure continuous monitoring and identification of tendencies of interaction and engagement with statistical precision. Most importantly, however, the addition of SNA to the model substantially changes the dynamics of the SEEM model itself. It enables an on-demand transition between the two perspectives on engagement: individual and group/community-based. The graphical representation of the SEEM model from the community/group perspective can be illustrated as presented in Figure 6-7.

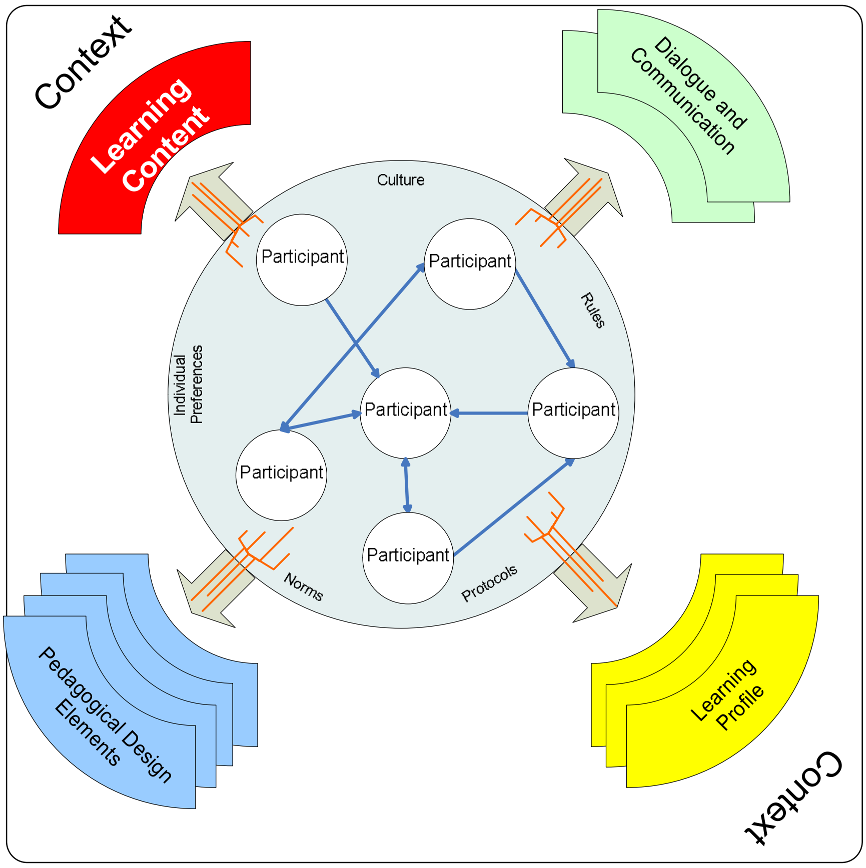

Figure 6-7: SEEM model - a community/group perspective.

Most commonly, the SNA techniques are employed to evaluate interrelation among actors/elements of a single type, even though a composition of various attributes is considered. There is however, an additional level of inquiry that allows association between subsets of actors and subsets of affiliations. These networks are called affiliation networks or two (or higher)-mode networks. Affiliation networks are considered a set of events (i.e. parties, clubs or committees) to which actors belong (Wasserman and Faust, 1994). Within the context of the SEEM model, the affiliations can be the components that participants interact with, i.e. pedagogical design elements, learning content or learning profiles. Analysing participant interaction by using affiliate networks will enable identification of behavioural similarities in relation to the existing components that participants engage with. A graphical representation of a two-mode network within the context of the SEEM model can be visualised as shown in Figure 6-8.

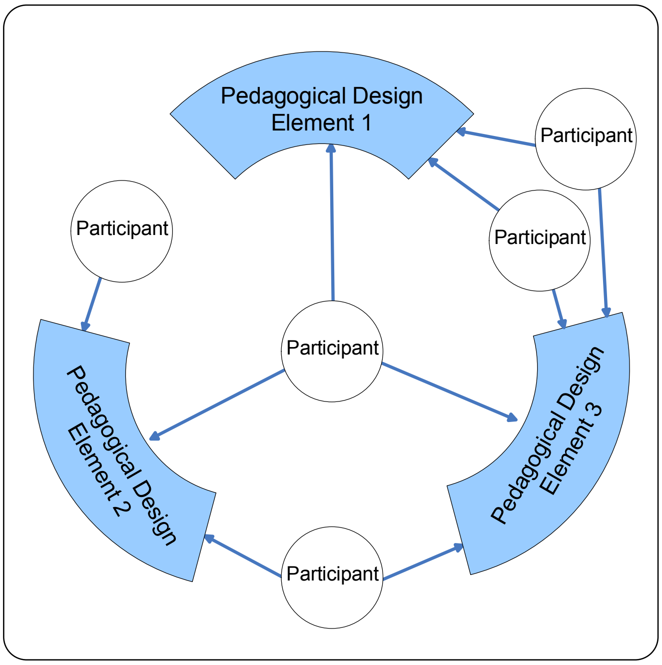

Figure 6-8: Affiliation network that includes a subset of actors and pedagogical design elements.

The community/group perspective of the SEEM model may be approached and understood in accordance with the concepts of Lewin's (1939) Field Theory and Arons' *et al.* (2004a) model of Self Expansion (Inclusion-of-Other-in-the-Self). Some conceptual similarities between those theories and the SEEM model allow their discussion along side.

Similarly to the SEEM model, the Field Theory stresses the importance of considering a number of factors that may affect research outcomes. Lewin *op.cit.* states that: "Every psychological event depends upon the state of the person and at the same time on the environment, although their relative importance is different in different cases" (p. 12). He introduces the notion of "life space" that encompasses the person along with his/her environmental factors – also referred to as a psychological field. He argues that the psychological action or change is a result of a complex field of overlapping life spaces at a specific time (Lewin, 1943). The SEEM model, similarly to Lewin's ideas can be studied from the community perspective, where the affective, attunement and socio-historical layers of each participant are constituting an overlapping and mutually affecting environment (as shown on Figure 6-9) – forming a dynamic cultural and psychological cloud that impels participant engagement and encompasses the online learning experience.

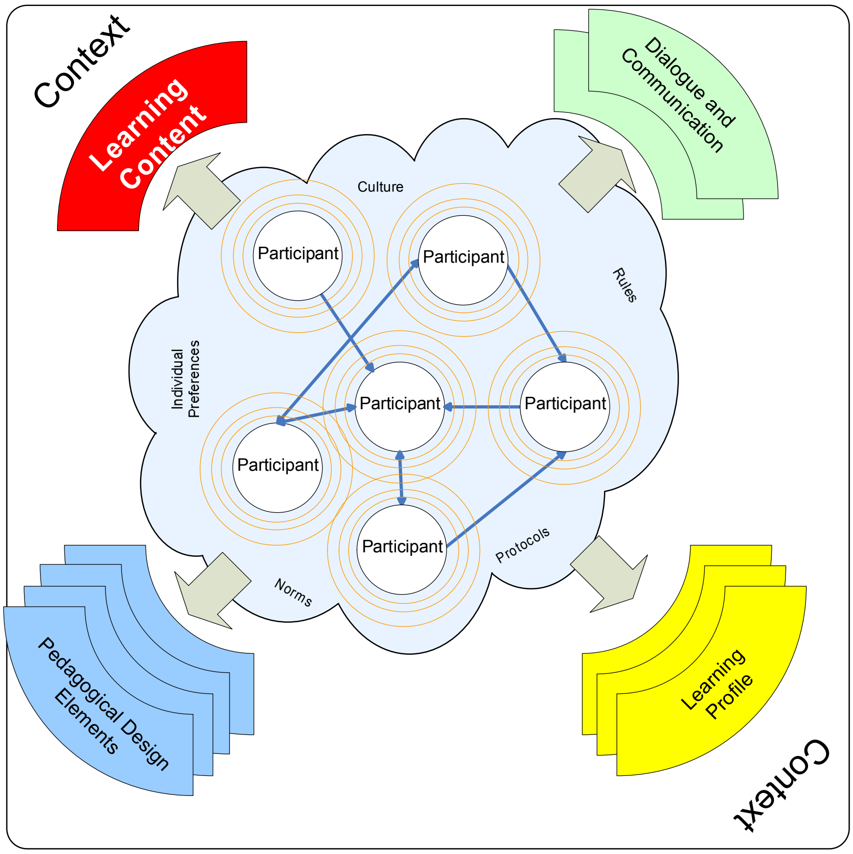

Figure 6-9: The SEEM model viewed from the Field Theory or Self-Expansion model perspective.

Aron *et al.* (1991), drawing inspiration from Lewin's work, propose the theory of self-expansion. Building on Lewin's notion of "life space" they define the self as an expanding life space of the self with the life space of the people around. The key principle of Self Expansion theory is in: [1] human motivation for self expansion – "to acquire resources, perspectives, and identities that enhance one's ability to accomplish goals" Aron *et al.* (1991, p. 104); and [2] human quest for including the other in the self through close relationships (Aron *et al.*, 2004b). Self-expansion, according to Aron, is the product of relationship among the members. For instance, rapid over-expansion occurs when the self develops a close relationship with the other. Similarly to Lewin's work, Arons' model adopts a holistic view of human relationships – focusing on studies of close inter-relations, such as between couples or among family members.

The brief overview of the Field Theory and Self-Expansion allows presenting the SEEM model from a viewpoint that is familiar to some social psychologists. Furthermore, developing this discussion as part of the methodological structure of the SEEM model highlights the affordances of SNA. While employing similarly holistic strategies for the studies of interaction, the SEEM model integrates a methodology that has great potential for adding rigour to the research, but was either unavailable at Lewin's time or is missing from the Aarons' model.

6.5.4.2. Content Analysis

Content analysis is a widely practised method for evaluating the content of communication. Garrison (2000) notes that content analysis that is based on theoretical grounds can be used to identify: [a] deep and surface learning approaches; [b] levels of student knowledge construction; and [c] levels of student critical thinking. However, he reports a number of challenges associated with employing content analysis, particularly related to coding and classification of the messages. As a subjective technique, qualitative analysis of the interaction content can be subjected to issues of reliability (Rattleff, 2007), objectivity and systematic consistency (Rourke *et al.*, 2001). The necessity of filtrating subjectivity from the process of content analysis resonates in the online learning literature. The need for addressing the objectivity and reliability of message coding is stressed by Rourke, Anderson *et al.* (2001) as an important criterion of research. They argue that objectivity and reliability should not be taken as an accidental feature of a conducted study. In fact, Riffe, Lacy, and Fico (2005) reiterate that "failure to report reliability virtually invalidates whatever usefulness a content study may have" (p.159). The potential of the SEEM model for the automated analysis of communication justifies the discussion and consideration of content analysis methodology here. The benefits of incorporating content analysis into the SEEM model are strengthening the methodological foundations of the model and open opportunities for deepening the understanding of student development and progress.

6.5.4.3. Analysis of Access Records (Logs)

Access records (also referred to as logs) encompass the information about participant access to a virtual learning environment (VLE). This information is captured and stored by most of the modern VLEs that are being used in educational institutions. Access logs record information that is not usually evident such as: [a] number of logins; [b] time spent within the environment; [c] resources accessed; or [d] total number of mouse clicks. As discussed earlier in section 3.4.5, the great majority of student participation remains invisible. Hence, access records are a valuable source of data that can help us to understand the reasons behind certain participation patterns and identify strategies for changing those patterns.

Unlike methods of content analysis, the analysis of access records can be automated relatively easily. Reduced to quantitative measures, the logs can summarise the number of student logins, most popular resources, widely read discussions or contributors. The analysis of passive participation, similarly to studies of Kuboni and Martin (2004), can then suggest institutional strategies for 'de-lurking' the learners and encouraging wider participation. Integrating the analysis of access records into the SEEM model will allow investigation of various participatory activities in relation to the components of the model and its variables.

6.5.4.4. Qualitative Techniques

The use of qualitative methods in educational research practice is common across the sector. The phenomenological approach, or qualitative research, allows more naturalistic data collection and more thorough investigation of processes and outcomes. Qualitative research enables detailed illumination, understanding and extrapolation that differs from quantitative inquiry – resulting into a different kind of knowledge (Hoepfl, 1997).

The analysis of qualitative data cannot easily be automated due to challenges of converting it into statistical measures. Hence, the perspective of integrating qualitative methods into the SEEM model may not therefore be as clear as in case of quantitative techniques. Yet, the qualitative research techniques are not incompatible with the SEEM model. The SEEM model, defining the use of certain methods but not limiting the application of others, can serve as a map for guiding qualitative research in student engagement. Even more, the holistic paradigm of the SEEM model enables it to serve as a comprehensive instrument, a theoretically and empirically refined guide, that can supplement qualitative research on online learning. The possibility of thorough analysis of interacting components and variables within the system can enrich qualitative data obtained from interviews or observations. The SEEM model can, therefore, be employed by practitioners of both qualitative and quantitative research.

6.6. Brief Overview of the Empirical Work

The following four chapters chronologically summarise the empirical work conducted as part of this research inquiry. These chapters pinpoint four major milestones that are aimed to be achieved as part of this thesis. The milestones are set to demonstrate the potential value of the SEEM model for acquiring insight into online learner engagement. The milestones are derived from the four main components of the model: Learning Content, Pedagogical Design Elements, Learning Profiles; and Dialogue and Communication. Each of the milestones marks the outcomes of the empirical studies directed towards evaluation of participant engagement with only one of the main components. The investigation is conducted in accordance with the conceptual structure of the SEEM model that takes into account only a limited number of variables from the inducing layers. The consideration of the variables is defined by the nature of the study and the available resources. Partially due to administrative constraints and partially for the purposes of keeping the study within the manageable realms, only one main component was considered at a time. Hence, the three other components were placed out of focus when one of the components is under investigation.

Student Engagement with Learning Content:

The first study of participant engagement discusses student interaction with the learning content and online learning environments in general. For the purposes of the study, data collected mainly via the Moodle virtual learning environment was considered. The lecture-notes and other learning materials were exhibited on this system. Participant access to the materials and the VLE were then analysed. The access records were subsequently compared to those of a less structured social software (Elgg), which was used as a supplement to Moodle. In addition to access records, a questionnaire that allows identification of participants' earlier experience with using web services and social software was used. Hence, this study is focused on testing participant engagement with one of the components of the SEEM model - Learning Content. Yet, additional factors are taken into account to allow evaluation of engagement in association with variables drawn from the socio-historical layer of the model. Although this study is considered in retrospect, it was considered optimal to revisit the study within the context of the SEEM model.

Student Engagement with Learning Profiles Elements

Similarly to the study that discussed student engagement with Learning Content, an empirical analysis was considered here to examine student engagement with another component of the SEEM model - Learning Profiles. This work extends the previously conducted study by introducing a new cohort of participants and shifting the focus from the use of Moodle VLE to that of the Elgg social software. In contrast to the earlier study, this research employed content analysis techniques in addition to the analysis of access records. However, no variables drawn from the inducing layers were used in this study. Hence, this empirical study is limited to one component (i.e. Learner Profiles) and two evaluation methods (i.e. content and access records analysis). Despite its focus on student engagement with social software, comparison between the use of social software and Moodle VLE is discussed here. Further references to the study conducted earlier are given where necessary. A detailed discussion of the study in the light of the SEEM model is presented.

Student Participation in Dialogue and Communication

This study was conducted to analyse the communication records in a discussion board. The communication data was acquired from an external source that constitutes a three-month long online course. The course was jointly designed and offered as part of the Sino-UK eChina project and targeted at educational professionals and practitioners in two countries: China and the UK. The analysis of the data was conducted using descriptive and probabilistic SNA techniques. As part of the study, variables (i.e. participant culture and role) from socio-historical layer were drawn and analysed along with participation data. The study identified a number of interaction patterns associated to the considered socio-historical variables. The results of the analysis are discussed in line with the SEEM model – focusing on its Dialogue and Communication component. The study highlights the benefits of using SNA techniques and socio-historical variables in analysing participant engagement, justifying their integration as key components of the SEEM model.

Student Engagement with Pedagogical Design Elements

The last empirical study focuses on the Pedagogical Design Elements component of the SEEM model. This study evaluates the use of peer assessment as part of a year-long module. Student engagement with this learning activity is investigated throughout the module. Variations of student engagement based on the design of the peer assessment activity are studied and reported here. Furthermore, this study includes an analysis that aims to identify an association between student engagement patterns and their learning styles. Learning styles, as variables drawn from the attunement layer, are identified by using the Felder-Silverman instrument. Considering achievement records in addition to learning styles data, allows a comprehensive analysis of student engagement with peer assessment learning activity – highlighting the benefits of continuous evaluation and re-adjustment of pedagogical design elements.

6.7. Summary

This chapter introduced the Situated Engagement Evaluation Model that was developed by referring to the earlier conducted empirical studies in dialog with the reviewed literature and examination of the available conceptual frameworks of online learning. The chapter critically reviewed the existing models and argued for the need of proposing a new evaluation model. The chapter positioned the SEEM model within theoretical perspectives and discussed its main components and evaluation methods. The argument of the chapter draws on interdisciplinary areas of research to inform the process of deriving the model and further developing it.

7. Learner Personal Characteristics and Learning Styles

The aim of this chapter is to provide a reflective account on student engagement with learning content and online learning environment. This study contributes to the initiated process of demonstrating the potential benefits of the SEEM model. Parts of this chapter have been previously published as a peer-reviewed conference paper (Stepanyan *et al.*, 2007b).

7.1. Introduction

The study, summarised in this chapter, investigates the use and impact of educational online environments adopted for teaching undergraduate level modules. It discusses the theoretical background to the use of educational software and reports the analysis of student engagement. The main aim of this chapter is to address the first milestone in demonstrating the potential utility and applicability of the model, as discussed earlier in section 6.6.

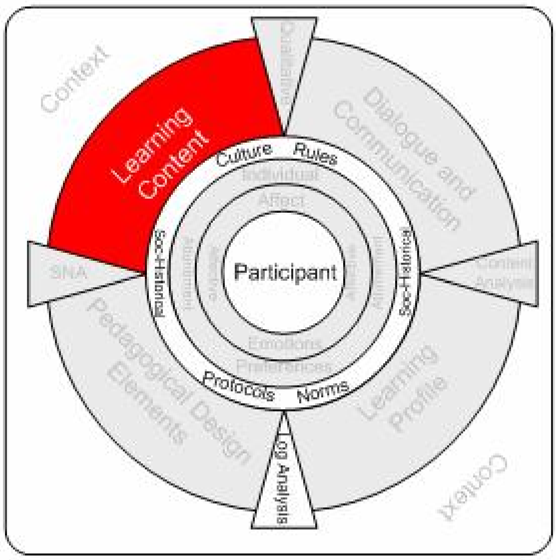

Figure 7-1: Highlighted components of the SEEM model to be analysed in Chapter 7

The study employed two conceptually different online environments – the Moodle VLE and Elgg social software. It enabled to capture and describe the variations in student engagement patterns. The comparison of student engagement with each of these online environments is reported here. In addition to evaluating student engagement, the study considered student prior experience of using social software outside an educational context. Student prior experience is identified here as a set of variables that are drawn from the socio-historical layer of the SEEM model. These variables allowed discussion of student engagement patterns in relation to the considered socio-historical layer of the SEEM model. The main methods employed here integrate quantitative measures of analysing access records. It is also necessary to highlight that the SNA, Content Analysis or qualitative techniques, which were discussed as part of the SEEM model, are not considered here. The three other main components of the SEEM model (i.e. Pedagogical Design Elements, Learning Profiles; and Dialogue and Communication) and the two inducing layers (i.e. Affective and Attunement layers) are not considered due to lack of relevant data records.

7.2. Aims and Objectives of the Empirical Study

Although, this study is re-visited and discussed within the context of the SEEM model, the primary focus of the research was placed on the use of educational software and the features of Web 2.0 technologies. This study was initially designed to contribute towards understanding the widely popularized but unproven impacts of using Web 2.0 technologies and social software in education. The following section presents a brief overview of the context in which the study was conducted.

7.3. Background: Web 2.0 Technologies and Online Educational Environment

The emergence of Web 2.0 technologies promoted the growth of service-based applications and greater user-control over content and connection (O'Reilly, 2005). The rapid growth in membership of social spaces such as MySpace, Flickr, del.icio.us and many others are evidence that web-based networking facilities are becoming an important part of our daily life (Jacobs and Polson, 2006). Given that people are apparently willing to collaborate, work and spend leisure time engaging with Web 2.0 technologies, it seems likely that educational interests may also benefit from adapting teaching practices, curricula and educational tools to exploit the social process and network benefits provided by Web 2.0.

Advances in web technologies continue to improve the communication, sharing and distribution of information. Attributes of Web 2.0 include greater integration of

RSS/Atom feeds, cloudtags, mashups and rich internet applications as well as new ways and tools for managing content and delivering services. By supporting openness, collaboration and information exchange, Web 2.0 level weblogs and syndication provide the foundation for the growth of popular social spaces (Downes, 2005b). These recent developments in web-based services and the enhancement of collaborative tools have fuelled the demand for similarly-specified educational software and services. Many schools and universities across the world now deploy blogs, ePortfolios and educational social software for use by the academic community. But despite the widespread promotion of these learning tools (Downes, 2005a), there is little empirical evidence on their utilization by institutions, tutors and students. The online learning sector lacks evidence-based guidance on best practices for promoting learning by using Web 2.0 tools.

Empirical studies that adopt the use of new technologies or environments enriched with Web2.0 features could allow the shedding of light on the benefits and disadvantages of their use in educational contexts. Evaluations, based on integrated Web 2.0 technologies, could help educators make informed decisions concerning appropriate software tools and introduce adjustments of teaching practices. In line with this strategy, the evaluation was directed towards understanding student engagement patterns with using Web 2.0 enriched social software in both formal educational contexts and in daily lives. The study was justified with intentions of suggesting possible administrative, educational and technical solutions by which the levels of student engagement and learning experience may be improved. The detailed objectives of the research were to: [a] compare the use of educational social software with more conventional educational tools such as Moodle VLE; and [b] identify the most common patterns of the use of educational software.

7.4. Theoretical and Technological Context of the Empirical Study

The pedagogical approach adopted within the boundaries of the study strived to accommodate and promote collaborative practices. The online environment was structured from the social constructionism perspective - aiming to encourage collaboration and peer support (McConnell, 2000). Hoping to achieve higher levels of self-reflection and learning, the online environment, which was deployed for the purposes of the taught module, extended beyond the traditional model of content repositories. Crediting the potential of Web 2.0 technologies for extending learner collaboration to the level of using blogs and personalized services, additional tools were considered and introduced as part of the online educational environment. More specifically, the use of social software was considered to be beneficial for enhancing communication and supporting collaborative practices exhibited within the online learning environment.

7.4.1. Employed Technology

In order to create the necessary environment, a set of tools was identified, evaluated and then selected for their appropriateness within the context of the study. These included the open-source software Elgg version 0.65, which allows users "…to establish personal digital-identities and connect with other people, collaborate with them and discover new resources through their connections" (Elgg, 2004). Elgg possesses much of the typical functionality of social software and provides access to Web 2.0 features such as weblogs, RSS feed-aggregation, tagging, mashups, personalization and file-sharing mechanisms. It therefore satisfied many of the technical requirements for this research, namely promoting information sharing, open collaboration, reflection, feedback and a sense of community.

The Moodle version 1.6 is widely known as an open source VLE. It was selected on the basis of a student-centric architecture, again, aligning with principles of social constructionism. The core VLE and other functional modules extensively used during preliminary studies included: features for managing and distributing course resources, messaging course members, course planning and administration. The use of the Moodle system was coupled with the Elgg social software through a module called ePortfolio. The entire core learning content and many additional resources were provided on Moodle; yet some materials were made available via Elgg.

Most students (86%) attended the formal lecture that introduced students to the technology and shared the rationale of using Moodle and Elgg. Support for learning tools was ongoing and was provided both in-class and electronically.

7.4.2. Collaboration, Reduced Competition and Openness

The importance of discussion and exchange of ideas for enhancing learning is widely accredited. Acceptance of a social dimension to learning led to the development of pedagogical concepts such as collaborative or cooperative learning. Cooperative learning generally describes a form of active learning by which students work together in small groups toward a common goal (Gokhale, 1995). This form of learning utilizes group discussions, long-term group projects, and group testing. Roger and David Johnsons (1998b), the exponents of cooperative learning, state that the exchange of ideas and opinions promotes critical thinking and increases motivation. Moreover, according to Roberts (2005), the benefits of cooperative learning extend to: improved classroom results and problem solving. The social benefits of cooperative learning include: establishment of positive atmosphere, development of diversity of understanding and development of student support systems. Resnick, Pea and Perkins presented their view on learning as a "dialogical process involving the social distribution of intelligence" (Schrire, 2006, p. 50). In line with authorities on educational practice, the pedagogical design of the studied module recognized the importance of social interchange.

Openness is considered to be an important part of cooperative learning (McConnell, 2002) and believed to be desirable for reasons such as encouraging learners to: share ideas and accept new ones; be intellectually-open and accept the possibility of change; be frank in self or peer assessment and to build healthy relationships. Hence, the value of openness stretches beyond the measured learning outcomes – fostering social and democratic development. As cited in Jones *et al.* (2007, p. 181), cooperative learning is considered to be a negator of social power: "Collaborative learning in this sense opens up the possibility of different balance of power in the classroom where pupils can explore own meanings and may challenge those of others in a supportive community of peers" (Cowie, 1992). Encouragement of open discussions and shared progress was maintained throughout the study, yet students were not formally rewarded or penalised for exhibiting certain behaviour online.

In addition to promoting collaborative practices and openness, the study strived to ensure that the level of competition among the learners was reduced. The meta-analysis conducted by Johnson *et al.* (2000), and cited by Jones *et al.* (2007), suggest that cooperative methods lead to higher student achievement results compared to competitive or individualistic methods. Hence, as competitive structures may often hinder learner willingness to share information and to work as a team, the reduction of competitiveness was considered to be important for conducting the study. The competitive assignments and individual projects were mainly replaced by group projects and selective assignments (self-selected by students from a common pool) - encouraging peer review and mutual help. Additionally, efforts were made to ensure that the technological infrastructure is aligned with the conceptual and methodological foundations.

7.4.3. Assignments and assessment

To encourage reflection and information sharing, a set of tasks was developed and offered to students throughout the course. Initial tasks took the form of "mini-assignments" and were intended to serve as icebreakers as well as provide students with an opportunity to introduce themselves to each other and to share their personal and professional interests. These tasks were aimed for creating a sense of community during the early stages of group formation – an important state (McConnell, 2006) to be pursued for an effective cooperative practice. The rest of the assignments were mainly concerned with educational content. It was suggested to the students that they could share completed assignments and learning experiences with the rest of the community, by uploading content to a personal or a common-file area or to a weblog.

The distribution and the nature of the assignments changed as the module progressed. In the early stages, tasks consisted of small, individual assignments. Later activities were based on group work and more complex tasks. For the group work, students were given freedom to form/join the groups. The group assignments were intended to promote online collaboration, and it was requested that the progress of group work was posted on an Elgg shared community space.

To observe the natural uptake of the software, student's personal space, artifacts and online activities were not subject to summative assessment. The course leaders specified that although online-participation was optional, it was nevertheless highly desirable. Whenever required, facilitators provided feedback of a formative nature on any student work in-progress. Suggestions were made for improvements to solutions by means of public weblogs as well as the more conventional forums available within Moodle.

7.5. Methodology, Data Analysis and Target Group

The main analysis was based on observing student access and use of educational tools as well as on the anonymous recording of student experiences of using other online systems, such as MySpace and LiveJournal, in a non-educational context.

Membership:	*Number:*
- HND (1 group):	14
- BSC (2 groups):	30
- Tutors:	2
- Observer:	1
- Administrator:	1
Participants Total:	48

Table 7-1: Membership of groups participating in the study of the use of collaborative software.

Notes: [1] Subjects were first-year undergraduates attending a module on web development technologies; [2] Reported results are based on observations made between 22 September and 22 December 2006.

The adopted research methodology was based on the following data collection techniques:

a) Preliminary questionnaire – to record student experiences of using social software outside the educational context, prior to the study.
b) Third party Google Analytics ® web statistics tool – to record frequencies of accessing integrated educational software systems throughout the study period.
c) Recording students' posts, comments, level of personal customization, friends network, use of RSS and tagging throughout the study period.
d) Recording independent comments received from and critical issues raised by students throughout the study period.
e) Use of a web-access statistical plug-in integrated with the content-centred system along with the adopted third party web access tool.

The data analysis included:

a) Comparison of web-access statistics of content-centred system and social software.

b) Comparison of student experiences of using social software outside the educational context with that observed throughout the course study period.

c) Mapping individual comments received from students regarding integrated educational software with their patterns of using the systems.

7.5.1. Student Access to the VLE and Social Software

Student access to both the VLE and the social software was monitored and logged. Due to the lack of a logging mechanism in the Elgg system and for the purposes of ensuring consistency of logged data for both Moodle and Elgg systems, a third party service tool – Google Analytics ® – was chosen for monitoring the access to the web software. Google Analytics ® is a free service that tracks the number of visits, pageviews, and IP addresses, and analyzes them along with many other parameters.

During the three-month period of observation a total of 1,092 visits and 2,509 pageviews were recorded for the Moodle VLE. During this time Elgg received only 234 visits and 351 pageviews. The fact that the number of visits and pageviews for Moodle were 4.6 and 7.1 times greater respectively than for Elgg demonstrates much less activity for social software than for the more conventional VLE.

Figure 7-2 and Figure 7-3 provide timeline summaries for daily access to Moodle and Elgg platforms.

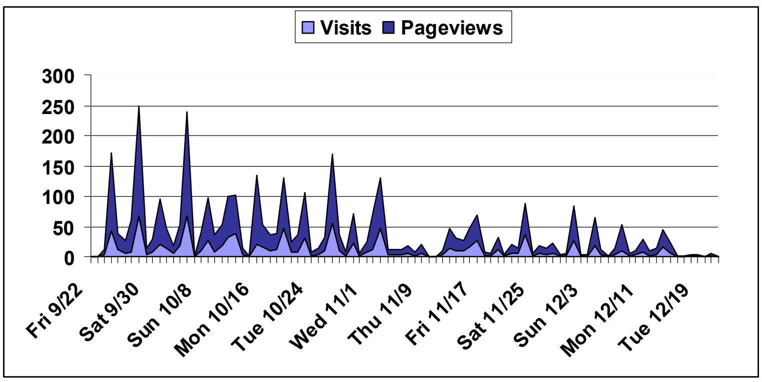

Figure 7-2: Timeline summary of student pageview and visit frequency for the Moodle platform.

Both graphs show that activity and presence on both Moodle and Elgg systems was greater before 6th November than afterwards.

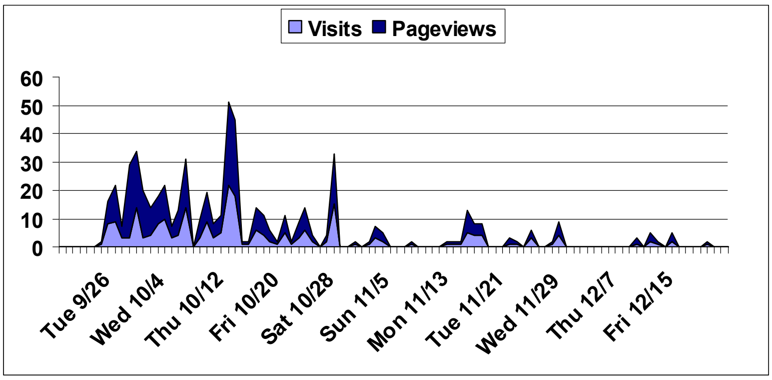

Figure 7-3: Timeline summary of student pageview and visit frequency for the Elgg platform.

An attempt was made to explain why the social educational software (represented by Elgg) was not accessed as frequently as the Moodle VLE and why students were using the system more actively in the first half of the course and not in the second half.

It is likely that the frequency of access was influenced by changes in the type of exercises given to students during the period of observation. During the first half of the course there were six relatively small assignments, whereas in the second half there were two much longer and more demanding assignments comprising a group project and work towards an assessment. Both the Elgg and Moodle systems were visited some 4.34 times more frequently during the period when shorter assignments and intensive facilitation were provided. During this initial period students were frequently notified about approaching due dates and a much greater level of individual feedback was given.

Another interesting finding demonstrates the similarity between the pattern for accessing educational resources and submitting shorter assignments. While shorter assignment submission required access to Elgg only, the logging tool records that there was also a significant number of visits to educational resources on Moodle during this period. It shows that during the period of working on shorter assignments, students were accessing educational materials on Moodle more often than during the period of working on larger group projects. According to Moodle logs, during the period of working on shorter assignments, the learning resources were accessed 3.8 times more frequently than during the group-work period. Although a comparison of web-access patterns with curriculum-based educational activities such as the number and nature of the assignments was not included in the research objectives, the observed facts suggest further research into the impact of the distribution and types of assignments on the uptake of such software.

7.5.2. Comparison of Learner Behaviour with Previous Experience

At the beginning of the course a questionnaire was issued to determine the level of prior experience of social software and Web 2.0 technology. This was mainly to determine whether or not the group were generally familiar with the use of weblogs and social software, thereby gauging how prepared they were for using these technologies in a learning environment.

The results of 32 valid questionnaires showed that while the majority of participants lacked specific experience of social software attributes such as RSS and tagging, many of them had general experience of working with social software. Only 16% of students were either unfamiliar with any social software or had not knowingly been exposed to these technologies. The most popular social software (56% of students) was MySpace followed by YouTube (31%). However, according to the questionnaire the number of weblog users was comparatively low. Only 50% of students had a registered weblog while 31% of students were not familiar with the notion of a weblog (see Table 7-2).

	Previous Experience		***Observed Behaviour***	
Exhibited Behaviour	*Num. of Students*	*%*	*Num of Students*	*%*
Have no weblogs or do not know what it is	16	50	11	25
Customized the environment	20	63	31	70
Have friends/are friends	23	72	30	68
Do not run any community	24	75	40	91
Run 1-2 communities	6	19	4	9

	Previous Experience		*Observed Behaviour*	
Exhibited Behaviour	*Num. of Students*	*%*	*Num of Students*	*%*
Use RSS	1	3	0	0
Have ever used tagging	12	38	17	39

Table 7-2: Comparative summary of questionnaire data (prior experience of non-educational social software) against log data (activity in the Elgg environment of educational social software).

The questionnaire revealed that most of the students do not usually use many of the attributes provided by social software such as tagging or RSS feeds. The majority of students (97%) were either unaware what a feed is or had never used it. Tagging, however, was used always or frequently by 19% of students and only 34% were unaware of what tagging was. Tagging was used at least once by 38% of students.

Results from the questionnaire also indicated the characteristics of their social networks. The students were mainly divided into two groups, one group having significantly large networks, the other having very small or no network at all. Of the sample, 56% had more than 15 friends listed in their social software, while a smaller group of 28% did not network with any friends. The questionnaire also revealed that 75% did not run communities, in contrast to 25% who established and ran mainly 1 or 2 communities.

The observation and analysis of data recorded on student engagement with educational social software showed that no one used the RSS syndication available in Elgg. Only 39% of students used keywords for tagging their posts, and only 9% of registered students started at least one community. However, in contrast to the low demand for RSS, 70% of participants customized the appearance of their social space and provided personal information on their profile.

Table 7-2 shows the similarities between percentages for prior experience of using social software and the use of similar features in Elgg. This suggests a correlation between prior experience of using social software and engagement with educational social software. The Chi-square test performed on the data presented in Table 7-2 does not reveal a significant distribution at the 0.05 level and therefore shows that similarity exists. With a degree of freedom 6, the Chi-square equals 6.60 (χ^2=6.6; d.f.=6; α<0.5), which is less than the value 12.59 required for significant difference at the abovementioned level. Given the limitations of the study, including the lack of functionality of social software, the small target group, and the anonymity of the questionnaire (which prevented comparison between previous and observed used of the social software), it is suggested to use the results with caution.

Given the range of patterns and reported similarities of behaviour with prior experience, it seems likely that an introductory lecture giving a basic overview of integrated technology might not be sufficient for optimal engagement with the software. A more intensive and longer period of formal support might be required to embed these technologies and the desired learning behaviour associated with them into teaching practice.

7.5.3. Research Limitations

At the time of the conducted study, the Elgg social software had a shorter development history compared to that of Moodle. As a result the specifications of the two technologies were not always easily comparable. The records of independent comments received from students revealed that most students were disappointed with the lack of e-mail notification functionality in Elgg. The version of Elgg used for this study did not send notification of important events such as the posting of public or community messages, adding participants as friends or when new members join the community. Students and tutors often favored Moodle forums because of the provision of automatic email alerts for spreading important information or requesting feedback. Additionally, Elgg had relatively limited functionality for managing users and monitoring their actions. It is therefore possible that the lesser popularity of the Elgg environment was affected by the limitations of its technical specification.

As recorded earlier, the number of students who participated in the research was relatively small, which restrain further generalization. Finally, another limitation was induced by the anonymity of the questionnaire, which prevented a one-to-one comparison of previous and observed use of social software. While anonymity could introduce a biased response to the result, the one-to-one comparison could allow further triangulation of the results.

7.6. Retrospective Analysis and Discussion in Relation the SEEM Model

The retrospective view on the conducted study enables reflection on the factors that may have influenced the patters of student engagement. The reflection on the exhibited differences in interaction with Moodle and Elgg advocate for the need of an instrument, such as the SEEM model, that can explain the patterns of participant engagement. The reflective account of the study presented here demonstrates the potential insight that can be gained from employing the model. The study may serve as an example for employing or testing the SEEM model.

The immediate and most prominent results of the study indicate great variations: [a] in participant awareness of the capabilities of educational software; and [b] in the use of features (i.e. tagging or RSS feeds) both within and outside the educational context. Furthermore, the results indicate [c] similarities in the ways in which learners engage with and utilize attributes of the educational software. These results can be analysed within the context of the SEEM model. More precisely, the SEEM model components: Learning Content; and the variables drawn from the Socio-Historical layer; are considered here as part of the evaluation of engagement.

The consideration of students' previous experiences of encounter with social software highlighted the diversity among the learners. It allowed comparison of the engagement patterns with technology prior to registering for the course with those of educational systems that were integrated into the pedagogical design. The diversity of student experiences echoed with the observed patterns of use highlighting the importance of commitment to consideration of socio-historical factors when envisioning the possible outcomes of student engagement. The similarity of prior experiences with the observed patterns of engagement (χ^2=6.6; d.f.=6; α<0.5) further amplifies it (elaborated in 7.5.2). For example, if learning content and learning materials are intended to be distributed via RSS aggregators, student prior experience of using aggregators needs to be considered. It can be argued here, that a continuous monitoring of participant engagement with learning content, along with variables drawn from the socio-historical layer, can inform practitioners on the adjustments necessary for effective distribution of learning materials.

Further analysis of participant engagement revealed a prominent difference in the patterns of accessing Moodle, which exhibited the main content of the module, and Elgg social software - intended for cooperative practices. The results identified the Moodle VLE to be a considerably more popular platform than the social software. As elaborated in section 7.5.1, the number of visits and pageviews for Moodle were 4.6 and 7.1 times greater respectively than for Elgg – indicating higher levels of activity on the conventional system that exhibited learning content. The difference is driven by the frequent access to the exhibited content. The lecture notes and task descriptions were regularly downloaded or accessed despite the distribution of hard copies at class. However, the frequency of accessing content decreased in the second half of the module.

Having used continuous monitoring of student access to the learning resources, as specified in the SEEM model, qualitative feedback on the teaching and learning experience could have been obtained. It can be speculated here, that the decreasing access to the learning resources was affected by the type of learning activities integrated into the course structure. During the first half of the module, when shorter tasks were assigned, the access to learning materials was 3.8 times higher than during the second half of the module, when more compound group work was introduced. Having adopted the SEEM model that can provide qualitative feedback on this kind of participatory pattern, the tutors can then introduce necessary adjustments or additional learning activities to change or maintain the desired pattern in interaction with learning content. As the comparison of access patterns with learning activities was not included in the research objectives, the causal relationship between participation and learning activities cannot be identified here with certainty. However, the observation of this variation can justify the integration of Learning Content as a component into the SEEM model – allowing researchers and practitioners to investigate the phenomenon further.

7.7. Conclusions

This chapter has initiated the process of demonstrating the potential benefits of the SEEM model by focusing on its components: [a] learning content; and [b] socio-historical layer. The analysis of access records constitutes the main methodology for evaluating participant engagement. The argument is based on a retrospective consideration of a previously conducted study. The results (as presented in sections 7.5.1 and 7.5.2) highlight the benefits of considering a number of variables that can be associated with the socio-historical layer of the SEEM model. More specifically, the study employs self reported measures of student previous experiences with using technology. It then reveals and highlights statistically significant similarities among observed patterns and previous experiences. Hence, the study represents an empirical example where a consideration of a socio-historical layer can contribute towards understanding of student engagement patters and foster consecutive alterations of pedagogical design if necessary.

Furthermore, the study reports variations in the ways participants engaged with the Moodle VLE and the Elgg social software. More precisely, greater popularity was observed for participant engagement with accessing learning content rather than participating in cooperative activities within the social software. In addition to the difference between engagement patterns with the two systems, the study reveals higher levels of engagement in the first half of the study compared to the second half. Restrained from identifying the factors that influenced participation patterns, the phenomenon itself – the change of student engagement – highlights the necessities of considering additional SEEM components for a more extensive analysis, i.e. the change in pedagogical design elements. Continuous monitoring of student engagement with the components of the model could have informed the practitioners about the exhibited changes and prompt alterations to pedagogical design. This retrospective account therefore, discusses a limited, yet sufficient empirical study that highlights the potential benefits and possibilities of employing the SEEM model in evaluating student engagement.

8. Empirical Analysis of Engagement with Learning Profiles

This chapter focuses on evaluation of participant engagement with specific elements of their online experience. These elements are referred to here as Learning Profiles. Similarly to Chapter 7, this section revisits an earlier conducted study aiming to contribute to the initiated process of demonstrating the potential benefits of the SEEM model. Parts of this chapter have been previously published in peer-reviewed conference proceedings (Stepanyan *et al.*, 2007a) .

8.1. Introduction

The main goal of this chapter is to address the second milestone (as positioned in section 6.6), illustrating the potential of the SEEM model for gaining insight into student engagement. Similarly to the previous chapter, this section casts a retrospective view on an earlier conducted study – revisiting and evaluating its outcomes in a different light. The components, considered for analysis in this study are highlighted in Figure 8-1.

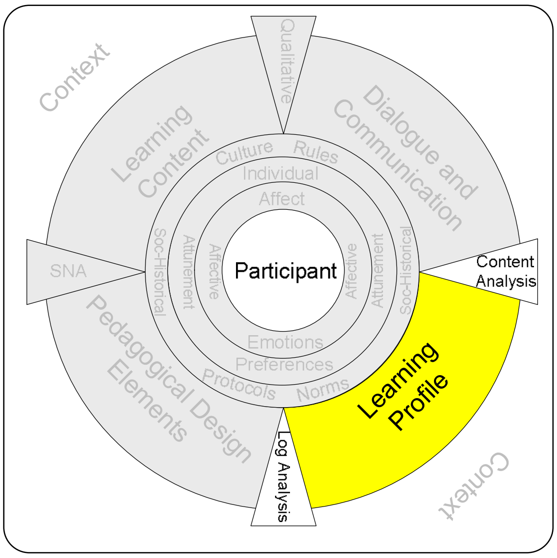

Figure 8-1: Highlighted components of the SEEM model to be analysed in Chapter 8.

The study summarised in this chapter extends the inquiry that was conducted earlier and discussed in Chapter 7. Building on the initial results, subsequent research actions were taken to accommodate the questions that arose from the previous study. Alterations of pedagogical design and consideration of an additional cohort of participants was introduced here. The results of the study are presented here and consecutively elaborated in the light of the SEEM model. Prior to discussing the results, the chapter defines the concept of learning profiles within the context of the study.

8.2. Definition of Learning Profiles

The SEEM model defines learning profiles as tangible, socio-historic artefacts accumulated by learners over time. Most commonly, these artefacts can include, for instance, grades, certificates, accomplishments or experiences. Learning profiles however, can also constitute a combination of individual artifacts – reflecting learner progress in all its complexity. Hence, the concept of learner profiles can be associated with the notion of e-portfolios.

Electronic portfolios (e-portfolios) have gained increasing attention from educational institutions as a means of capturing, measuring and evidencing progress of learning and personal development over time. While, defined as a collection of evidence to show learner progress, the key aspect of e-portfolios is believed to be the reflections of learners on the pieces of evidence of learning (Abrami and Barrett, 2005). Reflecting on the concept of e-portfolios, Smith and Tillema (2003) suggest that educators should focus on the process of constructing an e-portfolio rather than the end product that does not capture the evidence of learning. The concept of learning profiles in this study is aligned with Smith and Tillema's account of e-portfolios. Hence, learning profiles, as studied here, stretch beyond a collection of artefacts and comprise the learner development process.

The notion of e-portfolios has evolved and widened since its initiation – extending the range of its aims and functions (Smith and Tillema, 2003). E-portfolios have been integrated into a number of areas and used by different age groups. They differ by type, purpose and audience. The Joint Information Systems Committee (JISC), in supporting e-portfolios as part of the Personal Development and Planning programme, identifies three basic purposes of their use in a further and higher education context (JISC, 2006).

a. Learning – reflective personal portfolio that supports and guides learning and personal development.

b. Presentation – portfolio that contains materials to be used for application and admission to a study or job.
c. Transition – portfolio that supports development of skills for transition from one environment to the other; i.e. from a high support environment (FE college) to a low support environment (HE institution).

Learning profiles, referring to concepts of e-portfolios, are limited to the ideology of supporting learning. Therefore, learning profiles are introduced to encourage critical thinking, professional development and reflection on progress.

Social software is believed to be an optimal platform for introducing e-portfolios (Reid, 2006). The typical attributes of social software, which include blogs, communities and information sharing, offer a potential for hosting e-portfolios. Hence, social software can accommodate self-reflection upon learning and feedback from peers and tutors. Integration of e-portfolios based on social software, can enable learners share their learning artefacts, and improve those further supported by discussion and feedback. For instance, group papers or projects can be developed collaboratively and sections of writing from different learners can be linked and combined. The Elgg social software meets the necessary requirements for introducing e-portfolios as highlighted above. Similarly to the earlier study, as discussed in Chapter 7, the Elgg system continued to be used. However, the focus of the study was now shifted to a structured use of social software with the focus on reflection and collaborative practice in developing learning artefacts. A study that analysed the learning experience by developing learning portfolios was conducted.

8.3. Aims and Objectives of the Empirical Study

Similarly to the empirical research summarised in Chapter 7, the main aims of this study were: [a] to identify common patterns of learner engagement with social software; and [b] to compare the use of the social software against the VLE. However, in contrast to the study summarised in the previous chapter, this study: [i] adopts a different evaluation technique; [ii] focuses on the use of social software; and [iii] draws upon the results of the earlier study to compare the observed changes. The following sections report the comprehensive details of the analysis and the observed outcomes, highlighting the elements of research that can justify the use of the SEEM model for conducting a similar empirical study. Hence, a retrospective account is drawn, by revisiting the results of the empirical study.

8.4. Theoretical and Technological Context of the Study

8.4.1. General Overview of the Context

The study summarised here extends the previous research (Stepanyan *et al.*, 2007a) that was revisited and discussed in Chapter 7. The introduction of new variables and a different cohort of participants allowed focusing on learning profiles as opposed to learning content and VLE. Regardless of the change of focus, the context in which the following study was conducted, remained essentially unchanged. To avoid repetition in this thesis, cross-references are provided for pointing the reader to the earlier discussed context. Despite the contextual similarities between the two studies, they can be described as conceptually different. This section describes the main differences and similarities between the two studies.

The main difference introduced in the following study was: [a] the integration of learning profiles into the pedagogical design of the module; [b] the consideration of an additional postgraduate level module; and [c] the integration of content analysis methods for evaluation of the study. The changes allowed further investigation of student engagement, but this time exploring how introduced changes affect student engagement in relation to learning profiles. However, the main theories behind the pedagogical design and philosophies that determined the selection of technology remained unaltered. For the justification and the detailed discussion on selection of technologies, which were deployed for the purposes of the study refer to section 7.4..

As a brief overview of the pedagogical approach adopted in the study, a list of values and actions are highlighted here and cross-referenced to the sections that elaborate those:

- an effort was made for aligning the teaching and learning practice to social constructionist approaches (see 7.4)
- pedagogical design of the module encouraged collaboration and peer support (see 7.4.2)
- formative feedback was made available throughout the study and higher levels of self-reflection were promoted (see 7.4.2)

- efforts were made to deploy a technological environment that is aligned with the adopted pedagogical approach (see 7.3 and 7.4.1).
- technical induction was conducted (attended by 72%)and support provided throughout the study
- elements of learning activities were integrated into the design to encourage online communication (see 8.4.2)
- the level of competition was reduced by individual assignments (see 8.4.2)

8.4.2. Notable Changes in Learning Activities and Assessment

The extended study accommodated alterations of pedagogical design elements. More specifically, student completion of some of the learning activities now were considered in summative assessment and contributed to final grading. Namely, the participation of postgraduate students was an assessed component to the tasks. The completion of student coursework instructed participants to share and invite peers for feedback [a] prior to official submission (optional task) and [b] after (required task). Due to the individual nature of the coursework, plagiarism was not considered an issue when requesting students to exhibit their work for peer feedback.

While marks were allocated for some of the activities, many others remained optional. It is necessary to specify here that the participation of the undergraduate students remained optional throughout the study. Yet, to encourage student participation of the overall cohort, a set of tasks was developed and offered to students throughout the course. These tasks were intended to create a sense of community. In order to observe the 'natural uptake' of the software, student participation such as personalising their profiles, creating communities or supporting others was not assessed or graded.

8.5. Methodology, Data Analysis and Target Group

This section presents the methodology and the results of the original empirical study. The reflective discussion of the results in relation to the SEEM model are presented section 8.6.

The adopted research methods included quantitative and content analysis techniques for analysing student interaction among themselves and their use of social software. The study was conducted with four groups of undergraduate and graduate students in computing. The data collection was based on various sources (i.e. external and internal). Where applicable, the results were compared with the data collected and analysed earlier (see Chapter 7).

The study extends the research conducted earlier during the first semester that analysed the patterns exhibited by undergraduate students (Web Development module) when using the VLE. The extended study continues observing undergraduate students throughout the second semester. However, the main focus of the study was the cohort of graduate students enrolled on the Research Methods module (second semester). While considering and comparing the engagement patterns of undergraduate student observed during the two semesters, this section mainly focuses on observations of the second stage, namely the teaching/learning experience of graduate students acquired during the second semester. The required element of assessment introduced to the postgraduate students constituted the main pedagogical design difference between the two studies. The detailed information on the subject groups is presented in Table 8-1.

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Academic Level	*Number*	*Participation*	*Social Software Use*
- MSc (1 group):	11	Required	Tightly Integrated into PD
- HND (1 group):	14	Optional	Loosely Integrated into PD
- BSc (2 groups):	30	Optional	Loosely Integrated into PD
- Tutors:	3	-	-
- Observer:	1	-	-
- Administrator:	1	-	-
Participants Total:	60		

Table 8-1: Target groups and other participants included in the analysis. ***PD stands for Pedagogical Design.***

Similarly to the study summarised in the previous chapter, the data collection included the following techniques:

a) Collecting statistical data of accessing integrated educational software through a data recording plug-in. The data was used as additional evidence for triangulation with a third party web access tool.
b) Collecting statistical data through a third party Google Analytics web tool, namely recording frequencies of accessing integrated educational software systems throughout the study period.

The data analysis included:

a) Content analysis and categorization of recorded posts and comments.
b) Quantitative analysis of statistical data, particularly students' access logs, collected from two different sources.

8.5.1. Categorization and Data Analysis

Data for accessing both the VLE and the social software was monitored and logged. During the three-month period of observation of the Research Methods module a total of 3500 entries were recorded for accessing Elgg social software by the local logging mechanism. These records included each student's active participation, i.e. number of posts, comments or uploaded files, as well as passive participation, i.e. reading posts, downloading files or accessing other information.

The activities of participants (excluding the facilitators) in the Research Methods module generated a set of posts, comments and uploaded files. The summary of active participation records is presented in the following table.

No.	*Activities*	*Details*
1.	71 total blog posts	30 blog posts restricted to community members only
		38 blog posts restricted to logged in users
		3 posts for public access
2.	78 Comments	-
3.	13 Files	8 files restricted to logged in users
		5 files restricted to community members only

Table 8-2: Overview of student active participation within the social software environment.

Most of the content generated throughout the study constituted text-based posts and comments. No audio or video content was embedded by the participants. The analysis of the content of the exhibited posts and comments revealed that most of the generated content could be classified into the following categories:

- Participation in Discussion
- Self-Reflection
- Information Sharing
- Peer Feedback and Review

The categorization has been based on a qualitative analysis of both personal and community blogs. The passive participation (lurking) was analyzed alongside to highlight the most frequently accessed content and elements of the social software. The following sections describe the results of the analysis.

8.5.1.1. Participation in Discussion

The information exchange categorized as Discussion constitutes personal views, ideas, and questions and answers raised and covered by participants. Most of the discussions started during the course contained requests for help and feedback, or calls for information on a certain topic. The attributes of social software used throughout the study provided resources for starting discussions and conversations. Besides using personal blogs, participants could create/run communities on topics of their interest, and participate in discussions started in other communities and blogs. Users could also control access to certain information by setting access rights to their posts and other messages. The software allowed participants to see available communities and subscribe to receiving email notifications for accessible posts.

The observations revealed that no community was started by participants during the study period. Most of the messages were posted on the community blog created by facilitators prior to students' registration and intended for conducting the module and its educational activities. However, some students willingly participated in discussions started in a public community, established by and intended for PhD students. Additionally, a requested membership to access a closed community related to the subject of student interest was recorded. However, in contrast to general enquires that received comments from both facilitators and other students, most of the posts, which required some knowledge in the area of author's expertise, remained unanswered and did not develop into a discussion. The diversity of learners' areas of expertise limited the number and quality of responses.

From the total of 149 messages only 39 were classified as related to a discussion thread. The average number of posts within a single discussion thread was 2.9. The average number of words within messages was 192. The length of the discussion posts varied significantly from a one line response to several paragraphs. As the participation in discussions was not integrated into the assessment scheme, we can assume that they developed naturally but not without encouragement from lecturers and facilitators. The longest discussion thread recorded contained 20 posts and had 5 participants involved.

It was found that most of the discussions evolved around the tasks and assignments required by the course. Students were mainly asking questions that related to their tasks, asking for help or calling for feedback from peers. It was observed that the longest and the most thorough discussions evolve shortly before the deadline for the first task of the assignment. This comprehensive task and the approaching deadline encouraged students to share their concerns and their views with the rest of the group.

8.5.1.2. Self-Reflection

Despite the fact that the system recorded 47 messages posted on personal blogs, the number of self-reflective messages was quite low. Only two students posted 4 reflective notes, in response to facilitators' call for sharing their thoughts on their progress. These messages shared their concerns and problems with personal progress and understanding of the subject knowledge. Self-reflection upon learning and interaction of a learner with his/her peers and tutors is generally considered of major importance. It supports development of critical thinking, promotes creativity (Tiwari and Tang, 2003), and meaningful and deep learning (Abrami and Barrett, 2005). However, according to McMullan (2006), students can be reluctant to engage in self-reflection activities on account of feeling uncomfortable in writing about personal weaknesses as well as strengths. In fact, Self-Reflection was the category in which the least number of messages were placed. The results show that while students were provided with the necessary tools that carry a potential for self-reflection and exchange of personal experience, the desired outcomes were not observed. This pattern of participation echoes with earlier studies (McMullan, 2006) suggesting the value of further research for greater understanding of this phenomenon and identification of possibilities for changing it.

8.5.1.3. Information Sharing

Messages classified under the category of Information Sharing contained mainly external resources such as research papers, articles and links to learning materials related to the context of the course or participants' research area. In relation to the level of participation in discussions, the extent of information sharing was significantly low. Sharing of external resources was identified in seven posts only. Unfortunately, the messages containing external data were commented neither by peer students nor by lecturers or facilitators. Due to variations in participants' interests, the information shared on the system had limited value for the rest of the community. There was not any pattern identified for sharing information, as the posts are distributed throughout the course without evidence of relationship to a particular educational activity or course design.

8.5.1.4. Peer Feedback and Review

Throughout the study students were encouraged to share their research proposals and ask for feedback, as well as share their opinion on the work of classmates. The posts and comments, containing reflective thoughts and suggestions intended for peers, were classified into the category of Peer Feedback and Review. The ratio of posts and comments in this category was significantly higher than the number of messages classified as self-reflection or information sharing. In total, 45 messages related to inquiring/providing feedback on student proposals were identified. However, the great majority of these messages – 30 posts and comments – were published during the second half of the course. They were driven by the element of summative assessment that required students to exhibit the completed work within the social software environment.

The assignment, which was designed to be a part of the assessment, required each student to design a pilot study and report the results by posting them on their personal blogs. Later on, as part of an assessed learning activity, each student was asked to provide feedback on the work of at least two peer students by posting constructive comments that evaluate the quality of the exhibited work. However, prior to the required peer assessment task, students were encouraged to invite peers to comment on their work, motivated to improve their work prior to formal submission. The results showed that, despite repeated efforts to encourage students to exhibit and comment on each others work, the majority of students remained reluctant to participate in this non-assessed activity. Nine proposals were exhibited on the social software, but only three of them received feedback. The number of recorded comments that contained constructive feedback to the exhibited work reached six. Furthermore, the quality of the critical evaluation was shallow and lacked analytical details. The rest of the posts, six in number, remained unanswered.

The situation changed when the peer assessment task was redesignated as part of the assignment and assessment process. The number of posts related to peer feedback increased by 200% before the end of the term, and the quality of provided feedback improved considerably. Students were evaluating peer work to a greater depth and with a more thorough analysis than during the first part of the course. Hence, the results suggest that the feedback received from peers will be shallow in analysis and will rarely be initiated by peers unless made required by the course design.

8.5.1.5. Passive Participation (Lurking)

The research on the phenomenon of passive participation, or so called lurking, was discussed in the literature review section 3.4.5. A lurker is generally described as "someone who reads messages posted to a public forum such as a newsgroup but does not respond to the group" (Hine, 2000, p. 160). Recording student access logs throughout the study allowed enables analysis and reflection on the observed online student engagement. The system recorded both the actions participants took and the timeline of their online behavior. The list of records include mostly actions which otherwise would remain invisible, such as reading posts, editing messages, downloading files or accessing community profiles. From the recorded 3500 actions the most popular action is related to accessing user profiles, weblog posts and comments. Table 8-3 summarises the frequencies registered for accessing various elements of the employed social software.

No.	*Module*	*Action*	*Frequency*
1.	Weblog	View Post	**612**
2.		Edit Post	36
3.		Add Comment	87
4.		Add Post	77
5.	Profile	Update	12
6.		View	**675**
7.	Files	Delete File	2
8.		Upload File	15
9.		Create Folder	7
10.		Download File	**134**
11.		Access File list	227
12.	Friends	See All Friends	**188**
13.		Request Friendship	2
14.		Add as Friend	11

Table 8-3: The actions and frequencies that define student passive participation.

Although, passive participation was recorded throughout the period of study, the level of engagement with the social software (defined as number of access to the system) fluctuated over time. The number of records for accessing weblog posts increased by 53% after the second half of the course. This sudden increase may be associated to fact of introducing the assessed element of a learning activity at the second half of the study. In contrast, the first part of the study contained a learning activity that was optional for students to participate in. The required learning activity instructed students to exhibit their work on a blog and provide feedback to at least two other fellow students. Hence, this task not only encouraged students to active participation but also required browsing through the exhibited work before commenting. Nevertheless, the access records highlighted the variations in learner preference for accessing different areas of social software.

8.5.2. Course Design and Social Software Access Timeline

The use of the third party tool Google Analytics served as an additional data source and triangulation of the results with the data acquired through the logging mechanism of the social software. The data recorded by Google Analytics provided the timeline of participant access to the social software which was later mapped to the pedagogical design of the module. The records show that the number of visits increased by 35% and the number of page views increased by 66% after March 23rd. Although these results can be affected by the growing amount of data published by students, it is clear (see Figure 8-2) that the peaking points of accessing the software coincide with the deadlines for submitting the course assignments – April 10th and April 23rd.

Figure 8-2: The timeline for accessing the social software

8.5.3. VLE Versus Social Software

Despite the fact that students were provided with two conceptually different e-learning platforms, Moodle VLE and Elgg Social Software, the acquired data shows that throughout the Research Methods module the social software was considerably more popular than Moodle. It was found that Elgg was accessed 5.8 times more frequently than Moodle. This contrasts with records taken during the first part of the pilot study. The study that considered the work of undergraduate students on the Web Development course revealed that students were using Moodle 4.6 times more often than Elgg.

The major changes, introduced in the second semester, may explain this difference in student engagement with the technology. In the first semester, the learning tasks that encouraged learner engagement with the social software were optional and only loosely integrated into the pedagogical design. In the second semester however, the use of social software was made required and integrated into the pedagogical design along with the formal assignment. The results (summarised in Figure 8-3) show the prominent difference in the frequencies of accessing both Moodle and Elgg for the compared groups. The results suggest that engagement with educational software may considerably increase when the learning activities are made required and closely integrated into the pedagogical design of the module.

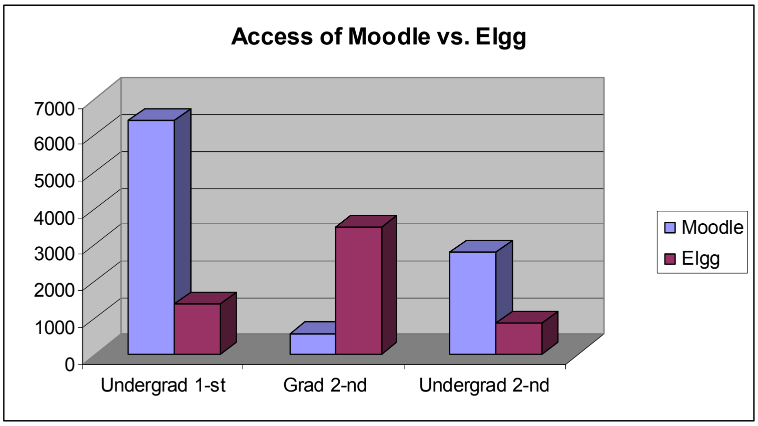

Figure 8-3: The frequencies of accessing the Moodle VLE and Elgg social software.

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8.6. Retrospective Analysis and Discussion in Relation to the SEEM Model

The reflective account drawn from casting a retrospective view, provides an opportunity to consider the conducted study within the context of the SEEM model. The research summarised in this section focuses on the use of social software by a cohort of postgraduate students. Having defined the concept of learning profiles in section 8.2, it is now possible to consider the results from a different perspective. Namely, the use of social software analysed here, can be viewed as student engagement with e-portfolios, or in other words, student engagement with developing their learning profiles. The module provided students with a tool and a necessary pedagogical structure to accommodate collaborative development of learning artefacts. These learning artefacts were exhibited in various stages of their development on learner blogs and community pages. The feedback provided and received by the students can also be considered as part of their learning profile – demonstrating their progress and the level of commitment. Therefore, an attempt can be made to review the study as an evaluation of student engagement with the learning profiles component of the SEEM model.

Prominent patters of student engagement with learning profiles were identified by using content analysis techniques. The results suggest qualitative engagement with learning profiles vary among the learners. Particularly, self-reflection and information sharing were rarely observed. In contrast, learner participation in discussions was a more frequent phenomenon. However, the introduction of a task that required students to exhibit their work and provide feedback to peers allowed acquisition of insight into the patterns of student engagement with learning profiles. More specifically, the patterns of exhibiting produced artefacts and commenting on peers' work varied according to the structure of the integrated task. As the results suggest, close integration of the learning activities into the pedagogical design can encourage greater depth of discussions and higher quality of peer review. Furthermore, the alteration of pedagogical design by adding an element of summative assessment to the integrated learning activity introduced a deviation from the previously observed level of student engagement with the educational software. On the contrary to the previously observed pattern of engagement, when the VLE was considerably more frequented than the social software, the study showed a reversed trend – with a greater level of engagement with the learning profiles.

Alongside content analysis and the categorization of learner active participation, passive participation was also analyzed. Consideration of learner access records complemented the evaluation revealing an increased frequency of access closer to the dates of expected completion of the assessment task. Furthermore, elements of learning profiles (i.e. weblogs, personal profiles, file-sharing area), varied in the level of interest exhibited by the learners. For instance, personal profiles, followed by access to blog-posts, were the most frequently accessed elements of a learning profile. Hence, the results of analyzing access records that highlight the most favoured elements of learning profiles can be found informative by practitioners. This information can be used for further encouraging learner engagement with the popular elements of learning profiles or diverting the focus of learners to other areas of the profiles.

8.7. Conclusions

This chapter has attempted to extend the discussion on the potential benefits of the SEEM model by considering evaluation of student engagement with learning profiles. The evaluation process is conducted by adopting the content analysis and analysis of access records as specified in the SEEM model. Similarly to the earlier summarised study, the research considered in this chapter is revisited and analyzed in retrospect. Nevertheless, the study enables highlighting the elements that show the SEEM model to be potentially beneficial in serving as a structured framework for the analysis of student engagement. More specifically, the benefits of the methods, incorporated into the SEEM model, are highlighted by means of the retrospective account presented here. Both content analysis and analysis of access records enable us to explain the reasons behind the observed change in learner engagement (as presented in sections 8.5.1.4 and 8.5.1.5). The use of content analysis techniques allowed the identification of least exhibited types of participation (i.e. self-reflection) and most common modes of contribution (i.e. participation in discussion). The analysis of access records, on the other side, revealed more or less frequented areas of learner profiles – highlighting information that would otherwise remain invisible. Hence, by demonstrating the value of the methods considered in this study, the inclusion of those into the SEEM model can be justified.

Furthermore, the results of the study, summarised in this chapter, provide a comprehensive evaluation of student engagement with learning profiles. The study highlights the patterns of student engagement, attempts their explanations and raises questions where further research is necessary. For instance, the study highlights the possible reasons for student active engagement with developing learning profiles. It also categorizes student engagement by employing content and log analysis. Yet, the study cannot explain how student contribution in a specific category (i.e. self-reflection) can be improved. However, constant monitoring of student engagement with learning profiles, can contribute to understanding the drivers behind certain patterns of engagement. This study, therefore, demonstrates the potential of considering the learning profiles component as part of the SEEM model for developing a greater understanding of student learning experience.

"To find a form that accommodates the mess, that is the task of the artist now."
Samuel Beckett

The psychological past and the psychological future are simultaneous
parts of the psychological field existing at a given time.
(Lewin, 1943)

9. Empirical Analysis of Dialogue and Communication

The aim of this chapter is to discuss the value of analysing and understanding communication within a learning environment. This chapter summarises a study that evaluates discussion board communication records as part of an online course. Hence, this study attempts to contribute towards further positioning and recognising the SEEM model by demonstrating its potential utility and applicability.

9.1. Introduction

This study analyses a discussion board communication conducted throughout a three-month long online course. The course was jointly designed and offered as part of the Sino-UK eChina project and targeted at educational professionals and practitioners in two countries: China and the UK. The data was kindly provided for analysis by the organizers of the course.

The results of the analysis are discussed in line with the SEEM model – focusing on its Dialogue and Communication component. As part of the study, variables (i.e. participant culture and role) from the socio-historical layer of the model were drawn upon and analysed along with communication data. The study identified a number of interaction patterns associated with the considered socio-historical variables. It highlights the benefits of considering SNA techniques and socio-historical variables in the analysis of student communication. Subsequently, this chapter discusses the potential of analysing communication data by using SNA techniques along with variables drawn from the socio-historical layer – justifying their inclusion into the SEEM model as key components (see Figure 9-1).

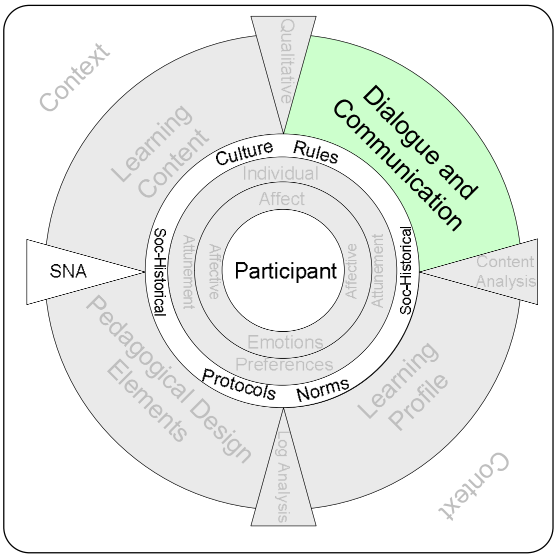

Figure 9-1: Highlighted components of the SEEM model to be analysed in Chapter 9.

9.2. Background and Introduction to Social Network Analysis (SNA)

The recent learning literature, as discussed in Chapters 2&3, acknowledges the central role of interaction and communication in a learning process. It is argued that participation and interaction encompasses the learning and development within communities (Wenger, 2009). Yet, despite the growing body of e-learning research, the studies of online interaction are often incomprehensive due to limitations of the employed research methods and the complexity of the field in general. The classroom, as a form of community, is viewed as a complex social setting in which the learning is being collaboratively constructed (Leach *et al.*, 2008). The complexity of the setting, therefore, requires extending the studies to look beyond individual actions – embracing the interrelated and complex systems of communication employed by individuals and dynamic environments. SNA is one of the techniques that can develop our understanding of online practices of teaching and learning (Haythornthwaite, 2005).

SNA is a technique that allows analysis of human interaction and relationships between individuals, groups and communities (Wasserman and Faust, 1994; Wellman and Berkowitz, 1997). It can be employed in studies of participant interaction, access (Park, 2003), as well as in analysis of group and community development (Monge and Contractor, 2003). The increasing availability of computer resources and the creation of standardized SNA software packages, such as UCINET, Siena or ORA, bundled with a variety of graphical visualisation tools, make SNA accessible and valuable for researchers in a number of disciplines including Education.

The evaluation and monitoring of student communication using SNA techniques can reveal the level of cohesion within the group of learners and identify disadvantaged participants (Haythornthwaite, 2005; Reffay and Chanier, 2003). The application of SNA can shed light on the hidden factors that may affect student participation, open collaboration and personal development. Thus, the use of SNA in educational research can become a valuable and a fundamental resource for understanding student interaction and participation, subsequently leading to improvement of teaching techniques and tools (Martínez *et al.*, 2003). The research methodology adopted in this study employs application of descriptive and probabilistic longitudinal SNA research techniques that allow identification of network dynamics and trends, and permit reporting with statistical precision.

The fundamental concepts of SNA were developed over the last five decades and discussed in the literature (Carrington *et al.*, 2005; Hanneman, 2001b; Wasserman and Faust, 1994). The basic constructs of SNA are actors and relational ties. Actors are social entities such as discrete individuals, corporate or collective social units. Relational ties, on the other hand, are the social bonds defining a linkage between a pair of actors. The combination of actors and ties forms a network – the structure of which is studied in SNA by using visual mapping and mathematical measuring. Some of the concepts frequently used in SNA are defined here.

Dyad/Triad: constructs that can be identified if there is a linkage established between two and three actors accordingly.

Density: the proportion of all the possible ties with those actually present in the network. Density shows the interconnectivity of the network.

Centrality: a concept that measures of actors' involvement with the network. Standardized degree centrality, the simplest centrality measure, is defined as proportions of nodes adjacent to the actor.

Clique: a maximal complete subgraph with at least three nodes.

Subgraph: a set of nodes and a set of lines from the graph.

9.3. Description of the Study and Data Operationalisation

The data used in this study constitute the messages communicated by course participants (i.e. students and facilitators) via a Moodle-based discussion board. The Moodle VLE served as a main platform for running the online course and was hosted on the web servers of the University of Lancaster. The discussion and group-work were integrated into the course design as central elements. While online communication and collaborative work was organised by various means in both synchronous and asynchronous modes, the data considered in this study is limited to public discussions only. The communication data was accumulated throughout a three-month long (October-December 2006) period that confined the course. The course was jointly designed by a team of Chinese and British educators as part of the Sino-UK eChina project and run purely in distance mode. The course was targeted at educational professionals and practitioners (i.e. academics, managers, postgraduate students) interested in multi-cultural aspects of online courses and e-learning in general.

The demographics of course participants comprised 'mainstream' British and Chinese cultures, yet some 'smaller' cultures were also represented (McConnell *et al.*, 2008). This study distinguishes between the two by using the term 'cultural proximity' to avoid a discrete dichotomy (i.e. Chinese/British) and indicate the spectrum of represented cultural identity and geographical distribution. The number of students from two main cultures was approximately the same – 21 from the UK and 23 from China. Along with seven facilitators, three from China and four from the UK, the total number of participants was 51 as summarised in Table 9-1.

	China	*UK*	*Total*
Students	23	21	44
Facilitators	3	4	7
Total	26	25	51

Table 9-1: Number of course participants by role and cultural proximity

The course was organized in three main units that comprised six stages, including introduction, group work in pairs and larger groups, and closing. The participants were given initial reading material, and they were free to choose the topics of particular interest to them to discuss and build knowledge collaboratively. The grouping of students and the assignation of facilitators was imposed without student involvement.

The collected data was processed as a set of longitudinal events recorded as messages posted by participants on the discussion board, either initiating a discussion or responding to another participant. This data, containing dyadic interaction between participants, was decoded and extracted into a directed social network. Pajek Arcs/Edges format (de Nooy *et al.*, 2005) was considered most suitable for extracting the data and, at a later stage, converting it into an adjacency matrix for analysis using the UCINET, NetDraw and SIENA/StOCNET software packages.

The directions of the relations are denoted according to the information flow between the interacting actors, i.e. if actor i replies to a message from actor j, then the direction of the relation goes from i to j ($i \rightarrow j$), denoted by the corresponding 'row on column' position in the matrix (Hanneman and Riddle, 2005). The messages posted to initiate a new discussion thread were discounted from consideration due to uncertainty as to their relational direction (Gruzd and Haythornthwaite, 2008). As the links between the actors are not always reciprocal the matrix is asymmetric, i.e. the rows and columns are not identical. It should also be noted that despite the availability of reflective links (i.e. ties to oneself), such data was discounted in this analysis. Thus, the values shown in the matrix are based on the number of dyadic messages exchanged between pairs of actors.

9.4. Research Methods: Exploratory Descriptive and Probabilistic Analysis

The methodology adopted in this study intended to identify and explain the patterns of interaction by applying various SNA methods and techniques. Hence, a set of descriptive and probabilistic SNA techniques were selected and employed in this study. Using descriptive SNA techniques, the study focuses on [1] analysing the network as a final static snapshot, and [2] longitudinally evaluating network dynamics. More specifically, a structural and positional analysis underpinned the exploratory study of network structures such as sub/groups and cliques. Additionally, the study explored the positional changes of individual actors over time. Finally, a probabilistic analysis of the observed patterns was conducted by [3] formulating and testing a set of hypotheses drawn from the network theory.

9.4.1. General Data Overview

Throughout the three months of the course the participants posted 1509 messages in total of which 629 were posted by the facilitators and 880 by student participants. The level of engagement, defined by participant contributions to the discussion, varied throughout the course. The frequency of messages posted per day raised in the first part of the course and considerably declined in the second. The frequency of postings is presented in the Figure 9-2.

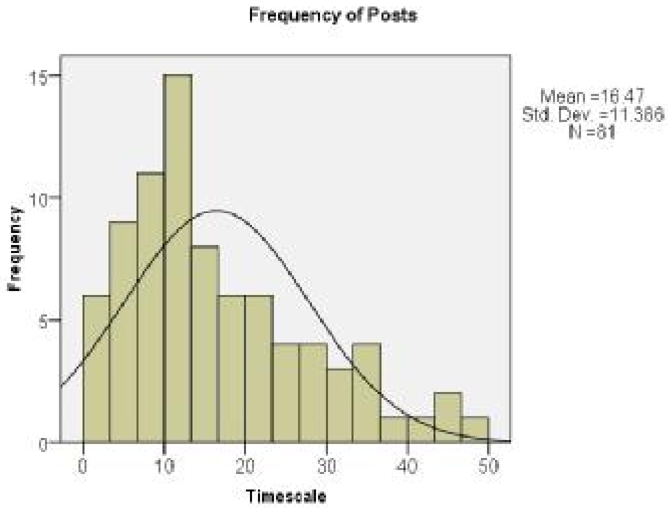

Figure 9-2: Frequency of postings throughout the course.

Significant variations were recorded in the numbers of messages posted by individual participants. The mean of posted messages was 20.17, while the standard deviation was as large as 16.4. The histograms presented below summarise the contribution of students (Figure 9-3) and facilitators (Figure 9-4). There was also a wide variation in the number of messages posted by facilitators. As shown on the histogram, the mean number of post for facilitators was 104.8 with a standard deviation of 59.3.

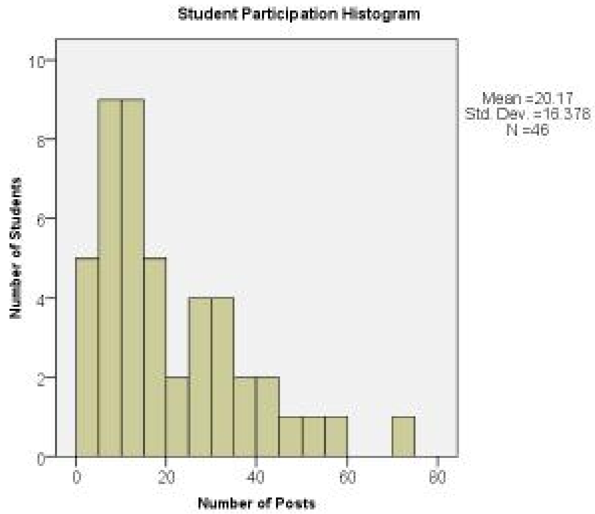

Figure 9-3: Student Participation Histogram.

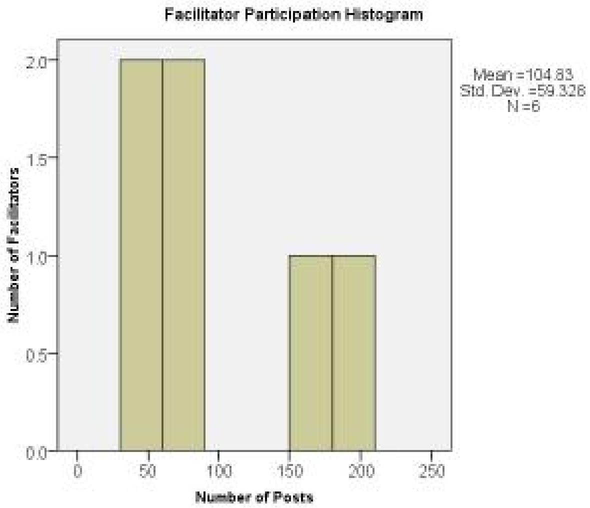

Figure 9-4: Facilitator Participation Histogram.

9.4.2. Data Overview Using Network Measures: Density, Isolates and Components

Density is a widely-used concept in social network analysis. It describes the general level of linkage among the actors of a network and shows the overall distribution of links. Along with inclusiveness, which refers to the number of actors that are included in the various connected parts of the network, it provides a general overview of the cohesion of the network. The measures of density and inclusiveness (see below) supplemented with the visualisation of the network provide an overview of the communication among participants.

Valued Network

Inclusiveness = 1.00

Density (matrix average) = 0.47

Standard deviation = 1.83

Dichotomized Network (Value > 0)

Density (matrix average) = 0.15

Standard deviation = 0.35

Dichotomized Network (Value > 3)

Density (matrix average) = 0.04

Standard deviation = 0.21

Descriptive Statistics (Degree Centrality)

1	Mean	30.549
2	Std Dev	36.378
3	Sum	1558.000
4	Variance	1323.385
5	Minimum	1.000
6	Maximum	210.000

Only participants who logged in and posted a message at least once were included in this study, which explains the recorded maximum value of inclusiveness. The visualisation of participants' network is presented in Figure 9-5 and depicts the high level of inclusiveness and density of the network.

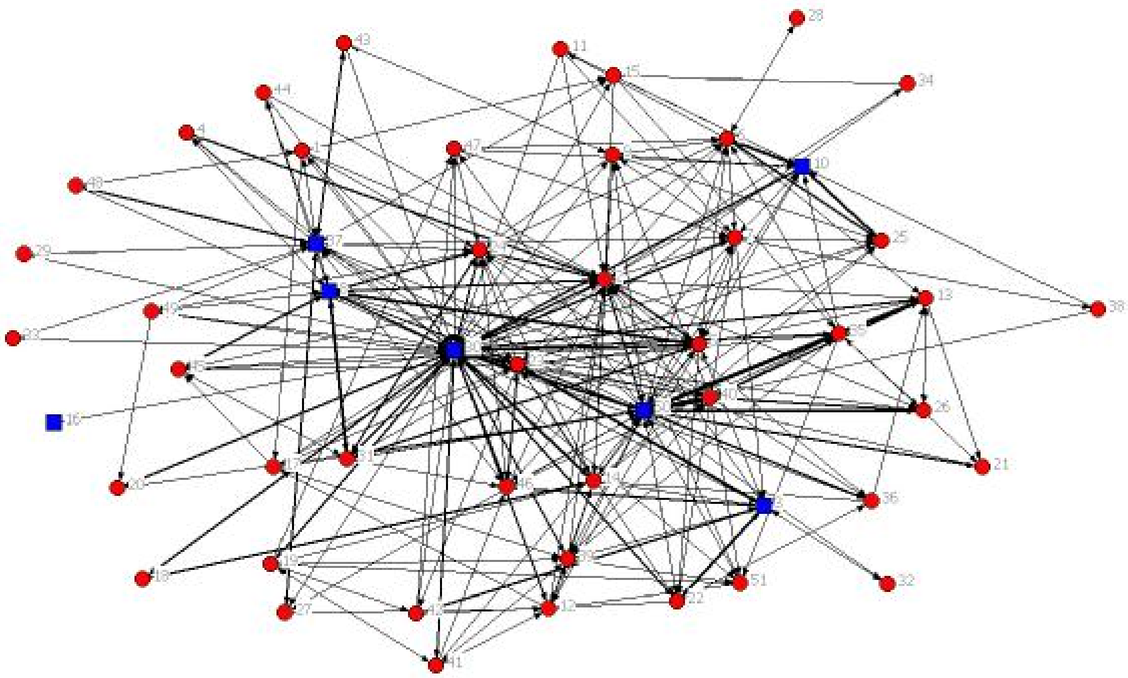

Figure 9-5: Overall Network of the course. The students and facilitators are shown with circles and squares respectively.

To further explore the parameters of the network a bi-component test was performed on the network data. The test intended to identify the cutpoints of the graph – the vertices, which increase the number of network components when removed. The bi-connected components test identified and segregated participants into three blocks only.

Block 1: Participant ID:16, Participant ID:30
Block 2: Participant ID:28, Participant ID:6
Block 3: The rest of the participants

Cutpoint 1: Participant ID:30
Cutpoint 2: Participant ID:6

This test shows that the number of components that can emerge with subsequent removal of only one vertex at a time is equal to 2. Furthermore, the size of these components will be equal to 1, i.e. the detached components will turn into isolates (Wasserman and Faust, 1994). In other words, the graph appears to be non-trivially connected – being close to a non-separable graph.

9.5. Exploratory Approach: Structural and Positional Analysis

9.5.1. Structural Analysis: Densities Within and Across Groups

The exploratory analysis was initiated by visualising the network data using SoNIA (Moody *et al.*, 2005) dynamic network visualisation software. The visualisation was rendered as an animation that showed the exchange of messages between participants over time. The visualisation allowed capturing the patterns of network dynamics visible to the naked eye. It highlighted differences in the ways the Chinese and British participants interacted. Noticeable differences in choosing interaction partner based on cultural proximity became evident from the animated visualisation of the network.

Further analysis of the network was conducted to shed light on the observed differences between the participants segregated into thee main blocks based on cultural proximity and role. Block 1 denoted the students who represented the British (22 students), Block 2 constituted the Chinese (23 students), and Block 3 denoted the facilitators (7 facilitators). Density analysis within and across these blocks was carried out using UCINET software (Borgatti *et al.*, 2002). Permuting the adjacency matrix of the network, the software measures the density within and across the denoted Blocks1, 2&3. The permuted adjacency matrix is presented in Appendix 3.

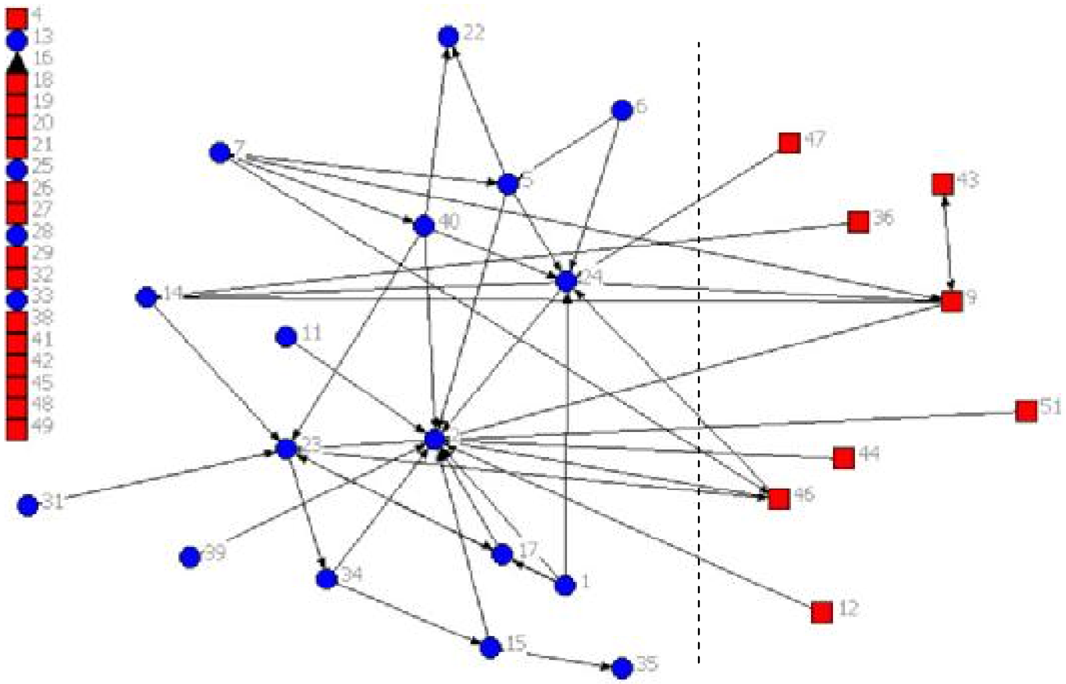

Figure 9-6: NetDraw (Borgatti and Chase, 2002) snapshot of the course network during the induction stage of the course. The Chinese participants are depicted with red squares and the British participants with blue circles. Facilitators are not included in the graph.

The density analysis of the network data showed considerable differences in the values of density within and across the blocks. The density within the Chinese block (0.042) was much lower than the density within the British one (0.345), revealing a considerable variance (0.303) in the ways the participants from the both blocks selected their communication partners (Table 9-2). The results indicate that the density of outgoing ties from Chinese participants to the British was higher (0.130). In contrast, while the British participants were more densely linked among each other, the density of outgoing ties from the British to Chinese participants was lower. The comparison of the densities within and across the blocks suggests that the Chinese participants preferred to communicate with the British. Additionally, the British participants appeared to have more frequent communication among themselves rather than with the Chinese.

In addition to analysing the densities within and across cultural proximities, the communication of facilitators (Block 3) with the Chinese and British cultural groups was also taken into account. The density of outgoing links between the facilitators' block and the British is higher (1.946) than the density of incoming links from the British to facilitators (1.850). However, interestingly enough, the density between the facilitators and the Chinese block shows a different pattern. Unlike the British, Chinese participants had denser ties to (0.975) and weaker ties from (0.783) the facilitators.

The question, raised by the observed patterns, is whether facilitators interacted with all the participants in a similar way or, as the figures indicate, did the Chinese participants receive less 'attention' from facilitators than the British? A probabilistic approach, developed in the following section, addresses and discusses this issue.

Density/average value within blocks				*Standard Deviations within blocks*			
	1	2	3		1	2	3
	-----	-----	-----		-----	-----	-----
1	0.345	0.157	1.850	1	0.962	0.687	4.058
2	0.130	0.042	0.975	2	0.628	0.236	2.141
3	1.946	0.783	1.310	3	4.234	1.980	2.899

Table 9-2: Density within the blocks of valued network. [1] British, [2] Chinese and [3] Facilitators.

Similar tests that study the interaction between the groups was also conducted using a dichotomised network matrix (limited to values 1 and 0 only). The existence of the tie was defined as 1 if at least one connection was established between participants and 0 otherwise. This approach allowed suppressing tie strengths. The resulting patterns differed slightly. As shown in Table 9-3, the density within the Chinese block is considerably lower than that of the British. This result resembles that of the previous test. However, a comparison of the results of analysing the valued and dichotomised matrices reveals differences in intra- and inter-block densities. In particular, while the difference of intra-density of the Chinese block is '0.042 - 0.034 = 0.008', the difference of the inter-block density is much bigger '0.130 - 0.066 = 0.096'. Furthermore, the difference of densities of the British block calculated from valued and dichotomised network is comparatively large i.e. '0.345 - 0.195 = 0.150', suggesting that the discussions of the British participants included the exchange of more than one message and were possibly more 'comprehensive'. In contrast, the figures suggest that the 'depth' of communication of Chinese participants was 'shallower', if the number of exchanged messages is considered. The small difference of densities of valued and dichotomized network within

Chinese block (0.008) and greater difference between Chinese and British blocks suggest that the discussion of Chinese participants with the British was 'deeper' and more 'comprehensive' than the discussion of the Chinese participants among themselves (based on the number of exchanged messages only).

Density/average value within blocks				*Standard Deviations within blocks*			
	1	2	3		1	2	3
1	0.195	0.083	0.333	1	0.396	0.276	0.471
2	0.066	0.034	0.286	2	0.249	0.180	0.452
3	0.381	0.242	0.333	3	0.486	0.428	0.471

Table 9-3: Density within the blocks of dichotomised network. [1] British, [2] Chinese and [3] Facilitators.

An additional fact, worth mentioning in this section, is that the Chinese language forum, available as part of the learning environment, remained unused throughout the course. While the forum was created for participants who may have required collaboration with peers in their native language, no discussion took place there. This impinges on the question as to why the selection of communication partners differed significantly according to participants' cultural proximity. What was the role of cultural proximity in formation of networks, and was it consistent at different stages of the course? The next section on probabilistic analysis partially addresses this question.

9.5.2. Clique Analysis: Effect of Course Structure on Network

Clique analysis is considered to be one of the fundamental techniques of descriptive network analysis. Clique is a network structure that is usually referred to as "a sub-set of a network in which the actors are more closely and intensely tied to one another than they are to other members of the network" (Hanneman, 2001a, p. 79; Hanneman and Riddle, 2005). However, this formal definition of a clique is more narrow and precise than the general notion of a high local density. A clique is the maximum number of actors who have all possible ties present among themselves (Wasserman and Faust, 1994). In other words it is a "Maximal Complete Sub-graph", which itself represent a grouping with mutual connection, expanded to include as many actors as possible.

Clique analysis was carried out as part of the exploratory study of the course network. The purpose was to identify the network structures that could possibly be connected to the imposed course structure, in particular the group-work that dominated the fifth stage of the course (which possibly had a significant impact on the dynamics and structure of the network).

Taking into account the high density of the network and wide distribution of tie strengths, a dichotomy of the matrix was carried out with ties considered present if the value of the tie was greater than 3 and absent otherwise. The N-clique analysis (Borgatti *et al.*, 2002) performed on the network was based on connections between actors with distance greater than 1 and path length 2. N-Clique test revealed 10 2-cliques within the network. The study of the visualization of the network with 10 cliques showed that the biggest clique had 26 members, as shown in Figure 9-7, and was formed around the most central facilitator-participant (actor ID:30). It is depicted on the figure as clique 1. This analysis revealed a complex pattern of overlapping cliques, mirroring the diversity in selection of communication partners. This analysis did not provide sufficient evidence to identify the effects of group-work activity on network formation.

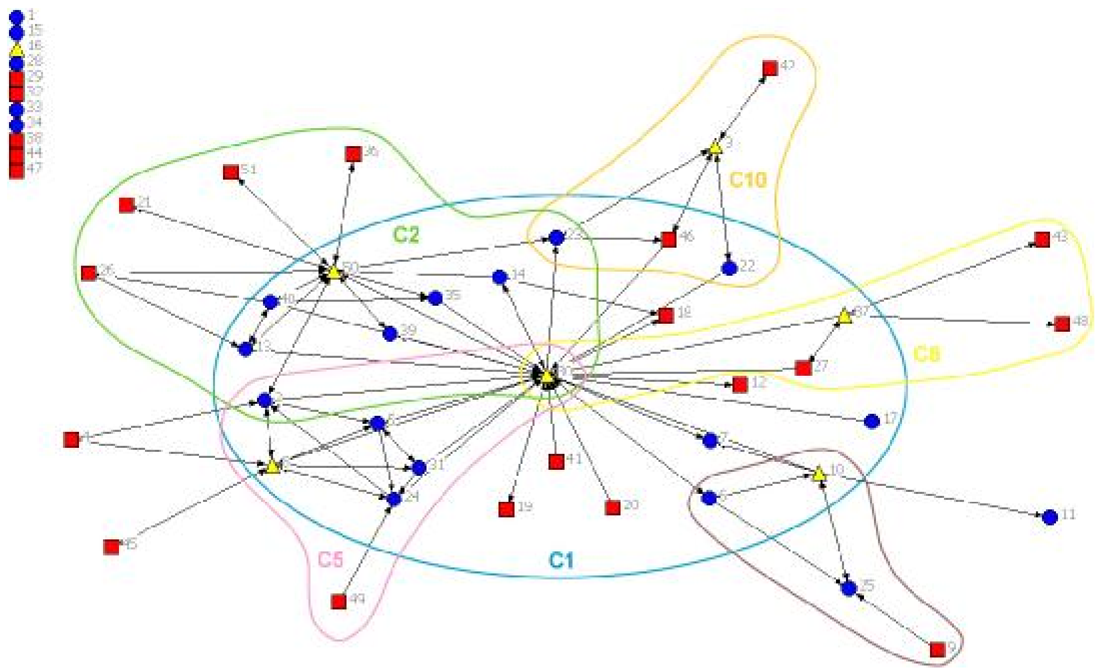

Figure 9-7: Dichotomised network of participants with several 2-clique groupings shown by coloured outlines.

Despite the complex pattern of overlapping of cliques, the overall picture changes dramatically when the most central facilitator-participant is removed from the network. As a result, five distinctive groups, with other facilitators in the centre, emerge as shown in Figure 9-8. The groups of actors in this graph mainly resemble the teams formed for group-work activity as part of the course structure. This clique analysis also revealed that there are strong and weak ties between cohesive network structures that could possibly be affected by group-work and group-affiliations within the course structure. The group affiliation and its possible effect is extensively tested in the probabilistic network model reported in the next section.

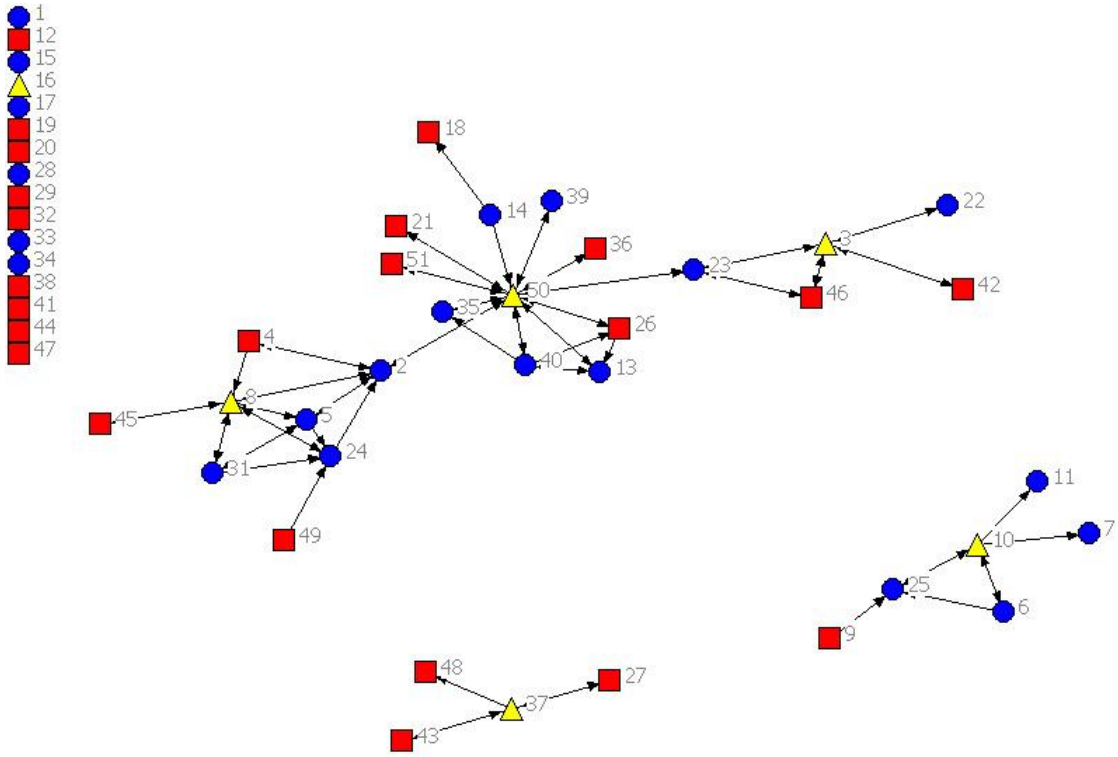

Figure 9-8: The dichotomised network without most central facilitator-participant (Actor 30).

While the clique analysis conducted in the previous section focused on identifying cohesive network structures and groups, and communication patterns associated with them, this section focuses on quantifying and understanding the positional dynamics of individual actors by adopting longitudinal techniques.

The first part of the longitudinal study uses an egocentric approach based on one of the most studied concepts in SNA – centrality. Numerous measures of centrality, including degree, closeness, betweenness, eigenvector and influence, have been considered for analysing networks. Borgatti (2005) argues that appropriate centrality measures should be used for analysing various networks. In networks where information flows with parallel duplication (i.e. when information is widely broadcast – radio, discussion boards), the degree or eigenvector centrality measure is advised to be used. Although, eigenvector, influence and power centrality were consequently used for evaluating network centrality, the chapter only reports the results based on the degree centrality measure.

The study was started by dividing the course period into six stages based on the educational activities integrated in the course, segregating five longitudinal waves of network data. Then the degree, the first centrality measure, was calculated for each phase and analysed. The analysis showed that the value of degree centrality grew faster for some participants and slower for the others, demonstrating substantial differences in growth rates. To understand the pattern of participants' constantly-changing network centrality a categorical variable was introduced to divide participants into two groups, one with a higher and, second, with a lower value of degree centrality. To do this, participants' degree centrality was calculated for each of the five waves of network data. The participants were then categorised into two groups: participants with higher and lower centrality. The study of changes within those two groups over time showed [a] little mobility of its members and [b] significant variance of average degree centrality growth rate within the two groups. The following line diagram shows the growth of average centrality for the groups Figure 9-9.

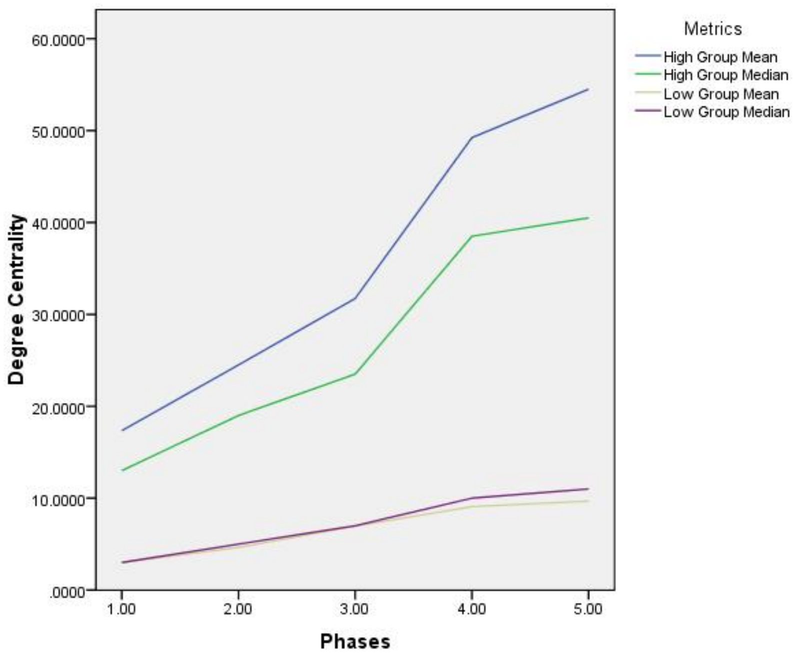

Figure 9-9: The growth of degree centrality within the groups with comparatively higher and lower degree. Greater variations are observed in the group with higher degree than in the lower.

A scatter plot for degree centrality values with linear trend estimation showed similar results (Figure 9-10). The correlation of the degree centrality in the initial and final phases of the course was 0.908 showing strong persistence of participants' acquired network position.

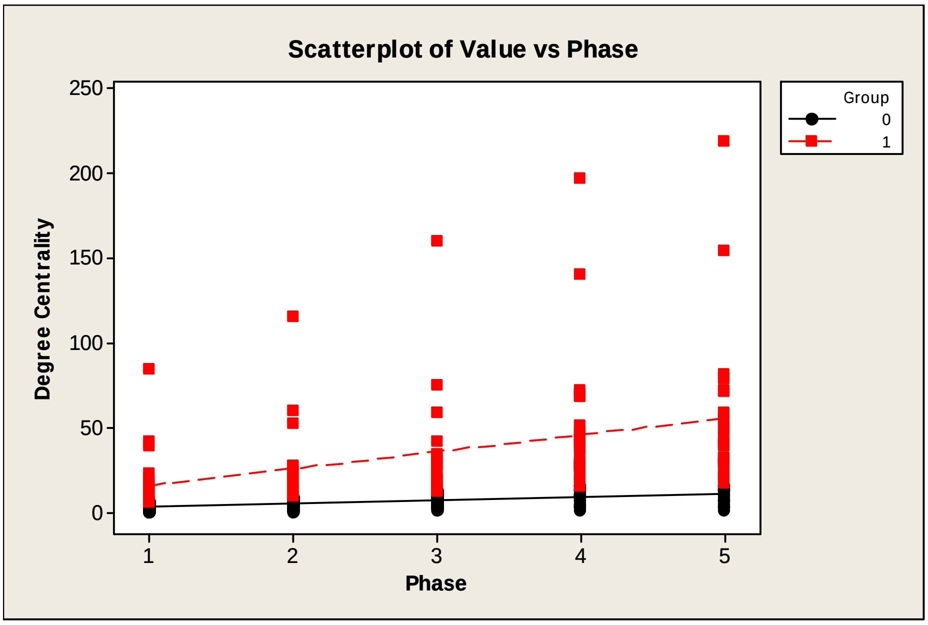

Figure 9-10: Scatter plot for participants' degree centrality within high (1) and low (0) value groups.

These findings suggest that the participants who are initially placed in the group with lower degree centrality were unlikely to get into the group with higher centrality due to its faster rate of degree growth. This pattern closely resembles the power-law distribution for exhibiting the property of scale invariance (Lui and Tsang, 2007). The power-law distribution commonly relates to many activities such as income distribution or one's connectivity and is frequently referred to the 'rich get richer' effect. The Figure 9-11 shows participants' degree centrality distribution with the curve of power-law distribution fitted in.

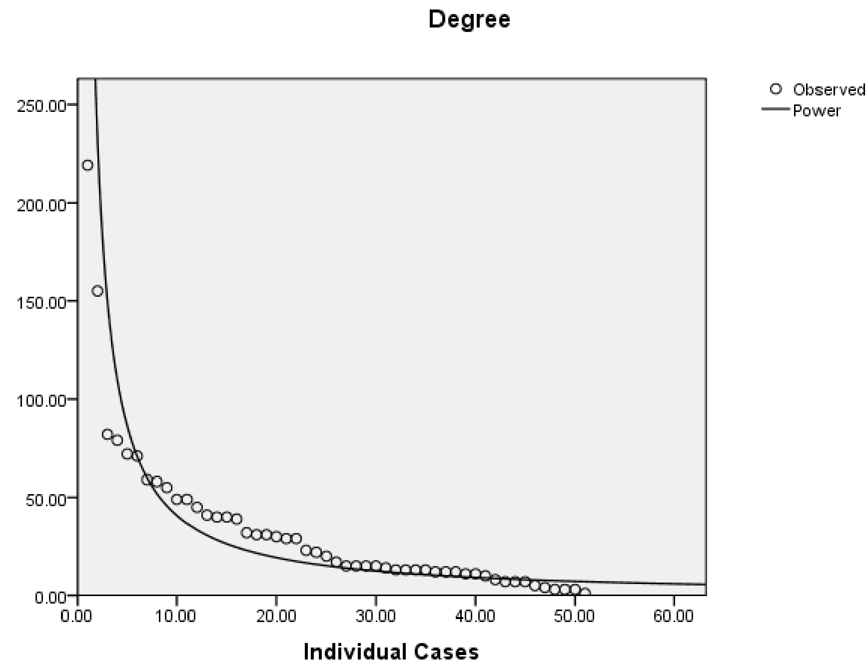

Figure 9-11: Degree of participants in the end of the course with power-distribution curve fitted into the observation.

Phase 1	85	39	20	13	42	17	17	15	17	2	13	23	11	6	11	12	15
Phase 2	116	60	28	28	52	20	25	24	28	10	22	25	13	8	18	14	17
Phase 3	160	75	42	34	59	29	20	30	34	18	31	32	18	20	20	17	23
Phase 4	197	141	69	69	72	68	51	43	48	46	45	43	37	39	38	29	27
Phase 5	219	155	82	79	72	71	59	58	55	49	49	45	41	40	40	39	32
Actors	30	50	3	8	2	40	10	5	23	13	37	24	31	14	6	22	46

Phase 1	19	6	9	6	6	6	15	0	5	7	7	5	3	11	6	0	6
Phase 2	24	9	20	11	12	10	16	2	6	11	10	8	8	13	10	1	6
Phase 3	28	12	24	18	12	13	19	6	11	14	12	9	8	13	13	10	5
Phase 4	31	26	30	28	28	18	22	12	15	15	15	15	11	13	13	13	10
Phase 5	31	31	30	29	29	23	22	17	15	15	15	15	14	13	13	13	13
Actors	7	25	35	39	26	12	9	41	49	36	19	45	42	17	47	4	1

Phase 1	7	3	3	0	0	4	6	7	2	0	2	4	3	0	2	1	1
Phase 2	7	5	5	1	1	5	7	7	4	6	2	4	3	1	2	1	1
Phase 3	6	6	5	6	7	7	8	7	6	1	1	4	3	3	2	1	1
Phase 4	12	11	11	11	10	10	8	7	7	4	5	4	3	3	3	1	1
Phase 5	12	12	12	11	11	10	8	7	7	7	5	4	3	3	3	1	1
Actors	51	43	27	48	18	21	11	15	20	38	32	44	34	29	33	16	28

Figure 9-12: Mobility of participants throughout the five phases based on their degree centrality. Shaded areas indicate members of the group with higher centrality (Group 0).

Although, the pattern shows persistence in gained levels of centrality, one can see (Figure 9-12) that individuals did move from one category to the other throughout the course. Particularly, the participant whose degree growth is highlighted with a rectangle on Figure 9-12 has acquired a degree that is even higher than the median of the higher-degree group. We also see a person who was active in the initial phase of the course, but compromised their position in the later phases, moving down the degree centrality measure list. This analysis is extended in the probabilistic analysis of the network in the following section. The question as to why some participants acquire greater gain in network centrality than others is outside the scope of this thesis. Nevertheless, it is important to address this question in future research and understand the forces that drive alterations in network dynamics.

9.6. Probabilistic Approach: Underlying Theory and Conjecturing

The descriptive techniques outlined in the previous section of this chapter provide useful measures for describing and understanding social networks. However, the recent theoretical and technical developments in network and social theories allow the extension of SNA far beyond descriptive statistics. The family of exponential random graph models, known as p*, offers evaluation of stochastic models, allowing the capture of patterns within the network with statistical precision (Robins *et al.*, 2007). The following section formulates a set of hypotheses within the boundaries of a developed conceptual framework and adopts a probabilistic SNA approach for making conclusions with statistical significance.

To evaluate the dynamics of the developed network, a set of concepts for addressing issues related to the formation and evolution of social networks have been selected, namely homophily (actor level), reciprocity (dyadic level), transitivity (triadic level) and preferential attachment (global level). The following sub-sections describe these theories and formulate a set of hypotheses to explain the interaction phenomena observed and discussed as part of the explorative analysis reported earlier in this chapter.

9.6.1. Homophily

Homophily is "the principle that a contact between similar people occurs at a higher rate than among dissimilar people" (McPherson *et al.*, 2001, p. 416). In line with the proverb - 'birds of a feather flock together' - homophily effect is present when contact between similar actors occurs more frequently than among dissimilar actors. This principle structures network ties of friendship, marriage, exchange, advice-giving and other relationships. As a result, homophily affects the formation of people's personal networks, making them homogeneous with regard to many sociodemographic, behavioural, and intrapersonal characteristics (Louch, 2000; McPherson *et al.*, 2001; Rogers, 1995).

The criteria for encoding similarity among the participants in this study is limited to their role, dichotomised to student and facilitator, as well as cultural proximity, as defined earlier in this chapter and attributed to participants representing Britain and China. The dichotomy of those composite cultures reduces the complexity to only dominative characteristics shared by the participants representing Britain and China. Based on the main principle of homophily and identified similarities between the participants, the following hypotheses were formulated:

Hypothesis 1: Cultural proximity affects creation of new links and interaction among participants.

The structure of the studied course rested on the philosophy of collaborative learning and promoted openness for creating favourable conditions for the learners to: share ideas and accept new ones; be intellectually-open and accept the possibility of change; be frank in self- and peer-assessment; and build healthy relationships (McConnell, 2000). The role of a teacher in a collaborative learning environment is less rigid than in more traditional individualistic or cooperative learning environments. In a collaborative learning environment, the differences between the teacher (referred to here as facilitator), as a community member or mentor rather than a separate, authoritative body, and a student, are blurred and less obvious. The more active participation of students and less authoritative attitude of facilitators suggest the following hypothesis:

Hypothesis 2: Participatory role has little if any effect on the creation of new links and interaction among participants.

9.6.2. Preferential Attachment

The concept of *preferential attachment* refers to the increased attractiveness of links to actors that already have high degrees of linkage (Barabási and Albert, 1999). In other words, actors accumulate new links in proportion to the number of links they already have, and therefore the development of networks resembles the multiplicative process, which is known to give power-law distributions (Barabási and Albert 1999; Faloutsos, Faloutsos et al. 1999; Dorogovtsev, Mendes et al. 2000; Newman 2001). The tendency for preferential attachment in the network leads to the emergence of actors with an extraordinarily high number of links and is typical for citation networks (Newman, 2001) or Internet topology (Faloutsos *et al.*, 1999).

The effect of preferential attachment is similar to the "rich get richer" phenomenon where some actors in the network become disproportionately well connected while others retain only few links. This network pattern in an educational setting, particularly in an open discussion space where some participants acquire a dominant position, may not be desirable, making the involvement of less active participants even less likely. However, depending on the philosophy, structure and methodology of the course, this pattern may be interpreted differently. For instance, a tendency towards preferential attachment may be read as an indicator of efforts by highly connected actors to reach out and engage students who were initially less involved in the collaborative activities and loosely connected in the network. Consequently, the study of preferential attachment and tendencies in educational networks can be an indicative factor for necessary methodological changes.

The exploratory analysis of the network, summarised in the previous section of this chapter, revealed significant differences in the growth rates of individual actors' centrality measures. However, taking into account the open and collaborative design of the studied course and the balanced grouping of participants, the following hypothesis can be conjectured:

Hypothesis 3: There is no tendency towards preferential attachment within the studied network.

9.6.3. Reciprocity and Transitivity

Katz and Powell (Katz and Powell, 1955) proposed an index for measuring the tendency of actors to reciprocate initiated contacts more frequently than would occur by chance; this measure is studied on the dyadic level through the process of dyad census. The empirical evidence shows great variations of the reciprocation index depending on the type of network. In a study of friendship networks, where high school students were asked to name their closest friends, the level of reciprocation was 60% (Campbell *et al.*, 1986). The study of physicians` reports, on the other hand, revealed a substantially lower rate of discussions of cases (37%) and an even lower rate (13%) for the exchange of advice (Coleman *et al.*, 1966).

While reciprocity is a structural property studied at the dyadic level, the basis of transitivity lies in triad census analysis. The triple of actors i, j and k is considered to be transitive if the ties between those actors follow the following pattern: i→j, j→k and i→k, where the arrow denotes the direction of the tie (Wasserman and Faust, 1994, p. 566). The structural pattern of transitivity, as part of the triad census, has been extensively studied by many social scientists (Davis and Leinhardt, 1967; Holland and Leinhardt, 1971). Networks with a high tendency for transitivity can be beneficial when trust and cooperation are required (Sparrowe and Liden, 1997); nevertheless, transitive relations may not be as useful if actors rely on innovation in a competitive environment (Burt, 1992).

The roots of analysing reciprocity and transitivity go back to balance theory, propounded by Fritz Heider in 1946 (Wasserman and Faust, 1994). Balance theory explains the emergence of transitive triads, which underlies the clustering effect within the network and the phenomenon of cohesiveness. Thus, the analysis of network dynamics within an educational setting, and particularly the course data used in the current study, can reveal tendencies towards cohesiveness as a result of course activities and structure. The result can be a quantitative measure and therefore a precise indicator of participant interaction dynamics.

The main activity incorporated within the studied course structure is the collaborative work in six smaller groups to which participants were affiliated. To test the changes in network dynamics and tendencies at dyadic and triadic levels (in the stage of group work activity) the following hypotheses were formulated:

Hypotheses 4: There is a tendency towards more cohesive interaction within the studied network.

Hypotheses 5: There is a tendency towards more cohesive interaction within smaller groups.

No.	***Hypotheses***	***Testing Method, Models and Conditions***	***Theory, Measures and Level***
H1	Cultural proximity	Homophily Effect estimation with SIENA,	Shared cultural

No.	***Hypotheses***	***Testing Method, Models and Conditions***	***Theory, Measures and Level***
	does not affect creation of new links and interaction among participants.	using 6 waives of longitudinal network data. Parameters: Same Culture, Culture Similarity Null Hypothesis: Estimate coefficient = 0, at α=0.05. Alternative Hypothesis: Estimate ≠ 0, at α=0.05.	proximity Network centralization Actor level
H2	Participatory role has little if any effect on creation of new links and interaction among participants.	Homophily Effect estimation with SIENA, using 6 waives of longitudinal network data. Parameters: Same Role, Role Similarity Null Hypothesis: Estimate coefficient = 0, at α=0.05. Alternative Hypothesis: Estimate ≠ 0, at α=0.05.	Shared role Network centralization Actor level
H3	There is no tendency towards preferential attachment within the studied network.	*[a]* Pearson Correlation degree centrality and involvement rank. Null Hypothesis: r = 0 Alternative Hypothesis: r ≠ 0 *[b]* Alter Activity effect estimation with SIENA, using 6 waives of longitudinal network data. Parameters: Alter Activity, Betweenness, Null Hypothesis: Estimate coefficient <= 0, at α=0.05. Alternative Hypothesis: Estimate >0, at α=0.05.	Network centralization Global Level
H4	There is a tendency towards more cohesive interaction within the studied network.	Parameters: Reciprocity, Transitivity Null Hypothesis: Estimate coefficients <= 0, at α=0.05. Alternative Hypothesis: Estimate >0, at α=0.05.	Differential mutuality and reciprocation Dyadic and Triadic level

No.	*Hypotheses*	*Testing Method, Models and Conditions*	*Theory, Measures and Level*
H5	There is a tendency towards more cohesive interaction within smaller groups. [H5a] There is a tendency towards interaction with members of shared small group. [H5b] Small group members are more likely to have mutual communication ties.	Parameters: Reciprocity, Transitivity, Group Similarity, Group Similarity + Reciprocity Null Hypothesis: Estimate coefficients <= 0, at α=0.05. Alternative Hypothesis: Estimate >0, at α=0.05.	Shared group attribute Differential transitivity Dyadic level

Table 9-4: Summary of the hypotheses-testing framework.

9.7. Probabilistic Approach: Hypotheses Testing

9.7.1. Patterns of Homophily and Heterophily

Testing these hypotheses of the homophily effect is based on a stochastic actor-driven simulation model introduced by Snijders (1996, 2005). Such models usually incorporate random changes within the network structure as well as purposeful changes driven by actors' involvement and attributes. These models are used to estimate the network evolution that results from the actions of individual actors, taking into account network constraints and, if applicable, external influences (Snijders, 1996).

To specify the actor-driven model which will be used for testing Hypothesis 1 and Hypothesis 2, a set of objective and rate functions needs to be defined. While the *rate functions* indicate the pace of actors' interaction change, the *objective functions*, to which random components are added, indicate the change within the interaction network itself (Snijders, 2001). The rate and objective functions, presented below, were estimated with SIENA software (Snijders *et al.*, 2006), using six waves of collected network data (with at least one additional interaction expected in each wave to consider a tie present). Additionally, constant covariates of actor attributes, i.e. cultural proximity and participatory role, were also taken into account. Below is the outline of the network effects considered in the analysis.

Outdegree effect:	The interaction may tend to stabilise over time (if a negative value is observed).
Reciprocity effect:	The actors may tend to reciprocate initiated communication.
Culture homophily:	Actors may choose to interact with actors of the same cultural proximity, e.g. the British may prefer to communicate with fellow British participants.
Culture ego effect:	Same-culture actors differ in the number of actors they prefer to communicate with, e.g. British students may prefer to communicate with more participants than Chinese.
Culture alter effect:	Same-culture actors differ in 'popularity', e.g. British students may receive fewer initiatives for communication than Chinese.
Role homophily:	Actors tend to choose interaction with actors of the same role, e.g. student to student, or facilitator to facilitator.
Role ego effect:	Same-role actors differ in the number of actors they communicate, e.g. facilitators may initiate more contacts with other participants.
Role alter effect:	Actors with the same participatory role may differ in 'popularity', e.g. facilitators may receive more initiatives for communication than students.

The model was run with standard actor-oriented model code, i.e. a multiplication factor of 2, 4 subsequent phases and 1000 of iterations in the third sub-phase, as advocated in the SIENA manual (Snijders *et al.*, 2006) and described by Steglich et al (2006). All the reported parameters are significant at α = 0.05 (except those in italic font) as seen from the values of the standard errors.

Parameters Same Culture and Same Role explain the homophily effect hypothesised in the previous section. The positive (0.9830) and significant result for the Same Culture (Model 1) parameter and similar result (0.3804) for Culture Similarity (Model 2) indicates that in this study interaction between participants of the same culture was more likely. Null Hypothesis 1, therefore, can be rejected.

Unlike the effect of cultural proximity, the result of Same Role and Role Similarity parameters are not consistent (positive/negative) and not significant. The negative result would indicate heterophily (Rogers and Bhowmik, 1970) among actors of the same role. Heterophily, being the opposite of homophily, would show a tendency towards interaction among divergent actors, in this case facilitators and students. Having had negative values would imply that student participants of the studied course would be more likely to communicate with facilitators and, vice versa, facilitators would be mote likely to communicate with the students. The results however, cannot be elaborated any further due to lack of statistical significance. High value of the standard error prevents the rejection of null Hypothesis 2.

Sub-model	***Parameter***	***Model 1 Coefficient (s. e.)***	***Model 2 Coefficient (s. e.)***	***Model 3 Coefficient (s. e.)***
Network Dynamics: Structural Effects	*Outdegree Density*	-2.2969 *(0.3566)*	-1.7558 *(0.1294)*	-1.5374 *(0.1337)*
	Reciprocity	0.8905 *(0.2255)*	0.8554 *(0.2189)*	0.7816 *(0.2113)*
	Transitivity	0.1229 *(0.0479)*	0.1319 *(0.0474)*	0.0974 *(0.0412)*
	Distance 2	0.2180 *(0.0561)*	0.1863 *(0.0510)*	0.1963 *(0.0672)*
Network Dynamics: Covariates Effect	*Same Culture*	0.9830 *(0.3798)*	-	-
	Same Role	*-0.1789*[a] *(0.3523)*	-	-
	Culture	-	0.3804	0.4451

Sub-model	Parameter	Model 1 Coefficient (s. e.)	Model 2 Coefficient (s. e.)	Model 3 Coefficient (s. e.)
	Similarity		*(0.1892)*	*(0.2148)*
	Role Similarity	-	*0.1417* [a] *(0.2127)*	*0.1047* [a] *(0.1827)*
Behaviour Evolution	*Effect Culture on Rate*	-	-	-0.9837 *(0.2888)*
	Effect Role on Rate	-	-	1.3057 *(0.2596)*

Table 9-5: SIENA estimation results. [a]Coefficient values shown in italic font are not significant, i.e. $\alpha < 0.05$.

The results for the three models, summarised in Table 9-5, are designed to test Hypotheses 1 and 2, yet they comprise more parameters that have extensive value for interpreting the dynamics of the studied course network. Those parameters are: objective functions: outdegree density, reciprocity, transitivity distance at two, and covariate effects of culture and role.

The value of outdegree density (-2.2969) is negative and significant, which is a common observation in many studies. This does not mean that the density reduces over time, but rather indicates that the participants are selective with whom they interact (Snijders *et al.*, 2006). It suggests that the pattern of interaction stabilizes over time, from the initial introduction stage, when participants initiate communication with many others, to the later stages where collaborative work in small groups is the main activity.

The values of the reciprocity and transitivity parameters are significant and positive, indicating the tendency of participants to [a] reciprocate ties by responding to initiated communication of others and [b] towards shortening of the geodesic distance from one actor to another as cohesiveness increases.

9.7.2. Preferential Attachment Pattern

The effect of preferential attachment, summarised in Hypothesis 3, was tested by [a] calculating the Pearson Correlation Coefficient between the initial and final measures of participant degree centrality; and [b] estimating the preferential attachment (alter activity) effect with a stochastic actor-driven simulation model (Snijders, 1996, 2005). The triangulated results were then used to assess the identified pattern.

[a] Pearson Correlation Coefficient was calculated on the same set of longitudinal degree centrality five wave data. Course participants were divided into two groups: participants with high and low degree centrality. The correlation calculated for the initial and final stages of the course ($r = 0.909$) demonstrating that participants who were in the group with higher degree centrality in the initial stage of the course were likely to remain in the same category at the end of the course. These results confirm the earlier conducted exploratory analysis that is discussed in section 9.5.2.

[b] Alter Activity Estimation was tested with estimation of the stochastic model, run with standard actor-oriented model code, multiplication factor of 2, 4 subsequent phases and 1000 iterations in the third sub-phase, as advocated in SIENA manual (Snijders, Steglich et al. 2006) and described by Steglich et al (2006). The results of the analysis are given in Table 9-6. All the parameters are significant at $\alpha = 0.05$ (except those in italic font) as indicated by the values of standard errors. Similarly to testing the homophily effect, the rate and objective functions, as shown below, were estimated with SIENA software (Snijders *et al.*, 2006), using the same six waves of collected network data (dichotomized to at least one expected interaction for each wave). In addition to the outdegree and reciprocity functions used in the previous section, the following effects were selected for the model estimation:

Activity of Alter:	"the rich get richer" effect (if the value is positive) is present in the network i.e. more active students become even more involved in discussions over time.
Betweenness:	"brokerage" effect, when actors position themselves between not directly connected others i.e. some individuals may have more control over information flow.

Sub-model	Parameter	Model 4 Coefficient (s. e.)	Model 5 Coefficient (s. e.)
Network Dynamics: Structural Effects	*Outdegree Density*	-1.6656 *(0.6751)*	-1.7418 *(0.1795)*
	Reciprocity	0.7344 *(0.2912)*	0.5913 *(0.1933)*
Network Dynamics: Covariates Effect	*Activity of Alter*	9.4729 *(2.7973)*	6.8497 *(3.2266)*
	Betweenness	*-0.2265* [a] *(0.4055)*	*0.0193* [a] *(0.0318)*
Behaviour Evolution	*Outdegree Effect on Network Rate*	-	0.1048 *(0.0462)*
	Indegree Effect on Network Rate	-	0.0870 *(0.0381)*

Table 9-6: Two models for Alter Activity Estimation . [a]Coefficient values shown in italic font are not significant, i.e. $\alpha < 0.05$.

The results of the estimation show that the Activity Alter effect is large, positive and significant. This indicates the existence of tendencies for participants who are involved in collaborative activities at the beginning of the course to get even more involved over time. Similar results are produced in estimation of both models (Model 4 and Model 5) with and without consideration of behavioural covariates. Therefore the null Hypothesis 3 can be rejected, supporting the alternative that Activity Alter in the studied network exists. To ensure that the exhibited preferential attachment is not the effect of brokerage in the network, betweenness covariate was considered in the model. The results are not statistically significant to indicate the existence of a brokerage effect. Therefore, the Activity Alter effect is unlikely to be the consequence of brokerage.

The existence of an Activity Alter effect was positive and significant in all the three tests. This provides consistent evidence that the observed phenomenon does resemble the pattern of power law distribution of degree centrality in the studied network.

9.7.3. Network Cohesion Measures

To capture the change in network dynamics conjectured in Hypotheses 4 and 5, the continuous longitudinal data was partitioned into three waves. The selected waves represented the network according to the three major elements of the course structure: [1] pre-group-work interaction, [2] group-work and [3] group-work presentation. These waves represented the snapshot of the participation network before the group-work and after – bearing the changes of network dynamics with the changed course structure.

The hypotheses testing was conducted with the same actor-driven simulation model introduced by Snijders (1996, 2005) and used in hypotheses testing earlier in this section. Model 6, 7 and 8 summarised in Table 9-7 were also estimated in SIENA with standard actor-oriented model code, multiplication factor of 2, 4 subsequent phases and 1000 iterations in the third sub-phase (Snijders *et al.*, 2006).

Sub-model	*Parameter*	*Model 6 Coefficient (s. e.)*	*Model 7 Coefficient (s. e.)*	*Model 8 Coefficient (s. e.)*
Network Dynamics: Structural Effects	*Outdegree Density*	-1.6198 *(0.1159)*	-1.7703 *(0.1696)*	-1.7053 *(0.1599)*
	Reciprocity	1.0248 *(0.2327)*	0.9937 *(0.2289)*	1.2710 *(0.6065)*
	Transitivity	0.1262 *(0.0469)*	0.1317 *(0.0492)*	0.0995 *(0.0351)*
Network Dynamics: Covariates Effect	*Group Similarity*	-	0.5978 *(0.2950)*	0.5053 *(0.2507)*
	Same Group x Reciprocity	-	-	*-0.3270* [a] *(0.8874)*
	Same Group	-	*0.1972* [a] *(0.1911)*	*0.3849* [a] *(0.2098)*
Behaviour Evolution	*Reciprocity Effect on*	-	-	0.3637 *(0.0520)*

Sub-model	*Parameter*	*Model 6 Coefficient (s. e.)*	*Model 7 Coefficient (s. e.)*	*Model 8 Coefficient (s. e.)*
	Network Rate			

Table 9-7: Network cohesion measures. [a]Coefficient values shown in italic font are not significant, i.e. $\alpha < 0.05$.

The estimation of Model 6 that uses only three variables mainly conforms to the same measures used in the previous models (i.e. Models 1, 2). The replication of these results in more than one model allows the reporting of the tendencies within the studied network with confidence. The large, positive and significant value of the reciprocity coefficient shows a tendency for an increasing number of mutual ties over time between course participants. The value of the transitivity coefficient is also positive and significant, though not as large as the value of reciprocity. Nevertheless, in addition to mutuality, the estimation shows a tendency towards an increasing number of transitive ties between participants. Therefore, the null hypothesis under Hypothesis 4 can be rejected, supporting the alternative of increasing cohesiveness within the studied network dynamics.

Models 6 and 7 contain additional objective and rate functions which extend Model 6, so allowing further insight into the dynamics of the observed network. The similarity and identity effects (i.e. Group Similarity and Same Group in Table 9-7; Same Role/Culture and Role/Culture Similarity in Table 9-5) added to the succeeding models were used earlier in this section for testing the homophily effect. A similar approach was adopted for testing Hypothesis 5 with the participant group affiliation attribute used as an independent variable. It may be argued that the existence of groups within the studied network (i.e. affiliation network) may require application of social network analysis techniques that are suitable for two-mode networks. However, the available software packages, such as SIENA, StOCNET, Statnet and PNet, used for statistical network analysis, do not support the use of two-mode network data at the time of writing this thesis. Nevertheless, due to a static number of participants in each group and, additionally, a single group affiliation policy (defined by the course structure) for each participant, the selected evaluation technique is valid. The estimation of shared group affiliation coefficients (i.e. Same Group and Group Similarity), if positive, will show a tendency for participants to interact with peer group members rather than with other participants.

The results show that both of the coefficients, Same Group and Group Similarity, have positive values in Model 7. This, however, is overshadowed by the result of the Same Group coefficient (0.1972) being comparatively small and not significant, in opposition to the comparatively large (0.5978), and significant estimated result of Group Similarity. Further estimation, extended with the two added coefficients in Model 8, change the value of the Group Similarity coefficient to 0.5053 that remains significant. Hence, the null Hypothesis 5a can still be rejected only based on the results of Group Similarity coefficient. Therefore, no tendency for participants to interact with co-group members only was identified.

Furthermore, the coefficient of Same Group and Reciprocity, added to Model 8, is not significant, suggesting that no tendency towards reciprocity among participants with shared group attributes (Same Group x Reciprocity = 0.3849). Additionally, the positive (0.3637) and significant coefficient of Reciprocity Effect on Network Rate (i.e. the effect of the coefficient on the frequency of network change) (Snijders, 2005) suggests a significant effect of reciprocity on network change. While, null Hypothesis 5b cannot be rejected due to lack of significance, the results suggest reciprocity in communication and the positive effect of reciprocity on network rate. The tests for Hypotheses 5a and 5b suggest that the cohesiveness of the community improved in terms of the increasing number of mutual ties improved over time, yet the communication was not limited or focused on interaction with group members only.

9.8. Immediate Results and Discussion

Exploring the studied online course using dynamic network visualisation and conducting network analysis highlighted a number of prominent patterns of participant interaction. Some of the patterns revealed the differences in the preferences of the British and Chinese participants in choosing communication partners. Initiating the study with exploratory analysis – namely, the density analysis performed on a network matrix, indicated on certain relations between cultural groups. The network matrix, permuted and partitioned by cultural proximity and role attributes, precisely measured the level of interconnectivity within and across the major cultural and role groups. While further analysis was conducted to explore the identified relationships, initial findings resulted in acquiring information about interaction that would otherwise remain invisible. The traditional tools available in most VLEs for reporting student engagement would only quantify student participation without revealing patterns of communication. Similarly, [a] conducting a basic centrality analysis for identifying the central actors, [b] performing positional analysis for classifying emerging cliques and their overlaps and [c] adopting a longitudinal approach for tracking network changes provide rich information that may be used for informing practitioners and designers of online courses.

The recent theoretical and technical advances in SNA allow educational researchers to extend the application of SNA methods by incorporating and evaluating stochastic models that allow the capturing of regularities with statistical accuracy. This chapter summarises the process of formulating and testing five hypotheses by applying probabilistic SNA techniques. The dynamic actor-driven models were defined and evaluated by using SIENA software as part of the StOCNET program collection. This chapter reports the results that showed and quantified dynamic changes and tendencies within the studied network with statistical accuracy. Namely, the evaluation revealed the existence of [1] a homophile effect based on participant cultural proximity, [2] a no heterophily effect based on participant role (i.e. student/facilitator) and [3] a preferential attachment effect resembling a power law distribution of centrality measures. Additionally, the evaluation revealed [4] a positive tendency towards cohesiveness on both dyadic and triadic levels and, finally, [5] a no further tendency towards reciprocation within smaller groups.

9.9. Limitations and Challenges of Employing SNA in E-Learning Research

The potential of applying SNA in e-learning research has been discussed earlier in this chapter. Furthermore, an empirical study that employs SNA has been conducted and reported here. However, along the benefits and great potential of employing SNA, e-learning researchers and practitioners should also consider the caveats of ‘reducing’ or ‘stripping down’ potentially rich interaction data into a limited social network matrix. However useful the SNA can be, the absolute reliance on employing SNA may distort the perception of practitioners and researchers from the actual learning experience. One of reasons to be cautious when operationalising network data and applying SNA is related to the challenge of considering the 'meaningful' connections and discarding those with little or no use.

Similarly to other quantitative techniques, SNA should take into account the actual value of communication and interaction. While communication data can be easily accessed and automatically processed, the rich context of the exchanged messages may represent a significant constraint to automatic evaluation. Namely, not all communication exchange can be positive or beneficial to learning. For instance, communication that is negative or discouraging in nature may be of little use when only the number of exchanged messages is taken into account. While the intensive communication may be perceived as useful by practitioners, it can be deceiving due to the negative context of the communication. Even though, the contextual information is less relevant when considering interaction with, for instance, educational content, extra care is necessary when considering participant interaction. When considering the development of automated services for evaluating interaction or communication, ranking (i.e. 1 to 5; or positive/negative) of the posts can be used to minimize the loss of contextual information without reducing the potential for automated evaluation.

9.10. Conclusions

The study summarised in this chapter demonstrates the feasibility of adopting and applying SNA techniques for evaluating interaction within a collaborative learning environment. It draws upon social network theories to define models for evaluating testing conjectured hypotheses. This study demonstrates the potential value of the adopted method in analysing the communication data. Hence, this study can be considered within the light of the SEEM model – in relation to its Dialogue and Communication component and the integrated SNA method. This study identifies prominent patterns and tests those with statistical precision by conjecturing a set of hypotheses and employing a number of probabilistic models.

In addition to probabilistic methods, the empirical study also considers descriptive network analysis. This study demonstrates that some of the network patterns can be identified early in the exploratory stage. It demonstrates the potential benefits of adopting descriptive SNA techniques that include visualisation, density and centrality analysis. Hence, when thus introduced into educational research these methods can provide visual and quantitative overview of student engagement. As many of the online courses integrate computer mediated communication and collaborative work into course structure, the introduction of automated tools for visualising and analysing communication data promises to benefit many practitioners and stands to gain wider recognition. Demonstrating the potential of the SNA in educational practice and research allows further development of the initiated process of demonstrating the benefits of the SEEM model. This study makes possible the argument that the use of SNA can reveal patterns that would otherwise remain unrevealed or may remain unnoticed.

Once the value and the benefit of SNA techniques are demonstrated, an argument in support of potential automation can be made. This study demonstrates that incorporating a set of models that employ SNA can provide answers to certain questions with affordable computation time. The development of modules and tools to automatically analyse the communication data and report the patterns is made viable by using the available open source network tools such as SIENA and SoNIA. Furthermore, the use of such tools can enable constant monitoring and provision of alerts when certain patterns are exhibited within the network.

While the analysis of participant interaction can only provide researchers with information regarding the exhibited prominent patterns, it can indirectly affect student learning experiences when used to inform adjustments of course structure and teaching/facilitation techniques. Furthermore, when the analysis of interaction is made available to students, the students themselves can reflect and act on some of the patterns that originate in their participation. Hence, the analysis can also encourage students themselves to self-direct and self-monitor their learning process.

In summary, this study evaluates discussion data addressing participant differences. It applies SNA techniques to analyse the student communication and report the prominent patterns. In the light of the SEEM, therefore, it focuses on the Dialogue and Communication component and variables form the Socio-Historical layer. It demonstrates the value of considering the combination of these elements by highlighting the revealed interaction patterns that would otherwise remain undetected or difficult to identify. It also touches upon the topic of automation and the potential for using the automated analysis tools in online learning – contributing to the process of positioning the SEEM model.

"Failure is instructive. The person who really thinks learns quite as much from his failures as from his successes."
(John Dewey, 1957)

"If you want to truly understand something, try to change it."
(Lewin, 1951).

10. Empirical Analysis of Engagement with Pedagogical Design Elements

This chapter aims at discussing variations of student engagement with another component of the SEEM model - pedagogical design elements. Peer assessment, a learning activity designed and integrated into the structure of a course, was consecutively practised and investigated. This chapter reports the results of this investigation highlighting the outcomes that contribute to achieving the main objectives of this chapter. Parts of this work have been previously published as conference papers (Stepanyan *et al.*, 2009a; Stepanyan *et al.*, 2009b).

10.1. Introduction

This study investigates a set of consecutive peer assessment activities and discusses the factors of peer assessment design that may affect student engagement. It reports student attitudes towards the integrated learning activity and investigates the relationship of student learning styles with their experiences. From the perspective of the SEEM model, this study takes into consideration: the pedagogical design elements component; attunement layer; and methods that include quantitative techniques such as log analysis (see Figure 10-1). Hence, this study enables an advance in the process of demonstrating the potential benefits of the model, addressing the points of the fourth and the last milestone as positioned in section 6.6.

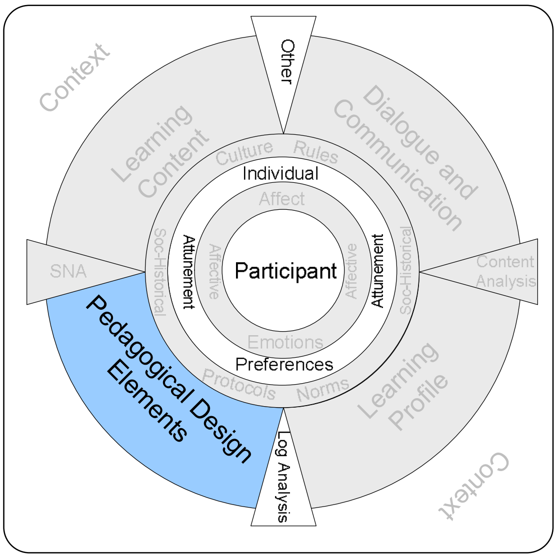

Figure 10-1: Highlighted components of the SEEM model to be analysed in Chapter 10.

This chapter combines three examples of peer assessment tasks (also referred to as Exercises 1, 2 and 3) and discusses the exhibited higher and lower levels of student engagement. The following sections discuss the exhibited patterns of engagement - emphasising the design of the pedagogical activity and reporting revealed associations among the considered variables. The first section of this chapter focuses on the two tasks (Exercise 1&2) with less intensive participation and engagement patterns. It identifies and discusses potential factors that hinder student engagement. The second section of this chapter discusses the results of a redesigned and reintroduced peer assessment exercise (Exercise 3). This exercise was redesigned accordingly to avoid lower levels of engagement as for Exercises 1 and 2. Extending the earlier study, the second section highlights student attitudes towards peer assessment and investigates the existence of possible associations across student learning styles, perceptions and grades.

10.2. Theoretical Background

Peer assessment is widely recognized as involving formative feedback and summative grading of individuals by peers of similar status (Bostock, 2000). Introduced as an innovative form of assessment, peer assessment aims at enhancing the learning experience, assisting deep learning and fostering the acquisition of critical thinking skills (McDowell, 1995; Mowl, 1996). Similarly to the peer review process used for evaluating work quality in professional occupations (Bloom, 1999; Cole and Simon, 1981), peer assessment encourages students to develop skills for analysis and critical evaluation (Johnson *et al.*, 1998a; Liu *et al.*, 2002). With the development of Internet technologies and the increasing uptake of online learning, web-based peer assessment is attracting greater attention in higher education (Topping, 1998; Yu *et al.*, 2005).

10.2.1. Theoretical and Empirical Studies of Peer Assessment

Assessment is an indispensable and an essential component of formal education. In a compound system, assessment - along with teaching practices - can support and encourage higher levels of thinking and learning (Biggs, 2003a). The interrelation of learning and assessment techniques has been widely researched (Black and Wiliam, 1998; Gardner, 2006). Formative assessment, which integrates constructive feedback for improvement of student work and achievement of individual learning goals (Sadler, 1989b), has been shown to be effective across different fields and educational levels (Black and Wiliam, 1998; Wiliam *et al.*, 2004). Formative assessment is often contrasted to summative assessment, the latter being commonly associated with judgmental and grading measures (Sadler, 1989a; Worthen and Worthen, 1999) that contribute to final awards. Peer assessment that accommodates formative feedback is believed to encourage intelligent questioning, reflection and generalization, self-disclosure and greater self-awareness (Topping, 1998).

A review of literature indicates great variation in the models of peer assessment used in higher education. While originally used in writing courses (Jacobs, 1987), studies on peer assessment span many subjects and areas. However, regardless of differences, all applications require students to play an active role in assessment. Peer assessment can embrace elements of summative and formative assessment; both of those approaches are considered in this study – investigating and reporting the differences of student engagement between the two.

Given the wide variations in characteristics of peer assessment, it is difficult to propose theories that are universally applicable to all practice. However, the principle of joint construction of knowledge through discourse suggests that a perspective of social constructionism forms the conceptual framework that underpins peer assessment (Topping, 1998). Higher levels of student involvement in defining assessment criteria and providing feedback also indicate that peer assessment is well-grounded in the philosophies of active learning and androgogy (Falchikov and Goldfinch, 2000). Topping's peer-assessment typology (Topping, 1998), based on a review of process and outcome studies, records seventeen variations in assessment that consider characteristics such as outputs, privacy, official weight, ability and many others. For example, Topping classifies peer assessment activities by the directionality of commentary process as one-way, reciprocal or mutual. Anonymity or confidentiality of participation, frequently considered in designing peer assessment activities, constitutes another characteristic of this typology. Earlier empirical studies suggest that place, time, anonymity and student reward are important factors in the successful implementation of peer assessment (Langan *et al.*, 2005; Liu and Carless, 2006; Topping, 1998).

Among the perceived potential benefits, peer assessment is thought to encourage student involvement with cognitively demanding activities; such as comparing, clarifying, contrasting, diagnosing, considering deviations and summarizing information. These activities are believed to reinforce knowledge and lead to better understanding and deeper learning (Van Lehn *et al.*, 1995). Additionally, peer assessment supports the development of teamwork and communication skills (Riley, 1995), and improves the understanding of institutional assessment processes (Fry, 1990). On the other hand, potential drawbacks of peer assessment include reluctance to accept responsibility for assessing fellow students and the possibility of inappropriate or abusive use of powers to assess. Summative assessment is associated with further issues of reliability and validity (Falchikov and Goldfinch, 2000; McDowell, 1995).

10.2.2. Peer Assessment Praxis in Online Learning

The widened access to computers and information services has provided an alternative platform for online practice of peer assessment. Similar to traditional paradigms, online assessment is shifting its focus from a summative model to a formative one. Building on the traditional foundations of peer assessment, web-based practices attract the attention of both educational practitioners and researchers. Roberts (2006) reports increased interest towards pedagogies that include online peer support in the form of group or collaborative work and argues that the discussion of peer assessment in e-learning is timely and important. Furthermore, while the benefits of providing formative feedback are well documented, the details and merits of web-based practices are yet to be established (Miller, 2009).

Earlier research reports a number of benefits associated with web-based peer assessment. Some of those benefits are: the possibility of allowing anonymity in the assessment process (Wen and Tsai, 2006); potential for reducing feedback/grading time (McGourty, 2000); and flexibility for completing the assessment at a preferred time and place (Miller, 2009). More widely, web-based practices offer the possibility of bringing a level of automation to peer assessment and other benefits associated with information technologies (Topping *et al.*, 2000).

Apart from organizational and administrative benefits, research literature reports on learner attitudes towards peer assessment in relation to their gender differences (Wen and Tsai, 2006). Lin *et al.* (2001) consider personal characteristics such as thinking styles to compare the quality and style of peer feedback. Others comment on the effect of peer assessment on learning and personal development highlighting the variations in student conceptions of deep and surface learning (Yang and Tsai, 2009). The reviewed literature however, signifies the need for further research in the field - particularly in respect of disciplinary epistemologies and psychology of peer feedback (Yorke, 2003). This study integrates web-based peer assessment into the pedagogical design, and aims to evaluate student engagement with these learning activities.

10.3. Methodology for Evaluating Engagement with Peer Assessment Tasks

This investigation reports the results of three consecutive studies that identify attitudinal, behavioral, pedagogical and technical factors that may influence levels of student engagement with peer assessment activities. When higher levels of student engagement are recorded, additional variables are drawn into evaluation and tests for various associations between the variables are conducted.

The three studies that constitute this investigation are based on three independent and consecutive peer assessment exercises (also referred to here as Exercise 1, 2 and 3). For the sake of clarity, the studies were categorized into groups based on the recorded levels of student engagement (i.e. lower and higher levels of engagement). This chapter proceeds by, firstly, reporting the studies that investigated lower levels of engagement, and secondly, discussing the outcomes associated with higher levels of engagement. The following sections present the aims and discuss the context of the studies. Where possible, cross-comparisons between experiences with higher and lower student engagement are made.

10.3.1. Lower Levels of Engagement

Studies that investigate lower levels of engagement are based on peer assessment exercises referred to here as Exercises 1&2. As part of this investigation an attempt is made to address the following questions:

- What encourages greater levels of student participation in peer assessment?
- Are there any associations between attitudes towards the peer assessment and student achievement as indicated by grade records?

The investigation employs mixed methodological techniques evaluating student access logs to the web-based environment and analyzing collected student feedback data. The investigation is in two consecutive research cycles. Each cycle introduced a specifically designed peer assessment exercise. Student participation in the designed peer assessment exercise was then evaluated, reflected upon and taken into consideration for planning the next research cycle. The cyclical approach was employed to ensure continuous improvement in practising a formative web-based peer assessment.

The investigation initially focuses on the first research cycle - where the peer assessment exercise was introduced and then evaluated in relation to student post-exercise feedback. It then elaborates the second cycle, which incorporated peer assessment practice adjusted according to initial findings. Evaluations are based on assessments of VLE access log metrics and the analysis of student feedback (36 respondents) expressed in a 21-item questionnaire. Subsequently, correlational analysis was used to test for possible associations between student attitudes and their achievement records (i.e. average marks for the first two summative assessment practices).

10.3.2. Higher Levels of Engagement

The other stream of investigation proceeds by adjusting the design of peer assessment exercise (Exercise 3) according to findings from an earlier peer assessment experience (Exercise 1). The factors identified as important in fostering student engagement are taken into account. Recording higher levels of student engagement, extension of the study becomes possible. Hence, additional variables, such as student learning styles and participation marks, are being considered. This investigation aims at answering the following questions:

- How beneficial the peer assessment is perceived to be by students?
- Are there any associations between student learning styles and the perceived benefits of the exercise?
- Are there any associations between student learning styles and the levels of student engagement?

To answer these questions, student learning styles and student attitudes towards the completed exercise were measured. Student attitude data was collected using a 36-item questionnaire that asked about: student expectations prior to the exercise; perceived usefulness of the exercise; perceived measures of engagement with the exercise and the course in general; perceived effects on learning and understanding. The characteristic preferences of student learning styles were identified according to the Felder-Silverman Learning Style Model as reviewed in Chapter 3.

10.4. Case Study and Pedagogical Design of Peer Assessment

The investigation is based on year-long modules concerning the development of database applications. The modules were offered to second-year undergraduate Bachelor of Science and Foundation Degree Science students in computing. The peer assessment exercises were introduced as [a] optional (Exercises 1&2) and [b] required (Exercise 3; 20% of the marks) part of a graded group assignment. The two optional exercises, which mainly recorded lower levels of participation and engagement, are discussed in section 10.5. The results of the peer assessment activity that included a summative assessment element are presented in section 10.6. The assignment required students to work collaboratively in pairs, to design and develop a database. A written report was then submitted for marking. As part of the peer assessment exercise, students were asked to post specific sections of their reports for assessment by peers.

According to the typology of peer assessment (Topping, 1998) these exercises could be categorized as being of a formative/summative, out-of-class/in-class, mutual, distance/face-to-face, non-graded/graded, voluntary/compulsory, cross-ability, individually assessed, group peer assessment activities. The main incentive for participation in an optional exercise was the opportunity for students to improve their work on the basis of suggestions made by their peers. In contrast to the optional exercise, allocation of marks was the main incentive for participation in the required exercise. The peer assessment exercises were delivered using a discussion board on a Blackboard™ virtual learning environment. Each discussion board thread comprised the original report and accommodated the peer feedback for each report. The peer assessment exercise consisted of two tasks: [a] posting student group-work on the VLE; and [b] posting constructive feedback on the work of other groups. The exercise was thoroughly explained and tutor support was made available to the students.

10.5. Results: Lower Levels of Engagement

The lower levels of participation were recorded for two exercises (Exercise 1&2). The first exercise required students to participate at their own time in a distance mode (prior submitting the work for grading). While the second exercise required students to work in-class and participate anonymously (after submitting the work for grading). The results of student engagement with both of the exercises are reported and discussed here.

10.5.1. Peer Assessment Exercise 1 (Autumn Term, 2008)

Only four students in two groups completed the first peer-assessment task. Although posts were of high quality, the low level of participation was of some concern. Participant attitudes and behaviour were therefore investigated further by questionnaire and with respect to: [a] critical reflection; [b] extent of passive (lurking) and active participation; and [c] by developing the study in an attempt to understand attitudes towards specific components of the peer assessment exercise.

This further enhancement to the initial investigation was achieved by collecting student feedback on the design and delivery of the exercise. The demographics of questionnaire respondents (36 students) are presented in Table 10-1.

	Category	*Frequency*	*Percent*
Age	*19-20*	8	22.2%
	21-22	15	41.7%
	Over 23	12	33.3%
	Not Spec	1	2.8%
Gender	*Female*	8	22.2%
	Male	27	75.0%
	Not Spec	1	2.8%
Total	**-**	**36**	**100%**

Table 10-1: Participant Demographics for Exercise 1.

10.5.1.1. Analysis of the Blackboard™ Access Records

In addition to active participation, log entries contain records of passive participation (lurking) around the discussion, assessment and announcement areas established to support the peer assessment process. Logs record 168 'views' of posted materials by 18 students (50% of the cohort) accessing exhibited work and feedback. Log statistics therefore suggest: [a] a high level of interest amongst 'passive' participants in work submitted by peers; and [b] that passive 'non-posting' involvement was much more widespread than active participation.

Despite seemingly low interest in initially posting contributions, the logs show that the peer assessment area continued to be accessed by students some time after the end of the exercise. Some 20% of all 'hits' recorded occurred up to two months following peer assessments with a further 6% logged during a 10 day period before students were to take a 'time-constrained assessment' (a formal test). Because this examination included problems similar to those given during the peer-assessment exercise, it seems very likely that students visited the peer assessment area for revision purposes.

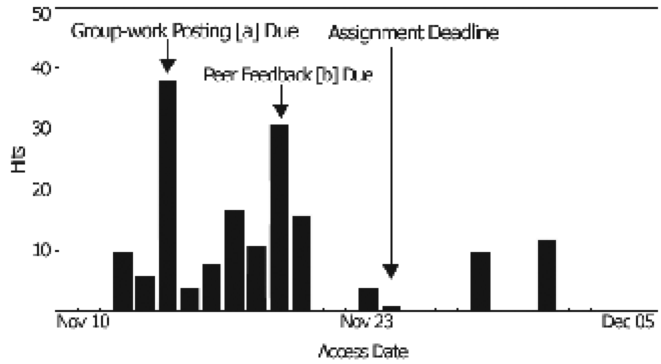

Figure 10-2: Access to peer assessment area on Blackboard™ with deadlines indicated.

Results indicate that many students who did not actively participate did in fact 'passively' view content. A further cycle of study was undertaken to investigate possible reasons for low levels of active involvement, and to suggest means by which greater participation in peer assessment work might be encouraged (see sections 10.5.2 and 10.6).

10.5.1.2. Student Feedback on Peer Assessment

A 21-item questionnaire (see Appendix 1a) was issued to determine student opinion concerning: [a] the rationale for peer assessment; [b] the design and delivery of the exercise; [c] levels of comfort/acceptance associated with elements of the peer assessment process; and [d] web technologies used for the exercise.

The great majority of students indicated that the exercise was fairly well explained and presented (86% or responses were recorded for categories of "satisfactory" and "very clear"). Additionally, results indicated that 67% of all respondents were interested in being able to view the work of their peers; this observation is also consistent with behaviour recorded in access logs. A greater proportion (78%) believed that the exercise could be beneficial. The proportion of those considering the exercise to be of no benefit (22%) was great enough to be of concern to the teaching team. While most students were interested in accessing their peers' submissions, only 50% were interested in providing feedback to their classmates. The discovery that students were more inclined (78%) to engage if marks were awarded for participation is consistent with earlier studies (Sadler, 1989a). A significant proportion (22%) suggested that one principal area of improvement would be to reward the quality/level of participation in peer assessments through summative grading.

The timing of the exercise was another factor shown to be important for increasing levels of participation. Two thirds of respondents indicated that timing would affect their level of engagement in peer assessments. Many preferred to conduct peer assessment in-class rather than off-site and three students (8%) were particularly emphatic on this point (see Figure 10-3).

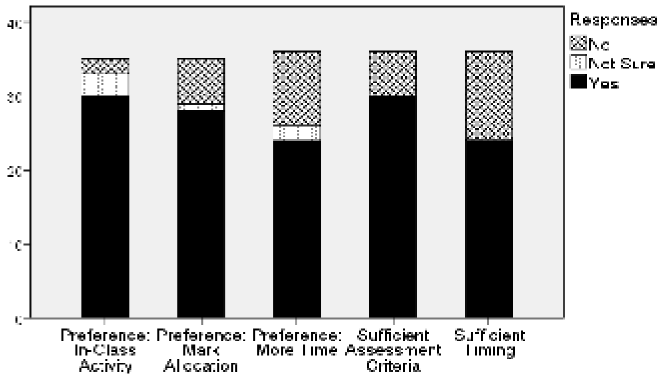

Figure 10-3: Preferences in peer assessment exercise format.

Earlier research suggests that less desirable effects of peer-assessments may include increased participant work-loads and anxiety levels (Worthen and Worthen, 1999). The assessment of student 'comfort' level with regards to anonymity and workload revealed that 43% of participants were "very/uncomfortable" to post their work publicly. Students felt relatively more comfortable in terms of workload: 74.2% (mean=3.09, std. dev.= 0.951, n=35) of respondents indicated that they regarded the additional workload to be "moderate" or "insignificant" (Figure 10-4). However, only 8.3% indicated insignificant increase in their workload, indicating the appreciation of the non-trivial nature of the exercise by the majority of students.

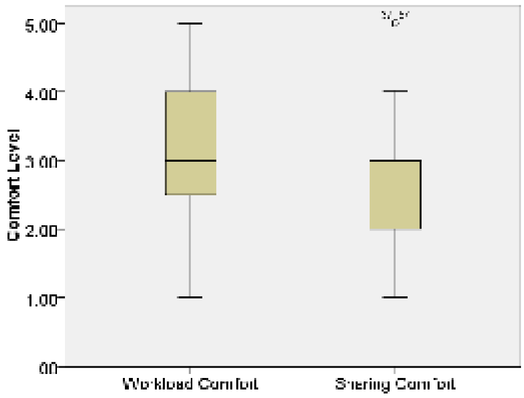

Figure 10-4: Comfort level ('acceptance') of students with [a] added workload and [b] required sharing of work (1: least; 5:most comfortable). ***Note: box plots are paired here for convenience of presentation only. Likert scales for the two boxplot distributions should not be compared because they are nominal and represent different but (statistically) interdependent 'comfort' metrics.***

For the purposes of triangulating/confirming the results reported above, students were also asked to express which improvement they believed might have the greatest "participation encouraging" impact in peer assessment exercises. Results (see Table 10-2) indicate that allocation of marks (22%) and clearer justification for exercises with provision of further support in completing reviews (together 20%) were the most important factors in influencing engagement with peer assessment. There was also notable support (11%) for delivering peer assessment exercises in-class.

The VLE and discussion board in particular, were central in facilitating the peer assessment. A Blackboard™ environment that contained an announcement, resource and communication area, was made available for the purpose of the exercise. Discussion board threads were created for posted work and peer feedback.

Student Suggestions	***Freq.***	***%***
Clear explanation and justification of peer assessment	2	5.6
Clear explanation and more support	5	13.9
Active participation of others	2	5.6
Allocation of Marks	8	22.2
In-Class Activity	4	11.0
More Time Allocation	2	5.6

Student Suggestions	***Freq.***	*%*
No Suggestions Made	*13*	*36.1*
Total	***36***	***100***

Table 10-2: Student perceptions of the most important factors for encouraging participation in peer assessment.

VLE access records were notably consistent with questionnaire data; both sources indicated that 56% of all participants accessed the peer assessment area. Most of those who used the system (91%) rated access as being "very" to "moderately" easy. However, because 44% of participants did not visit the VLE, this observation cannot be extrapolated to the remainder of the cohort.

10.5.1.3. Correlation Analysis of Survey Data against Student Marks

Student marks for the first two module assignments were averaged and were then analyzed alongside questionnaire data. The intention of analysis was to reveal patterns between responses and mark performance. For example it was of interest to know if higher achievers were more likely to appreciate the benefits of peer assessment or more willing to provide feedback. Due to the non-parametric nature of the data Kendall's tau statistic was used for calculating correlation coefficients (Table 10-3).

The results indicate that average marks (AM) and anticipated level of additional workload (ALAW) associated with peer assessment are significantly correlated (r=-.335). The direction of this relationship suggests that higher achieving students are more likely to report lower levels of expected extra workload as a result of undertaking peer assessment. The statistically significant correlation (r=.334) between student average marks (AM) and willingness to access peers' work (WAPW) suggests that higher achieving students are also more likely to be interested to see the work of their peers. While some practitioners may expect that lower achievers would be most interested in the work of others, the results suggest the opposite.

Kendall's tau_b		***CI***	***AU***	***ALAW***	***WTF***	***WAPW***	***AM***
CI (Clarity of Introduction)	Cor. Coeff.	1					
	Sig. (2-tailed)	.					
	N	36					
AU (Anticipated Usefulness)	Cor. Coeff.	0.205	1				
	Sig. (2-tailed)	0.154	.				
	N	36	36				
ALAW (Anticipated Level of Additional Workload)	Cor. Coeff.	-.431**	0.038	1			
	Sig. (2-tailed)	0.003	0.795	.			
	N	35	35	35			
WTF (Willingness to Receive Feedback)	Cor. Coeff.	-0.025	0.13	0.187	1		
	Sig. (2-tailed)	0.876	0.408	0.246	.		
	N	35	35	34	35		
WAPW (Willingness to Access Peers Work	Cor. Coeff.	0.252	0.071	0.18	.356*	1	
	Sig. (2-tailed)	0.112	0.649	0.257	0.041	.	
	N	35	35	35	34	35	
AM (Average Mark TCA&CW1)	Cor. Coeff.	0.076	-0.002	-.335*	0.181	.334*	1
	Sig. (2-tailed)	0.572	0.987	0.014	0.219	0.024	.
	N	34	34	33	33	33	34

*Notes: [1] ** = Correlation is significant at the 0.01 level (2-tailed).*

*[2] * = Correlation is significant at the 0.05 level (2-tailed).*

[3] CI, AU and ALAW are likert scale, and WTF and WAPW are dichotomous (y/n) data

Table 10-3: Bivariate Non-parametric Correlation (Kendall's tau) of Collected Questionnaire Data and Student Marks.

Another, less surprising result, indicates a highly significant correlation (r=-.431) between anticipated level of additional workload (ALAW) and the clarity of introducing (CI) the peer assessment exercise. The results suggest that students are more likely to record a lower level of anticipated workload when clarity of introduction is perceived to be greater. No other statistically significant correlation was discovered. As in any correlation analysis these findings do not imply causality.

10.5.2. Peer Assessment Exercise 2 (Autumn Term, 2009)

While the Exercise 1 highlighted patterns of engagement and factors affecting participation (see section 10.5.1), it also raised questions for future research. More specifically, to which extent the factors identified from the post-exercise feedback can affect student participation? To address this question, another non-graded peer-assessment exercise, virtually identical to the earlier one, was offered to the students who registered for the same module a year later. On this occasion peer assessment was structured as an anonymous and in-class activity. This was delivered after the groups had formally submitted their assignments for grading. The actual task, evaluation criteria, tools and all the other elements of the exercise remained unchanged. Hence, it was intended that this additional study might provide some insight as to how changes in delivery (namely, the provision of an anonymous environment and scheduling peer assessment as an in-class activity) might influence the participant engagement.

10.5.2.1. Comparison of results for Peer Assessment Exercises 1 and 2

The evaluation of the first peer assessment exercise (Exercise 1) revealed factors that can affect levels of student participation. These were: allocation of marks towards participation; allocation of in-class time for support; and the endorsement of anonymity. Organizing the second peer assessment exercise (Exercise 2) by offering confidentiality and in-class support, allowed observation of changes in the patterns of student engagement and their comparison with the previous peer assessment exercise.

Participation in the second peer assessment exercise was considerably greater than for the first. While some of the participants preferred not to participate in the study, 7 out of 21 groups (33%) exhibited work on the discussion board. Therefore, those who were willing to review their peers' work had a greater opportunity to do so than for the earlier exercise. Reviews, comprising feedback and comments of varying quality and detail, were posted by eleven students.
Analysis of VLE logs revealed that 62% of all students accessed the discussion board areas allocated for peer assessment. This figure is similar to that observed for the earlier exercise. Some students however, were particularly active with one participant logging 76 visits. The average number of 'hits' registered per person was

12. This pattern of high levels of student interest towards work and feedback of the peers is consistent with that observed for the earlier exercise.

The allocation of a timeslot for in-class peer assessment changed the pattern of the VLE access. Most visits were logged shortly after the in-class work, as opposed to the rather scattered and delayed pattern of responses associated with the first exercise. Two email-announcements reminding and encouraging student participation during the second exercise did not appear to influence the pattern of access over time.

A notable difference, in comparison with the first exercise, was that almost three times as many works were exhibited on the discussion board, when submission was made anonymous and a formal component of in-class activity. Although some students were highly engaged in browsing the peer assessment area, the number of active participants and posted comments (twelve) recorded in the second exercise was still relatively low. This suggests that an element of grading reward may be an appropriate incentive for encouraging greater participation. For purposes of education practice, studies therefore suggest the importance of peer-anonymity and of formalizing assessments as part of scheduled contact time with students. Results also imply the value of some form of grade reward (if permitted under institutional regulations) for encouraging participation.

10.5.3. Lessons Learnt from Lower Levels of Engagement

Some critical issues that deserve the attention of practitioners and researchers were identified. These included that: [i] students may not initially perceive the rationale for and potential benefits of peer assessment. Nevertheless, average marks were not found to be correlated with perceptions of 'anticipated usefulness' of peer assessment; [ii] student marks were significantly correlated (r=-.335) with anticipated levels of increased workload, suggesting that peer assessment activities must be designed to meet the needs of all students; [iii] from the questionnaire study it was apparent that participants were very interested in the solutions submitted by their colleagues. Correlation analysis suggested that those achieving highest marks were most interested in studying the solutions of their colleagues (r=.334).

The results of the VLE access statistics are consistent with this finding and indicated that solutions posted were continuously viewed, in some cases long after the peer assessment exercise had been completed; [iv] many students are not completely comfortable with posting work publicly, often preferring to remain anonymous when making their own submissions and when assessing peers; [v] questionnaire results suggest that grading and in-class work are important factors for encouraging participation; [vi] the extended study records improved levels of engagement when confidentiality and in-class support are provided, and implies (but does not directly test) that some measure of grade reward may further encourage participation.

The identification of the factors affecting student engagement opens new directions for research. Great variation in levels and patterns of participation were observed in the above studies. It is therefore evident that further investigation is required to understand: how benefits in participation and learning relate to individual needs and profiles; how peer assessment and technologies may be implemented and modified to match the requirements of groups and individuals. There is therefore a need to further explore interrelations between student engagement with peer assessment and the learning environments.

10.6. Results: Higher Levels of Engagement

The studies that looked at lower levels of student engagement with peer assessment (i.e. Exercise 1&2) revealed a number of possible factors impeding learner engagement. Hence, adjustments to the design of peer assessment were made. Another exercise (Exercise 3), which took into account the earlier findings was introduced and evaluated as part of the module. The following section reports and discusses the results.

10.6.1. Overview of Peer Assessment Exercise 3 (Spring Term, 2009)

In contrast to Exercises 1&2, Exercise 3 contained an element of summative assessment which was introduced to improve student participation. Twenty percent of the grade awarded for the assignment was derived from assessing student ability to provide constructive peer feedback. Furthermore, the peer assessment exercise accommodated confidential participation and integrated further student support by being practised in-class as part of the planned lesson. Similarly to Exercise 2, the peer assessment activity was practised after the formal submission of the assignment for grading.

As a result of the changes introduced in the pedagogical design of the activity, the number of active participants considerably increased. Higher levels of participation enabled further investigation into student engagement. A 36-item questionnaire (see Appendix 2a) was issued to determine student attitudes towards peer assessment: [a] prior to participation; and [b] after participation. The questionnaire also targeted: [c] the perceptions of students on their own engagement with the exercise and the course in general; [d] the perceived effects of peer assessment on learning; and [e] student attitudes towards the web technologies used for the exercise. In addition to student feedback the characteristic preferences of student learning styles were identified using the Index of Learning Styles (ILS) instrument as discussed in Chapter 3. The comprehensive analysis of all the data is reported in the following sections. The overview of participation and general response is presented in Table 10-4. The demographics of participants are summarised in Table 10-5.

Student Participation and Response	***Number***	***Percent***
Submitted Assignments	18	N/A
Exhibited Assignments for assessment	18	100%
Posted Feedback (Assessment)	54	81.8%
Returned Questionnaires	32	96.9%
Measured Learning Styles	29	88.9%

Table 10-4: Overview of student participation and response to the call for data collection.

	Category	*Frequency*	*Percent*
Age	*19-20*	6	18.8%
	21-22	16	50.0%
	Over 22	10	31.3%
Sex	*Female*	7	21.9%
	Male	25	78.1%

	Category	*Frequency*	*Percent*
Total	-	32	100%

Table 10-5: Participant Demographics for Exercise 3.

10.6.2. Analysis of the Post-Exercise Questionnaire Data

10.6.2.1. Student Pre-Exercise Attitudes

Student attitudes towards the peer assessment task were evaluated and compared with the results acquired from the earlier questionnaire. The most notable change (i.e. from Exercise 1 to 3) was recorded in student perceptions about the clarity of explanation of the peer assessment process. While virtually no change was introduced in explaining the task, the greater number of students (94%) reported the clarity of explanation to be 'Clear' or 'Very Clear' (mean=4.34, std. dev.=0.7, n=32). Considering the fact that the participants of Exercises 1&3 represented the same cohort, one can speculate that previous experience with a similar activity may affect the student views regarding the clarity of introduction. Hence, consecutive practice of an activity may allow reduction of time and resources in introducing it.

An increase in the perceived usefulness of the task (mean=3.91, std. dev.=0.82, n=32) was also recorded. Similarly to the results from the previous studies, students (90%) reported high levels of interest in the work of their peers. Yet, still relatively fewer (56%) number of students had positive feelings about the peer assessment exercise. This attitude changed after participating in the peer assessment process, as reported in section 10.6.2.2. Less change is recorded in student perceptions of the workload associated with peer assessment. Students continuously reported higher levels of anticipated and experienced workload. This pattern contrasts with the results of the previous study (see section 10.5.1.2), where lower levels of anticipated workload were recorded. Considerably fewer students (53%) reported the anticipated workload to be "not demanding" to "moderate" (mean=3.5, std. dev.=0.95, n=32).

10.6.2.2. Student Post-Exercise Attitudes

Another section of the questionnaire aimed at capturing the possible changes in student post-exercise attitudes towards the peer assessment. The great majority of the students, after taking part in the exercise (see Figure 10-5), were positive about the value of: [a] having access to the work of their peers; [b] receiving feedback; and [c] the peer assessment in general. The most notable change is recorded in general attitudes towards the peer assessment. The number of initially positive students 18 (56%) increased to 27(84%) after participating in the exercise. Nevertheless, a slight dispersion of the level of usefulness was recorded (from mean=3.91, std. dev.=0.82, n=32 to mean=3.81, std. dev.=0.91, n=31). Finally, a slight change in the anticipated (mean=3.5, std. dev.=0.95, n=32) and experienced (mean=3.23, std. dev.=1.04, n=30) workload of the exercise was recorded too.

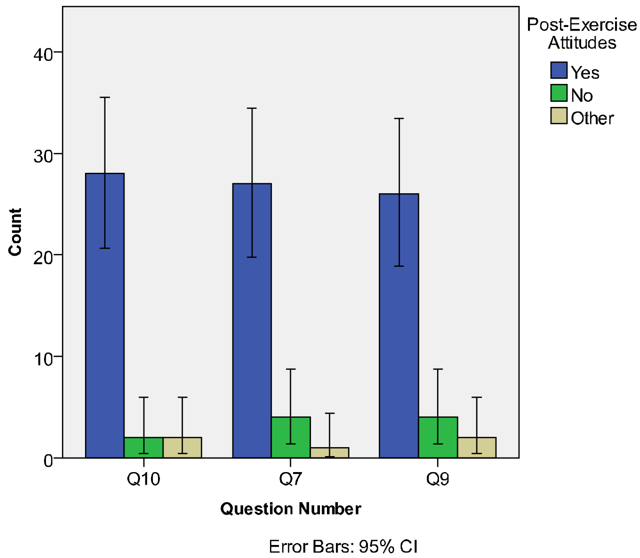

Figure 10-5: Student post-exercise attitudes; *The questions capture the: [Q10] usefulness of having access to peers' work; [Q7] usefulness of receiving feedback; and [Q9] positive attitude towards the exercise in general.*

10.6.2.3. Self-Reported Engagement with the Exercise and the Course

As reported earlier in this chapter (see Table 10-4), the level of student engagement with Exercise 3 was considerably higher compared to Exercises 1&2. Most of the students took part in the exercise exhibiting their work and commenting on that of their peers. However, in addition to actual quantitative measures of student participation, self-reported measures that reflect student engagement with the peer assessment exercise were collected.

Students were asked whether they read the received peer-feedback or the comments that were addressed to other students. The results suggest that the great majority of the class (88%) reported reading the feedback posted on their work. A similarly large group of students (72%) accessed comments related to the work of their peers. It can be concluded that students were interested not only in accessing the work of their peers but also reading the associated feedback. Yet, according to the results, 47% of the students would choose not to participate in the exercise if it were not designed as an in-class activity. The fact of having the peer assessment in-class was ranked as "important" or "very important" by (55%). Further research is necessary to address this point. Given the acquired data it is impossible to explain the reasons behind student reluctance to participate in peer assessment in asynchronous or distance mode.

The questionnaire also included a number of items targeted at identifying the contribution of taking part in a peer assessment exercise to a perceived level of engagement within a wider context, i.e. engagement with the module or the course. For instance, the students were asked whether the peer assessment exercise brought them closer to their classmates or contributed to motivating them in accessing the VLE. While the questions attempt to capture a wider area, they reveal interesting patterns and suggest directions for further research.

When asked whether the peer assessment brought the students closer to their peers, the majority (53%) answered negatively (see Figure 10-6). The requirement of the exercise to post critical feedback may be the key to explaining this general response. However, as the exercise was designed to enable confidential participation, further investigation of the pattern is impossible at this stage. More generally, students were also asked to report their perceptions on changes in the levels of their engagement with the course. Some 69% of students answered positively, reporting greater engagement with their course as a result of participating in the exercise. Understanding why the perceptions of engagement may change or remain at the same level is an interesting and important question to investigate in the future.

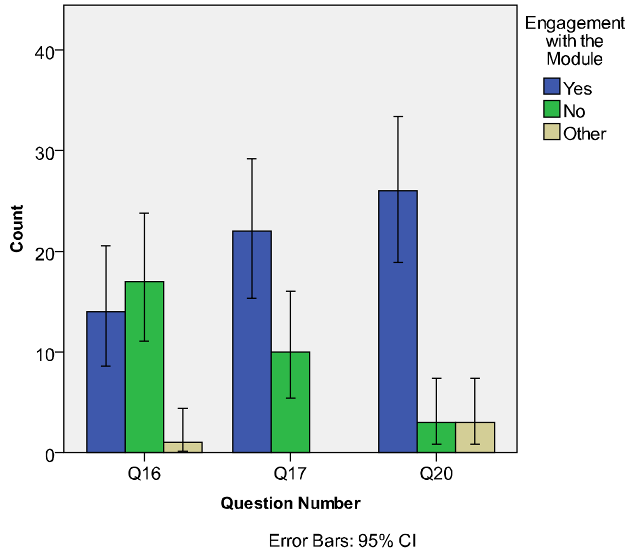

Figure 10-6: Student perceptions on elements of engagement. ***The questions capture perceptions of: [Q16] becoming closer to peers; [Q17] being more engaged with the course; and [Q20] comfort in using discussion boards.***

The overwhelming majority of students (81%) reported an increase in the levels of comfort in using discussion boards as a result of participation in the peer assessment. Running the exercise by means of a discussion board may explain the tendency. Finally, the students were asked whether peer assessment encouraged them: [a] logging in to the VLE more frequently; and [b] learning more about their peers. Students reported greater incentive for more frequent (mean=3.41, std. dev.=1.13, n=32) access to the VLE. A slightly lower, but still above average (mean=3.22, std. dev.=1.24, n=32) incentive to learn about their peers was also self-reported.

10.6.2.4. Perceived Effect on Learning and Understanding

An effort was made to investigate whether the peer assessment exercise encouraged any improvements to student learning. Six items were included in the questionnaire to ask, for instance, about the extra effort in perfecting the assignment, or rating the benefits of receiving and providing feedback. Based on the self-reported measures, the peer assessment exercise can be considered to be somewhat beneficial for learning. More than half (56%) of the students indicated that extra effort was put to perfect the work prior to posting it for peer assessment. A similarly high number of students (59%) report improvement of their work as a result of the exercise and believe that others improved their work too. Furthermore, an above average degree of learning was reported by students in learning from receiving comments and commenting on the work of others. The majority of students (mean=3.9, std. dev.=0.9, n=28) regard the learning from the received peer feedback particularly highly (see Figure 10-7). Similarly high results are recorded for providing feedback. The reported quality of peer feedback, in line with the perceived level of learning, is also reported to be considerably high (mean=3.4, std. dev.=0.63, n=27). However, there is still place for improvement, which encourages further research in understanding the reasons why some participants benefited less than the others.

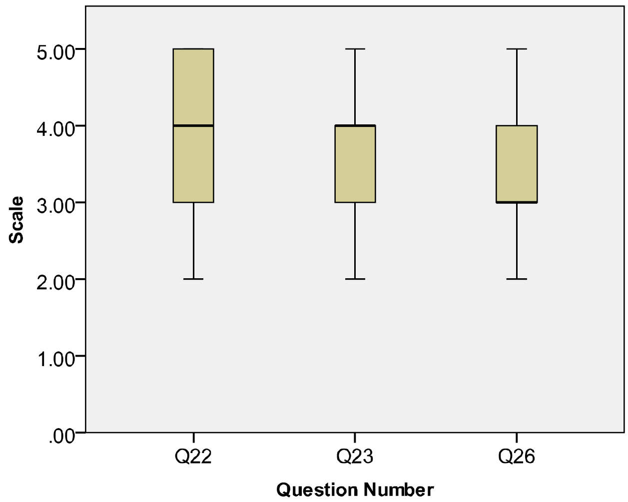

Figure 10-7: Frequencies of self-reported measures of student learning. The questions indicate the levels of: [Q22] learning from receiving feedback; [Q23] learning from providing feedback; and [Q26] quality of feedback.

10.6.2.5. Feedback on the Employed Technology

The questionnaire asked the students to comment on the technology employed for practising the peer assessment. The exercise was designed to use Blackboard™ Discussion Boards. The students responded positively about the employed tools, more specifically, ranking the general satisfaction with the VLE (mean=3.72, std.dev.=0.85, n=32) and the discussion board (mean=3.55, std.dev.=0.99, n=31) considerably high. More than the half of the students (53%) recommended that the adopted technology be retained.

10.6.2.6. Correlational Analysis of Questionnaire Results

To investigate the patterns of student engagement with the peer assessment exercise a cross-correlation of the Likert scale questions was conducted. The main aim of conducting this analysis was to identify possible relationships between the answers of the questions. The full results of the analysis are shown in Appendix 2c. Some of the results are overviewed in this section - highlighting the patterns that might be of interest to practitioners and researchers.

The results indicate that the level of student satisfaction with the peer assessment exercise correlates (at $p<0.01$) with: [a] learning from receiving feedback ($r=.521$); [b] learning from commenting on others work ($r=.471$); [c] motivation to learn about peers ($r=.496$); [d] level of satisfaction with technology ($r=.530$); [e] anticipated level of usefulness ($r=.547$); and [f] clarity of introduction ($r=.514$). This pattern highlights the aspects of interwoven nature of peer assessment elements that are related to general satisfaction from the exercise. However, the absence of significant correlation is equally informative. More specifically, the results indicate that the anticipated and perceived levels of workload are not correlated with the perceived benefit gained from the exercise. No correlation was identified between student performance and the perceived usefulness of the exercise. A correlation was identified between incentives to log in and student interest in learning about peers ($r=.401$). Furthermore, the clarity of introduction is correlated with: the anticipated ($r=.486$) and perceived levels of usefulness ($r=.514$).

10.6.2.7. Interrelation of Learning Styles, Perceptions and Performance

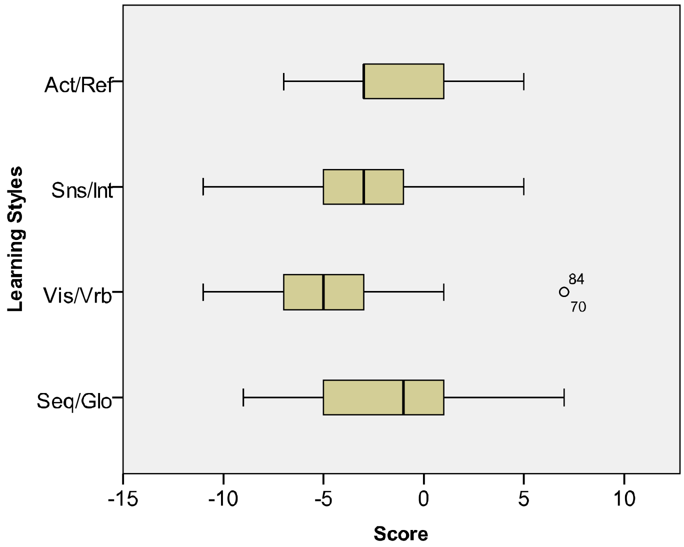

Figure 10-8: Distribution of learning styles

A categorical analysis was conducted to investigate the possibly existing relations between the learning style preferences and the student views on the peer assessment. Additionally, student performance, derived from the marks allocated for reviewing/commenting on the peer-work, was analysed against the learning style preferences.

To identify relationships between the considered categorical variables Pearson's chi-square tests were performed. Student learning style preferences were categorized into three groups to the score. The preferences were classified as strong/moderate for the values from +5 to +11 or -5 to -11. Preferences were categorized as balanced when the scores were within the range of +3 to -3. Similarly, the performance data was classified into three main grades: high, medium and low. All four of the learning style categories were then tested against the questionnaire data. The statistically significant relationships identified as a result of the analysis are reported in Table 10-6.

	Test Results			
Relationship between:	χ^2	*d.f.*	*Sig. exact/ asympt.*	***Possible Interpretation***
1. Student Performance and preference towards Visual/Verbal LS	9.88	4	*.018** .043	*Students with visual preference perform better?*
2. Anticipated benefit of receiving feedback	8.52	2	*.018**	*Students with visual*

	Test Results			
Relationship between:	χ^2	*d.f.*	*Sig. exact/ asympt.*	***Possible Interpretation***
from peers (Q4) and Visual/Verbal LS			.014	*preference anticipate greater benefits?*
3. Anticipated benefit of accessing the work of peers (Q5) and Sensing/Intuitive LS	9.83	2	.054 .007	*Students with balanced Sns/Int LS anticipate greater benefits?*
4. Post-exercise attitudes (Q7) and Active/Reflective LS	10.59	4	*.046** .032	*Students with balanced Act/Ref LS are more positive?*
5. Post-exercise attitudes (Q7) and Sensing/Intuitive LS	29.43	4	*.021** .001	*Students with balanced Sen/Int LS are more positive?*
6. Reported usefulness of received feedback (Q9) and Visual/Verbal LS	14.32	4	.054 .006	*Students with visual preference find feedback more useful?*
7. Reported usefulness of accessing others work (Q10) and Visual/Verbal LS	13.86	4	*.019** .008	*Students with visual preference benefit more from accessing others work?*
8. Reported readings of comments to others and (Q13) and Visual/Verbal LS	8.52	4	*.018** .014	*Students with visual preference are report reading feedback to others more?*
9. Motivation to learn about peers (Q19) and Active/Reflective LS	14.59	8	*.05** .068	*Students with reflective preference are less motivated, while balanced more?*
10. Level of comfort gained for using discussion board (Q20) and Active/Reflective LS	10.36	4	.138 .035	*Students with reflective preference are less comfortable, while balanced more?*
11. Level of perceived learning from feedback (Q22) and Visual/Verbal LS	12.78	6	.086 .047	*Students with verbal preference report less learning while vis./balanced more?*
12. The reported quality of received feedback (Q26) and Visual/Verbal LS	26.85	6	.57 .001	*Students with verbal preference value the quality higher than visuals?*
13. Level of satisfaction with the technology (Q27) and Sequential/Global LS	18.08	6	*.006*** .006	*Students with balanced Seq/Glo LS are more satisfied with the technology?*

Table 10-6: Results of the Chi-square tests – an investigation of existing relations between learning styles and other variables. ***Note: * = Correlation is significant at the 0.05 level (2-tailed). ** = Correlation is significant at the 0.01 level (2-tailed).***

The analysis revealed a number of statistically significant relationships between the learning styles and the elements of student engagement. For instance, there is a significant difference (Relationship 4, Table 10-6) in student post-exercise attitudes in relation to preferences in active/reflective learning styles. It appears that the students who are considered balanced on the active/reflective scale are more likely to appreciate the peer assessment exercise than those with strong/moderate preferences to either active or reflective styles. Similarly, a relationship between learning styles and student performance (Relationship 1, Table 10-6) was identified. An interpretation may suggest that students with strong/moderate visual learning style preferences performed better in the exercise.

However, the generalisation and extension of the findings to peer assessment processes in general is problematic. There are a number of reasons why a more holistic view cannot be elicited from this study. Firstly, the context in which the exercise was organized should be taken into account. For instance, the requirement to assess a diagrammatic model and the appearance of the designed application (visual elements) in addition to reviewing the details of the implementation could have influenced the outcome. Hence, extending the results to peer assessment practices that do not contain visual elements (i.e. based on text based assessment only) may be misleading. Secondly, and most importantly, a larger and more diverse sample of participants needs to be considered for reporting the results with confidence. The small number of the considered sample prevents from interpreting the results with confidence and generalising the outcomes further. While consecutive studies or larger samples can significantly enhance the generalisability of similar studies, smaller studies (such as the one considered here) can support practitioners in adjusting the design of exercises based on the results that are not immediately apparent.

10.7. Discussion in Relation to the SEEM model

The peer assessment exercise that elicited higher levels of engagement confirmed the importance of marking, in-class support and confidentiality for designing a peer assessment activity. Further evaluation of student feedback acquired by means of a questionnaire allowed the extension of the initial findings by highlighting the differences in attitudes and trends in student engagement.

Viewed in light of the SEEM model, the study focuses on the Pedagogical Design Elements component and thoroughly investigates student interaction with its instance – a peer assessment activity. The evaluation of student engagement employs quantitative assessment of access records, active participation and continuous feedback. The consideration of all the various methods and data sources enables a thorough understanding of a practised learning activity and student engagement with it. Furthermore, a detailed evaluation that includes various methods informs the adjustments of a pedagogical design fostering improvements in student engagement. This chapter therefore, can be viewed as an example that demonstrates how the focus on a single learning activity can improve its pedagogical design – leading to the desired patterns of student engagement. Yet, regardless of achieving greater levels of engagement, continuous evaluation can lead to further improvements. This study advocates continuous evaluation and demonstrates its benefits. For instance, as reported in section 10.6.2.4, while the majority of participants reported improvement of their initial work as a result of participating in the peer assessment, the number of students who did not remained relatively high. Subsequent evaluations can lead to greater understanding of student engagement and further improve student learning experiences.

The evaluation of student engagement acquires new dimensions when additional variables, such as student preferred learning styles, are being introduced. The study summarised in this chapter, identifies a number of relationships between the patterns of student engagement and the learning style variables. More specifically, as discussed in section 10.6.2.7, the study reports variability in attitudes, reported benefits and general engagement associated with learning style preferences. Consideration of variables, in this case drawn from the attunement layer, can help practitioners making informed decisions. The information about student preferences in learning styles and the engagement patterns associated with those can be used by practitioners for developing effective learning designs. For instance, informed about relationships between student preferences and engagement trends, practitioners can either adjust the learning activities to meet student preferences and needs, or challenge the learners by encouraging them to work in a less preferred style.

Last, but not least, it is necessary to discuss the selection of methodological approaches employed here for evaluating student engagement. One may argue that analyses of engagement as thorough and detailed as the one presented in this chapter, may be too resource-intensive to be applicable in real-life practice. However, the quantitative techniques used in the analysis offer a great potential for automation. When standardized and built into the online learning environment (for instance VLE or PLE), the required input from the practitioner can be greatly reduced. Hence, it can be argued here that the SEEM model can extend beyond a set of guidelines and grow into a practical application that supports evaluation of student engagement.

10.8. Potential Benefits and Challenges for Automated Application

This chapter highlighted the use of learner preferences in relation to their engagement with pedagogical design element, namely, a peer-assessment exercise. However, how accessible are such evaluation services for educational practitioners and researchers? This section, attempts to highlight the possibilities and challenges of integrating a practical application of evaluating engagement as part of an automated software tool.

The automated use of learning style data has been discussed in the earlier literature (Graf, 2007). Graf not only points to eliciting participants' learning styles from student online behaviour, but also adapting the courseware to meet their requirements. This thesis integrates the consideration of personal differences and preferences for evaluating student engagement. Similarly to Graf's (ibid.) approach, the learning style data or other preferences in learning can be derived from patterns of using e-learning systems. However, the automatic identification can be substituted with more conventional techniques for collecting data on learner differences or preferences. These techniques can include tests and questionnaires provided to learners via e-learning systems. While the methods for collecting the data may require students to complete the given test or questionnaire, the method of data collection will have little or no effect on evaluating student engagement. The engagement patterns can be automatically compared to data collected on learner preferences and reported to educators or researchers.

Despite the rather complex analysis performed and reported in this chapter, the automation of engagement evaluation can be technologically affordable and manageable. Given the data on personal preferences, such as learning styles, testing the relationship between engagement patterns and personal preferences can be integrated into an automated evaluation system. The evaluations can be conducted either continuously for the purpose of monitoring and triggering alerts to educational practitioners and researchers, or, alternatively, they can be used periodically on request. Either of the techniques may be potentially informative and useful. The continuous evaluation over a longer period of time may provide further information for introducing principles of artificial intelligence and automated guidance towards improvement of learner engagement. However, the limitations of data collection and the need for continuous extension of software solutions can be challenging and time consuming. The potential for automation and application, however, does highlight a potential area for enhancing teaching by applying computer science in e-learning practice.

10.9. Conclusions

This chapter evaluates and discusses student engagement as attested in consecutively practised peer assessment learning activities. In doing so, it attempts to advance the illustration of the potential utility of the SEEM model. In line with the adopted strategy this chapter highlights the actual and potential benefits of considering Pedagogical Design Elements component and the Attunement Layer in evaluating student engagement. It takes the peer assessment activity as an instance of Pedagogical Design Elements component and draws in student learning style preferences as a set of variables from the model's Attunement Layer. This chapter reports the experience of practising peer assessment and highlights the benefits of evaluating student engagement with this activity. Hence, this chapter highlights the roles and the values of the discussed components of the SEEM model.

The chapter develops by: [a] discussing the continuously re-designed and re-introduced peer assessment exercises; and [b] reporting the outcomes for improving the design of the studied learning activity. It stresses the value of identifying student engagement patterns and the factors that influence student engagement.

Furthermore, continuous evaluation allows understanding of the influencing factors that lead to desired engagement patterns or, at least, provides directions for further research. The studies that focused on lower levels of engagement allowed identification of the factors that improved student engagement in the subsequent practice. Further studies allowed evaluation of higher levels of student engagement and corresponding outcomes. Moreover, by highlighting the variations within the levels of engagement or inter-relation of engagement patterns the studies enable further and deeper understanding of the practised learning activity. Hence, this chapter contributes to highlighting the importance of evaluating student engagement with a single learning activity (a peer assessment exercise). In contrast, the evaluation of student engagement without considering the learning activities could lack detail for signifying improvements of pedagogical design. Therefore, this chapter justifies the integration of the Pedagogical Design Elements component into an engagement evaluation model such as the SEEM.

In addition to evaluating student engagement with learning activities, this study highlights the values of the variables drawn from the Attunement layer of the SEEM model. These variables are the characteristic preferences of student learning styles. The analysis of student feedback against the learning style data reveals a number of differences in student attitudes, perceived benefits and levels of satisfaction associated with student preferred learning styles. Although, due to the small sample size, the results are only suggestive, they highlight the concept and the potential of considering variables from the attunement layer. Informed about student preferences and engagement patterns the benefits of learning designs can be maximized and student learning experience in general further enhanced. In summary, both the Pedagogical Design Elements component and the variables drawn from the Attunement layer of the SEEM can explain or indicate further directions for recognising, understanding and altering student engagement.

'We will not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time.'
(T S Eliot, Little Gidding)

11. Discussion and Conclusions

This thesis summarises the exploratory work that led to proposition of the SEEM model. Having now considered a series of empirical studies in the light of the model and having discussed the immediate outcomes, the study adopts a broader focus in this present chapter to overview the implications of this research, its limitations and the scope for future work. It starts by reviewing and reinstating the essential outcome of this research in the following sections 11.1 and 11.4. It then proceeds to address the implications and future work as presented in section 0. It finally outlines the work and draws conclusive remarks.

11.1. Concise Overview of the Contribution

Learner engagement is a subject of numerous papers and articles. Educational researchers largely consider engagement and interaction as essential components of learning. Despite its multifaceted nature, learner engagement is perceived to be beneficial across various dimensions, for instance, retention, learning outcomes, learner capacity and development. The positive relationship of learner engagement with the desired outcomes of formal education is commonly demonstrated in the literature. Learner engagement and participation is also widely considered in e-learning research. The studies of learner online engagement and participation resonate with the outcomes that emerge from the learning research in a traditional setting. Yet, the literature is lacking a comprehensive solution for measuring and monitoring it. Hence, the studies of online engagement are usually sporadic. They are often narrow or limited to a single aspect of student engagement. Furthermore, while there are a number of sufficient techniques for measuring online learner engagement, most of them are disjointed. This thesis attempts to address this gap by defining a comprehensive mechanism that may enable gaining insight into online engagement and further advance engagement research. The proposed mechanism integrates a variety of instrumental methods to allow a holistic, comprehensive, yet, rigorous evaluation and monitoring of online learner engagement.

This thesis defines the Situated Engagement Evaluation Model (SEEM) and presents it as a conceptual guideline for measuring and monitoring learner engagement. This conceptual model is intended for evaluating participant interaction with various components that are commonly present in online learning. These elements include learning activities, online discussions, electronic content and personal profiles. The model however, not only measures student engagement with certain components but also enables comparison with a number of individual and collective variables. Hence, the SEEM model builds into a comprehensive framework – highlighting the components, variables and complex interrelations that bind the elements of the framework into a single complex system of engagement and interaction. The evaluation of participant interaction with the four main components of the model (i.e. Learning Content, Pedagogical Design Elements, Learning Profiles; and Dialogue and Communication) enables identification of structural or descriptive patterns of learner engagement. The model however, extends further by integrating variables from three conceptually different layers (affective, attunement and socio-historical layers) that may affect the levels of learner engagement. Finally, the model also takes into account the virtual environment, which enables online learner engagement in the first place. Hence, variables that denote technological attributes of the environment such as, usability, accessibility, response time and security, can also be aligned and studied along with engagement.

The proposed model encompasses a number of intertwined components and variables. These components are arranged into a system that captures the variety of processes associated with learning. It is, indeed, designed to reflect a variety of online learning experiences. Yet, it goes further by enabling rigorous evaluation of learner engagement. The engagement is derived from the rigorous measures of learner interaction with the various components of the model. Hence, the methods used for measuring user interaction are the inseparable part of the model. The integration of the methods into the SEEM model is informed by a theoretical overview of the available techniques and methods adopted or potentially useful in an analysis of interaction and engagement. Given the diversity of instrumental approaches the SEEM model allows integration of a set of techniques that can be applied interchangeably or jointly. The empirical studies considered in this thesis mainly include quantitative techniques. However, the model can be extended to include additional methods.

The integrated methods are drawn from the literature according to their potential benefit for evaluating student engagement. Neither of the methods is prioritised in the system. Each of the methods provides a valuable contribution in evaluating student engagement. However, the SEEM model, and this thesis in particular, focuses on the potential for automating the process of evaluation. Therefore, due to technological limitations and affordances, the methods that are considered in the model constitute mainly quantitative techniques. Qualitative techniques and their potential, however, are briefly discussed. While the model accommodates a wide variety of techniques for measuring learner engagement (i.e. Social Network Analysis, Content Analysis, Log Analysis and Qualitative Techniques) it can accommodate additional methods, when they become accessible or technologically feasible for consideration.

This thesis sets the agenda to discuss the potential of using the SEEM model for evaluating online learner engagement. It draws, mainly in retrospect, upon a number of empirical studies that are presented here to highlight the potential benefits of adopting the model. This thesis embarks on a process towards recognising the capacity of the model as a beneficial and nuanced instrument for practitioners and researchers. It confines the notion of utility mainly to the potential gains and insights from employing the model as a guideline for evaluating learner engagement. The potential for automation is defined as another requirement to be addressed by the thesis. The empirical studies are aligned to initiate the process of demonstrating the applicability, potential benefits and possibility of automation. While this thesis claims to demonstrate the potential of the model, it also emphasises its comprehensive nature. Hence, this thesis only initiates the process of positioning and recognition. Further development, extension and refinement of the model is not only permitted but also highly expected. At the moment, however, the proposed model is grounded and defined by the current research literature and the limited empirical work.

This thesis has drawn together four independent empirical studies, each of these representing an example of employing the SEEM model as a practical guideline for evaluating student engagement. Although no comprehensive study was conducted as part of this research, the integration of the four independent studies allowed partial recognition of the benefits that the SEEM model can offer. Each of the empirical studies addressed one of the four major milestones aimed to be achieved within the scope of this thesis. Sequentially discussed, this thesis attempts to justify the integration of the four main components of the SEEM model (i.e. Learning Content; Pedagogical Design Elements; Learning Profiles; and Dialogue and Communication). Namely, the empirical studies highlighted the integral importance of each of the components in evaluating and understanding learner engagement. In addition to the components the studies allowed consideration of variables from the Attunement layers. Variables like learning styles, culture, or learner prior experiences exemplified the use of the Attunement layers in real-life studies. Most importantly, however, the empirical work allowed demonstration of the importance of considering a variety of evaluation methods. For instance, consideration of SNA techniques enabled identification of engagement patterns that would hardly be identified by other techniques. The more traditional, content and log analysis, on the other side, afforded valuable insight on the patterns and qualitative difference of interacting with various elements of the online environment. The empirical studies therefore, present the SEEM model as applicable in e-learning research and practice.

11.2. Discussion of Implications

The direct goal of the SEEM model is the evaluation of learner engagement. As the major contribution of this thesis however, it addresses a wider gap in the e-learning research – the need for providing comprehensive answers for informing online learning practice. This need requires researchers to overcome narrow perspectives and limitations of traditional methods. This thesis attempted to address this challenge by stretching across the disciplinary boundaries and integrating the drawn knowledge, research methods and practices into a single model.

However, to what extent does the model fill a demonstrable gap in current e-learning research? It is clear that an individual application of the model can hardly lead to comprehensive understanding of learner engagement or student experiences in general. The model is not a direct contribution to the knowledge explaining learner engagement. It is however, a useful tool to that can be employed by researchers and practitioners for developing the understanding of engagement, contributing to the knowledge in the area and advancing e-learning research practices. One may ask here, does the lack of definitive answers, which explain learner engagement, diminish the contribution of this thesis to the area of e-learning, or discard the value of the SEEM model? The answer to this question is a definitive 'No'. The SEEM model sets grounds, a foundation for explaining and enhancing e-learning practice. Provided to researchers, teaching practitioners and the students themselves, it can be used for continuous evaluation and monitoring. The application of the model can indirectly foster qualitative changes in practising online teaching and learning. A few examples can illustrate the possible implications of employing the SEEM model.

First, the SEEM model can be adopted by educational researchers. The main benefit of adopting the model for studies of learner engagement can be explained in using a single guideline for various evaluations. Applying a single approach to measuring, analysing and evaluating learner engagement would enable greater integration of independently conducted studies. Hence, by employing the SEEM model, the researchers will have more opportunities for generalising and conducting meta-analysis. Furthermore, the integration of various studies that consider with a limited number of components can lead to studies of holistic nature. When conducted in accordance to a common model, partial studies can be collated for explaining and generalising learner engagement. Second, the SEEM model can be used by teaching practitioners for continuous monitoring and adjustment of the pedagogical design and the teaching techniques. Identification of the individuals or groups that exhibit certain patterns of engagement, which may be considered as undesirable, can allow the practitioner to make informed decisions on adjusting the teaching practice and, again, re-evaluating it in relation to the observed student engagement. Hence, employing the model, the practitioners can dynamically adjust their teaching techniques to improve the learning experience in general. Last, but not least, the model can be employed by the learners themselves. Learners, for instance, can be provided with diagrams that summarise their level of interaction with various components of the model and compare it with that of peers. Students will be able to see a detailed account of their engagement and self-regulate their own learning journey. Although, this scenario can only be possible after development and deployment of an automated engagement evaluation service, the potential of applying the model in this context should not be underestimated.

11.3. Application

The SEEM model was designed to be generally applicable and independent of existing software technologies. Yet, the potential for development and integration of automated services are of greatest importance for harnessing its potential. Design and implementation of a service would, in fact, be a rational succession to the proposed conceptual model. The scope and limits of this thesis restrain further elaboration of technological design and implementation. As part of this discussion however, it is possible to demonstrate the applicability of the SEEM model. This section attempts to discuss possible routes for automation and integration of the SEEM model into e-learning practice.

The development of an automated service based on the SEEM model would need to take into account the wide variety of e-learning platforms. Due to wide employment of VLEs, such as Moodle or Blackboard™, it would be practical to make the engagement evaluation service available for these platforms. At the same time, the development and implementation of the service should also take into account the more recent trends in online learning practice - more specifically - the use of PLEs and distributed web applications. Allowing the engagement evaluation service to cover a wide variety of learning platforms and systems will maximise its use and benefits. The use of the service on a wide variety of platforms will allow the eliciting of feedback on the structure of the SEEM model itself. The feedback from multifarious resources will enable further development and refinement of the SEEM model and the services that are based on it.

Reflecting the structure of the SEEM model, the services developed for automated evaluation of engagement should support a modular structure. The modular integration of various components of the SEEM model should allow the gradual development and maintenance of the service. Developing the core application as an extensible service, will allow further development and extension of the service to mirror the possible development of the SEEM model. The modular structure therefore, will allow the addition of new components and elements to the SEEM model by extension of the service, rather than the requirements for redevelopment and reimplementation. The architecture of the Moodle VLE is a perfect example of a modular design that enables extension and proliferation of the system. Furthermore, the modular structure of the system will allow rapid prototyping and agile development cycles for gradual integration of the service.

The automated engagement evaluation service can provide a descriptive account that summarises learner interaction over time. The descriptive account can then be used by the researchers and practitioners to feed back on the effectiveness of pedagogical design and learning resources. The practitioners can then adjust the pedagogical components according to the feedback. However, the functionality of the system can be extended to providing suggestive guidance based on elements of artificial intelligence. For instance, rather than providing the practitioner with an analysed account of engagement, the system can make suggestions on the introduction of certain pedagogical techniques, that can lead to more favourable patterns of engagement. Prior to developing and providing a service that could suggest appropriate teaching or facilitative techniques, further understanding of student engagement is necessary. The SEEM model and the automated services developed on the basis of the model can help in accumulating the necessary knowledge for providing the suggestive service. The suggestive service can also be opened to students themselves. Based on the analysis of student engagement, the system can direct the student to maximise the effectiveness of the learning experience. Students can also be provided with snippets of analysis and sets of possible actions to counteract the identified tendencies. Some of those services can be as simple as reminders to log in and participate in online discussions. Others can highlight student central attention to a topic and the lack of it to others.

Furthermore, the provision of automated services can extend the traditional notions and considerations of learner engagement. Namely, learner engagement can be converted into a tangible outcome that describes or supplements the learning experience. For instance, the engagement that constitutes: participation in discussions; use of learning resources; or development of a personal profile, can be recorded as part of the learning experience. The individual records of learner engagement can represent a chronological archive of learner development. Hence, the records of engagement can gain a value not yet commonly perceived as useful. Similar to the history of search in personalized Google accounts, the records of student engagement can represent student growth and the course of progress. The accounts of learner engagement may at some stage be considered an important element of personal profile or portfolio. Even if the records of learner engagement are not considered to be part of the learning portfolio, they may still be a valuable resource for referring to past learning experiences. Hence, representation of learner engagement as structured and chronologically accessible records may become a useful and tangible outcome of the experience. Technologies, such as XML can provide the backbone for recording the engagement experiences, exporting them, storing and moving from one environment to the other. Learners can accumulate learning experiences, review or share them when needed. The accounts of learner engagement can be used for tailoring future learning experiences, for example. Students can transfer their records of engagement across courses, institutions and organizations. While these ideas require further development, rigorous research, interoperable design and implementation, they highlight possible development that can spur out of the development of the SEEM model.

11.4. Checklist for Research Outcomes and Contributions

The initial chapter of the thesis outlines a number of goals and objectives to be achieved as a result of this research inquiry. This section outlines the outcomes of the research in relation to the original goals – highlighting the achievements and contribution of this thesis to the knowledge in the area of e-learning.

This research aimed to: [1] identify, review and suggest an alternative approach to comprehensive evaluation of online learner engagement; [2] provide educational practitioners and researchers with a general and extendable model/mechanism to guide evaluations of engagement; [3] discuss further practical application of the model/mechanism and its integration into e-learning systems and environments. To achieve these aims, the research focused on a set of less general objectives.

The review of the literature that discusses theoretical foundations of teaching and learning (as summarised in Chapter 2) established the theoretical foundation for the first research aim. The chronological review of learning theories and their development acknowledges the tradition of social learning. The thesis, therefore, considered the potential benefits of recent technological developments in relation to social learning. The focus of the thesis, however, narrows down to evaluation of learner engagement with various components of learning. Along with empirical work, that constitutes four studies, the thesis reviewed the literature on the subject.

Highlighting the need for consideration of personal differences and preferences for providing quality education services, the thesis attempts to investigate whether the existing models are capable of addressing this need. Hence, a comprehensive review of engagement evaluation models is proposed later in the thesis. Chapter 3 reviewed four models in detail and considered three further models for evaluating learner engagement. The thesis highlighted the benefits and disadvantages of reviewed models leading to proposition of potential improvements. As a result, the thesis identified some limitations of existing models and proposed potential improvements. Therefore the first aim of the research is addressed - leading the way towards further development of a conceptual engagement evaluation model. This research therefore contributes to the knowledge base a critical evaluation of current models and directions for further enhancement.

The second aim of the research represents the main contribution of this thesis to the knowledge base of online learner engagement. The SEEM model was developed and further refined based on the empirical studies and an ongoing review of e-learning literature. As a result, the thesis proposes a comprehensive model for evaluating learning engagement that potentially overcomes the disadvantages of existing models and proposes an improved mechanism for performing evaluations. However, the achievement of the second aim is subject to limitations of the research. The limitations are discussed in detail later in the thesis. The main limitation to fulfilling the second aim is a need to further validate SEEM in practice. Due to the comprehensive nature of SEEM, it was impossible to both propose and validate the model in a single study. Yet, the contribution of this thesis to the knowledge base of engagement studies should not be underestimated, as the development of the model was based on a continual review of literature and consistency checks with empirical studies. By developing SEEM, this research contributes to the knowledge base with an improved engagement evaluation model that is more comprehensive and methodologically inclusive compared to the reviewed models and frameworks.

Finally, the thesis discusses the potential for application and possible benefits from using SEEM model. The third and the final aim of the research was to discuss practical use of the model in e-learning settings. The potential use of the model is discussed above (Section 11.3) highlighting the benefits of developing an automated service targeted for use by researchers, educators and students. Furthermore, the use of SEEM is discussed as a general framework/guideline for teachers who are willing to monitor or examine student engagement (discussed earlier in Section 6.5.2). Elaborating on the use of the model in practice clarifies and highlights the most notable outcomes of the research. By doing so, the thesis extends its audience beyond e-learning practitioners and researchers to also include e-learning software designers and developers. Software developers and other technologists can, therefore, be informed by the outcomes of the research and also benefit from directions proposed for further technological implementation and integration into current e-learning systems; thereby contributing to the practical domain of e-learning.

11.5. Limitations and Future Work

The most considerable limitation of this thesis is encompassed in a set of constraints that inhere in the design of the empirical studies. While the SEEM model represents a holistic and comprehensive model of learner engagement, the empirical studies that reflect the conceptual structure of the model focus on one of its components at a time. The ideal empirical study would constitute a diverse teaching and learning experience that could allow an inclusive consideration of the model. However, mainly due to administrative constraints, it was impossible to design and conduct a fully comprehensive study. The requirement to re-visit some of the conducted studies in retrospect constitutes another limitation. However, a single study – even a much comprehensive one – will hardly allow the elimination of these limitations. The holistic nature of the proposed model will require repetitive consideration and application for revealing its actual shortcomings and highlighting the areas that require further attention.

There are a number of objectives for future work that emerge from the results, which have been presented in this thesis. The road ahead can constitute two major endeavours that can be carried out in parallel. One endeavour is the continuous progress in validation and refinement of the SEEM model through empirical studies. The other endeavour is the design and development of an automated service that is based on the proposed conceptual model. The development of a service can provide a foundation for more robust and quick analysis of the results and, therefore, accelerate the advance in refining, validating and developing the

SEEM model. While this research may not provide definitive answers, it sets out a direction that can lead to a number of discoveries and insights into online learning.

11.6. Summary and Conclusion

This thesis represents a structured account of the endeavour to understand, master and transpose the field of online learning. Setting a number of questions in its initial chapters, this thesis proceeds by elaborating the attempts to answer and address these questions. Nurturing its argument through each of the chapters, this thesis identifies engagement to be an important element of learning and develops a comprehensive representation of evaluating learner engagement

Most generally, this thesis acknowledges the research literature by offering an insight into the development of learning theories, their implications on teaching practice and their relevance to e-learning research. Recognising the wider schools and traditions of learning research, this thesis positions itself within the theoretical perspectives of social learning. Drawing upon social learning theories, it embarks on examining relevant pedagogical design elements and online teaching and learning practice. The thesis, namely, focuses on the issues of learner interaction, participation and engagement. It discusses learner engagement in relation to individual differences and characteristics, highlighting the need for developing greater understanding about the role that individual differences play in shaping learner engagement. Within the limited scope of the thesis some of the differences are discussed in greater detail. Namely, personal preferences in approaches to learning, commonly referred to as learning styles, are elaborated and considered in empirical work. Yet, the thesis advocates consideration of a wider range of individual differences and preferences for addressing the pedagogical constraints that educational institutions are facing today.

Consistently with the reviewed literature, the thesis proposes a conceptual model for evaluating and monitoring online learner engagement. Named as the Situated Engagement Evaluation Model (SEEM), it differs form previous models and frameworks by neither trying to explain the nature of online learning nor offering techniques for improving learner engagement. It represents a multi-dimensional guideline that researchers and teaching practitioners can refer to for analysing and evaluating online learner engagement. In its current stage of development, the

SEEM model, as argued in the thesis, represents a descriptive and exploratory instrument for evaluating online experience. However, the continuous use of the model aligned to various pedagogical structures may shed light on understanding of the general epistemological structures and may inform the refinement of teaching and learning techniques.

The core argument of this thesis is conducted to elicit and introduce a conceptual proposition – the SEEM model. This thesis proceeds to initiate positioning of the model by conducting or revisiting empirical studies in an attempt to demonstrate the benefits of the proposed model. Four independent studies were brought together to investigate the value and the potential of the SEEM model. Each of the discussed studies focused on one major element of student interaction and discussed the results in line with the SEEM model. It is however, necessary to emphasise that it is the integrated outcome, and not the individual results, that support the main argument of this thesis. The empirical work, as introduced in this thesis, enabled presentation of the implications that may arise from a practical application of the SEEM model. While the results of the studies vary widely, they share in common a propensity to identify engagement patterns that, in some cases, may have remained undetected. The studies explored and discussed association between individual characteristics and the observed patterns of engagement. The empirical work demonstrated the potential and relevance of the methods that are integrated into the SEEM model – strengthening the lead argument in support of the model. Despite the constraints of designing and including a comprehensive empirical study, this thesis presents a sufficient account for further consideration, application, evaluation, refinement and automation of the proposed model. In line with the opening quote, this thesis, as any other scholarly endeavour, is still a work in progress. However satisfying this experience was, it set in train a journey that is still to be completed and thus written about…

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Appendix 1a

Feedback Questionnaire on Peer-Assessment Task (Exercise 1)

In the beginning of November 2008 you were given a supplementary task to your assignment to post a section of your group assignment for the prospect of getting feedback from your classmates.

Answer the following questions if you did not post the work as described in the task. (The task description is attached for your reference)

1. Rate how clearly the Peer-Assessment task was explained to you (on paper/presentation)?
   (Circle the most appropriate where 1 Not Clear – 5 Very Clear)

   1 2 3 4 5

2. Rate how useful, in your opinion, the task was for your *personal* benefit?
   (1 Potentially Not Useful – 5 Potentially Very Useful)

   1 2 3 4 5

3. Were you given enough time to post your work and complete the task on time?
   (Circle One)

   Yes No Other ________________

4. Would you participate in this task if you were given more time?
   (Circle One)

   Yes No Other ________________

5. Would you participate in this task if marks were allocated (if this was a non-optional task)?
   (Circle One)

   Yes No Other ________________

6. Would you like to receive feedback on your work from one of your fellow classmates?

   Yes No Other ________________

7. Would you like to get feedback according to the given assessment criteria (See Part 2 of the task for details)?

   Yes No Other ________________

8. Rate how comfortable did you feel sharing part of your work with the rest of the students?
   (Circle the most appropriate where 1 Not Comfortable – 5 Very Comfortable)

   1 2 3 4 5

9. Were you interested in having a chance to look at yours classmates work?

   Yes No Other ________________

10. Would you find it easier to participate in the task if anonymous participation was possible?

    Yes No Other ________________

11. Would you find it easier to post the task having your work visible to the assessor-classmate only?

    Yes No Other ________________

12. Would you prefer to do this task during the class rather than working at your own time?

    Yes No Other ________________

13. Rate how much workload, in your opinion, the task added to your 'normal' routine?
    (1 Unbearable – 5 Almost Nothing)

    1 2 3 4 5

14. Have you accessed the Blackboard area prepared for this task?

    Yes No Other ________________

15. If answered "Yes" to question 14; Did you find the work posted by your classmates and the feedback by the assessor useful?

    Yes No Other ________________

16. If answered "Yes" to question 14; Rate how easy it was to locate the Blackboard area dedicated for the task?
    (Circle the most appropriate where 1 Very Difficult – 5 Very Easy)

    1 2 3 4 5

17. As far as future peer-assessment activities are concerned; what would encourage you to participate?

    Please Explain:

____

18. Student ID: ____

19. Age: ____________

20. Sex: ____________

21. Level of studies: ______________

Appendix 2a

Post-Exercise Feedback Questionnaire on Peer-Assessment Task (Exercise 3)

The second assignment you have submitted contained an element of *peer assessment* that allowed receiving feedback from your classmates.

Please answer the following questions recalling your experience with the peer assessment exercise.

Initial Attitude and View on the Rationale.

22. Rate how clearly the Peer Assessment task was explained to you (on paper/presentation)?
    (1:Not Clear – 5:Very Clear)

    1 2 3 4 5

23. Did you feel positive about the Peer Assessment task? (***before*** start of the exercise)

    Yes No Other ________________

24. Rate how useful you thought the task would be for learning experience? (***before*** the start of the exercise)
    (1:Not Useful – 5:Very Useful)

    1 2 3 4 5

25. Did you like the idea of receiving feedback from one of your classmates? (***before*** the start of the exercise)

    Yes No Other ________________

26. Did you like the idea of having a chance to look at yours classmates work? (***before*** the start of the exercise)

    Yes No Other ________________

27. Rate how demanding you thought it would be (***before*** the start of the exercise) from the workload perspective? (1:Not Demanding – 5:Very Demanding)

    1 2 3 4 5

Post-exercise Attitude and Perceived Usefulness of the Experience.

28. Did you feel positive about the Peer Assessment task? (***after*** the exercise)

    Yes No Other ________________

29. Rate how useful the task was for your learning experience? (***after*** the exercise)
    (1:Not Useful – 5:Very Useful)

    1 2 3 4 5

30. Was it useful receiving feedback from one of your classmates?

    Yes No Other ________________

31. Was it useful having a chance to look at yours classmates work?

    Yes No Other ________________

32. Rate how demanding was the peer assessment task? (1:Not Demanding– 5:Very demanding)

    1 2 3 4 5

Engagement with the exercise

33. Did you read the feedback on your work from your peers?

    Yes No Other ________________

34. Did you read the comments for other people's work?

    Yes No Other ________________

35. Rate how important the fact of having peer assessment **in class** (and not at your own time) was for you?
    (Circle the most appropriate where 1:*Not important* – 5:*Very important*)

    1 2 3 4 5

36. Would you participate in peer assessment if this was not an in-class activity?

    Yes No Other ________________

Change in engagement with the course and materials in general

37. Did you feel that peer assessment exercise brought you closer to your classmates?

    Yes No Other ________________

38. Did you feel more engaged with the course as a result of this exercise?

    Yes No Other ________________

39. Rate the importance of the peer assessment task in motivating you to access/login to the Virtual Learning Environment (Blackboard)?
    (Circle the most appropriate where 1:*Not important* – 5:*Very important*)

    1 2 3 4 5

40. Rate how much the peer assessment encouraged you to learn more about the other students? (i.e. checking profile, communicating with)
    (Circle the most appropriate where 1:*Not at all* – 5:*Very much*)

    1 2 3 4 5

41. Did you feel more comfortable to use the public discussion board after the peer assessment exercise?

    Yes No Other ________________

Effect on Learning and Understanding

42. Did you put extra effort in perfecting your assignment when peer assessment was in place (compared to the task without peer assessment element)?

    Yes No Other ________________

43. Rate how much did you learn from the **comments to your work**?
    (Circle the most appropriate where 1:*Nothing* – 5:*Very much*)

    1 2 3 4 5

44. Rate how much did you learn as a result of **commenting others work**?
    (Circle the most appropriate where 1:*Nothing* – 5:*Very much*)

    1 2 3 4 5

45. Do you think **you** improved your initial work as a result of peer review?

    Yes No Other ________________

46. Do you think **others** improved their initial work as a result of peer review?

    Yes No Other ________________

47. Rate the grading/criticism you received in the feedback?
    (Circle the most appropriate where 1:*Undergraded/Unnecessarily Critical* – 5:*Overgraded/Not critical*)

    1 2 3 4 5

Adopted Technology

48. Rate your level of satisfaction with the general Virtual Learning Environment (Blackboard)
    (Circle the most appropriate where 1:*Very low* – 5:*Very high*)

    1 2 3 4 5

49. Rate your level of satisfaction with the general peer assessment tool **only** (Discussion Board)
    (Circle the most appropriate where 1:*Very low* – 5:*Very high*)

    1 2 3 4 5

50. Would you offer us to consider an alternative tool for peer assessment?

    Yes No Other ________________

General

51. Would you prefer peer assessment to be organized before final submission or after final submission of the assignment?

    Before After Other ________________

52. Is the extra workload with peer assessment worth the benefits it offers?

    Yes No Other ________________

53. Would you like having peer assessment exercises in other modules?

    Yes No Other ________________

54. Student ID: ____

55. Age: ____________

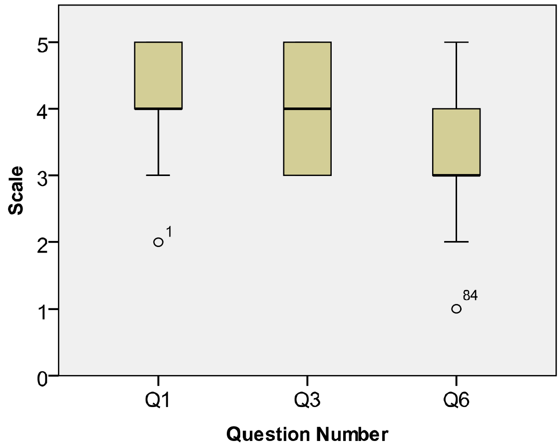
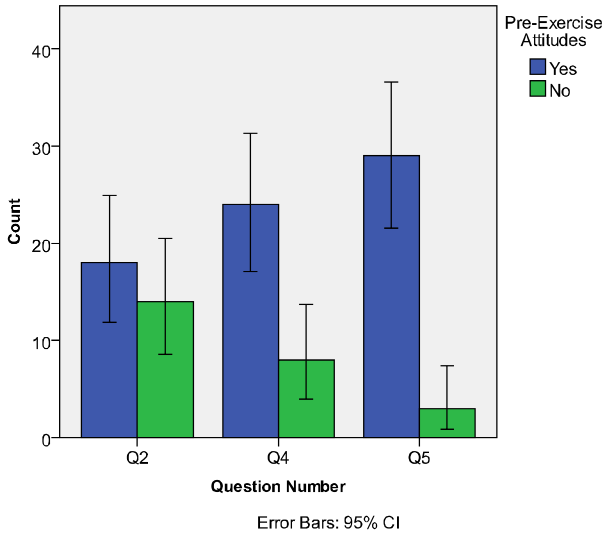
56. Sex: ____________

57. Course: ______________

Appendix 2b

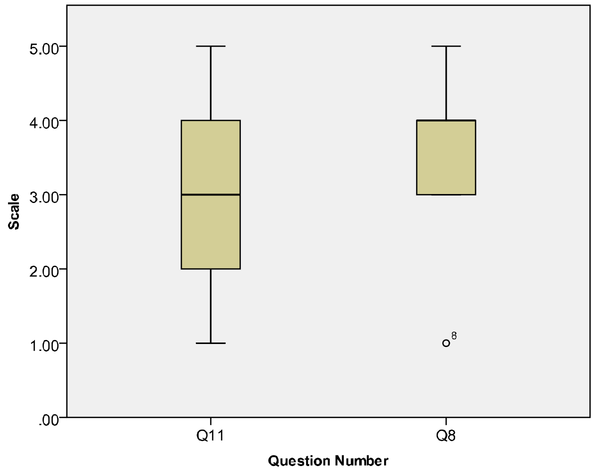
Graphical Summary of the Post-Exercise Questionnaire Results (Exercise 3)

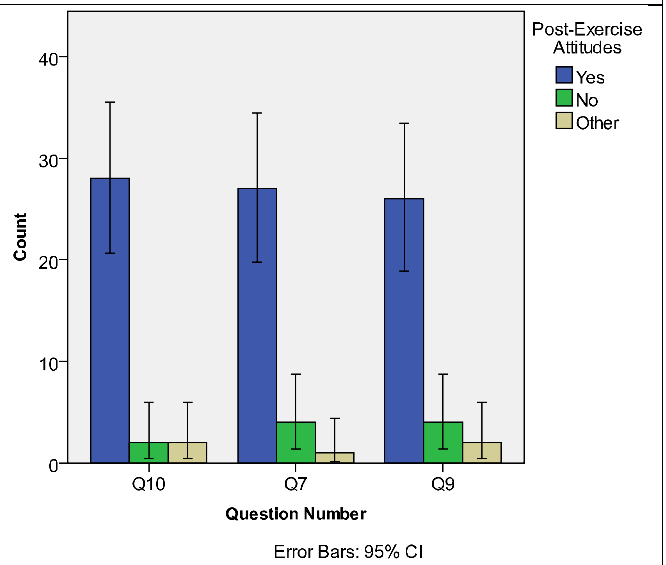
Pre-Exercise Attitudes

<table>
<tr><td>Q1:</td><td>Rate how clearly the Peer Assessment task was explained to you (on paper/presentation)? (1:Not Clear – 5:Very Clear)</td><td rowspan="3">
</td></tr>
<tr><td>Q3:</td><td>Rate how useful you thought the task would be for learning experience? (before the start of the exercise)
(1:Not Useful – 5:Very Useful)</td></tr>
<tr><td>Q6:</td><td>Rate how demanding you thought it would be (before the start of the exercise) from the workload perspective? (1:Not Demanding – 5:Very Demanding)</td></tr>
<tr><td>Q2:</td><td>Did you feel positive about the Peer Assessment task? (before start of the exercise)</td><td rowspan="3">
</td></tr>
<tr><td>Q4:</td><td>Did you like the idea of receiving feedback from one of your classmates? (before the start of the exercise)</td></tr>
<tr><td>Q5:</td><td>Did you like the idea of having a chance to look at yours classmates work? (before the start of the exercise)</td></tr>
</table>

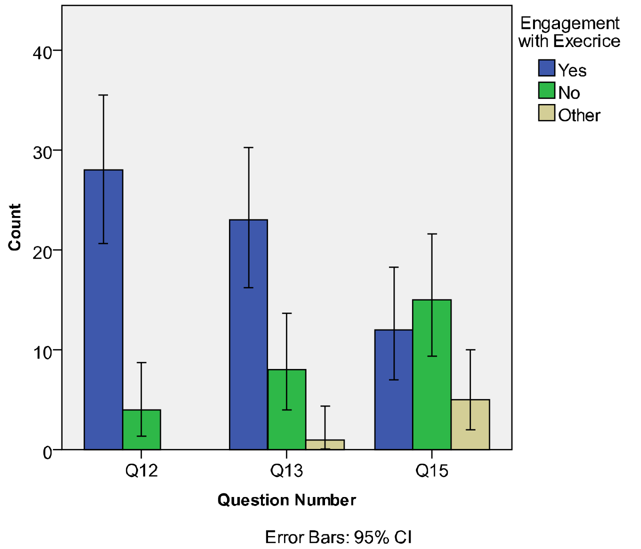
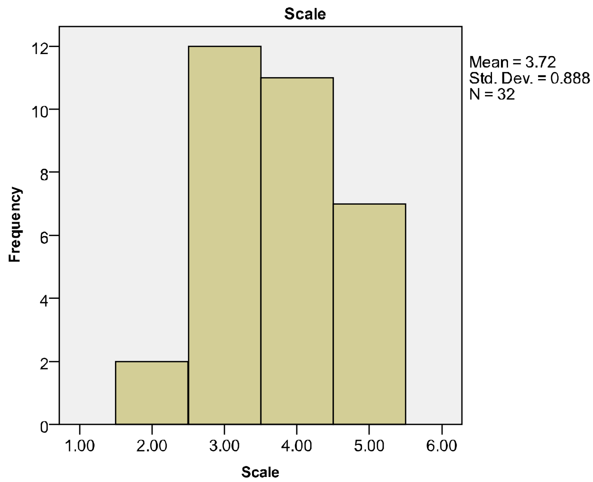
Post-Exercise Attitudes

Q8:	*Rate how useful the task was for your learning experience? (after the exercise) (1:Not Useful – 5:Very Useful)*
Q11:	*Rate how demanding was the peer assessment task? (1:Not Demanding– 5:Very demanding)*
Q7:	*Did you feel positive about the Peer Assessment task? (after the exercise)*
Q9:	*Was it useful receiving feedback from one of your classmates?*
Q10:	*Was it useful having a chance to look at yours classmates work?*

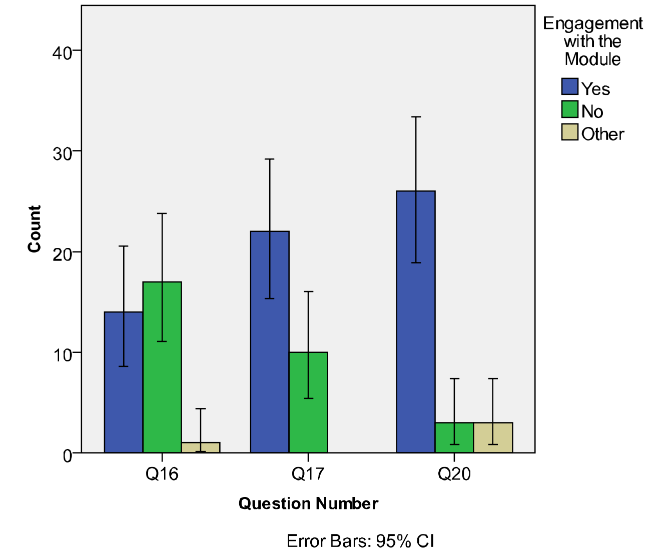
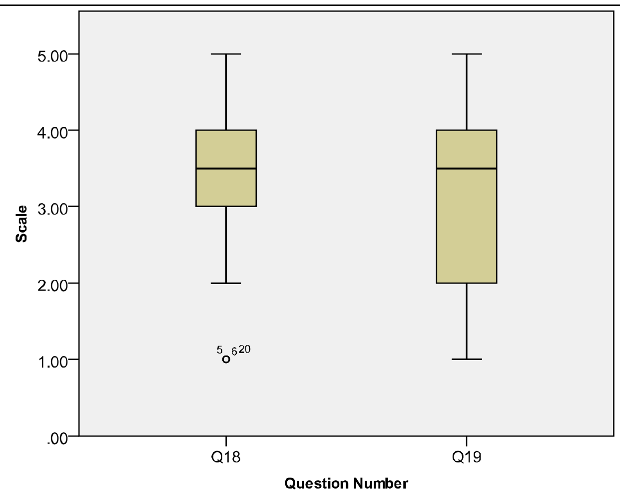




Student Engagement with the Exercise

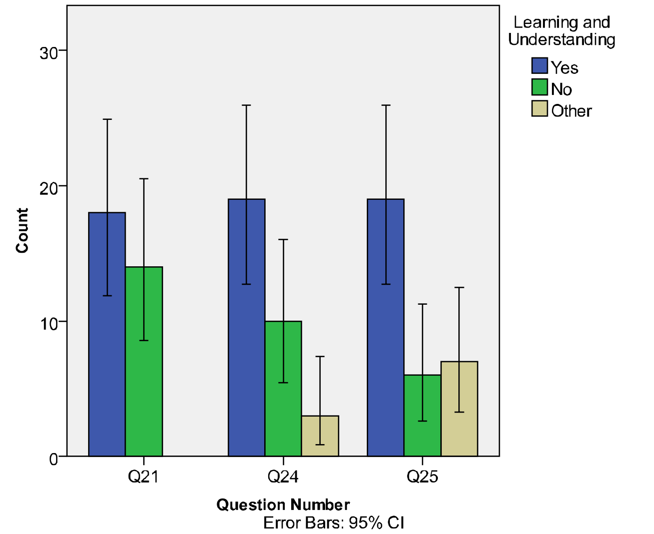
<table>
<tr><td>Q12:</td><td>Did you read the feedback on your work from your peers?</td><td rowspan="3">
</td></tr>
<tr><td>Q13:</td><td>Did you read the comments for other people's work?</td></tr>
<tr><td>Q15:</td><td>Would you participate in peer assessment if this was not an in-class activity?</td></tr>
<tr><td>Q14:</td><td>Rate how important the fact of having peer assessment in class (and not at your own time) was for you? (1:Not important – 5:Very important)</td><td>
</td></tr>
</table>

Engagement with the Module

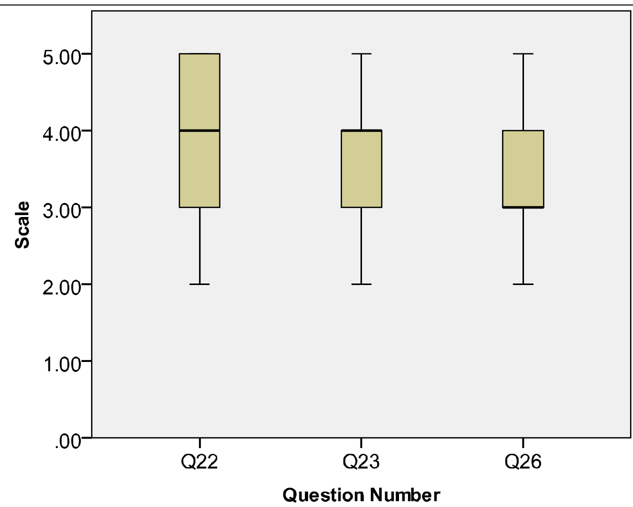
<table>
<tr><td>Q16:</td><td>Did you feel that peer assessment exercise brought you closer to your classmates?</td><td rowspan="3">
</td></tr>
<tr><td>Q17:</td><td>Did you feel more engaged with the course as a result of this exercise?</td></tr>
<tr><td>Q20:</td><td>Did you feel more comfortable to use the public discussion board after the peer assessment exercise?</td></tr>
<tr><td>Q18:</td><td>Rate the importance of the peer assessment task in motivating you to access/login to the Virtual Learning Environment (Blackboard)? (1:Not important – 5:Very important)</td><td rowspan="2">
</td></tr>
<tr><td>Q19:</td><td>Rate how much the peer assessment encouraged you to learn more about the other students? (i.e. checking profile, communicating with) (1:Not at all – 5:Very much)</td></tr>
</table>

Effect on Learning and Understanding

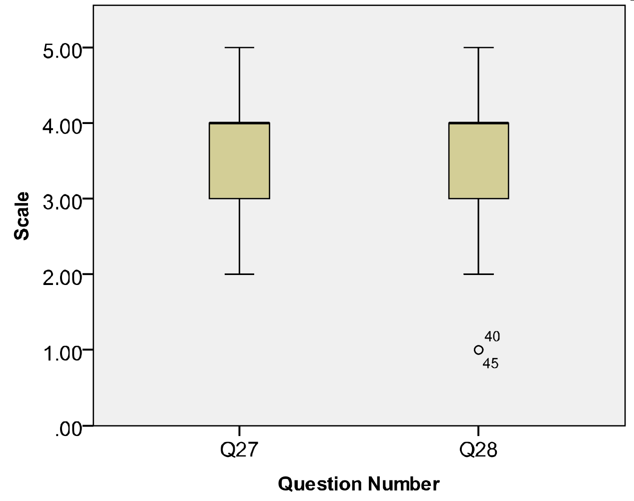
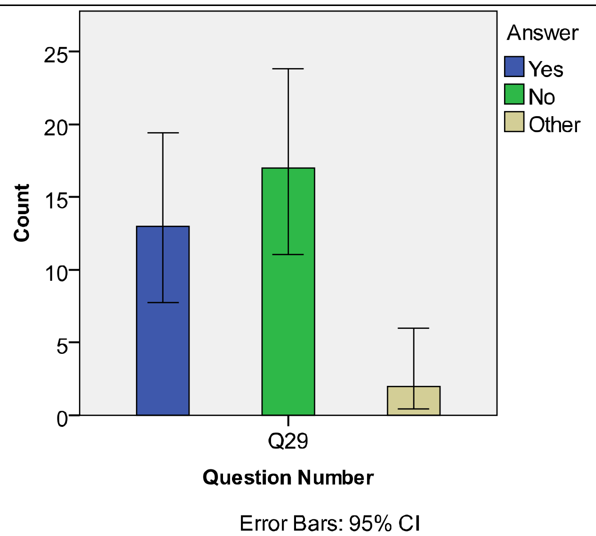
Q21:	*Did you put extra effort in perfecting your assignment when peer assessment was in place (compared to the task without peer assessment element)?*
Q24:	*Do you think you improved your initial work as a result of peer review?*
Q25:	*Do you think others improved their initial work as a result of peer review?*



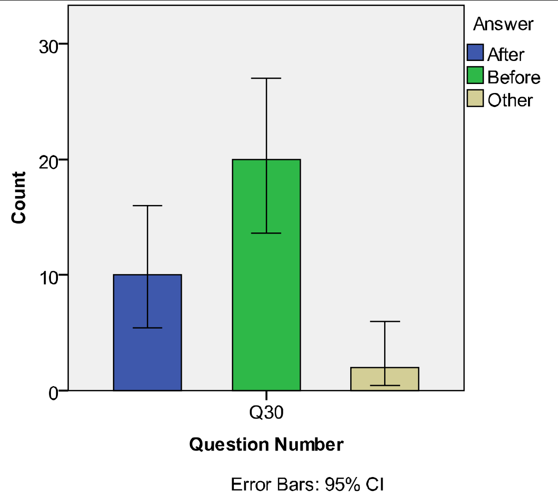
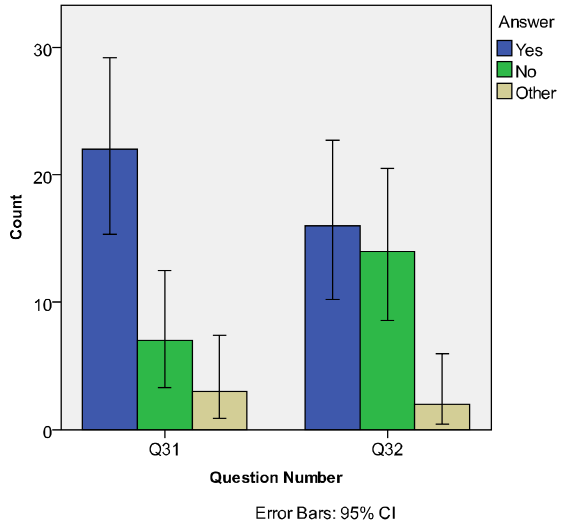
Q22:	*Rate how much did you learn from the comments to your work? (1:Nothing – 5:Very much)*
Q23:	*Rate how much did you learn as a result of commenting others work? (1:Nothing – 5:Very much)*
Q26:	*Rate the grading/criticism you received in the feedback? (1:Undergraded/Unnecessarily Critical – 5:Overgraded/Not critical)*



Adopted Technology

<table>
<tr><td>Q27:</td><td>Rate your level of satisfaction with the general Virtual Learning Environment (Blackboard)
(1:Very low – 5:Very high)</td><td rowspan="2">
</td></tr>
<tr><td>Q28:</td><td>Rate your level of satisfaction with the general peer assessment tool only (Discussion Board)
(1:Very low – 5:Very high)</td></tr>
<tr><td>Q29:</td><td>Would you offer us to consider an alternative tool for peer assessment?</td><td>
</td></tr>
</table>

General Perception on Usefulness

<table>
<tr><td>Q30:</td><td>Would you prefer peer assessment to be organized before final submission or after final submission of the assignment?</td><td>
</td></tr>
<tr><td>Q31:</td><td>Is the extra workload with peer assessment worth the benefits it offers?</td><td rowspan="2">
</td></tr>
<tr><td>Q32:</td><td>Would you like having peer assessment exercises in other modules?</td></tr>
</table>

Appendix 2c

Kendall's tau_b		*Q1.*	*Q3.*	*Q6.*	*Q8.*	*Q11.*	*Q18.*	*Q19.*	*Q22.*	*Q23.*	*Q28.*
Q1. Clarity of Introduction	Cor. Coeff.	1									
	Sig. (2-tailed)	.									
	N	32									
Q3. Anticipated Usefulness	Cor. Coeff.	.486**	1								
	Sig. (2-tailed)	.003	.								
	N	32	32								
Q6. Anticipated Level of Workload	Cor. Coeff.	.114	.183	1							
	Sig. (2-tailed)	.482	.245	.							
	N	32	32	32							
Q8. Exercise Usefulness	Cor. Coeff.	.514**	.547**	.304	1						
	Sig. (2-tailed)	.002	.001	.056	.						
	N	31	31	31	31						
Q11. Level of Workload	Cor. Coeff.	.069	.175	.501**	.267	1					
	Sig. (2-tailed)	.675	.275	.001	.094	.					
	N	30	30	30	30	30					
Q18. Effects on Logging in	Cor. Coeff.	-.052	.366*	.380*	.295	.315*	1				
	Sig. (2-tailed)	.744	.018	.013	.060	.043	.				
	N	32	32	32	31	30	32				
Q19. Learning About Others	Cor. Coeff.	.292	.398**	.087	.496**	.360*	.401**	1			
	Sig. (2-tailed)	.065	.010	.565	.001	.019	.007	.			
	N	32	32	32	31	30	32	32			
Q22.Learning from Comments	Cor. Coeff.	.103	.285	.346*	.521**	.237	.362*	.403*	1		
	Sig. (2-tailed)	.554	.092	.037	.002	.148	.027	.013	.		
	N	28	28	28	28	28	28	28	28		
Q23. Learning from Commenting	Cor. Coeff.	.171	.155	-.093	.471**	-.212	-.083	.152	.494**	1	
	Sig. (2-tailed)	.348	.384	.594	.008	.222	.633	.379	.005	.	
	N	26	26	26	26	26	26	26	26	26	
Q28. Satisfaction with Technology	Cor. Coeff.	.419*	.359*	.172	.530**	.007	.277	.319*	.183	.472**	1
	Sig. (2-tailed)	.011	.025	.277	.001	.967	.076	.038	.282	.010	.
	N	31	31	31	30	29	31	31	27	25	31

*Notes: [1] **. Correlation is significant at the 0.01 level (2-tailed).*
*[2] *. Correlation is significant at the 0.05 level (2-tailed).*
[3] Q1-Q28: are likert scale questions in 1-5 range.

Appendix 3

Permuted Interaction Matrix with three groups of participants: Chinese, British and facilitators. UCINET software (Borgatti, Everett et al. 2002)

Actors	1	2	35	17	5	6	7	34	15	23	11	25	13	14	22	40	31	28	33	24	39
1		1		1					1	1										1	
2		3		1	6	1	1			1			1	1						1	
35			1			1				1						3					2
17		2																			2
5		5			3	1	1			2					1		5			4	
6					1		1				1	5	1					1		1	
7					1		2					1				1					
34		1							1												
15	1	1	1																		
23			1	1	2			1							1					1	
11		1					1														
25						3	1			1		4									
13		1			1								3			5					
14					1					1		1		4		1					2
22										2					3						
40		1	4							1			8		1	2				2	3
31					4					1						1				6	
28						1															
33																					
24		5			2									1			3			1	
39		1	1	1										1		1					
19														1							2
29																					
12		1		1																	2
4		4																			
21			1																		
41																					1
36		1											1	1							
42																					
18																					
32																					
20																					
46		2								8										1	
9		1				3						4		1		1				1	
48	3																				
49																				4	
38							3														
26													4			3					
27																					
43																					
47						2	1													1	
45					1												1				
44		1																			
51		1																			
3		3			1					10				1	17						1
8		8			14					1						1	18			7	
16																					
30	2	8	3	2	8	4	5		1	5		2	5	12	3		3		1	3	6
37	2						2		1	1						1			2	1	
50		5	9	1	3	1	1			4		1	22	3	2	25				1	4
10		2			2	16	4				4	11									

Actors	19	29	12	4	21	41	36	42	18	32	20	46	9	48	49	38	26	27	43	47	45	44	51
1														3									
2				7			2										1				1		
35					1							1					1						1
17																					1		
5			1																		2		
6													1							3			
7												1	3			1				1			
34																							
15																							
23								3				5			1						1		
11																							
25													1										
13					1												2						
14			2						6														
22							1	1															
40							3						1				6						1
31												1									2		
28																							
33																							
24															1								
39	1		2			1																	1
19	1					2		1												1			1
29																							
12						2																	
4																							
21																							
41	2		2									1											
36																							
42	1																			1			
18																							
32																							
20																							
46																							
9																			1				
48																							
49											1						1						
38																							
26															1								
27			1																				
43													1										
47																							
45																							
44																							
51			1																				
3								6		3		9											
8				2											3						5	1	
16																							
30	6		7			2			5		1	1	3		2		1	1		1	3		2
37		2		1								1		7	2			4	4			1	
50					6		6			1	1	1	1				15	1		1			4
10													3										

Actors	3	8	16	30	37	50	10
1					3		
2		7		9		4	
35				6		6	1
17				4		1	
5	1	13		9		2	3
6				4			8
7	1			6			1
34							
15					1		1
23	16	1		1		4	
11				1			3
25				2			12
13				7		17	
14				9		4	
22	10			7		2	
40		1		4	1	29	
31		14		6		1	
28							
33					2		
24		7		7	1		
39				8		4	
19				4			
29				1	1		
12				10		2	
4		4		1			
21				1		7	
41				10		1	
36				1		4	
42	5			2			
18				4			
32	2						
20				5			
46	6			5	1	2	
9				3		1	3
48				1	3		
49		3		3	2		
38						3	1
26				1		14	
27				4	6	1	
43				3	8		
47				3			2
45		5		1			
44				1			
51				2		4	
3	12			3			
8		5		10		1	
16				1			
30	2	3		7	1	7	
37		1		4	4		
50				14	1	5	
10				6		1	3

```
Density / average value within blocks
       1     2     3
   ----- ----- -----
1  0.345 0.157 1.850
2  0.130 0.042 0.975
3  1.946 0.783 1.310

Standard Deviations within blocks
       1     2     3
   ----- ----- -----
1  0.962 0.687 4.058
2  0.628 0.236 2.141
3  4.234 1.980 2.899

Use MATRIX>TRANSFORM>DICHOTOMIZE procedure to get binary image matrix.
Density table(s) saved as dataset Density
Standard deviations saved as dataset DensitySD
Actor-by-actor pre-image matrix saved as dataset DensityModel
----------------------------------------
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```