Online collaborative learning in tertiary ICT education to enhance students' learning in Malaysia

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Abstract

This study investigated the nature of students', and student group, interactions through the incorporation of an online collaborative learning (OCL) initiative, with its aim to enhance students' learning in a Malaysian tertiary classroom. In order to contribute to knowledge and understanding about the nature and quality of OCL, the learning processes and outcomes were drawn predominantly from Harasim's model, with inclusion of a socio-cultural framework aimed at enhancing learning outcomes for undergraduate science and ICT education students. Harasim's model of OCL that was used in the intervention includes steps to setting up the stage and a system for Idea Generating (IG), modeling and guiding the OCL discussions for Idea Organizing (IO), and evaluating and reflecting the OCL discussions for Intellectual Convergence (IC). The interactions in OCL were analysed through four dimensions: participative, interactive, social, and cognitive in support of the students' cognitive, social and emotional development.

The OCL intervention in this study was conducted through an ICT education course in a Malaysian university that required OCL discussions for 13 weeks: the first four weeks were intra-group work discussions (Task 1), followed by four/five weeks of inter-group work discussions (Task 2), and the remaining four weeks were for the final intra-group work discussions (Task 3). The OCL intervention was aimed at facilitating interdisciplinary collaboration and interaction between students from Chemistry, Physics and Mathematics majors through the university's Learning Management System (Moodle), which provided the shared space for the OCL discourse and tools for collaboration. A total of nine groups of four to six students (N=46) were involved in this study. In order to evaluate the OCL intervention using a holistic view, an interpretive approach that included the collection of quantitative and qualitative data was adopted to frame the collection and analysis of the data. Quantitative data were obtained from online questionnaires, together with online data based on the frequency of students' posts in participative, interactive, social, and cognitive dimensions. Qualitative data were gathered via interviews with students (group and post-course interviews) and lecturers, and online transcripts that included online postings and students' online journal entries. These data were collected and

analysed in order to triangulate the findings and to help the researcher assess the extent to which the intervention was successful in enhancing students' learning.

The findings from the study revealed the nature of students' interactions in OCL correspond with particular socio-cultural views that students' interactions are characterised based on the participative, interactive, social and cognitive dimensions in support of the students' cognitive, social and emotional development. From a socio-cultural perspective, the outcomes that arose from the study included:

- The socio-cultural learning constructs have been useful as a framework for the analysis of the OCL intervention based on the participative, interactive, social and cognitive dimensions.
- The affordances of the OCL group work helped the students' in their group work.
- The constraints of OCL influence the communication methods, and interaction styles used by students in achieving task goals through group work in the OCL intervention.

The findings also show students' interactions and student group interactions were an important part of the learning process. The implementation of OCL intervention into the course can lead to the facilitation of the student group learning process as well as supporting their cognitive, social and emotional development, and potential constraints from the technology (e.g. Internet connection) or the lack of social and verbal cues (e.g. facial expression) can lead to different working methods of communication for achieving task goals and different styles of interactions. Overall, the findings of the study indicate the value of OCL in a tertiary classroom to enhance learning.

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Chapter 1 Introduction

1.1 Introduction

The use of online learning in Malaysian Higher Education Institutions (HEIs), either in public or private universities to support conventional teaching approaches or as a teaching medium for long-distance or off-campus studies, has increased tremendously in recent years (Aris, Ali, Harun, Tasir, Atan, & Noor, 2006; Embi, 2011; Goi & Ng, 2009; Raja Hussain, 2004; Salleh, 2008). Online learning has been identified as one of the Critical Agenda Projects (CAP) and a Key Result Area (KRA) of the Ministry of Higher Education Malaysia (MOHE) as a result of the National Higher Education Strategic Plan (PSPTN); the latter translates the direction of national higher education for the future and focuses on the development of quality human and intellectual capital, and the country's aspirations to become a developed, prosperous, and competitive nation (Embi, 2011). Although online learning has been used in Malaysian HEIs since 2000, the use of online learning in Malaysian tertiary classrooms is still growing, specifically in the area of tertiary teaching and learning. More efforts on practice and research are required to enhance and stimulate online learning activities in Malaysian tertiary education and to "tackle the digital natives" (Embi, 2011, p.98).

Likewise, this study has been shaped by the researcher's own commitment to embrace and fulfil the Malaysian government's aspiration for the use of online learning in teaching and learning in Malaysian Higher Education; this is also in line with the Malaysian government's aim to democratise education as well as contribute to the formation of knowledge workers (or k-workers). The study also reflects the researcher's own personal engagement with online learning systems (e.g. web-based courses, WebCT, Moodle) through teaching undergraduate pre-service teacher programmes at the Universiti Teknologi Malaysia since 2001; it also reflects his personal interests and concerns in research inquiry, which has the potential to enhance students' learning through online collaborative learning interactions as indicated in the literature (e.g. Johnson & Johnson, 1996; Harasim, 2004; Miyake, 2007; Pallof & Pratt, 2005; Stahl, 2006). Therefore, this study is an inquiry into pre-service teachers' learning through the incorporation of an online collaborative learning environment, with its aim to enhance students' learning in a Malaysian conventional tertiary classroom.

The current chapter outlines the introduction to the thesis by starting with the context and background of the study, followed by the rationale of the study. Next, the statement of research and research questions are addressed. The chapter also discusses the significance of the study and provides an overview of the thesis.

1.2 Context and Background of the Study

The Ministry of Education Malaysia introduced Information Technology (IT) subjects in secondary schools in 1999, but revised the curriculum to include a new syllabus of Information and Communication Technology (ICT) in 2006 (Education, 2006). Since then many ICT teachers have been recruited to meet the growing demand for qualified and skilled ICT teachers in Malaysian secondary schools. Additionally, as the Ministry views ICT as a means and not as an end in itself, many efforts have been made in developing a richer ICT curricula, enhanced pedagogies, more effective organisational structures in schools, stronger links between schools and society, and the empowerment of learners (Ronchaud, Launay, & Dantec, 2005).

The ICT and multimedia education programme in Malaysian tertiary education aims to produce ICT teachers in schools who are able to utilise and develop technology-based learning applications (or TBL) and incorporate them into education (Abdullah, 2011). These teacher trainees, who are also known as pre-service teacher students, are trained and equipped with ICT and multimedia knowledge and skills to develop computer-based teaching aids (or courseware) and other related ICT teaching materials (Aris, et al., 1999). However, there are some concerns and issues regarding the lack of technical and ICT competence and confidence among these students (Abdullah, 2011; Hew & Leong, 2011). This lack resulted in the computer-based teaching aids or courseware not achieving the expected levels of success (Abdullah, 2011; Education, 2004; Hew & Leong, 2011; Kamariah, 2006). In order for pre-service teacher students (or teacher trainees) to have a better understanding and practicing knowledge of ICT in tertiary education, the emphasis on learning is achieved through the active social process of knowledge acquisition rather than passive (Abdullah, 2011; Goi & Ng, 2009). A survey of employment among Malaysian ICT non-teacher graduates conducted in 2011 (Ramakrishnan & Yasin, 2011) showed that more than 80% of Malaysian ICT graduate students reported that the lecturers need to abandon the traditional lecture and adopt a student-centred model of learning (e.g. collaborative learning) as the core model of pedagogy. They believed that lecturers should encourage collaboration among students inside and outside the university; and instead of simply memorising and storing information, students should engage actively in discovering knowledge and critical thinking (Ramakrishnan & Yasin, 2011).

In the Universiti Teknologi Malaysia, Bachelor of Computer Science Education (Chemistry), Bachelor of Computer Science Education (Physics) and Bachelor of Computer Science Education (Mathematics) have been offered since 1996 to cater for the needs of teachers training for ICT and computer use in Malaysia. This is specifically to equip secondary school teachers with ICT, multimedia and computing knowledge to enable them to develop computer-based teaching aids and other related ICT teaching materials. The students are trained and equipped with both science education knowledge and ICT education. Nonetheless, some of the ICT subjects are also offered to non-science teachers such as Sports Science, Islamic Studies, TESL, and Technical Education (Aris et al., 2006). According to Aris, et al. (1999) the ICT education programme in Malaysian tertiary education, particularly in the Universiti Teknologi Malaysia, aims to produce competent ICT teachers with knowledge and expertise in ICT technology that can be applied in education. Furthermore, the studies of *Computer Science Education* focusing on learning Computer Science, Information Technology and Multimedia, and computer-based learning materials, are still little explored in literature and very much an emerging field of study, specifically in the Malaysian context (Aris, et. al., 2006). Other examples of research related to Computer Science Education in the literature, particularly in the Malaysian context in which this study is situated, includes students learning about the concept of information systems, computer systems and interactive multimedia packages, and multimedia technology on the web (Aris, et. al., 2006; Aris, 2001).

The introduction and development of online learning in Malaysian higher education institutions started during the pre e-learning era when the Educational Technology division unit was set up by the Ministry of Education in 1972 (Aris et al., 2006; Goi & Ng, 2009; Ronchaud et al., 2005). However, in the pre e-learning era, Internet was not part of e-learning (Hussin & Salleh, 2008). The rapid growth of Internet technologies has made tertiary teaching and learning in Malaysia, via the online learning environment (or Learning Management System), viable since 2000 (Embi, 2011; Aris, et al., 2006). The development of online learning in Malaysian education institutions can be divided into two phases (Raja Hussain, 2004; Hussin & Salleh, 2008). The first phase is through the acquisition of sufficient ICT infrastructure to enable the Malaysian education institutions to offer online learning to students (Raja Hussain, 2004). Sustainability of online learning in teaching and learning becomes a major hurdle in this phase, which leads to the second phase. This is the integration of ICT in teaching and learning guided by the Ministry of Education's strategies to stimulate and enhance the use of ICT in online learning (Raja Hussain, 2004; Goi & Ng, 2009), namely:

- The preparation of sufficient and up-to-date tested ICT infrastructure and equipment to all educational institutions
- The roll-out of ICT curriculum and assessment and the emphasis of integration of ICT in teaching and learning
- The upgrading of ICT knowledge and skills in students and teachers
- The increasing usage of ICT in educational management
- The upgrading of the maintenance and management of ICT equipment in all educational institutions

The first online learning system started in the Faculty of Education (Universiti Teknologi Malaysia) in 1997, and was a response to the university's teaching and learning policy and the Ministry of Higher Education (Aris, et. al, 2006). The first version of a developed online learning system was called *CyberDidik*. It was a static based online learning system developed using HTML coding (Aris, 2001). Much of the online interactions in *CyberDidik* were about viewing the online course and downloading the lecture notes and materials (Aris et al., 2006). Nonetheless, the course offered through *CyberDidik* successfully provided the on and off-campus students with online access to the complete lecture notes. The second version of the online learning system adopted by the Universiti Teknologi Malaysia called WebCT (version 3.5) in 2004, had more capabilities compared to *CyberDidik* such as download and upload processes, ability to create electronic learning materials, provide online discussions, record all students' activities and facilitate online communication (Masrom, Zainon, & Rahiman, 2008). However, the WebCT system had some drawbacks, since the lecturers needed to have a certain level of technical knowledge (e.g. html coding) for publishing teaching and learning materials (Aris et al., 2006). After three years of implementing the WebCT system, the university decided to adopt an open source-based learning management system called Moodle (Aris et al., 2006; Masrom et al., 2008). This was much easier for teaching and learning, with more emphasis on online interactions between students, students and peers, and students and lecturers (Aris et al., 2006; Maikish, 2006; Pallof & Prat, 2005). This online learning system (Moodle) is still being implemented by the Universiti Teknologi Malaysia, and is divided into four components: constructing, collaborating, creating and sharing (Masrom et al, 2008, p. 50). However, the research conducted in 2004 (e.g. Raja Hussain, 2004) reported the weakness of higher education institutions in Malaysia in the planning and implementation of online teaching and learning, particularly at tertiary level, including course, teaching or learning development, course structure, student and institutional support, evaluation and assessment (Raja Hussain, 2004).

1.3 Rationale of the Study

Online learning is rapidly gaining popularity as a method of knowledge delivery through the use of the Internet and network technologies. In the field of tertiary education, online learning has been seen as an alternative strategy to help educators accommodate the numbers and diversity of students who are coming into tertiary classrooms (Curtis & Lawson, 2001; Hiltz & Turoff, 2002; Hughes, 2005; Mason & Rennie, 2008). Several researchers (e.g. Collis & Moonen, 2001; Harasim, 2004; Hiltz & Turoff, 2002; Hughes, 2005; Mason & Rennie, 2008; Pallof & Pratt, 2009) have discussed the advantages of online learning in tertiary education. One of the advantages of online learning that has been the focus of much of this research is the flexibility to meet the needs of the learner, through adaptability to different learner needs, learning patterns and settings, and media combinations that can benefit full-time campus-based students as well as distance learners (Collis & Moonen, 2001). The flexibility of online learning has encouraged many educators to make their learning materials and resources available online, thus enabling students to reach them via the Internet anytime and anywhere. However, often the use of online learning in such a way is consistent with ‘knowledge transmission’ and limits learning; it does not always result in meaningful online learning experiences nor enhance the quality of learning (An et al., 2008; Garrison & Anderson, 2003; Goodfellow, 2007; Goodyear, Jones, Asensio, Hodgson, & Steeples, 2005; Kirkwood, 2009).

Reported research advocates a move in online learning away from the typical teacher-centred model towards a student-centred one in which social collaboration among students is encouraged (An et al., 2008; Häkkinen, Arvaja, & Mäkitalo, 2004; Mason & Rennie, 2008; Stahl, Koschmann & Suthers, 2006; Palloff & Pratt, 2006). Such an approach that promotes a student-centred learning model is collaborative learning, which has been considered an effective instructional method in both traditional and distance learning environments (Johnson & Johnson, 1996; So & Brush, 2008; Miyake, 2007). Current Computer Supported Collaborative Learning (CSCL) research has also regarded collaborative learning as a popular type of learning that promotes learning as a social process (Miyake, 2007). Online collaborative learning, which is supported by the Internet and network technologies, provides the space for creating online communities that allow learners to participate in social learning activities and build socially shared expertise (Häkkinen et al., 2004). Hence, this reduces the loneliness of learning and working in isolation in an online environment, which may affect learner’s satisfaction and learning outcomes within online courses (Palloff & Pratt, 2005). In online collaborative learning, it is important for the students to own their knowledge, rather than the teacher or the textbook, so that they can become committed in the process of knowledge construction, rather than merely receiving or reproducing it. Through participation and collaboration in online collaborative learning, students can learn more effectively, particularly because learning is central in a community of learners (Lave & Wenger, 1991) and learning is not viewed as the mere acquisition of concepts or skills but as the appropriation of the culture specific to the knowledge community (Häkkinen et al., 2004; Harasim, 2012).

Online collaborative learning can also potentially be an alternative solution to the shortcomings of individualised instructions. Johnson and Johnson (1996) state that learning collaboratively in a group can result in higher achievements and knowledge retention than in competitive and individualistic learning. Furthermore, students involved in individualistic learning tend to depress achievement due to competitive and individualistic natures that isolate individuals from each other (Johnson & Johnson, 1996). Johnson and Johnson (1996) summarised some of the shortcomings of individualised instruction: (1) isolating students – working alone for long periods may lower personal motivation by increasing boredom, frustration, anxiety, and the perception that learning is impersonal; (2) limiting the resources and technology available to students, and the support and encouragement of peers; and (3) no cognitive benefits associated with explaining to peers and developing shared mental models.

There are many reported benefits of learning collaboratively in a group over individualistic learning, for instance, improved critical thinking skills, improved self-esteem, increased motivation, engagement of students in the learning process and reduced anxiety (Johnson & Johnson, 1996; Palloff & Pratt, 2005; Panitz, 1996). With the introduction of Learning Management Systems (LMS) also known as Virtual Learning Environments (VLE) in tertiary institutions (Goodyear, et al., 2005), crucial knowledge construction, collaboration and communication can be facilitated (Coomey & Stephenson, 2001; Ingram & Hathorn, 2003; Harasim, 2012). An example of a current LMS that can be used to facilitate online collaborative learning is Moodle (Modular Object-Oriented Dynamic Learning Environment) (Aris et al., 2006; Maikish, 2006; Vighnarajah, Wong Su Luan, & Bakar, 2009). Other examples of LMS are WebCT, BlackBoard, Desire2Learn, Dokeos and Mahara (Aris et al., 2006; Dillenbourg, 2000; Harasim, 2012). Pedagogically, LMSs are constructivist in nature and facilitate user-generated content as well as assist teachers in producing online content tailored to their respective classes in a collaborative and interactive environment (Aris et al., 2006; Dillenbourg, 2000; Harasim, 2012; Maikish, 2006; Mason & Rennie, 2008). According to Harasim (2012) LMSs are maturing in the sense that they can support new pedagogical approaches, incorporate scaffolds and facilitate knowledge building and collaborative learning. However, the availability of these constructivist online learning environments' features (e.g. forums and user-generated contents) does not usually encourage their effective use. This is due to a lack of educational frameworks in place, such as teachers' lack of understanding of the underlying pedagogies or theories, teachers' lack of knowledge on how to use them, or simply their choice not to use them in their classroom. In this study, the terminology e-learning equates to learning using a LMS (Moodle).

In today's climate, students entering university are no longer isolated learners (Palloff & Pratt, 2005). Their engagement with digital learning resources and online social networking are strong forces in education (Mason & Rennie, 2008). In fact, many of them have experienced social networking activities prior to entering the university and the tertiary classroom, which exposes them to the 'gift culture' on the web, whereby users contribute as much as they take (Mason & Rennie, 2008). These are often students who have grown up with technology in a world requiring them to be highly connected. Howe and Strauss (2000) call these students the Net Generation (or Millennials). Millennials prefer to learn through active participation, in teams with peers, and with information available when it is needed (Oblinger & Oblinger, 2005). Online collaborative learning, where learning and building knowledge are through active participation and collaboration, potentially suits Millennials as an alternative to traditional forms of higher education that emphasise the transmission of knowledge (Harasim, 2012; Tu, 2004).

With the limited number of studies on pre-service undergraduate teacher students in online collaborative learning environments (An et al., 2008; Bulu & Yildrim, 2008; Capdeferro & Romero, 2012; Pan, Lau & Lau, 2010; Graham & Misanchuk, 2004), and specifically in the Malaysian tertiary context (Ali, 2004; Embi, 2011; Goi & Ng, 2009; Hussin, 2004; Puteh & Hussin, 2007; Ronchaud et al., 2005), this study therefore aims to examine the incorporation of online collaborative learning in a pre-service teacher ICT education programme in a Malaysian tertiary classroom. The understanding of how to seamlessly incorporate online collaborative learning into ICT education in Malaysian tertiary classrooms can help broaden the existing knowledge of learning with technology (Jonassen, Peck, & Wilson, 1998). This can also lead to new educational opportunities through the use of advanced, Internet-based means of communication and sharing information (Mason & Rennie, 2008).

1.4 Statement of Research

Many universities both in Malaysia and abroad are enthusiastically embracing some sort of Content Management System or Virtual Learning Environment in teaching and learning, at either or both undergraduate and graduate level (Aris, et al., 2006; Embi, 2011; Goi & Ng, 2009; Raja Hussain, 2004; Kirkwood, 2009; Salleh, 2008). However, online teaching and learning requires a different teaching and learning strategy to that of traditional classrooms, in which the instructor has all the control (An et al., 2008). Simply providing students with online access to learning materials and replicating a classroom model of teacher-centred learning is inadequate (Garrison & Anderson, 2003, Mason & Rennie, 2008, Harasim, 2006). Research advocates that online learning should move towards a model of student-centred learning in which social collaboration among students is encouraged (Garrison & Anderson, 2003, Mason & Rennie, 2008, Harasim, 2006). The emphasis is on learning through an active social process rather than a passive process of knowledge acquisition, where knowledge is fostered through interactions and collaborations (Connell, 2006, Palloff & Pratt, 2005, Wenger, White & Smith, 2009). This study is therefore conducted to investigate the incorporation of online collaborative learning in a conventional Malaysian tertiary classroom, underpinned by a socio-cultural historical framework. This may lead to enhanced learning outcomes in terms of supporting students' cognitive, social and emotional developments in ICT education subjects. This study involved both face-to-face and online participation components of the interdisciplinary collaboration between subject major programmes (Chemistry, Physics, and Mathematics, with Computer Education). The activities were authentically designed according to the students' disciplines and applications in order to stimulate socially shared knowledge and expertise in ICT education subjects (Aris, 2001; Barab, Schatz & Scheckler, 2004; Häkkinen et al., 2004; Harasim, 2004).

1.5 Research Questions

This study aims to investigate the incorporation of online collaborative learning in conventional face-to-face tertiary classrooms, as a teaching and learning approach that may help in enhancing students' learning in ICT education. It examines tertiary students' perceptions of online collaborative learning, which is underpinned by a socio-cultural theoretical framework. The study also aims to examine how online collaborative learning enhances learning, through evaluating the students' and student group interactions, and their outcomes of learning. In order to achieve this aim, the following research questions are considered:

1. What is the nature and effects of pre-service teacher education students' interactions in online collaborative learning?
2. What is the nature of pre-service teacher education student group interactions in online collaborative learning?
3. How does online collaborative learning affect pre-service teacher education student learning?

1.6 Significance of the Study

The use of online learning in pre-service teacher education programmes has increased tremendously in Malaysian education institutions and specifically at the University of Technology Malaysia. The use of online learning in Malaysian education has been given appropriate emphasis as one of the instructional methods in higher education and other ICT initiatives in order to steer the country towards a high-income and knowledge-based society, as well as to achieve the status of a developed nation as stated in the Vision 2020. As for the University of Technology Malaysia, online learning is an integral part of the institutional teaching and learning policy. Lecturers are encouraged to utilise online learning in their classes and students' are encouraged to participate in online learning activities. This stimulates and enhances the online learning activities for students' learning in ICT education.

This study hopes to provide implications for the theory, understanding and practice of technology in Computer Science Education in Malaysia. Theoretically, the study is important, in that it may have the potential to help improve Computer Science Education classroom practices in Malaysia by addressing certain theoretical gaps in current online collaborative learning theory from socio-cultural historical perspectives. The consideration of technology-based learning (TBL) in Computer Science Education classrooms, contrary to traditional classroom lecture-based learning, is sensible in that it may contribute to existing literature on online learning practices through designing, implementing and evaluating the use of online collaborative learning for ICT education within the Malaysian context. The results and findings from the study, along with other previous related research on online collaborative learning environments and applications, may help others (e.g., educators, practitioners or researchers) to understand how to seamlessly integrate online collaborative learning into ICT education in Malaysian tertiary classrooms. This may in turn foster increased knowledge and confidence among lecturers or educators in Malaysian education institutions to adopt and apply the online learning applications into their classroom teaching and learning. Finally, the study is also considered strategically important for extending ICT education learning into further collaborative contexts with the consideration of different stakeholders, not merely for tertiary institutions but also for the larger community such as the industries, schools and other stakeholders who are seeking to develop ICT, multimedia and computing education knowledge and skills.

1.7 Overview of the Thesis

This chapter outlines the introduction to the thesis, setting out the reasons why this study is currently the focus of the researcher's attention and interest. Then, the thesis is organised into a further eight chapters. A brief outline of each chapter is described as follows:

Chapter 2: Literature Review presents a review of literature on online collaborative learning approaches. It begins with an overview of online learning in tertiary education, including its terminology, mode of delivery, technology, interaction and participation. This is followed by an overview of online collaborative learning approaches, including the context, models and pedagogies as well as online collaboration phases to inform the study. An overview of online collaborative learning within a community of learners and personalisation within the context of online collaborative learning are also presented.

Chapter 3: Theoretical Perspectives on Learning presents a review of literature on the theoretical references for understanding learning from the perspectives of 20th and 21st century learning theories. The socio-cultural historical theoretical frameworks that underpin the study are also presented. This chapter further provides a review of literature pertaining to the potential theoretical components for characterising the process of designing and supporting the implementation of online collaborative learning. The chapter concludes with a description of developing the online collaborative learning model used in the thesis.

Chapter 4: Research Methodology details the methodological approach adopted in the study followed by the research design and the methods chosen for data collection. It also provides a full description of data analysis and discuses the quality issues (validity and reliability) in the research. The chapter concludes with the ethical considerations of the research.

Chapter 5: Incorporating the Intervention describes the design and implementation of an online collaborative learning (OCL) intervention in an undergraduate ICT education course in a Malaysian tertiary classroom. It begins by describing the design phase of the OCL intervention followed by the development phase and the implementation phase.

Chapter 6: Online Class Findings presents results and a discussion of incorporating online collaborative learning environments at the classroom level. It begins with a description of the class, and the activities that students undertook during this research. This is followed by examining the effects of online group discussions for online collaborative learning based on the analyses of postings in participative, social, interactive and cognitive dimensions, and students' overall perceptions of their online collaborative learning.

Chapter 7: Online Groups' Findings presents results and a discussion examining the nine groups' participation in the online group discussions. It reports the findings, and analyses from each participating group followed by a summary of the findings.

Chapter 8: Evaluating the Intervention presents results and a discussion examining the students' perspectives regarding the intervention in facilitating and enhancing students' learning in the ICT education course.

Chapter 9: Discussions, Conclusion and Implications discuss the findings of the study and present a conclusion, and implications based on the research findings are put forward.

Chapter 2 Literature Review

2.1 Overview of the Research Framework for the Thesis

A research framework is a term commonly used by educational researchers to refer to a skeletal structure for guiding, supporting or enclosing their research investigations, and may "…come in various shapes and sizes; may fit loosely or tightly; are sometimes made explicit, sometimes not" (Eisenhart, 1991, p.202). According to Eisenhart (1991) a research framework can be distinguished as theoretical, conceptual or practical, and basically it is used to inform the three conceptual steps of conducting a research study. The first conceptual step is defining the research problem and question, which has been outlined in the previous chapter. The subsequent two conceptual steps involve the process of deciding the perspective of the study and data analysis which Eisenhart (1991) argues, as an explicit research framework, becomes crucial and is required to guide investigations at this and later stages (e.g., data collection and analysis). Thus, the research conceptual framework is presented in this chapter and is used to inform the following chapters as shown in the form of a flowchart in Figure 2.1 below. The rest of this chapter deals with the first part of the conceptual framework which is the literature review of the online collaborative learning approach used in this study. It begins with an overview of online learning in tertiary education including its terminology, mode of delivery, technology, interaction and participation. This is followed by an overview of an online collaborative learning approach including the context, models and pedagogies as well as online collaboration phases to inform the study. Next, the two subsequent sections are aimed at providing an overview of online collaborative learning within a community of learners, and personalisation contexts which are relevant to the study are also presented. The chapter ends with a summary.

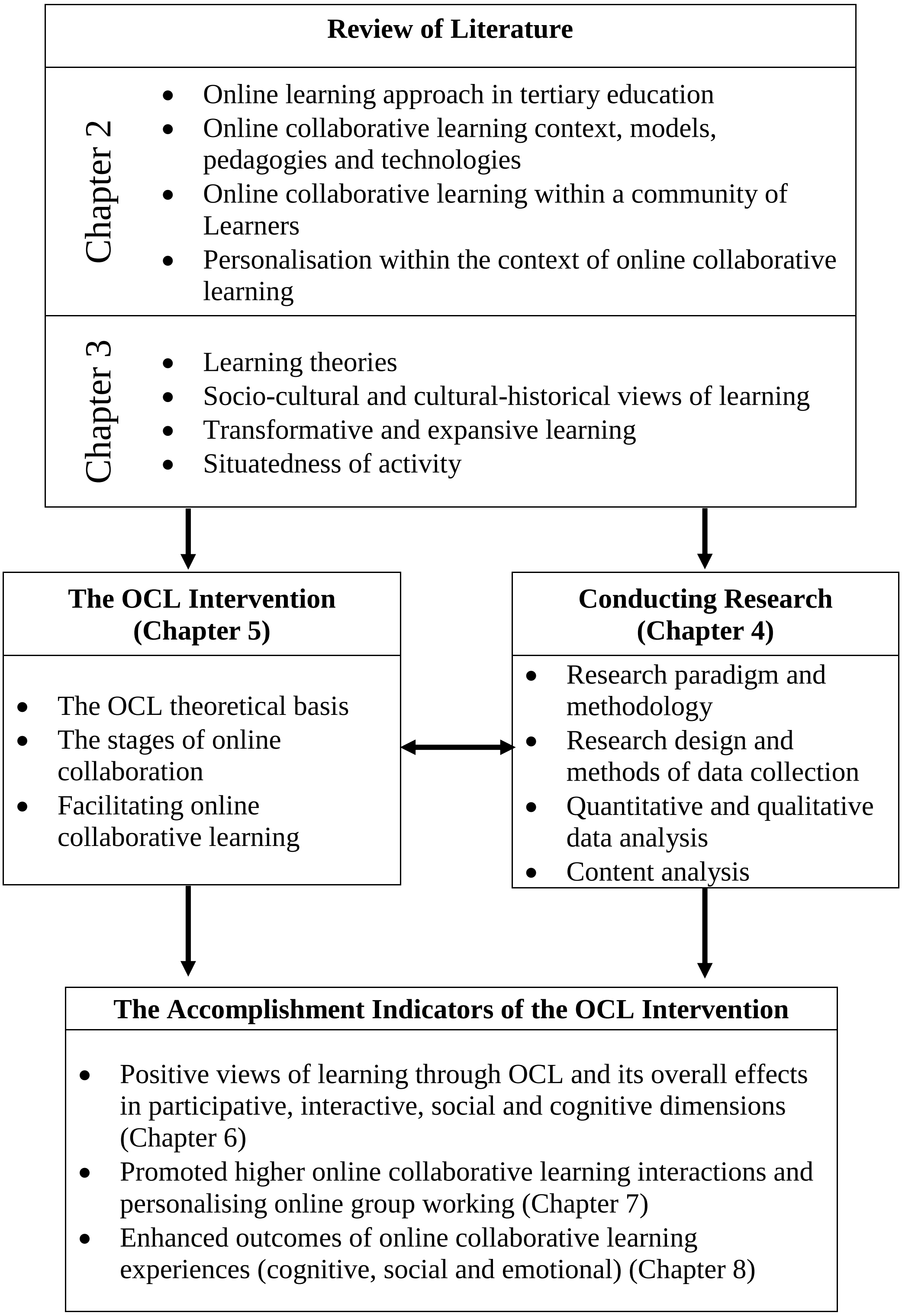


Figure 2.1: Conceptual framework for the thesis

2.2 Online Learning in Tertiary Education

Learning through online methods, specifically through the use of ICT, has increased formally and informally in schools, colleges and universities throughout the world (Kirkwood, 2009). This situation arises due to several factors. First, the coverage of Internet connectivity is widening, so permitting greater access to the Internet. To-date the number of Internet users that have Internet access has risen to 32.7 % of the world's population, or roughly 2.2 billion persons (Internetworldstats, 2012). This number shows that there has been a substantial growth in Internet usage each year which has led to extensive use of Internet applications (e.g. email and computer conferencing) for the exchange of information and knowledge in education (Kirkwood, 2009). Second, the emergence of web 2.0 as a result of the advancement of web technologies has had a great influence on learning online. In this regard, the use of open educational resources has flourished in that it provides educators with tools to create and share their works (Mason & Rennie, 2008). Wikis, e-books, blogs and social networking websites are some examples of open educational resources embedded in web 2.0 that are widely used in education. The engagement of students with open educational resources has led them to be exposed directly or indirectly online (Mason & Rennie, 2008). In fact, many of the students have become involved in the social networking activities that require them to communicate, interact and broadcast casual information and knowledge (Mason & Rennie, 2008). Kirkwood (2009) described the key motive of ICT (or e-learning) being adopted in tertiary education as to facilitate what he called 'pedagogical function(s)' (p.108). Pedagogical function, according to Kirkwood (2009) is an application, tool or system that can be used to execute one or more of the following functions:

- presentation – making materials and resources (text, data, sounds, still and moving images, etc.) available for students to refer to, either at predetermined times or 'on demand';
- interaction – enabling learners to actively engage with resources, to manipulate or interrogate information or data, and so on;
- dialogue – facilitating communication between teachers and learners or between peers for discussion, cooperation, collaboration, and so on;

- generative activity – enabling learners to record, create, assemble, store and retrieve items (text, data, images, etc.) in response to learning activities or assignments and to evidence their experiences and capabilities.

Garrison and Anderson (2003) have argued that new communication technologies that have been predominantly adopted in e-learning have the potential to change the nature of the teaching and learning transaction in higher education. The transformation brought by e-learning would extend conventional approaches in terms of its delivery efficiency or its entertainment value (Garrison & Anderson, 2003). However, there are critics of the use of technology in the teaching and learning transaction; they believe that technology (e.g. e-learning or online learning) can have a contextual influence on learning (Garrison & Anderson, 2003). The notion of learning through online methods has always been associated with distance education. This is particularly due to communication and interaction held at a distance. Nipper (1989) pointed out that online learning represents a fundamental shift in distance education, where it moves into the "third generation" of distance education (as cited in Littlejohn & Pegler, 2007). The teaching and learning transaction as it is now can be as rich as it would be in face-to-face, campus-based settings (Littlejohn & Pegler, 2007). Online learning provides an alternative to the shortcomings of distance education particularly from the aspect of face-to-face interactions, and provides many more opportunities for dialogue compared to print or broadcast-based distance education (Littlejohn & Pegler, 2007). Although learning in distance education could sometimes occur through online methods, the tools and scope of distance education is much wider than online learning. This situation is also applied to e-learning, where the term has been used to describe the online applications used in teaching and learning. While being fully aware of the variety and vagueness associated with the term online learning, the following section is devoted to providing a description for the term for the purposes of this study.

2.2.1 Terminology of Online Learning

There have been quite a number of articles regarding online learning linked to distance education or vice versa. There are also various terms that have been used to describe learning through online methods, including e-learning, networked learning, tele-learning, technology-enhanced learning, and asynchronous learning network. In the literature, the term “online learning” sometimes is used interchangeably with “e-learning”. However, both terms could denote quite different technologies and applications. For instance, e-learning applications could be also referred to as the use of stand-alone learning packages (e.g. CD-ROM) and interactive web-based packages (Moule, 2007). It is also noted that the use of e-learning applications can extend to distance learning that uses audio and video as well computer delivery modes (or Internet) (Martyn, 2003). This is slightly different with online learning, where learning activity is normally conducted through Computer-Mediated Communication (CMC) or web applications that are using the Internet to deliver or support learning activity (Littlejohn & Pegler, 2007). The difference in meaning that the terms hold is due to the fact that each research study has a different emphasis. Some researchers place emphasis on the content, some on communication, and some on technology (Mason & Rennie, 2004, as cited in Kirkwood, 2009).

The Joint Information System Committee (JISC) defines e-learning as “learning facilitated and supported through the use of information and communications technology” (JISC, 2004, p.10). That definition provides the closest description for this study, which is particularly interested in research that investigates the use of the Internet and networked technologies in facilitating and supporting learning. In this study, the term e-learning equates to learning using a LMS (Moodle).

Fundamentally, communications in online learning are the result of the use of applications in the form of asynchronous, synchronous, or combined forms (Goodyear et al., 2005; Gayol, 2010). Asynchronous online learning is a means of communication that allows interactions to occur at different times and at different locations. It usually involves tools such as electronic mail, bulletin boards and electronic forums. In contrast to asynchronous communication, synchronous communication enables multiple interactions to occur in real time at different locations. Synchronous tools are synonymous with the use of electronic chatting, for instance chat rooms, instant messaging, and Internet relay chat. The vast development of online learning technologies has led to the development of Learning Management Systems (LMS) also called Virtual Learning Environments (VLE), known as WebCT, BlackBoard and Moodle, that provide students with access to a wide and integrated range of online tools (e.g. asynchronous and synchronous) and services to support their learning activities (Kirkwood, 2009). Many tertiary institutions throughout the world now have LMS or VLE integrated in their conventional courses, which allows greater flexibility and autonomy for lecturers and students to engage with a greater variety of materials, experts and support tools (Coomey & Stephenson, 2001). The integration of LMS or VLE in conventional courses has led to a different proportion of online learning being implemented in the tertiary classroom.

2.2.2 Mode of Delivery

Based on the survey of tertiary courses conducted by The Sloan Consortium, online courses are those in which at least 80 % of the course content is delivered online (Sloan Consortium, 2008). Face-to-face instruction includes those courses in which 0 to 29 % of the content is delivered online; this category includes both traditional and web-facilitated courses. The remaining alternative, blended (sometimes called hybrid) instruction is defined as having between 30 % and 80 % of the course content delivered online. The following Figure 2.2 illustrates the proportion of online contents implemented in a course, as retrieved from the Sloan survey.

Proportion of Content Delivered Online	Type of Course	Typical Description
0%	Traditional	Course with no online technology used — content is delivered in writing or orally.
1 to 29%	Web Facilitated	Course that uses web-based technology to facilitate what is essentially a face-to-face course. May use a course management system (CMS) or web pages to post the syllabus and assignments.
30 to 79%	Blended/Hybrid	Course that blends online and face-to-face delivery. Substantial proportion of the content is delivered online, typically uses online discussions, and typically has a reduced number of face-to-face meetings.
80+%	Online	A course where most or all of the content is delivered online. Typically have no face-to-face meetings.

Figure 2.2: Online course classification (retrieved from Sloan Consortium, 2008)

While the purpose of this research is to study online learning in a conventional tertiary course, the mode of delivery for fully online would seem to not be very well-matched with the program and curriculum, because they are not designated specifically to serve that purpose. However, the blended or hybrid integration of online learning into a conventional tertiary course could serve well the purpose of this research. Furthermore, the integration of fully online learning has been criticised for its lack of human interactions (So & Brush, 2008). Martyn (2003) has indicated that research on blended learning conducted by Thompson learning comprised 128 students both from industry and university has resulted in the students performing tasks with 30 % more accuracy and 41% faster than the online-only group.

There also has been growing research into blended learning in tertiary institutions which provides students with the blend of learning activity experience (e.g. online and offline interaction) or media blend (e.g. webcast and print resources) (Littlejohn & Pegler, 2007; So & Brush, 2008). Littlejohn and Pegler (2007) assert that blended approaches could be used to overcome some of the issues, such as high drop-out rates with large online courses and specific difficulties in campus-based teaching. Further, they have stated that blended approaches are practical, especially when dealing with students with diverse educational backgrounds and different motivational reasons for study.

The reason for this study is to examine learning online collaboratively through a blended mode of delivery so as to investigate the benefits of a blended approach over fully online methods and to overcome the limitations of face-to-face in a traditional classroom. Although the purpose of adopting blended methods in this research is to minimise the problem of human contact when learning is conducted online, the issue of isolation when a student is working online alone has to be addressed through technology. Curtis and Lawson (2001) have argued that the medium (the technology) did influence students' interactions. When compared to traditional text-based distance education, online learning has the potential to reduce such isolation through the use of current technology. The following section discusses the benefits of such technology.

2.2.3 Blended Learning Contextual Influence

According to Sloan Consortium (2008) a blended or hybrid course in tertiary education is defined as having 30 % to 80 % of the course content delivered online wherein the face-to-face interactions is blended together with online interactions. Although, the frequency of face-to-face meeting can be predominantly in blended learning environments, a proportion of the content can be delivered online, typically through the use of online discussions which reduces the number of face-to-face meetings (Sloan, 2008). Several researchers (e.g. Garrison & Vaughan, 2008; Stacey & Gerbic, 2009; Caner, 2012) see 'blended learning' as "many different ways of combining pedagogical approaches in order to produce optimal learning outcomes" (Caner, 2012; p. 23). These pedagogical approaches are considered by taking into account a variety of the pros and cons of each individual approach in order to take advantage of both instructional modalities and minimise the disadvantages (Caner, 2012).

While the research focus of this study was to examine the nature and outcomes of online collaborative learning interactions between Chemistry, Physics and Mathematics Education students through their participation in an online learning environment (Moodle), there was a blended learning component to this the study. Although, students were participating and interacting online, they also could easily meet face-to-face because other parts of the course were structured predominantly face-to-face. Therefore, in addition to their online interactions, students were also abode to interact face-to-face offline and both types of interactions will have influenced their learning within this study.

2.2.4 Online Learning Technology

Due to advances in Internet and computer network technologies, distance learning has been able to move from an isolated, correspondence approach to one of collaborative and interactive learning through Computer-Mediated Communication (CMC). According to Harasim (2012), the online learning technologies could be categorised according to their roles in learning. The online learning technologies used in facilitating learning tasks are known as learning tool(s), while online learning technologies used in facilitating learning processes are known as learning environments (Harasim, 2012, p.98). The online learning technologies, or learning tools, are referred to as web tools that can facilitate or enable users to perform particular learning tasks in a learning activity. These tools can be web-generic specific (such as search engines, web browsers, email tools, productivity tools, graphic presentation tools, blogs, wikis, podcast-authoring tools, web-authoring tools, social networking tools and user-generated tools). Education-specific online learning tools could include websites or portals with resources aimed at teachers, students or particular disciplines. For instance, websites that provide teachers or students with lesson plans, assessments, inventories, support or tutoring, learning content, and related teaching and learning links. However, Harasim (2012) argues that online learning technologies used as learning tools do not provide suitable "spaces" for conducting and facilitating collaborative learning, even though these learning tools offer potential enhancements to collaborative discourse and group conversation. But they are not shared environments that are "able - in and of themselves - to support collaborative learning and knowledge building discourse" (p.98).

The central aspect of online collaborative learning and knowledge building is the need for a shared space for discourse and interaction which is provided by the online learning technologies referred to as a learning environment. The term "online learning environment" refers to a web-based system or software that is designed to "host or house the learning activities" (Harasim, 2012, p.98). Harasim (2012) describes an online learning environment as equal to a physical classroom, whereby users can construct knowledge and negotiate meaning through conversation and collaboration, and not just merely transmitting information or receiving communication. The experience gained is also considered as 'lived spaces' which facilitate both the perception of opportunities for acting as well as some means for acting (Allen & Otto, 1996, p.199). The content of an online learning environment for collaborative learning is generated by learners through the use of generic group-discussion applications such as forum, bulletin board or computer conferencing system. Forum discussion in an online learning environment can be organised by instructors to represent different topics and different group activities, with different group sizes that can be conducted at different times, whereby students can navigate at their own convenient time to read or contribute to the assigned work. Harasim (2012) argues that online learning technologies used as a learning environment have the potential to support highly effective learning and knowledge creation processes through various tools embedded within the environment which could provide learners with relevant information and content.

The research in this study is focused on a tertiary education context by which the tools and technology for the online learning environment are provided by the institution itself. As is the current trend, almost all universities throughout the world now have their own online learning system, and many have also shifted to a free and open online learning environment (e.g. Moodle). Currently, there are 38,670 active sites that have registered in the Moodle site, representing 204 countries. Most of the registered sites are educational institutions (Moodle, 2009). The increasing use of Moodle as an online learning environment in conventional tertiary institutions is of particular interest because it “promotes social constructionist pedagogy (collaboration, activities, critical reflection)” and is “suitable for supplementing face-to-face in-class teaching and learning” (Cornell, 2003). Moodle as an online learning environment also offers support for a customised learning environment informed by a pedagogical model and framework to scaffold for particular learning processes (Harasim, 2012).

2.2.5 Interaction in Online Learning

Interaction has been described as vitally important (Moore, 1989; Mason & Rennie, 2008) and fundamental to the effectiveness of e-learning and online learning (Mason & Rennie, 2008). As mentioned previously, the challenge of incorporating online learning revolves around learners being separated physically from other learners and teachers, hence affecting their interactions in an online learning environment (So & Brush, 2008). Some researchers believe that an online learning environment is lacking the traditional classroom’s vital interactivity such as social and emotional interactions (e.g. Downing et. al., 2007). Interaction is said to influence student retention and enhance student learning (Cornell & Martin, 1997; Daugherty & Funke, 1998; Chou, Peng & Chang, 2010) as well as influencing the success or failure of an online course (Miltiadou and Savenye, 2003; So & Brush; 2008). There are four types of interactions associated with online learning courses, namely learner-content, learner-instructor, learner-learner and learner-interface:

- **Learner-Content**

Learner-content interaction is the process whereby learners intellectually interact and access learning content in the online learning environment (Moore, 1989; Hillman, Willis and Gunawardena, 1994; Miltiadou & Savenye, 2003; Chou, Peng & Chang, 2010). The interaction of learner-content occurs in the learners' "heads" while attempting dialogue, constructing meaning, answering questions, or finding the appropriate place to integrate incoming information with existing schema (Collin & Berge, 1994). There are numerous learner-content interactions within an online learning course related to educational purposes such as lecturer notes, coursework and assignments, links for activities and resources, online quiz and self-evaluation, and individualised learning (Chou et al., 2010). Online discussions also provide opportunities for such interactions through discussion questions, debates, case studies and so forth, all providing situations where students could interact with the content (Harasim, 2012). One of the advantages of interaction within an online discussion is that a learner's cognitive reprocessing can be made public and possibly reviewed by a critical audience (Sutton, 2000). Sutton (2000) explains that when learners contribute to a discussion forum the learner must first translate the idea from the mind into writing before submitting to the discussion forum. The result of reprocessing, reformulation and reorganization of content could extend the learning and understanding in which learners support and possibly defend their learning (Sutton, 2000; Harasim, 2012).

- **Learner-Instructor**

Learner-instructor interactions within an online learning course are typified when the learner interacts with the instructor, whereby the instructor helps the learner to maintain his or her interaction with the topic; this includes motivating students to learn, assessing their progress, and providing appropriate support and encouragement (Moore, 1989; Hillman et al., 1994; Miltiadou & Savenye, 2003; Chou et al., 2010).

The instructor can interact with students by posting questions, moderating and keeping the discussion on track, redirecting, and providing feedback to the contributions posted within an online discussion (Harasim, 2012). Interactive learner-instructor functions are typically generic group discussion forums, social networking tools, and user-generated content (Harasim, 2012). Generally in online learning discussions, learners would not receive feedback until they have posted their contribution, due to the asynchronous nature of online discussion forums (Curtis & Lawson, 2000; Ingram & Hathorn, 2003). However, some students can tolerate the delay of online discussions so that they could have more time for reflection; others may find it to be frustrating and dissatisfying (Ingram & Hathorn, 2003; Suthers, et al., 2008). The responsive feedback of the instructor in learner-instructor interaction through the active role of the instructor and learner in the online discussion can help reduce dissatisfaction and the potential for learner isolation (Palloff & Pratt, 2005), whereby students can learn from feedback provided for a question they have posted and gain information from their peers for a particular posting.

- **Learner-Learner**

The learner-learner interaction occurs when students interact with themselves or peers in order to complete the assigned tasks, reflecting the learning process as well as monitoring their progress in learning activities within an online learning course (Moore, 1989; Hillman et al., 1994; Miltiadou & Savenye, 2003; Chou et al., 2010). The learner-learner interactions as in inter-learner discussions are valuable as a way of helping students to think through the content that has been presented and test it by exchanging it with their peers (Moore & Kearsley, 1996). There are numerous learner-learner interactions within an online learning course including providing access to alternative opinions and viewpoints, influence on motivation, anxiety and satisfaction, strengthening learning (Moallem, 2003; Palloff & Pratt, 2005), tracking utilities, e.g. login, learning materials, grade and learning dashboard (Chou et al., 2010), and creating a feeling of closeness between learners (Moallem, 2003; Palloff & Pratt, 2005; An, Kim, & Kim, 2008). Through online learning, students can interact with their peers via the discussion boards. This may be asynchronously via discussion boards, synchronously via live chat or possibly even private communication via email, telephone conversation and if geographically possible, through face-to-face meetings. However, simply providing access to an online forum does not guarantee successful online discussions (LaPointe, 2003; An, Kim, & Kim, 2008). Previous researchers have found that some students believe that online discussion is an obligation rather than an opportunity (LaPointe, 2003) and a lack of integration of discourse in forum discussion could lead to weak support for knowledge building and construction (Suthers, et al., 2008).

- **Learner-Interface**

The learner-interface interaction takes place between the learner and technology to access information and content within the online learning environment (Hillman et al., 1994; Sutton, 2000; Chou et al., 2010). According to Hillman et al., (1994), the students must be able to interact with the technology before they can successfully interact with the content, instructor, and other learners. The interface potentially creates a 'wall' that restricts students' access to the learning environment and only when they can successfully 'break the wall' and go through the interface of the learning environment can they begin navigating and learning the course content (Hillman et al., 1994; Sutton, 2000). Hillman et al. (1994) argue that "regardless of the proficiency level of the learner, an inability to interact successfully with the technology will inhibit his or her active involvement in the educational transaction" (p.34). Students with a lack of confidence towards using the online learning environment may be at a disadvantage and early exposure to the learning environment can be used to help the students overcome this problem (Moore & Thompson, 1997; Curtis & Lawson, 2000). Previous researchers (e.g. Miltiadou and Savenye, 2003) argue that if students are unsuccessful in their efforts to understand the interface, they may drop out of the online course and may not participate in the online learning activities.

2.2.6 Participation in Online Learning

Previous researchers (e.g. Hiltz & Turoff, 2002; Harasim, 2004; Skinner, 2009) have found many benefits of online learning discussions. However, online learning discussions have not always been successful. One factor that impacts the success of online learning is student participation. Participation as described by Hrastinski

(2009) through Webster's definition is ‘‘to have or take a part or share with others (in some activity, enterprise, etc.)" (p.78) and Wenger (1998) refers to participation as ‘‘a process of taking part and also to the relations with others that reflect this process" (p.79). According to Hrastinski (2009) participation in online learning is a complex process which includes the process of doing, talking, thinking, feeling and belonging; this involves action such as talking with someone, and connection, e.g., feeling that one is taking part. Some researchers argue that online participation drives online learning and affects learning online in very positive ways such as satisfaction and achievement (e.g. Poole, 2000; Zafeiriou, et al., 2001; Jung, et al., 2002; An et al., 2008; Hrastinski, 2009). Jung et al. (2002) further state that the facilitation and direction provided by instructors are factors that promote online participation. Furthermore, how online participation has been conceptualised in the literature has been examined by Hrastinski (2008) based on 2253 papers that included online learning participation from the Education Resources Information Center (ERIC). He found that there were six levels of ways in which online learning participation has been conceptualised in the literature. They are as follows:

- **Level 1: participation as accessing e-learning environments**

First level conceptions of online participation are characterised by participation being equal to the number of times a learner accesses an e-learning environment, e.g. a learner that accesses an e-learning environment many times is assumed to participate more actively than a learner who does not. Davies and Graff's (2005) study is an example of a first level conception of participation: ‘‘The students' access to the group area and their access to the communication areas were combined and used to represent the degree of participation" (p. 658).

- **Level 2: participation as writing**

Second level conceptions of online participation are characterised by participation being equal to writing, e.g. a learner that writes many messages or many words is assumed to participate more actively than a learner who does not. An example of this category of approach is provided by Lipponen, Rahikainen, Lallimo, and Hakkarainen (2003): ‘‘The definition of who is active and who is inactive in the class was made on the basis of percentile values; a participant was considered active if the participation rate (number of written notes) was in the upper quartile and inactive if it was in the lower quartile" (p. 492).

- **Level 3: participation as quality writing**

Third level conceptions of online participation are characterised by participation being equal to writing contributions of high quality, e.g. a learner that writes many contributions of high quality is assumed to participate more actively than a learner who does not. For example, Davidson-Shivers, Muilenburg, and Tanner (2001) conducted a qualitative analysis and identified nine types of substantive and non-substantive comments (e.g., responding and reacting statements).

- **Level 4: participation as writing and reading**

Fourth level conceptions of online participation are characterised by participation equalling writing and reading, e.g. a learner that writes and reads many messages is assumed to participate more actively than a learner who does not. A definition is provided by Lipponen et al. (2003), even though it should be noted that they chose not to examine the number of read messages in their study: ''One can define at least two forms of participation in CSCL (Computer-Supported Collaborative Learning) environments: writing notes and reading notes ('lurking')" (p. 492).

- **Level 5: participation as actual and perceived writing**

Fifth level conceptions of online participation are characterised by participation being the equal of actual and perceived writing, e.g. a learner that writes many messages that are perceived of importance is assumed to participate more actively than a learner who does not. This conception is explained by Mazzolini and Maddison (2003), when discussing the limitations through their "assumption that the participation rate by students, plus the length of discussion threads, might provide some simplistic measure of the quality of the discussion forum interactions" and "might not tally with students' perceptions of whether discussion forums are in practice a useful part of an online program" (p. 241).

- **Level 6: participation as taking part and joining in a dialogue**

Sixth level conceptions of online participation are characterised by participation being related to taking part and joining in a rewarding dialogue, e.g. a learner that feels that he or she is taking part and is part of a rewarding dialogue is assumed to participate more actively than a learner who does not. Vonderwell and Zachariah (2005) provide an example of a conception belonging to the sixth level: ‘‘in this article, the authors define participation as taking part and joining in a dialogue for engaged and active learning. Participation is more than the total number of student postings in a discussion forum.” (p. 214)

2.2.7 Section Summary

The section 2.2 described several useful points of online learning in tertiary education including its terminology, mode of delivery and online technologies. The section also discussed online learning in terms of its types of interaction and levels of participation which are crucial to consider in data analysis of students’ online forum transcripts. The types of online learning interaction and levels of participation are important in providing understanding of the types of students’ engagement in a particular online learning activity in this study.

2.3 Online Collaborative Learning Methods

The integration of collaborative methods in an online environment is not an easy task. There are several drawbacks to online collaborative methods in learning such as the “Free-rider effect” whereby one team member just leaves it to the others to complete the task (Kerr & Brunn, 1983), “Sucker effect” whereby a more active or capable member of a team discovers that (s)he is taken for a free ride by other team members (Kerr, 1983), “Status sensitivity” whereby active or capable members take charge and have an increasing impact on the team’s activity and products (Dembo & McAuliffe, 1987), and “Ganging up on the task” whereby team members collaborate with each other to get the whole task over as easily and as quickly as possible (Salomon & Globerson, 1987, p. 64). As such, learners are reluctant to work together in online groups and they are often dissatisfied with their collaborative work (Dirkx & Smith, 2003). These circumstances tell us that learners “struggle with the development of a sense of interdependence and inter-subjectivity within their online groups (Lushyn & Kennedy, 2000), but end up holding fast to subjective, individualistic conceptions of learning” (Dirkx & Smith, 2003, p. 134). Such aspects could become more aggravated in online environments (Dirkx & Smith, 2003) due to inadequacy of “emotional dynamics, which are often cited as being critical elements of the collaborative learning process” (An, Kim & Kim, 2008, p.68). Despite the above shortcomings, collaborative learning is widely reported positively in online learning literature and in fact is widely acknowledged as an effective instructional method in both traditional and distance learning environments research (Johnson & Johnson, 1996; So & Brush, 2008; Gayol, 2010).

2.3.1 Context of Online Collaborative Learning

The “heart and soul” of an online learning community is collaboration (Palloff & Pratt, 2005, p. 6). Learning through collaboration is often quoted as collaborative learning, which happens to be an umbrella term for an instructional strategy that emphasises active knowledge construction through mutual efforts by students. Usually in collaborative learning, students are expected to work together towards the whole knowledge construction process and learning, not only to appreciate their own work but also contributions of their peers (Panitz, 1996).

At present, there is a broad definition of collaborative learning in the literature and the broadest definition of collaborative learning as described by Dillenbourg (1999) is “a situation in which two or more people learn or attempt to learn something together” (p.1). Collaborative learning, more or less is a philosophy of interaction of how students actually work together, rather than how teachers wish they will work together (Panitz, 1996).

Collaborative learning represents a significant shift away from the typical teacher-centered approach. The underlying concept for collaborative learning is firmly grounded in socio-constructivism (Bruner, 1996; Piaget, 1973; Dewey, 1916), socio-cultural (Vygotsky, 1978; Rogoff, 1990; Wertsch, 1991), and distributed cognition and situated learning (Brown, Collins & Duguid, 1989; Lave & Wenger, 1991), where social interactions are emphasised. The context of social interactions has shifted from merely a background for individual activity to a focus of research, where it has become a unit of analysis (Dillenbourg, Baker, Blaye, & O'Malley, 1996). Johnson and Johnson (1996, p.787) claim that collaborative learning derives its roots from Vygotsky (1978). The foundation of learning is interpersonal where learning originates from dialogue and interactions with other students and, sometimes, teachers (Johnson & Johnson, 1996). Although Johnson and Johnson (1996) state that much of the work using collaborative methods are derived from traditional classroom settings, collaborative methods are favourable for online learning communities as well (Ashcraft & Treadwell, 2008). Research on distance education reveals that collaborative learning through its electronic technology has advantages of interactions and communications over face-to-face collaboration. Through online settings, collaborative interactions among students are becoming easier to manage and monitor. Students are able to read others' responses and at the same time participate by adding their own opinions and ideas to discuss and solve problems (Ingram & Hathorn, 2003). In campus-based collaborative settings, students have access to face-to-face interaction with their lecturer in lecture halls and in individual consultations. However, the numbers of students that a lecturer can accommodate at one time is small and limited and therefore inhibits further development of collaborative relationships between students and teachers. Online learning, by contrast, offers greater convenience for collaboration to take place. However, Curtis and Lawson (2001) point out that the ease of interactions initiated by students through online technologies occurs at the expense of efficiency and also can be time-consuming.

2.3.2 Collaboration versus Cooperation

It is important to distinguish between collaboration and cooperation in educational settings so that proper methods and measurement can be applied. It is not surprising to find that these terms are often used interchangeably. Johnson and Johnson (1996) point out that the substantial ambiguity of collaborative learning that resulted from the vagueness of definition of the nature of collaborative learning has led to the terms of cooperative learning and collaborative learning being used interchangeably and synonymously. Ashcraft and Treadwell (2008) assert that researchers should not be confused with the conflation of the terms collaborative and cooperative, although cooperative interaction can occur in collaborative learning; the interaction is not considered an important characteristic. Students in cooperative learning settings as indicated by Dillenbourg, et al. (1996) work together towards project completion by splitting the workload among team members and solve the problem independently. While in collaborative learning settings, students work together towards the formulation of a joint solution to solve problems by contributing and building on each other's ideas, along with sharing the workload. The significant characteristic of collaborative learning as noted by Ashcraft and Treadwell (2008) is the development of ideas through interactions with other students. In collaborative learning, students engage in the construction of large projects compared with cooperative learning where students engage on a portion of the project. Johnson and Johnson (1996) indicate that "collaborative learning has historically been much less structured and more student directed than cooperative learning, with only vague directions given to teachers about its use" (p. 788).

2.3.3 Online Collaborative Learning Models

Much of the research on collaborative learning has focused on traditional classrooms in which the spotlight is on face-to-face learning in small groups. Although there are efforts to extend the application of traditional collaborative learning into online learning environments, in reality, most online collaborative learning activities are usually demoted to discussion forum conversations, in which students are merely posting dialogues about their weekly readings, which limit the extent of actual collaboration (An et al., 2008). Educators also often instruct students to form small groups, hoping that students will collaborate; but this is not always the case. Simply assigning students to groups does not guarantee that an appropriate collaborative learning situation would occur (Tu, 2004). However, Harasim (2002) argues that collaborative learning facilitates "higher developmental levels in learners than accomplished by the same individuals working alone" (p.181). She further points out that "conversation, argument, and multiple perspectives that arise in groups contribute to such cognitive processes as verbalization, cognitive restructuring, and conflict resolution" and there is also "reduction of uncertainty as learners find their way through complex activities and increased engagement with the learning process as a result of peer interaction" (p.188). Harasim examined Bruffee's work and found that "knowledge is a construct of the community's form of discourse, maintained by local consensus and subject to endless conversation" where "learning is a social, negotiated, consensual process" (Harasim, 2002, p.181). Harasim's study of collaborative learning online (Harasim 1999) was initially created for the analysis of online courses, but was later modified for the study of the Global Authors Network (GAN) and the Global Educators Network (GEN). It outlines three main phases for intellectual development:

- **Idea generating**

In this stage multiple unconnected ideas are presented by the group. It implies divergent thinking, brainstorming, verbalization and thus sharing of ideas and positions. The idea generating phase includes both the quantity and quality of messages that are considered indicators such as introducing ideas and understandings, new ideas, or beginnings of threads or new topics.

- **Idea linking**

The group starts linking or clustering ideas. It involves evidence of conceptual change, intellectual progress and the beginning of convergence as new or different ideas become clarified and identified and clustered into various positions. The idea linking phase includes numbers of reply messages; numbers of references to previous messages; numbers of name referencing; and the qualitative nature of the discourse.

- **Intellectual convergence**

The group coalesces around common ideas. It is typically reflected in shared understanding (including agreeing to disagree) and is especially evident in co-production, whether a theory, a publication, an assignment, a work of art, or some similar output. The intellectual convergence phase includes the number of substantive contributions, e.g., messages that compare, structure, extend, and synthesize ideas; the number of conclusive supported position statements; and online communications characterised by some joint initiatives, e.g. joint writing or presentations or co-production of an artifact.

Meanwhile, the study conducted by Curtis and Lawson (2001) revealed evidence for collaboration in online interactions and categorised the most common as planning, contributing, and seeking input, while other common events were initiating activities, providing feedback, and sharing knowledge. The study also found that few students challenge others or attempt to explain or elaborate and suggested using debates and modelling appropriate ways to challenge others. The study of social construction by Gunawardena, Lowe and Anderson (1997) examined the quality of learning and social knowledge construction that occurred during debate and discussion through online courses. The debate was held in an online asynchronous discussion environment. A total of 554 scholars from around the world participated in a week-long debate over the role and importance of "interaction" in distance learning. The focus of the analysis was to examine knowledge construction within the group through interaction among its participants and individual participants' change of understanding through creating new personal constructions of knowledge as a result of interactions within the group. Computer transcripts from the online environment were collected and a content analysis was conducted based on the type of cognitive activities participants engaged in (questioning, clarifying, negotiating, synthesizing, etc.); the types of arguments participants advanced; the resources participants leveraged in exploring their differences and negotiating meaning (e.g., reports of personal experience, literature references, data, etc.); and evidence of changes in understanding or the creation of new understanding (e.g. knowledge construction) as a result of group interactions. The study revealed the process and characteristics of knowledge construction within the group as five phases of development which include sharing or comparing of information; the discovery and exploration of dissonance or inconsistency among ideas, concepts or statements; negotiation of meaning or co-construction of knowledge; testing and modification of synthesis or co-construction; and agreement statement(s) or applications of newly constructed meaning. This five-stage process of development as argued by the authors is necessary in order to generate new knowledge and understanding within an online group discussion. They also argued that the structure of the online debate might both hinder and help participants during the learning process. The five-stage of knowledge construction model by Gunawardena et al. (1997) was focused on the social interactions of online learning in constructing knowledge while Harasim's intellectual model was focused on social and intellectual conceptual change (Harasim, 2002). However, the intellectual model by

Harasim (2002) resonates with the five-stage model by Gunawardena et al. (1997) in terms of idea organization that mirrors the sharing or comparing of information and the discovery and exploration of dissonance or inconsistency among ideas, concepts or statements followed by idea linking mirrors is similar to negotiation of meaning or co-construction of knowledge, and intellectual convergence is comparable to testing and modification of synthesis or co-construction; and agreement statement(s) or applications of newly constructed meaning.

Social presence has been described as the major vehicle of social learning and is required to strengthen and encourage online social interaction (Tu, 2000). A previous definition which interpreted social presence as an attribute of the medium itself, now recognizes that different users will perceive different amounts of social presence and that this amount will vary depending on the type of medium (Gunawardena, 1995). Tu (2000) states that an ideal level of social presence, encouraged by increases in the level of interaction and social presence, should be viewed as a subjective quality, since it relies on both the characteristics of the medium and the user's perception and it "may actually be taught or cultured" (p. 10). Intimacy and immediacy are two concepts that are related to social presence. Intimacy includes physical proximity, eye contact, and topics of conversation, while immediacy includes vocal expressiveness, overall body movements, eye contact and smiling, spending time with someone, being relaxed, the ability to be expressive, and to convey feelings and emotions (Tu, 2000). In the online environment, which is often text based, intimacy and immediacy are often difficult to achieve in the traditional manner mentioned above. Other forms of intimacy and immediacy must therefore be promoted. Some examples of interactions that are said to increase social presence include use of humour, addressing students by name, praising students' work and contributions, use of personal examples, anecdotes and self-disclosures, uses of we, our, us, phatics (communications such as inquiries about one's health, remarks about the weather, comments about trivial matters), expressions of emotions, feelings and mood, use of emoticons and paralanguage, complimenting, acknowledging, expressions of appreciation, self-introductions, greetings and closures, informal versus formal messages, short versus long messages, the use of slang, social exchanges, and promotion of online etiquette (Rourke et al., 2001).

2.3.4 Online Collaborative Learning Pedagogies

In online collaborative learning pedagogy, the instructor plays a key and essential role, a role that is neither "guide on the side" nor "sage on the stage" (Harasim, 2012, p. 94). Rather, the role of the lecturer is to engage students in the collaborative learning activities associated with building and acculturating them into the discourse of the knowledge community. The instructor is a facilitator and representative of the knowledge community, and as such introduces the students to the appropriate activities as well as their application within their discipline. Figure 2.3 illustrates the processes of online collaborative learning (OCL) pedagogy in group discussion from Idea Generating to Intellectual Convergence that approximates the knowledge community.

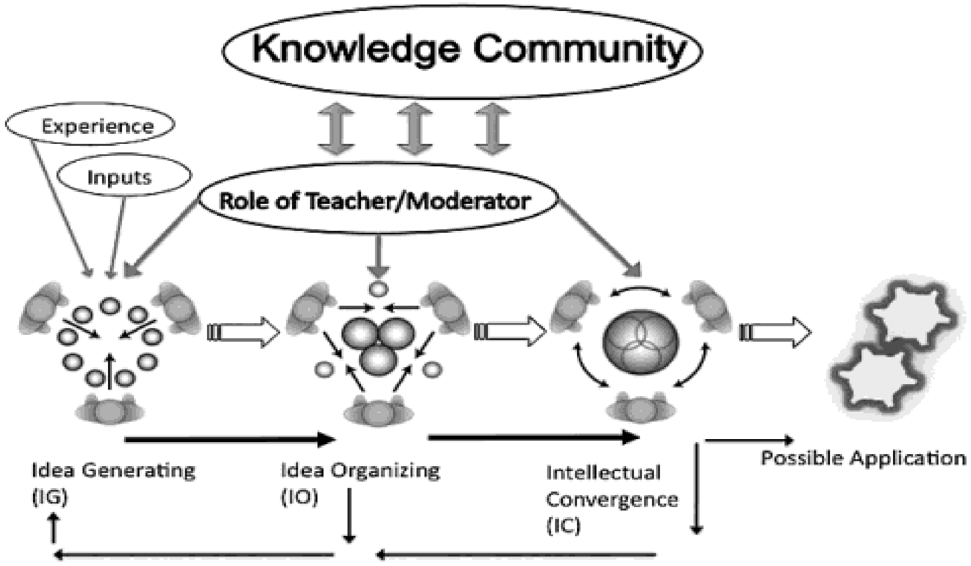


Figure 2.3: The OCL pedagogy adapted from Harasim (2004, 2012)

In Idea Generating (IG), students engage in a group discussion on a specific topic or knowledge problem assigned by the lecturer through presenting their views in a discussion forum. In this process, students articulate their views and generate a range of divergent perspectives on the topic. The instructor establishes the processes of discussion and the knowledge problem to be discussed. Students interact with one another in the Idea Organizing (IO) phase and confront new ideas through their engagement in the activities. Information gained from one another in the activities enriches students' awareness and appreciation on the topic. Students begin to organise, analyse and sort out some ideas through a negotiation process. In this process, the instructor's information on the topic is used as a framework of reference which may be applied by the students to deepen their understanding of the topic. The process of idea organizing is characterised by references to ideas, applying analytical concepts and organizing common ideas into more refined statements. The Intellectual Convergence (IC) is accomplished through informed discussion, particularly when students reach shared understanding by coming into a position on the topic or a resolution to the knowledge problem. Intellectual convergence is typically characterised by agreement or disagreement or in some cases reaching a consensus. It also may be reflected in a co-produced final product (e.g. group report) or summary of the discussion. When a product is the goal (e.g. project or assignment), the intellectual processes aim toward a consensus on the shape of the final product. Finally, the ultimate application may be the outcome of the discussions in terms of the decisions or strategies of the group for real-world applications; it may also trigger further consideration by recycling the processes of idea generating and organizing as shown in Figure 2.4 (Harasim, 2012, p. 97).

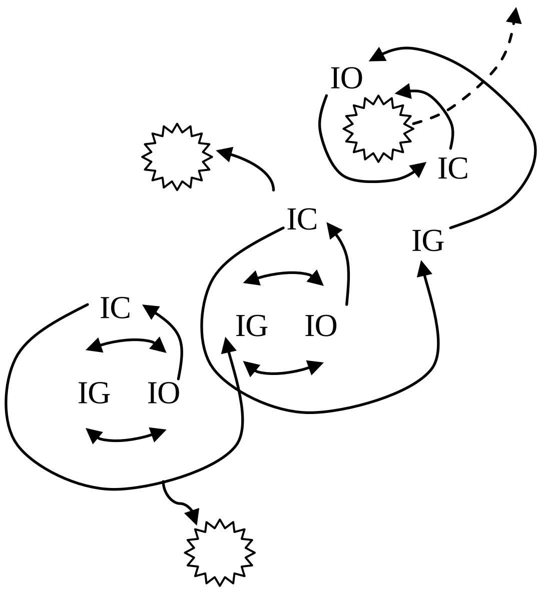


Figure 2.4: The OCL spirals adapted from Harasim (2012)

The incorporation of online collaborative learning into student work takes into consideration the process of enculturation to online group discussion activities that students may experience as they meet new perspectives on a particular knowledge problem and learn to apply new analytical processes to problem solving. Through their interactions with peers and other students, and the instructor and learning resources, the students may come to a new and deeper understanding of the knowledge problem and eventually learn to address it in the manner of the knowledge community.

2.3.5 The Phases of Online Collaboration

The phases of online collaboration as indicated by Palloff and Pratt (2005) which is of value to this study are:

- **Set the stage**

Setting the stage means the educator needs to provide students with a clear explanation of the importance of collaborative work and clear guidelines of task completion. This is needed to prepare students prior to the engagement in collaborative activity. The preparation includes presenting the agenda and instructions for the activity and creating the environment.

- **Create the environment**

The second stage of online collaboration involves the creation of an environment or shared learning space where students can interact and connect to one another for their online collaborative activities. It has been argued that a Learning Management System (LMS, e.g. Moodle) could be used to facilitate OCL activities (Maikish, 2006), and OCL implementation could be made easier by incorporating OCL into the LMS (Harasim, 2012; Pallof & Prat, 2005).

- **Model the process**

By modelling the process, the instructor allows the students to take charge of their learning process and allows them to construct their own learning as they progress through the collaborative activities. This is important because successful collaborative activity requires an instructor to stay present and involved, in order to ensure that students will engage with one another in a meaningful way (Pallof & Pratt, 2005).

- **Guide the process**

The instructor has a responsibility to guide the process once collaborative activity begins by facilitating the activity towards meeting the learning outcomes. Letting students take charge of their learning process and allowing them to construct their own learning will give them a sense of confidence to move forward. An instructor's role in the process is as a facilitator that allows students to create their own learning as they move through the phases of collaborative activity.

- **Evaluate the process**

The final stage of online collaboration is the evaluation and reflection of online collaborative learning activities which requires the instructor to monitor and gain an insight into whether the learning goals of the specific activity are met and encourage students to reflect on the learning experience. There are two ways of evaluating collaborative activity. First, by evaluating student perceptions of the value of the collaborative activity they have experienced, and second, the evaluation of the learning generated by the activity (Pallof & Pratt, 2005).

2.3.6 Section Summary

The section 2.3 illustrated several important aspects of online collaborative learning methods such as its context, concept, model and pedagogy as well as the phases of online collaboration which are crucial for understanding prior to the development of intervention of online collaborative learning in Chapter 5. The model of online collaborative learning (e.g. idea generating, idea organizing & intellectual convergence) within the framework of knowledge community by Harasim (2004) is considered for the development of the intervention (see Chapter 5) situated in a Malaysian tertiary classroom that aimed to facilitate the interdisciplinary online collaboration and interactions between students from Chemistry, Physics and Mathematics Education majors and to enhance their learning.

2.4 Online Collaborative learning within a Community of Learners

It is agreed among social learning researchers that today knowledge is no longer perceived as the outcome of the individual mind but as a collective outcome based on the contribution of different individuals in the discourse, in the social relationships that bind them, in the physical artefacts that they use and produce, and the theories, models and methods they use to produce them (Jonassen & Land, 2000 as cited in Hrastinski 2008). Socio-cultural perspectives of learning advocate the formation of learning communities through participation in the social groups that are focused on a common outcome (Lave & Wenger, 1991). Although there are various definitions of a community of learners, a learning community is usually guided by two important elements: (a) tasks to be fulfilled by the community, and (b) goals to be achieved through the collaboration and interactions within the community (Lave & Wenger, 1991; Rogoff, 2002; Reynolds & Hodgson, 2005). It is considered that through the tasks and goals, the community members can construct their knowledge. In other words, a community of learners can also be seen as an advanced interpretation of collaborative design where students take joint responsibility for planning, implementing and evaluating the design, content and direction of the course (Reynolds & Hodgson, 2005). For educators, the values of collaborative learning within a community of learners are seen as offering an alternative to more individualistic approaches, and these values are reflected in group work. A key benefit of participating in the learning community is that a learner has the opportunity to take increasing responsibility for learning and autonomy in learning. The teacher's role is supportive and they act more as a facilitator and coordinator to structure and guide the overall direction for students' learning. Students, on the other hand, increasingly learn to participate and manage their own learning and involvement and provide some leadership at times, demonstrating increasing confidence and expertise as they progress from the periphery towards the centre of the community (Lave & Wenger, 1991). By participating in online collaborative learning environments, students enter a large group that could be viewed as a community of learners. This is crucial as learning is not viewed as the mere acquisition of concepts or skills but as the appropriation of the culture specific to the target community (Häkkinen et al., 2004).

2.5 Personalisation within the Context of Online Collaborative Learning

In the early years, personalisation was a term widely used in trade relations and marketing (Vesanen, 2005). Nowadays, personalisation is widely used in areas such as education, technology, computer science, health care, broadcasting, and the like (Adomavicius & Tuzhilin, 2005; Vesanen, 2005; West-Burnham & Coates, 2005). In the literature there are several descriptions of the concept of personalisation as expressed by industry practitioners and academic researchers (Adomavicius & Tuzhilin, 2005). However, most of the practitioners' definitions linked the use of technology with e-commerce. For instance, the Personalisation Consortium defines personalisation as:

> Personalisation is the use of technology and customer information to tailor electronic commerce interaction between a business and each individual customer. Using information either previously obtained or provided in real-time about a customer, the exchange between the parties is altered to fit that customer's stated needs as well as needs perceived by the business based on the available customer information (Dyché, 2002, p.47).

Nonetheless, scholars use several different terms of personalisation in relation to teaching and learning. Personalisation particularly related to an online learning environment refers to an adaptation of learning approaches to educational content, presentation and navigation, and learning support and services that will match and accommodate learners' specifications for learning (Magoulas, Papanikolaou, & Grigoriadou, 2003; Mbendera, Kanjo, & Sun, 2010; West-Burnham & Coates, 2005). In a personalised learning environment, there is no single instructional strategy that is best for all students. Instead, appropriate pedagogical strategies should be designed to achieve learning goals and to accommodate students' individual differences (Magoulas et al., 2003). Generally, personalizing an online collaborative learning environment in this study refers to a process of designing and implementing online collaborative activities for different groups of students in order to achieve particular shared learning goals. The main goal of personalizing online collaborative learning is to help students find information that interests them, which can considerably improve their online learning experience.

2.5.1 Approaches to Personalisation

Providing educational information and educational resources in a personalised manner must take into account several factors of online learning personalisation such as (1) providing flexible learning outcomes which are based on prior knowledge of learners and structure; (2) meeting the needs of individual learning styles where personalisation should take into account how the learner perceives the information and manages it; (3) keeping the learner engaged; and (4) enabling the learner to use their time well (Lan, 2009; Mbendera et al., 2010). A primary goal of personalisation approaches is to provide the learners with a personalised learning strategy (Nelson, 2008; Lan, 2009). Lan (2009) lists five personalisation approaches which may be included in the online learning environment. They are: personalised user interface, personalised learning resource, personalised learning activities, personalised guidance, and personalised communication.

- **Personalised User Interface**

In personalised user interface, different interfaces are provided to different users including teachers and students. It is a personalisation of a work space; students are allowed to customize their own learning environments. Rossi, Schwabe and Guimarães (2001) distinguish applications interfaces in an online learning environment in which different user roles have different access rights or authorizations. In other words, it means that different information and access to educational materials are available to various users including teachers and students. The use of personalisation of user interface is to facilitate navigation and increase speed of access but reduce the time required to find useful information (Lan, 2009; Rossi et al., 2001).

- **Personalised learning resources**

In personalised learning resources, learning material and resources are filtered to the student based on certain characteristics of the filter rules. Nonetheless, teachers or instructors can propose different resources to different students according to their situation, based on their existing knowledge, and students can subscribe to various resources that they find interesting (Lan, 2009). In personalised learning resources, a student can have a learning resource path which is based on current knowledge and the abilities of the student. This approach is successfully applied in distance learning. Approaches to personalised learning resources are guided by existing knowledge of the student and the objectives to be achieved as a result of the course. Content of the course is chosen appropriate to the individual learner. Chen, Lee and Chen (2005) state personalisation of learning resources is based on the course material difficulty and learner ability, because these variables reflect learner interest and learning results.

- **Personalised learning activities**

In personalised learning activities, students can have different learning processes and progress depending on their learning status. The learning activities are different and interactive which describes how the students perceive information (Graf, Kinshuk, & Liu, 2008; Lan, 2009). The incorporation of personalised learning activities into the online course could lead to the facilitation of the learning process (Graf et al., 2008). The idea of this approach consists of the personalisation of learning content based on the learning style of the students, because students have different learning styles, preferentially focusing on different types of information and tending to operate on perceived information in different ways (Felder & Brent, 2005; Magoulas et al., 2003). Incorporating personalised learning activities for different students can improve learning performance, increase the rate of perception of the educational material, and help students become self-directed (Felder & Brent, 2005; Lan, 2009; Magoulas et al., 2003; Mbendera et al., 2010).

- **Personalised guidance**

In personalised guidance, the online learning environment which includes a personalised guidance approach makes personalised recommendations for learning study materials. Including personalised guidance in an online course facilitates the search of relevant learning materials, and makes learning more comfortable, giving the students the materials to meet their personal needs (DuroviC & Ivanovic, 2010; Lan, 2009). The learning materials can be presented by any form of text, articles, audio and video which are based on the technical level of difficulty of the learning object (DuroviC & Ivanovic, 2010), namely:

- Basic level in which information presented is based on fundamental principles or concepts. It is introduction material. It is the level for novice learners.

- Intermediate level in which information presented is based on more difficult concepts. Understanding this information requires more advanced knowledge and skills in the topic of interest. It is the level for intermediate learners.

- Advanced level in which information presented is devoted to highly advanced concepts and new techniques in respect of the learner's topic of interest. The difficulty level of this material requires a well-rounded knowledge, ability, and experience in dealing with the topic's content. It is the level for advanced learners.

- **Personalised communication**

In personalised communication, the collaborative learning group is an important form of learning and offers teachers or students that have similar interests and are knowledgeable in certain areas the opportunity for knowledge sharing (Bahrami, Abedi, & Daemi, 2007; Lan, 2009). The use of personalised communication in the online learning environment is based on the fact that communication plays an important role in the learning process (Bahrami et al., 2007; West-Burnham & Coates, 2005). The process of knowing consists of sharing, thinking and learning components and through a process of communication and sharing knowledge students can reaching an understanding of the studied learning materials (Harasim, 2012; Lan, 2009; West-Burnham & Coates, 2005). Through the affordances of an online learning environment, communication processes can be carried out through messaging, chat rooms, group discussions, conferencing and audio or video applications (Harasim, 2012; Lan, 2009). Incorporating personalised communication into the online learning environment provides students with a focus on the best interests and issues regarding communication and knowledge sharing (Lan, 2009).

2.5.2 Approaches to Learning

Approaches to learning are sometimes referred to as "learning styles", "cognitive styles", "learning strategies", "learning patterns" or "study orchestrations" (Case & Marshall, 2009; Entwistle, 1991). The term approaches to learning refers to "the specific form of study activity provoked by a student's perception of a task instruction on a particular occasion" (Entwistle, 1991, p.201). It used to be that the same term was used in relation to memory processes but has been changed to include not only the process but also the intention (Entwistle, 1991). The learning process is basically what individual students undertake in order to gain their personalised learning. Some of the previous research has outlined approaches to the learning process (Basharina, 2004; Case & Marshall, 2009; Entwistle, 2000) that are relevant to personalisation. According to Entwistle (1998, 2000), the approaches to learning derived from an intention to obtain the highest possible grades and relied on organised studying and an awareness of assessment demand. Table 2.1 shows three types of approaches to learning based on process and intention.

Table 2.1: Approaches to Learning adopted from Entwistle (1998, 2004)

Surface Approach (Reproducing)	Strategic Approach (Organizing)	Deep Approach (Transforming)
Intention: to cope with content and task set	Intention: to excel on assessed work	Intention: to understand material for oneself
Studying without reflecting on purpose or strategy	Alertness to assessment requirement and criteria	Showing an active interest in course content
Seeing the course as unrelated bits of knowledge	Gearing work to perceive preferences of lecturers	Relating ideas to previous knowledge and experience
Difficulty in making sense of ideas presented	Putting consistent effort into studying	Looking for patterns and underlying principles
Memorising facts and procedures routinely	Ensuring right conditions and materials for studying	Adopting a cautious, critical stance
Feeling undue pressure and worry about work	Managing time and effort to maximise grade	Checking evidence and relating conclusions

More recent research especially related to online learning environments shows that the pedagogical approaches also influence the individual student's learning process. Factors such as individual differences (Magoulas et al., 2003; West-Burnham & Coates, 2005), motivation (West-Burnham & Coates, 2005), teaching and learning strategies (Case & Marshall, 2009; Magoulas et al., 2003), adjustment to the learning environment (Garrison & Anderson, 2003) and collaborative support from tutors or peers (Harasim, 2012) are seen as essential during the personalised learning process. Although a personalised learning process and outcomes could be viewed as two different occurrences in learning, both are interrelated and intertwined during the knowledge construction process which is closely related to the individual student's personalised approaches to learning (Doug, 2000; Entwistle, 2000; Meyer, 1998; Nelson, 2008; West-Burnham & Coates, 2005).

2.5.3 Section Summary

The section 2.5 discussed several useful ideas of approaches to personalisation and approaches to learning within the context of online collaboration prior to the development of the intervention for the students' group interactions. The approaches to personalizing online collaboration and approaches to learning are important in order to provide understanding for customization of the design of online collaboration that could be considered for students' group interactions in accomplishing the OCL shared goal in a particular online learning activity in this study.

2.6 Chapter Summary

The literature reviewed above has shown that the use of an online approach in learning, particularly in tertiary education, has increased tremendously. Although there are several approaches to online learning, with blended or hybrid mostly adopted by tertiary institutions, there is no direct link to specific integration of online collaborative learning in the tertiary classroom. Thus, online collaborative learning models, pedagogies and technologies help inform the researcher of the framework of the design and implementation of an online collaborative learning approach in a Malaysian tertiary classroom context (as well as help to fulfil one of the Malaysian government aims to optimize e-learning as one of the instructional methods in Malaysian higher education (MOHE, 2006), focusing on learners working together and supporting one another to create, invent and explore ways to innovate and solve knowledge problems rather than reciting the right answer (Harasim, 2012). An OCL approach can also potentially contribute to the development of an online learning community as well as support personalisation of online learning approaches and an online learning environment. The current study, therefore, strives to explore the potential of OCL approach by inserting it into the practices of collaborative Malaysian undergraduate students through the model of online collaborative learning (Idea Generating, Idea Organizing & Intellectual Convergence) within the framework of knowledge community by Harasim (2004) that aims to facilitate the interdisciplinary online collaboration and interactions between students from Chemistry, Physics and Mathematics Education majors and to enhance their learning in the Malaysian socio-cultural context.

The next chapter provides the theoretical perspectives on learning for this study which concludes with the socio-cultural historical theoretical framework that underpins the study.

Chapter 3 Theoretical Perspectives on Learning

3.1 Introduction

The previous chapter presented the first part of the literature review in this study. This chapter presents the second part of the literature review that provides the theoretical references for understanding learning from the perspective of the learning theories of the 20th and 21st centuries. The socio-cultural historical theoretical framework which underpins the study is also presented. The theoretical framework of this study suggests that the incorporation of online collaborative learning as a particular case of socio-cultural views may help students' learning. This could lead to enhanced learning outcomes in terms of developing and supporting students' cognitive, social and emotional learning of their ICT education subject. This chapter provides a review of literature pertaining to theoretical perspectives on learning and theoretical components for characterising the process of designing and supporting the implementation of online collaborative learning (OCL). The chapter has four major sections: theories of learning (Section 3.2), socio-cultural views of learning (Section 3.3), learning from the Activity Theory point of view (Section 3.4), and the online collaborative learning model used in this thesis (Section 3.5). The chapter ends with a summary.

3.2 Theories of Learning

The aim of a learning theory (or theories) is to help understand how people learn, thereby assisting researchers or educators reflect on their educational practices, reshape, refine and improve upon their work, and their contribution to the educational field (Harasim, 2012; West-Burnham & Coates, 2005). Many learning theories emerged in the 20th century; they can be categorised as three major prominent learning theories known as behaviourist, cognitivist and constructivist. These three major learning theories are shaping the study of learning, providing educators with insights for teaching and learning with associated pedagogies and technologies (Harasim, 2012; Jonassen et al., 1998). Harasim (2012) argues that educational researchers should not consider these learning theories (behaviourist, cognitivist and constructivist) as “distinct silos - independent or autonomous of one another” but that they may reflect different theoretical perspectives, some of the old and some of the new (p. 10). She further argues that learning theory should not be viewed as something detached from how humans work or their practices (e.g. teaching). However, not all practitioners or educators have addressed learning theories as integral to practice or vice versa (Harasim, 2012; Wenger, 2009) as they are seen to be unproblematic. This particular view of educational practice is consistent with the traditional notion of learning as the acquisition of knowledge, skills and values based on memorization and replication of information, which literature indicates as narrow, instrumentalist and reductionist of learning processes (West-Burnham & Coates, 2005). Indeed, humans are an evolved species and are capable of learning on their own (implicit) and in response to teaching (explicit). Understanding learning theories gives knowledge of how they were shaped, and how they were shaped by, technologies and educational practices and informed teaching and learning. In the following sections, behaviourist, cognitivist and constructivist views of learning are discussed, including the pedagogies and technologies associated with each.

3.2.1 Behaviourist Learning Theory

In the early 20th century, behaviourism was introduced as a learning theory that was empirical, observable and measureable. Much of the approach of the theory focuses on how people behave or change particular behaviours on the basis of a stimulus-response principle through the manipulation of external stimuli of the environment. Behaviourists argue that certain behaviours can be enhanced by repeated stimuli (Schunk, 2012). In other words, learning with this view of theory in mind is conditioning students to respond to environmental stimuli in order to enhance the observable behaviours. In behaviourist learning, the mind is viewed as a black box that is not accessible and relevant to educational practice. Behaviourist theory emphasizes two types of conditioning: classical and operant. In classical conditioning, behaviour becomes a reflex response to a stimulus as indicated in Pavlov’s dog experiments, and operant conditioning as the reinforcement of behaviour by reward or punishment as indicated in Skinner’s rat experiments (Harasim, 2012; Pritchard, 2008, 2009; Schunk, 2012). The prominent key figures of behaviourist learning theory were Pavlov (1849-1936), Watson (1878-1958), Thorndike (1874-1949) and Skinner

(1904-1990) (Harasim, 2012; Schunk, 2012). Behaviourist learning pedagogy consists of reward and punishment, behavioural instructional design and taxonomies of learning (Harasim, 2012). The most commonly used technique of behaviourist pedagogy is reward (positive reinforcement) and punishment (negative reinforcement) as shown in Table 3.1.

Table 3.1: Behaviourist Learning Pedagogy retrieved from Harasim (2012, p.38)

Positive Reinforcement • A positive stimulus is added to strengthen response • Example: Student is given praise for good behaviour	Positive Punishment • A negative stimulus is added to weaken response • Example: Student is given extra homework for misbehaving
Negative Punishment • A negative stimulus is removed to weaken response • Example: Student is exempt from field trip for misbehaving	Negative Reinforcement • A positive stimulus is removed to strengthen response • Example: Student is exempt from quiz for good behaviour

The main purpose of the behaviourist learning pedagogy is to accomplish the correct behaviour which focuses on achievable learning objectives; the link between a stimulus and the response must be consistent, automatic and replicable (Harasim, 2012; Pritchard, 2009). The behaviourist learning pedagogy has been relevant in the context where learning objectives are clearly stated and achievable according to a set of agreed evaluation criteria based on task or examination oriented learning. Some others examples of educational practice based on behaviourist learning techniques are known as memorization, repetition, rote-learning, reinforcement of correct answer, examinations, organization of the curriculum content into specific behavioural objectives, and behavioural instructions (Pritchard, 2009; Schunk, 2012). Learning technologies that are designed and developed based on behaviourist learning theory are known as computer-assisted instructions (CAI), teaching machines and programmed instruction (Harasim, 2012). These learning technologies are intended to support practice and reinforcement of specific tasks. In the context of online learning based on the behaviourist theory the focus is on delivering learning content with clear intended behavioural objectives, and drill and practice and ’electronic page turning‘ (Harasim, 2012). These approaches were reflected as limitations in behaviourist learning theory as it was unable to explain social behaviours that cannot be measured based ‘only on seeing’. However, educational researchers began to realize the limitations of this theoretical approach and behaviourism’s rigid focus on behaviour and its extreme rejection of the human mind (Harasim, 2012). Furthermore, there have been many critiques towards the online programmes based on behaviourism such as “long sequences of ‘page-turner’ content, and, point and click quizzes” (Singh, 2004, p. 51). Limitations in the behaviourist learning theory in teaching and learning eventually led to the next wave of views of learning which recognised the power of the human mind to influence that are not directly related to an external stimulus.

3.2.2 Cognitivist Learning Theory

Cognitivism emerged as a response to behaviourism. Cognitivist views of learning recognize the importance of the human mind in making sense of the material with which it is presented (Harasim, 2012; Schunk, 2012). Cognitivists sought to understand what was inside the black box of the human mind and tried to emulate it computationally. In other words, cognitivists were seeking to understand the processes of the mind that behaviourists viewed as the black box, revealing the box by modelling the mental structures of the human mind as a central computer processor in order to understand behaviour (Harasim, 2012). The rise of cognitivists’ learning theory was related to the development of technology, particularly the invention of the computer. In educational practice, the terms ‘mind as a computer’ and ‘human information processing’ refers to cognitivist theory. Its key proponents were Ausubel, Piaget and Gagne (Pritchard, 2009).

Cognitivism viewed learning as similar to computer information processing, where information from the real world is processed as input, and transformed into a form of representation that can be manipulated, stored, and retrieved as output. Cognitivist learning pedagogy comprises cognitivist instructional design (e.g. Gagne’s nine events of instruction), schema techniques, and cognitive information processing

(Harasim, 2012). In a cognitivist approach, teaching and learning was designed to be prescriptive, based on certain learning outcomes and strategies to ensure mastery of the skill. Computers were the main technological component of cognitivists and there were attempts to replicate the human mind through the computer whereby cognitivists developed educational technologies such as intelligence tutoring systems (ITS) and artificial intelligent (AI) (Harasim, 2012, p.53). In addition, online learning based on a cognitivist approach is focused on a learner's working memory and sensory system. This is done through utilising different multimedia modalities (e.g. audio, visuals, animations, or video), the proper location of information on screen, screen attributes (e.g. colour, size of text, or graphics), the pacing of the information, and information chunks to avoid information overload. In order to avoid overload, learning content or information is presented on screen as items sized between five or nine chunks, together with the use of concept maps, intrinsic and extrinsic motivational strategies, learning reflection and metacognitive strategies, so as to enhance learning based on the cognitivist approaches (Ally, 2008; Harasim, 2012).

Eventually, cognitivist views of learning were being criticised for failing to address the role of the learner in respect of active knowledge construction. Fundamentally, the cognitivist approach to learning still depicted learning as the transmission of knowledge from teacher (or computer software) to learner; this approach was also called instructor or teacher-centred. Cognitivism advocates that the primary role of the learner is to assimilate what the teacher or computer software presents on screen. This concept of the didactic model of teaching and learning held until the late 1970s when social reform movements began to penetrate education in the United States. Also at this time, new perspectives on learning began to surface focusing on active learning and student-centred learning models. These are discussed next.

3.2.3 Constructivist Learning Theory

In educational research, constructivism surfaced around the 1970s during a period of educational reform in the United States and Europe that recognized the role of the individual learner in making sense of the world (Harasim, 2012). It was based on the argument that humans could not be programmed as robots to always respond in the same way to a stimulus (Harasim, 2012). The constructivist learning theory advocates an active joint endeavour between teacher, students and their peers in constructing meaning. Constructivist philosophical view of constructivism is knowledge constructed through interactions with one another including the community and environment and the result of the interaction is not always absolute (Harasim, 2012, p.12). Harasim (2012) further argues that constructivist learning theory is not one unified entity. Rather, it is an umbrella term representing a range of perspectives on learning. Educational practices adopting the constructivist approach include situated and active learning, learning by doing, problem-based learning, inquiry-based learning, cooperative learning, collaborative learning, personalised learning, the learning community, active participatory learning, activity and dialogical processes, anchored instruction, cognitive apprenticeship, discovery learning, and scaffolded learning (Ally, 2008; Harasim, 2012; Pritchard, 2009; Schunk, 2012). Two key theorists associated with constructivist approaches were Jean Piaget (1896-1980), known as a key theorist for 'cognitive constructivism' emphasizing individual learner knowledge construction in terms of biological developmental stages; and Lev Semyonovich Vygotsky (1896-1934), who advocated a 'social constructivism' emphasis on social knowledge construction.

- **Cognitive Constructivism**

Cognitive constructivism posits human learning through the construction of progressively complex biological structures from infancy through adulthood, and the complexity of knowledge is moved from one stage to another stage of development: *Sensorimotor*, birth to 2 years, reflex based and known through the senses; *Preoperational*, 2-7 years, acting on objects, words and thoughts, self-oriented; *Concrete Operational*, 7-11 years, problem solving and more than one view point; *Formal Operational*, 12 years and above, abstract thinking and theoretical reasoning (Harasim, 2012; Pritchard, 2009; Schunk, 2012). Related to the developmental stages is how humans internalize knowledge through experience and make sense of it through adaptation, assimilation, accommodation and equilibration, or disequilibration. Piaget (1969) believes that through these processes humans learn, grow and outgrow ideas, and create new ones. Assimilation involves applying a pre-existing mental structure to human sensory data; equilibration or disequilibration occurs when new cognitive structures are constructed which can lead into disequilibration when it cannot be assimilated; while accommodation compels the constructed structure to be modified in order to re-assimilate.

- **Social Constructivism**

Social constructivism advocates the social process of human interaction rather than individual context in active knowledge construction. The focus of social constructivism is on the relationship between the student's cognitive process and his or her social activities. The essence of social constructivism is the social context of human development and learning in contrast to the individual development context as proposed in cognitive constructivism (Harasim, 2012, p.66). The human mind is regarded as situated in the social and cultural context, and does not exist in isolation. The essential concept of social constructivism as proposed by Vygotsky (1978) is the *Zone of Proximal Development* (or ZPD). According to ZPD, learning takes place when learners solve problems beyond their actual developmental level but within their level of potential development under adult guidance or in collaboration with more capable peers. In other words, within ZPD a learner's learning is observed in terms of what a learner can do without help and what she or he can do with help. As result of this approach, the term of scaffolding is coined as a metaphor to reflect guided or supported learning, in which the peer or adult supports the learner in constructing meaning. In the classroom context, a scaffold is a set of activities designed by the teacher to assist the student's progress in accomplishing difficult tasks or to master a new skill.

The constructivist learning technologies are often associated with learning environments (e.g. Construction Kits, Microworlds, Scaffolded Intentional Learning Environment, Learning Network or Telecollaboration and Learning Management Systems such as BlackBoard, WebCT or Moodle) with characteristics including the following: providing multiple representations of reality to prevent oversimplification; representing the natural complexity of the real world; emphasize knowledge construction instead of knowledge reproduction; emphasizing authentic tasks in a meaningful context rather than abstraction out of context; providing learning environments such as real-world settings or case-based learning instead of a predetermined sequence of instruction; foster reflection on learning experiences;

enable context and content dependent knowledge construction; and support collaborative construction of knowledge through social negotiation and not through competition among learners for recognition (Harasim, 2012, p.73). In addition, online learning based on a constructivist approach including learning should be an active process; learners should construct their own knowledge; learners should make use of collaborative and cooperative learning; learners should be given control of the learning process; there should be an opportunity for reflection; and learning should be meaningful and interactive in order to enhance learning based on the constructivist approaches (Ally, 2008).

3.2.4 Section Summary

The section 3.2 discussed several important theoretical perspectives on learning such as the behaviourist learning theory which highlighted the important of external stimulus in accomplishing desirable goals followed by the cognitivist learning theory with the recognition of the human mind as similar to information processing and the constructivist learning theory that addressed the role of the learner in respect of active knowledge construction. It appears that constructivism is the most useful way of theorizing learning for this study up to this point of the discussion.

3.3 Socio-cultural Views of Learning

As discussed previously, constructivist learning theory views learning as a process by which a student constructs knowledge through interacting with more knowledgeable others. However, constructivist learning theory also ignores some other important aspects potentially contributing to the success or failure of learning including the role of cultural artefacts, the nature of the learner, the nature of the environment, and their relations within a cultural context (Gunawardena et al., 2003; Tu, 2007). This led to the emergence of a view of learning that recognizes the importance of social and culture influences. Socio-cultural theory views learning and educational practice as a social activity focusing on the relationship between social interaction and individual cognitive change within a cultural context (Tu, 2007). It explains the educational practice and learning as a process of participating in cultural and social activity in which knowledge is constructed in a joint activity within a social and cultural context.

Vygotsky (1978) argues that it is difficult to understand individual cognitive development without reference to the social and cultural context in which such development is promoted, and further asserts that higher mental processes can be understood only if we understand the cultural tools and signs that mediate them. Cultural artefacts or tools emerge and change as the culture develops and socio-cultural views of learning stress the importance of historical and cultural perspectives in understanding human mental functions (Gunawardena et al., 2003; Ravenscroft, 2005; Vygotsky, 1978). According to Wertsch (1998), "the task of a socio-cultural approach is to explicate the relationships between human action, on the one hand, and the cultural, institutional, and historical contexts in which this action occurs, on the other" (p.24). Furthermore, Cole (1998) proposes several principles of cultural psychology for guiding educational practice and learning, but four principles: mediated action (Cole, 1998; Cole & Engeström, 1993), distributed cognition (Salomon, 1993), situated activity (Lave & Wenger, 1991) and goal-directed (Engeström, 2001; Yamagata-Lynch, 2010) are specifically important and of value to be considered in this research.

3.3.1 Mediated Action

Mediated action refers to an interaction between the individual and mediating artefacts or tools or signs, a semiotically produced cognitive tool that resulted from the interaction (Yamagata-Lynch, 2010). The mediating artefacts can include artefacts or tools (e.g. physical, technical, psychological or symbolic tools), social others and prior knowledge that contribute to the subject's mediated action experiences within the activity (Wertsch, 1998; Yamagata-Lynch, 2010). Wertsch (1998) argues that human action employs the cultural artefacts as meditational means to accomplish a task or objectives. The human action can be externalised and internalised or executed by groups or by individuals. In fact, groups and group activities are just as real as individuals because they are abstract, analytic units rather than concrete entities (Sawyer, 2006; Tu, 2007; Yamagata-Lynch, 2010). The importance of the humans and the cultural tools they use to achieve goals are irreducible in the context of the individual's mental functioning (Wertsch, 1998). These cultural tools act as an intermediate agency between the mental processing of the individual and the object of the mental processing. A mediated action view on learning also signified Vygotsky's ideas such as mediation by tools (e.g. symbols, texts, signs, language) and its role in bridging the learner's cultural development. Vygotsky (1978) argues that every function in the learner's cultural development occurs twice: initially on the social level (between people, inter-psychological), and later, on the individual level (inside the individual, intra-psychological). According to Yamagata-Lynch (2010) individuals as learners are not passive participants waiting for "the environment to instigate a meaning-making process for them but, through their interactions, individuals make meaning of the world while they modify and create activities that trigger transformations of artefacts, tools, and people in the environment" (p.16). The important characteristics of mediated action as described by socio-cultural theorists (e.g. Cole & Engeström, 1993; Wertsch, 1995, 1998; Yamagata-Lynch, 2010) are of importance to this research: mediated action as an active process occurs when the individuals use it in the process; the introduction of cultural tools has an influential impact on the transformation of human action; the introduction of cultural tools in the process has limitations (constraints) as well as an enhancement affect on human action; and mediated action can also have unanticipated benefits (or spin-offs) by which the same cultural tools can facilitate actions other than specifically original actions.

3.3.2 Distributed Cognition

The notion of distributed cognition suggests that learning is distributed across the members of a social group (Salomon, 1993) and the person-plus, the individual student, and the environment (Perkins, 1993). Cognition is located outside the individual learner's brain and occurs in the interactions among many individual learners' brains, and cultural tools (or environment) (Halverson, 2002; Salomon, 1993). Salomon (1993) states that distribution or distributed is a term intended to mean sharing including sharing authority, language, experiences, tasks and a cultural heritage. Distributed cognition occurs within social interactions and communications of cultural activities. Cognition is distributed in a learning community (between and among students, peers, teachers and tools to achieve particular goals) and is not merely something that occurs inside a learner. According to Salomon (1993), the distribution of cognition across a learning community is seen as being stretched over, rather than solely focused on the inside of the individual. Cognition is seen "residing in between and as jointly composed in a system that comprises an individual and peers, teachers, or culturally provided tools" (p.112). Salomon (1993) argues that knowledge has the potential to be off-loaded on to a device like a calculator or computer with cognitive functions placed on the machine. Cognition or knowledge is communicated into external representations in physical or virtual form which embodied experience through the sensory systems and mental filters of individual learners interacting with learning artefacts, environmental elements, and other people (Halverson, 2002; Salomon, 1993; Pea, 1993). In the literature of computer supported collaborative learning (CSCL) and computer supported collaborative work (CSCW), distributed cognition has been considered in terms of how collaborative spaces are designed and used (Harasim, 2012). In this research, the distributed cognition of learning online is considered with less radical views. The participants become enculturated into the social and cultural activities embedded in the online learning environment in which they are provided with access to the learning resources, knowledge and understanding that are distributed across their discipline within the community based on the affordances of the online learning environment. This research therefore would need to take into account what and how the students are learning as they participate in the distributory processes of learning and the construction of knowledge.

3.3.3 Situated activity

Viewing learning as situated within cultural activities is the central focus of the situated activity approach. Fundamentally, situated activity represents a range of perspectives on learning including situated learning (Lave & Wenger, 1991) and situated cognition (Brown, Collins, & Duguid, 1989). The situated approaches view learning as situated and embedded in a system of activity, communications, culture and context. The unit of analysis involves not only the individual learner or the tools, setting and environment but also the relationship between the two (Barab & Plucker, 2002). From this perspective, separating the learner, the material to be learned, and the context in which learning occurs is impossible and irrelevant because learning and activity are irreducible into separate processes (Barab, Schatz, & Scheckler, 2004). Barab and Plucker (2002) argue that knowledge is more aptly phrased 'knowing about', and 'knowing' is a perceptual activity that always occurs within a context only after the event (or in anticipation thereof) can be known about and can be discussed as a thing. Barab and Duffy (2000) describe the central tenet of situativity perspective including ‘knowing about’ as:

> Knowing about refers to an activity—not a thing; knowing about is always contextualized—not abstract; knowing about is reciprocally constructed within the individual- environment interaction—not objectively defined or subjectively created; and knowing about is a functional stance on the interaction—not a “truth.” (p. 28)

In situated learning, learners go through a kind of cognitive apprenticeship in a community of practice within an applied learning environment of various levels of expertise, the learners move from the periphery to the centre of the practice (Lave & Wenger, 1991). In other words, the newcomer learner moves from novice to an expert through developmental phases of learning and through interacting and engaging in authentic learning works (e.g. real-world problem solving, problem-based learning, project-based learning, and creative work) within the community of practice. This research considers learning activity through the creation of authentic situated activity that affords learners with the opportunities to be engaged in authentic problems situated in the cultural context in collaboration with peers in developing knowledge and understanding.

3.3.4 Goal-directed

A goal-directed perspective on learning emphasizes the embeddedness of goals within cultural activities in accomplishing desirable learning. The notion of learning as goal-directed is seen to be highlighted in Activity Theory which refers to goal-directed actions anchored with other related activities, the goal and the motives for participating in an activity and material product that participants try to gain in an activity (Yamagata-Lynch, 2010, p.17). Kaptelinin (2005) argues that an object or goal is the reason why individuals and groups of individuals choose to participate in activity, and it is also what holds together the elements in activity (as cited in Yamagata-Lynch, 2010). In an object-orientedness and goal-directed action, the individuals and groups of individuals' participation are motivated by their goals and motives which may potentially lead to the creation of new artefacts that can make the activity robust (Yamagata-Lynch, 2010). Consequently, people as human beings are normally considered to respond when "an environment consists of entities that combine all kinds of objective features, including the culturally determined ones, which, in turn, determine the way people act on these entities" (Kaptelinin, 1996, p.103). Viewing learning as goal-directed in the educational practice requires the structuring of goal-directed learning activities when teaching in the classroom. Through these goals, the students are supported in their way to attain the goals through meaningful social activities (Häkkinen et al., 2004). In this research, the goal-directed approach considers different types of goals embedded within the designed situated activities to foster students' participation and collaborative interaction in understanding learning and constructing knowledge.

3.3.5 Three Planes of Socio-Cultural Analysis

The three planes of socio-cultural analysis, consisting of the personal, interpersonal, and community or institutional planes, rely on the subject of an activity to describe the socio-cultural processes (Rogoff, 1995; Yamagata-Lynch, 2010). The individual is the subject of activities that take place in the personal plane. This is followed by the subject comprising groups of participants or individuals who are involved in the collaborative activities in the interpersonal plane. Institutional-based collective activities occur within the community or institutional planes. According to Yamagata-Lynch (2010), socio-cultural analysis through these lenses can help elucidate goal-directed actions and object-oriented activities into units of bounded systems (p.24). Furthermore, the focus of the analysis is based on consideration of the apprenticeship, guided participation, and participatory appropriation of activity - that of individuals interacting with others in socio-cultural activities. Rogoff (1995) argues that an apprenticeship model involves "active individuals participating with others in a culturally organised activity that has as part of its purpose the development of mature participation in the activity by the less experienced people" (p.142), while guided participation places emphasis on "the mutual involvement of individuals and their social partners, communicating and coordinating their involvement as they participate in socio-culturally structured collective activity” (p. 146). In the participatory appropriation, development is viewed as “a dynamic, active, mutual process involved in people’s participation in cultural activities” (p.153), unlike the internalization perspective views of development and reification in learning in terms of a static, bounded ‘acquisition’ or ‘transmission’ of pieces of ‘knowledge’ (p.153). Rogoff (1995) suggests that during investigations that researchers may become overwhelmed in the analysis and could zoom into one plane of analysis at a time and blur out the other two planes. Blurring out is not the same as ignoring but it is the process of identifying the salient features of the planes that are not being examined, yet are essential and relevant to the study to help further understand the intervention learning activities.

3.3.6 Section Summary

The section 3.3 discussed several important principles of socio-cultural perspectives in guiding the educational practice and learning such as mediated action through learners’ interactions and mediating artefacts or tools; distributed cognition through learners’ participation in the distributory processes of learning; situated activity where learners have the opportunities to be engaged in authentic problems situated in the cultural context; and goal-directed where learners are supported to attain the goals of learning activities; as well as the analytical components of socio-cultural known as three planes of socio-cultural analysis.

3.4 Learning from Activity Theory Point of View

The socio-cultural perspectives on learning acknowledged learning as fundamental cultural processes and recognized the role of social interactions in facilitating learning as situated in cultural-historical context. The Cultural-Historical Activity Theory (or Activity Theory) is a theoretical perspective that highlights learning as cultural-historical activities that are mediated by cultural artefacts (Daniels & Gutierrez, 2009; Yamagata-Lynch, 2010). Cultural artefact in this thesis is intended to mean tools (e.g. computer software, procedures, methods, rules, forms of work organization) that have their own mediating role and carry a particular culture-historical residue (Kuutti, 1996). It is agreed among social learning researchers that today knowledge is no longer perceived as the outcome of an individual mind but as a collective outcome based on the contribution of different individual minds involved in different activities such as “in the discourse among individuals, the social relationships that bind them, the physical artefacts that they use and produce, and the theories, models and methods they use to produce them” (Jonassen & Land, 2000, p. 6).

Despite the confusion associated with the term, *Activity Theory* refers to the Soviet cultural-historical research that represents neither activity nor theory in general. The core concept or basic unit of Activity Theory is still called activity in which it carries a minimal meaningful context for individual actions (Kuutti, 1996). It is through activities that humans develop skills, personalities and consciousness, transform social conditions, resolve contradictions, generate new cultural artefacts, and create new forms of life and the self (Sannino, Daniels, & Gutierrez, 2009). Some researchers also believe that through such activities humans transform learning and embrace the possibility of expansive learning (Engeström, 2001). Rogoff (2003) asserts human development is a cultural process, and has a great influence on the content and course of development and learning. Activity Theory views learning as inseparable from activity; activity is not carried out by the human alone but mediated by tools within a cultural-historical context. Engeström (1999) argues against behavioural and social science researchers that separate the study of the human activity and his or her cultural artefacts from the study of individual behaviour and human agency. He believes that human activity is never isolated and separated from cultural artefacts and made it clear in his writing that “the individual could no longer be understood without his or her cultural means; and the society could no longer be understood without the agency of individuals who use and produce artefacts” (Engeström, 2001, p. 134). He points out the key to understanding the human mind is through the object-orientedness of action between human and object through mediating tools. Kuutti (1996) sees Engeström’s arguments as an invitation to serious study of artefacts as integral and inseparable components of human functioning (p.27).

Activity Theory has evolved through different generations. The first generation of Activity Theory traces its history from the early works of Vygotsky, Leont’ev and Luria (Engeström, 2001). Vygotsky and others developed the concept of mediation which serves as the core of the first generation of Activity Theory. The mediation model advocated by Vygotsky encompasses two basic components called stimulus (S) representing subject, and response (R) representing object. The relationship between the stimulus or subject and response or object is mediated by an intermediate term called a mediating artefact which carries with it the history of the relationship (Kuutti, 1996). When the object is transformed the outcome is produced as depicted in Figure 3.1.

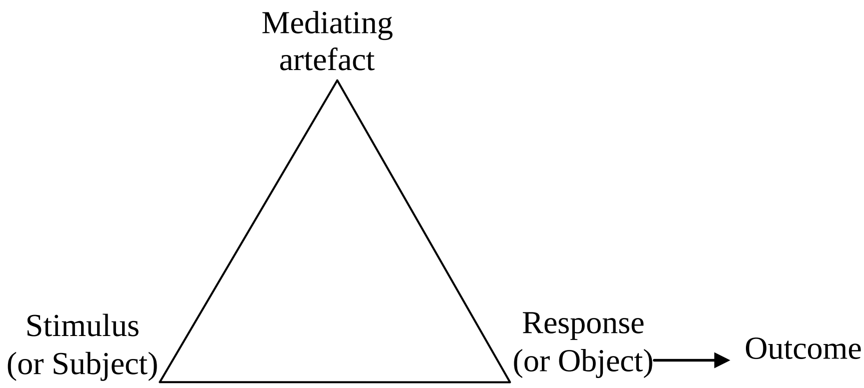


Figure 3.1: First generation of Activity Theory (Vygotsky, 1978)

However, the process of transformation as depicted in Figure 3.1 is limited because the main unit of analysis only occurs at the individual level, which is missing the component of collective activity (Engeström, 2001). Inspired by Leont’ev’s famous example of *primeval collective hunt*, Engeström presents a much more integrated model of a collective human activity system that borrows Leont’ev’s explication of the crucial differences between an individual action and a collective activity. Engeström defends his action by claiming that Leont’ev never explicitly expanded Vygotsky’s model into a triangular model of a collective activity system as depicted in Figure 3.2.

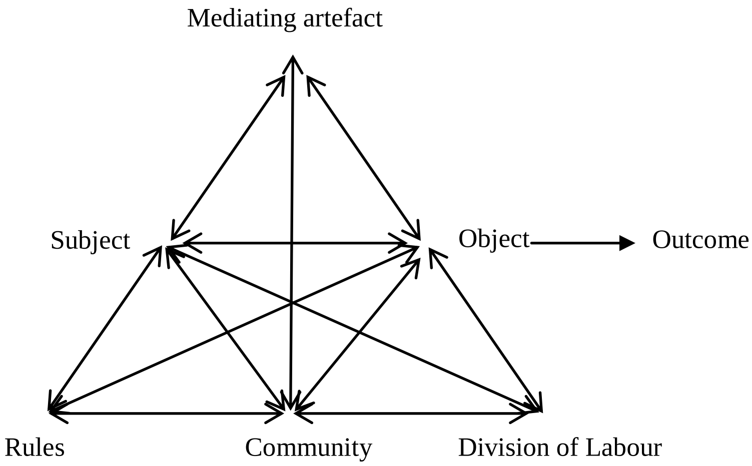


Figure 3.2: Second generation of Activity Theory (Engeström, 1999**)**

In this triangular model, the insertion of community into the first model of Activity Theory is to illustrate the collective (or society) level of activities. Engeström calls the top side of the sub-triangle "the tip of the iceberg" which acknowledges activity at the individual level, and the opposite of the top sub-triangle as "group actions embedded in a collective activity system" (p.134). The triangular model consists of two overlapping triangles, known as the external (outer) triangle and the internal (inner) triangle. The external triangle of the triangular model encompasses the components of the artefact, rules and division of labour, while the internal triangle encompasses subject, object and community. The mutual relationship between components in the external triangle and internal triangle can be explained in a systemic and interrelated manner where the relationship between subject and object is mediated by the artefact, the relationship between subject and community is mediated by rules, and the relationship between object and community is mediated by division of labour. In the context of Activity Theory, "rules" is intended to mean ''the explicit and implicit regulations, norms and conventions that constrain actions and interactions within the activity system'' and "division of labour" means "both the horizontal division of tasks between the members of the community and the vertical division of power and status" (Engeström, 1993, p. 67).

In studying Activity Theory in a learning context, Barab, et al. (2004) point out that the focus of doing activity from an Activity Theory perspective is not doing as a disembodied action but rather doing in order to transform an object into something within its contextualized activity of the system as a whole. In other words, learning and doing (activity) cannot be carried out independently. Kuutti (1996) warns theorists that Activity Theory does not accept a dualistic conception of an isolated, independent mind. He argues that activity occurring on the internal side of a triangle cannot exist without the external one. In similar vein, Jonassen and Murphy (1999) elaborate that conscious learning emerges from activity, not as a precursor to it, which provides us with an alternative way of viewing human thinking. From this perspective, activity theorists see that learning and activity cannot be separated and cannot be understood outside of the context in which they operate. As Engeström (1996) stresses, context is not simply a container or a situationally created experiential space but is an entire activity system, integrating the participant, the object, the tools, communities, rules and division of labour into a unified whole. In order to understand and analyse learning, therefore, we must examine not only the kinds of learning activities that people engage in but also who is engaging in that activity, what their goals and intentions are, what objects or products result from the activity, the rules and norms that circumscribe that activity, and the larger community in which the learning activity occurs (Jonassen & Murphy, 1999). Activity is the core essence of human functioning. Activity is also centred by the interaction of minds in the world, socially constructing and sharing meaning (Holt & Morris, 1993 as cited in Jonassen, 2000). Consequently, it drives human life towards participation in an object-oriented activity (Sannino, Daniels, & Gutierrez, 2009). So, in order to allow the enactment of activity, particularly for this research, a closer look into the structure of activity that is oriented towards an object is described in the following section.

3.4.1 The Structure of Activity

According to Kuutti (1996), activities involve several steps of transforming objects into outcomes. These steps are illustrated as in Figure 3.3.

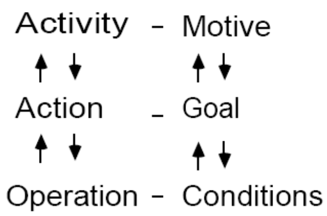


Figure 3.3: Levels of an activity (Kuutti, 1996)

Fundamentally, an activity provides a motive for an activity system and this motive is carried out by action which is normally directed by a goal. An action performed by an operation sometimes involves chains of operations which are specified by conditions. It is noted that when conditions are disrupted or changed, this process will be reversed and operations become actions. Thus, the relationships among activities, actions, and operations are dynamic and consume long-term formations which will not end even after the action has been carried out. It is these factors which distinguish Activity Theory from other socio-cultural theories where the focus of structure is not on action but on activity (Sannino et al., 2009). Sannino, et al. (2009) argues that action does not account for the historical continuity and has a short life span which will end once a goal is achieved. It is difficult to classify an activity, action and operation because these elements are dependent on how the subject or object is involved in a particular context. However, based on Kuutti's (1996) examples of activity structure, an adapted and modified example is produced to illustrate the activity structure based on the context of this research and is shown in Table 3.2.

Table 3.2: Example of the structure of activity, adapted from Kuutti (1996)

Activity level	• Completing an online collaborative project
Action level	• Forming a group • Arranging a meeting • Participating in discussion • Contributing and negotiating ideas • Reflecting and evaluating ideas
Operation level	• Using online learning environment facilities - forum, chat, instant message, and the like. • Selecting collaborative approaches

In order to simulate an activity system for this research, it is necessary to identify the activity structures entailed by the activity. Figure 3.4 serves as an example of how an activity structure can be identified and therefore could help researchers to identify tools to support actions and operations. Jonassen (2000) states that the activity structure could help a researcher to determine what learners in a learning environment will be doing while learning in the simulated activity system. The next section provides an overview of contradictions in an activity system.

3.4.2 Contradictions in Activity System

Activity systems are characterised by their internal contradictions (Engeström, 1987, 1993; Leont'ev, 1974). These contradictions are best understood as tensions among the components of the activity system. For example, in school learning there is a pervasive tension between learning the material to receive a grade (what Lave, 1993, described as the 'exchange value' of what is learned) and learning material because of its importance in addressing real-world problems (what Lave described as the 'use value'). Tensions are critical to understanding what motivates particular actions and in understanding the evolution of a system more generally. These tensions can be thought of as system dualities, and it is through understanding the interplay within and among these dualities that one can best understand and support the continued innovation of the system. Wenger (1998) argued that it is the interplay within the dualities that drives the system, with the design goal being to leverage the dynamics of system dualities and not to treat them as polar opposites or to eliminate one side or the other. As tensions enter the system they become the moving force behind disturbances and innovations and eventually drive the system to change and develop. Activity theorists see contradictions as sources of development (Kuutti, 1996; see also Engeström, 1999; Jonassen, 2000; Barab et al., 2004; Miettinen, 2009). Engeström (1987) characterises a contradiction as "a social, societally essential dilemma which cannot be resolved through separate individual actions alone – but in which joint cooperative actions can push a historically new form of activity into emergence" (p. 16). The resolution of contradictions, according to Engeström, takes place in the process of "living movement leading away from the old" (p. 16), when transforming an object/goal into a new outcome takes place. An example of contradiction is evident in a situation, when a person is torn by two or more opposite goals, and when the additional immediate circumstances may influence his/her final decision-making. This is very similar to construction of new knowledge in a community of learners as a result of negotiation of different, and often times, opposite meanings (Wenger, 1998). Figure 3.4 depicts contradictions in an activity system model.

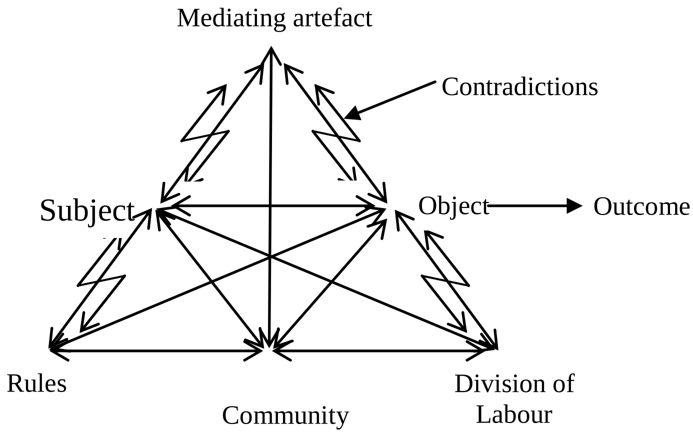


Figure 3.4: Contradiction in an Activity System (Engeström, 2001)

The next section provides an overview of how learning from an Activity Theory point of view is transformed and expanded.

3.4.3 Transformative and Expansive Learning

According to Engeström (2001), when a minimum of two activity systems come into contact there may be a possibility for the third object or 'space' to surface. This third object indicates the emerging of the third generation of Activity Theory as depicted in Figure 3.5.

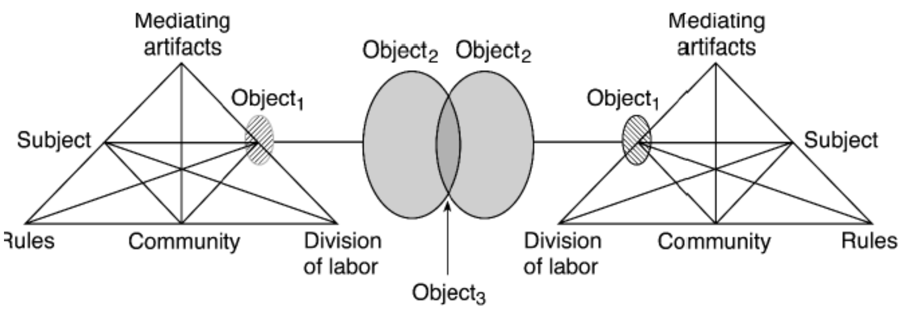


Figure 3.5: Third generation of Activity Theory (Engeström, 2001, p.136)

The third generation of Activity Theory is expanded to include at least two interacting activity systems. As Engeström further elaborates, the objects (object 1) of two interacting activity systems are transformed from their initial state of "unreflected" to collectively meaningful objects (object 2) constructed by the activity systems, and to a potentially shared or jointly constructed object (object 3) where expansive learning is possible. If students and teachers (or lecturers) engage in discussion, debate and reflection, then learning beyond what is possible within a single activity system becomes possible (Robertson, 2007). In this regard, the transformation of an object in an activity system can be explained through five principles (Engeström, 2001, p.136-138), namely:

- Activity system as unit of analysis - The prime unit of analysis is a collective, artefact-mediated and object-oriented activity system, seen in its network in relation to other activity systems.
- Multi-voicedness - An activity system is always a community of multiple points of view, traditions and interests.
- Historicity - Activity systems take shape and become transformed over lengthy periods of time.
- Contradictions - Contradictions play a central role as sources of change and development.
- Expansive cycles - The possibility of expansive transformations in activity systems.

The notion of expansive learning is referred to as the creation of new concepts and practices for emerging forms and patterns of activity (Yamazumi, 2009). It concerns the interaction between activity systems with a partially shared object as a minimal model (Yamazumi, 2009). These challenges have not been addressed by both the first and second generation of Activity Theory (Yamazumi, 2009). The challenges are to "acquire new ways of working collaboratively" (Engestrom, 2001, p. 139), and to develop concepts and tools to manage dialogue, multiple perspectives and networks of these intersecting systems (Engestrom, 2001, p. 135). Piuonti (2004) conceptualises how expansive activity can lead to collaboration between activity systems which can be either sequential or parallel in nature as shown in Table 3.3.

Table 3.3: Types of collaborative activities (Piuonti, 2004)

Sequential collaborations (Hierarchical)	Parallel collaborations (Inter-organisational)
Isolated, individual efforts to collaborate	Common ideology as basis for collaboration
Restricted information exchange only	Rules modified to enable functional

when necessary	information exchange
Interaction between key members (authorities) only when needed	Liaising with other agencies to increase personal contacts/shared projects. Shared training
Separate training (for each authority)	Collaborative operations
Executive assistance as the standard form of collaboration	Multi-organisational projects standard form of collaboration

The next section provides an overview of the analysis of activity system within the landscape of situatedness of activity that was used to analyse the success of the intervention activities in facilitating learning based on the transformative outcomes of the activities.

3.4.4 Situatedness of Activity

An activity system does not exist in a vacuum and is never constructed "ex nihilo (or out of nothing)" (Boer, van Baalen, & Kumar, 2002, p. 94). It is situated within and between activities and relies on the language, tools or equipments, institutions and conventions; and in order to understand the activity system under investigation, the researchers have to reveal its *temporal interconnectedness* (Boer et al., 2002). Boer et al. (2002) state that an activity system occurs over time and can be described at three different contextual levels of analysis: at high, middle and lower contextual levels as shown in Figure 3.6.

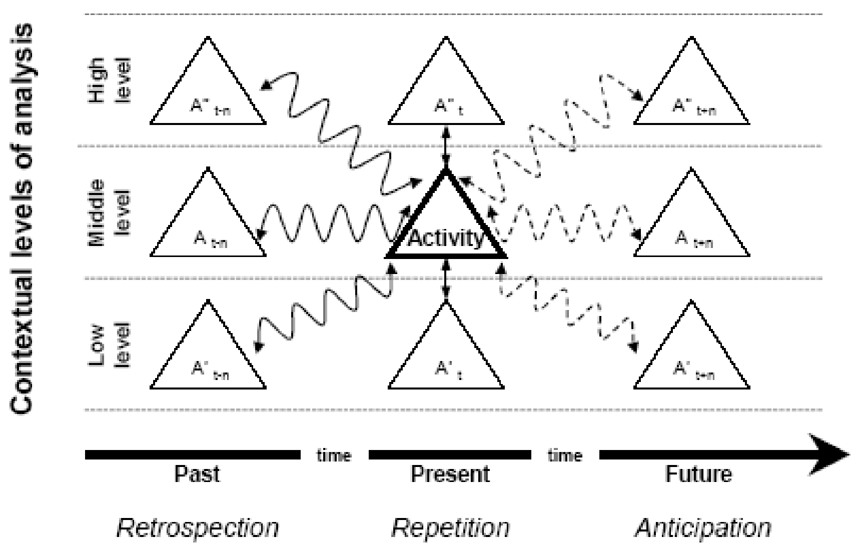


Figure 3.6: Three contextual levels of analysis adapted from Boer et al. (2002)

The first level of analysis is the high contextual level which refers to the analysis of an activity system on a broader institutional cultural contextual level within which the intervention activities takes place. The second level of analysis is the middle contextual level that takes place within the intervention. According to Boer, van Baalen and Kumar (2002), an activity system under investigation is not only affected by “an activity system at other contextual levels but it also exerts influence on itself” which is in line with “Giddens’ theory of structuration” which states that on the one hand human action is restricted by institutional properties of social systems, while on the other hand, these institutional properties are the product of human action (p.94). The third and final level of analysis is the lower contextual level which is conducted by narrowing the analysis of the intervention activities to its outcomes and constraints. Changes in any part of the contextual levels may have the potential to affect any or all of the other related activities. By describing the activity system at different contextual levels of analysis, one can avoid perceiving the context of an activity as a static picture of reality or as an individual influencing factor, and therefore the negative effects of reification can be decreased (Boer et al., 2002). In this research, the contextual levels of analysis adopted from Boer et al. (2002) within the landscape of situatedness of activity were used to analyse the transformative outcomes (cognitive, social and emotional) of the intervention activities in facilitating students’ learning based on their experiences participating in the intervention activities.

3.4.5 Section Summary

The section 3.4 discussed several important components of Activity Theory such as the structure of activity, contradictions in Activity System, transformative and expansive learning as well as the situatedness of activity. These components of Activity Theory are important in this study as they provide a framework of online collaborative learning for developing the intervention. Activity Theory proves to be useful because it provides a structure for conceptualizing human practices in relation to a computer within a context (Barab, Schatz & Sheckler, 2004; Jonassen & Land, 2000; Kuutti, 1996; Mwanza, 2002). In the following, section the online collaborative learning model that used in this thesis is elaborated upon.

3.5 Developing the Online Collaborative Learning Model Used in This Thesis

Engeström (2001) argues that when two or more activity systems interact there is a possibility for a third space to emerge. This space can be assumed to be a door that opens for "events in classroom discourse where the seemingly self-sufficient worlds and scripts of the teacher and the students occasionally meet and interact to form new meanings that go beyond the evident limits of both" (Engeström, 2001, p. 136). In this research, the nature of how single groups work together towards their project completion is described diagrammatically, as depicted in Figure 3.7.

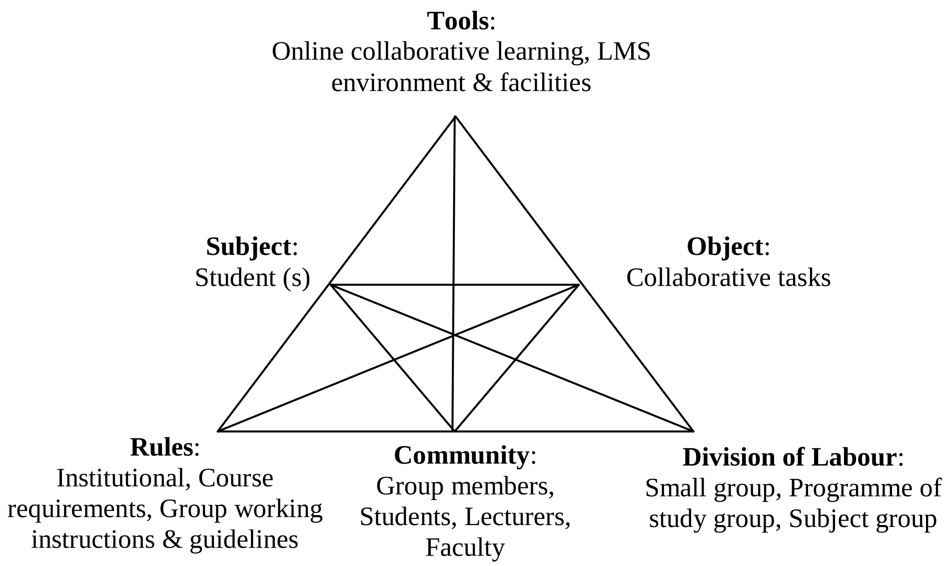


Figure 3.7: Online collaborative learning as an activity system, adapted from Engeström (2001)

The single group represents an activity system in which all elements constantly interact with one another and are virtually always in the process of working through changes. Changes in the design of a tool may influence a subject's orientation towards an object, which, in turn, may influence the cultural practices of the community. In addition, it is possible that the object and motive themselves will undergo changes during the process of activity (Kuutti, 1996). When the single activity system is forced into interacting with other activity systems - in the case of this research, study groups of Chemistry, Physics and Mathematics - in a particular context, it will result in the development of what Engeström calls "the third object" which indicates a potentially shared or jointly constructed object (p. 136). Figure 3.8 illustrates the formation of shared communicative space between the three study domain groups of this research – two groups in Chemistry, two groups in Physics and five groups in Mathematics.

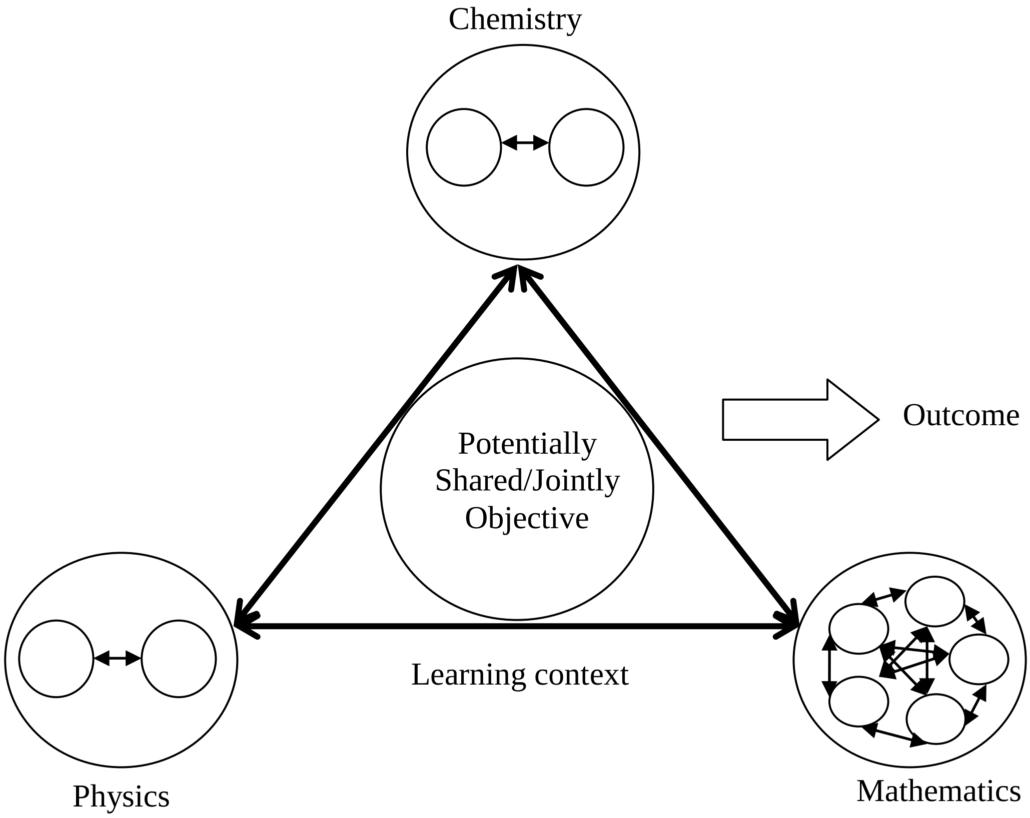


Figure 3.8: Online collaborative learning model, adapted from Engeström (2001)

Within this research model, the groups engage in the online collaborative learning project in similar ways, and when their objects, rules or norms coincide, they form an object represented in Figure 3.8 as an inner circle. This circle carries the shared objective or motive and also represents a ‘shared/jointly object’ (Engeström, 2001). When this object is transformed, the outcome is produced. The usefulness of this approach has been demonstrated in respect to children’s health care in the Helsinki area (Engestrom, 2001). Through discussion, reflection and critical analysis, the model provides the opportunity to produce an explicit outcome, and hence a better understanding of the activity systems.

3.6 Chapter Summary

Previous section 3.3 and section 3.4 have highlighted several useful ideas of learning from the socio-cultural and Activity Theory perspective in guiding and developing the educational practice and learning. It is proposed that Activity Theory, with its emphasis on social, cultural and historical contexts mediated by cultural artefacts provides a useful way of analysing the learning context for this research. Through Activity Theory, this study is able to characterise the process of designing and supporting the implementation of online collaborative learning for Malaysian pre-service teachers. The online collaborative activities in which learning is embedded serve as the core of this research. From these collaborative activities, this research would be able to understand the nature of how students with shared motives work together towards their online group project completion, how students learn online collaboratively, the artefacts that mediate their online collaborative activities, the online collaborative interactions between students, and the overall context. Activity Theory proves to be useful in the way that it provides a powerful socio-cultural historical framework for implementing such research where it provides the researcher with a framework for the understanding of human work and praxis in context.

By adopting Activity Theory, the researcher is able to analyse learning processes and outcomes for the purpose of designing instruction. Rather than focusing on knowledge state, this research focuses on the activity in which people are engaged, the nature of the tools they use in the activity, the social and contextual relationships among the collaborators in the activity, the goals and intentions of the activity, and the objects or outcomes of the activity. Rather than analysing knowledge states as detached from these entities, this research sees consciousness as the mental activity that suffuses all of these entities which is in line with the principles of Activity Theory. Articulating each of concepts, objects, rules, and approaches that are associated with activity and their dynamic interrelationships is important in this study, because the richer the context and the more embedded the conscious actions are in the context, the more meaning learners will construct both for the activity and the learning.

Designing an online learning environment for collaboration in the classroom is a complex activity that can be difficult to characterise and describe to others because of its dynamic social nature. Acknowledgement of the appropriateness of Activity Theory for an investigation of online collaborative learning focuses the research onto the aspects of tools that mediated student experience and that have a social and cultural aspect. The investigation would therefore focus on how the incorporation of online collaborative learning in a conventional tertiary classroom may create new tools and forms of activity based on the students' collaborative endeavors that would be transformed into learning outcomes. Activity Theory fits well with such research that attempts to explore the collaborative production of new object-oriented collective activity systems (Engestrom, 2001; Sanino et al., 2009; Yamzumi, 2009). The next chapter describes how the study is carried out.

Chapter 4 Methodology

4.1 Introduction

This chapter outlines the methodological approach that is adopted in this study followed by the research design and the methods chosen for data collection. It also provides a full description of data analysis and discusses the quality issues (validity and reliability) in the research. Finally, the ethical considerations of the research are also presented and the chapter ends with a summary.

4.2 Methodology

The aim of research methodology is to describe approaches to, and paradigms of research (Cohen, Manion & Morrison, 2000, p.47), so it is important for the researcher to employ a research methodology under an appropriate paradigm as a frame of reference in which he views and thinks about the world. Lincoln and Guba (1985) argue the actions that the researcher takes as inquirer cannot occur without reference to a paradigm in which the researcher thinks and acts. In the literature, there are a variety of meanings about what constitutes a paradigm, but the term generally refers to a conceptual framework (Kuhn, 1970), a basic set of beliefs (Guba, 1990), a model (Lewis-Beck, et al., 2004) or a loose collection of logically related assumptions, concepts or propositions (Bogdan & Biklen, 2007) that guide thinking and research. It comprises the researcher's ontological, epistemological and methodological beliefs (Denzin & Lincoln, 2003) of the educational research. A research paradigm should also be compatible with the research questions, the theoretical or conceptual framework, as well as informing the methods and data collection (Cohen, et al, 2000).

There are several well known research paradigms that a researcher can employ in educational research including positivism, anti-positivism or interpretivism, post-modernism or critical theory, phenomenology, constructivism, ethnography and so forth (Creswell, 1994; Maykut & Morehouse, 1994; Miles & Huberman, 1994; Cohen, et al, 2000; Denzin & Lincoln, 2003). The research in this study is located within the interpretive paradigm. The interpretive paradigm views knowledge as socially constructed, created between the observer and the observed, and that lived experiences need to be understood from the perspective of the observed (Bryman, 2004; Denzin & Lincoln, 2000). It is the interpretation of phenomena in terms of "the meanings people bring to them" (Denzin & Lincoln, 2000, p.3). In this study, the interpretivist approach is defined as "systematic analysis of socially meaningful action through the direct detailed observation of people in natural settings in order to arrive at understandings and interpretations of how people create and maintain their social world" (Neuman & Kreuger, 2003, p.71). It guides the researcher in identifying the natural research settings and the phenomena under study, which in this study refers to the conventional tertiary classroom and online collaborative learning. It is noted that in this paradigm, interpretivist researchers adopt a relativist ontology claiming that there can be no single correct way of perceiving the world. With multiple realities, notions of prediction and control and objectivity are replaced with thinking about understanding, choice and subjectivity. This subjective view of the world means that people's view of reality can change as new meanings are constructed (Schwandt, 2000). Interpretivist researchers are therefore interested in finding out how people, in the case of this research, students, collectively construct social reality (Cohen, et al., 2005; Lather, 1992). Epistemologically, interpretivist researchers argue that the knower and the known interact and shape one another (Denzin & Lincoln, 2000). This epistemology is consistent with the theoretical underpinning of the research in this study (see Chapter 3) that knowledge is co-constructed in forms of joint activity within a specific context to accomplish particular goals.

The research in this study is guided by an interpretive methodology which is consistent with constructivist philosophical approaches (Denzin & Lincoln, 2000; 2003). The reason for adopting an interpretive methodology is because the data was interpreted according to the context of the students experiencing the research and the world they live in. According to Cohen et al. (2000), the central endeavour of the interpretive paradigm is to understand the subjectivity of human experience within its context. The interpretive paradigm views of knowledge are subjective and based on the research participants' interpretations of reality within a particular context and constructed through their understanding of the world (Cohen et al., 2000; Patton, 2002, Lincoln & Guba, 1985). That means by adopting an interpretive methodology, this study attempts to explain the reality, not through universal laws of knowledge but through understanding the complex interactions of the students experiencing online collaborative learning and their understanding of the desired learning outcomes. It also acknowledges that student understanding of reality is subjective and the examination of online collaborative learning is performed through the eyes of students. It is the students that experience the online collaborative learning and it is they who provide the data of their experiences of learning for interpretation and understanding. This study therefore is interested in finding out how students in this research understand their lived experience of an ICT education course through online collaborative learning to transform their learning experiences.

4.3 Research Design

Research design has been defined as a logical plan or blueprint for doing the research (Yin, 2009). It includes rigorous steps of collecting, analysing and interpreting data under investigation to ensure that the evidence addresses the research questions. In this study, the case study is designed to elicit the details from the viewpoint of students regarding their experience engaging in online collaborative learning by using multiple sources of data (Tellis, 1997; Yin, 2009). Yin (2003, 2009) suggests that the choice of research design or strategies should be based on the type of research questions being posed. Yin (2003) argued that:

> ...the first and most important condition for differentiating among the various research strategies is to identify the type of research question being asked. In general "what" questions may be either exploratory (in which case any of the

> strategies could be used) or about the prevalence (in which surveys or the analysis of archival records would be favoured). "How" and "why" questions are likely to favour the use of case studies, experiments, or histories. (p. 7)

The case study is an ideal way of designing research that seeks a holistic and in-depth investigation that is bound in a particular context (Patton, 1990; Merriam, 1998; Stake, 2003; Yin, 2009). Case studies also have been widely adopted by researchers of online learning (Hara et al., 2000; Bélanger, 2004; Harasim, 2012). This is also observed in Harasim's (2012) review of eight institutional case studies of adopting and applying online collaborative learning (OCL) and blended courses. They are often chosen, not because they are extreme or unusual in some way, but because they provide a suitable context for understanding complex phenomena and allowing certain research questions to be answered (Patton, 1990; Bryman, 2004; Yin, 2009). According to Yin (2003), case studies are used to understand complex phenomena "…when users' intentions, technology use patterns, and social impacts cannot be clearly separated from the social, technological and organisational contexts in which they occur" (p. 47). This is especially relevant to this study of online collaborative learning because the phenomena cannot be separated from the technological context. This study also fulfils the characteristics of case study research that focuses on phenomena that are bound in a particular context and seeks an in-depth investigation of the case (Merriam, 1998; Yin, 2009). Building on the work of Yin (1994, 2009) in line with the work of Tellis (1997) and Bélanger (2006), the researcher adopted the classroom case study design with some modification based on the research context which comprised four stages as described in the following section.

4.3.1 Designing the Case Study

An important decision at the start of this research was to determine that the case study be a single case design. Yin (2009) offers a number of rationales for a single case design. The rationale for this study is that the single case study design approach clearly aligns with the socio-cultural and cultural-historical assumptions of examining an online collaborative learning case situated in a specific cultural, historical, social, and institutional context. The case study in this research is unique because the case is designed to be bounded in a specific Malaysian tertiary classroom in line with the study aims to investigate the incorporation of online collaborative learning in a Malaysian tertiary classroom leading to a framework that may help in enhancing students' learning in ICT education. The research questions in this study included both *how* and *what* questions which align with the case study strategies in examining tertiary students' perceptions of online collaborative learning that is underpinned by a socio-cultural theoretical framework. The study aims to examine the nature of online collaborative learning interactions in order to enhance learning through evaluating the students' and student group interactions together with their outcomes of learning. In order to achieve this aim, the following research questions are considered:

1. What is the nature and effects of pre-service teacher education students' interactions in online collaborative learning?
2. What is the nature of pre-service teacher education student group interactions in online collaborative learning?
3. How does online collaborative learning affect pre-service teacher education student learning?

4.3.2 Conducting the Case Study

The second stage of a case study research approach as recommended by Yin (2009) is the stage of conducting the case study through preparing for and collecting the data. In this study, the research involves collecting both quantitative and qualitative data. Quantitative data involved the distribution of online questionnaires at the beginning and at the end of the research, while qualitative data was obtained through students' and lecturers' interviews, online transcripts and online journals. The summary of data collection events is depicted in Table 4.1.

Table 4.1: The summary of data collection events

<table>
<tr><th>Week</th><th colspan="3">Research activity</th></tr>
<tr><td>Week 1</td><td rowspan="2">Attain informed consent letters and Pilot Study</td><td rowspan="3">Online transcripts 1</td><td rowspan="13">Lecturers’ interviews</td></tr>
<tr><td>Week 2</td></tr>
<tr><td>Week 3</td><td rowspan="3">Pre-questionnaire</td></tr>
<tr><td>Week 4</td><td rowspan="6">Online transcripts 2</td></tr>
<tr><td>Week 5</td></tr>
<tr><td>Week 6</td><td rowspan="4">Semi-structured group interviews</td></tr>
<tr><td>Week 7</td></tr>
<tr><td>Week 8</td></tr>
<tr><td>Week 9</td></tr>
<tr><td>Week 10</td><td rowspan="4">Online journal
Post-questionnaire and interview</td><td rowspan="4">Online transcripts 3</td></tr>
<tr><td>Week 11</td></tr>
<tr><td>Week 12</td></tr>
<tr><td>Week 13</td></tr>
</table>

Prior to the data collection, the researcher had sent a formal letter to the Dean of the Faculty of Education, Universiti Teknologi Malaysia (UTM) requesting his permission to conduct the research. The formal letter consisted of an information sheet describing the research in detail and seeking permission to approach targeted participants at the Faculty of Education for this study in August 2009 (see Appendix A). With permission from the Dean of the Faculty of Education, the researcher emailed the Head of the Department of Educational Multimedia requesting the schedule of ICT education subjects offered in semester II 2009/2010. The SPM 2322 Authoring Language was chosen, particularly because it was the only course offered to three subject major programmes (Chemistry, Physics and Mathematics) and with online participation. The researcher then verbally informed the Head of the Department of Educational Multimedia of lecturers’ participation in the interviews in this research and their informed consents were obtained (February to March 2010) (see Appendix B). The students’ informed consents were also gained at the beginning of the course (December 2009) (see Appendix C). The researcher explained briefly to the students the research objectives and how the data would be collected. A pilot study was conducted with a different group of students who were not involved in the research but had experience in studying an ICT education course through eLearning participation. The pilot study included the testing of the online questionnaire to ensure the necessary information was collected and the questions were interpreted appropriately by the students. The online questionnaire was conducted at the start and end of the course (see Appendix D & E). Semi-structured group interviews (see appendix F), post-course interviews with students (see Appendix G) and lecturers' interviews (see Appendix H) were also conducted. The researcher had undertaken a certain amount of checking and debriefing prior to the interviews. A senior lecturer with qualitative research experience was asked to help check and verify the interview questions including probes into the questions prior to the data collection. The researcher was also the lecturer for much of the course.

4.3.3 Analysing the Case Study Evidence

The third stage of a case study research approach as recommended by Yin (2009) is analysing the case study evidence or data. The data generated during the case study in this research was analysed quantitatively and qualitatively. Quantitative data from the online questionnaires were retrieved online, computed and analysed using SPSS (Statistical Package for the Social Sciences) version 15, statistical analysis software, and the number of messages per student within the group was counted. The online discussion transcripts were analysed using content and thematic analysis techniques in participative, interactive, social, and cognitive dimensions (Henri, 1992; Hara et al., 2000; Lipponen et al., 2003; Gerbic & Stacey, 2005; Pozzi et al., 2007). Data from semi-structured students' interviews and lecturers' interviews were transcribed verbatim, categorised, coded and analysed using NVivo 7.0, qualitative analysis software. Other qualitative data were also collected such as documents (group reports, assessments and marks, and final grades) and online students' journal entries. These data were collected in order to triangulate the findings and to help the researcher assess the extent to which the intervention was successful in facilitating online collaborative learning experiences.

4.3.4 Preparing the Report

The final stage of a case study research approach as recommended by Yin (2009) is the stage of reporting the findings of the study. Creswell (2008) suggests that the report of a study include both quantitative and qualitative methods depending on whether the strategy for conducting the study was sequential or concurrent. A sequential study is one where qualitative and quantitative phases are conducted separately in the research and a concurrent study is one in which the quantitative and qualitative methods are applied concurrently, as was the case in this study. Therefore, the report of the findings in this study is structured to answer the research questions using both analysis and interpretation of quantitative and qualitative data. This was the structure adopted for reporting in the three findings chapters in this study. The first is Chapter 6 which reports the findings of the online class (the first research questions) followed by Chapter 7 which reports the findings of the online groups (the second research question), and finally Chapter 8 reports the findings of the outcomes of the intervention (the final research question). The design and overall steps in conducting the research, including data collection methods, are depicted in Figure 4.1.

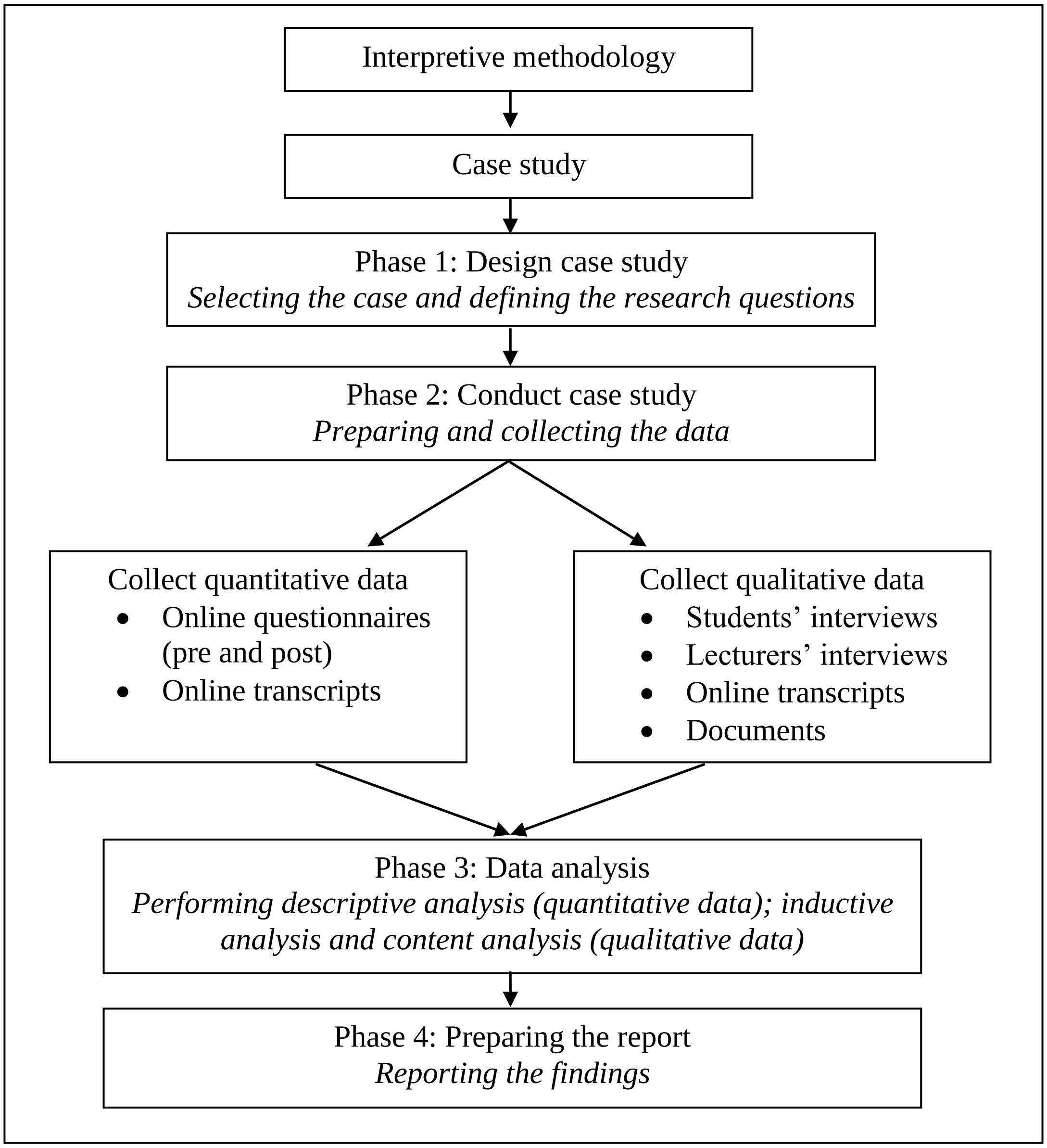


Figure 4.1: The design and steps of conducting the research

4.4 Methods of Data Collection

There are two types of methods in educational research known as quantitative and qualitative. The choice of methods determines the data generation. For example, quantitative methods (associated with the positivist approach) often refer to the use of experimentation, observation and survey to elicit responses to predetermined questions, recording measurements, describing phenomena and performing experiments where data can be quantified for statistical analysis, while qualitative methods (associated with the interpretivist approach) include participant observation, role-playing, non-directive interviewing, and episodes and accounts where the meaning of data can be examined and interpreted qualitatively (Cohen et. al, 2000). Although data collection in case studies can be either purely quantitative or qualitative, they also can be conducted using a combination of quantitative and qualitative methods, also known as mixed-methods (Creswell, 2008; Merriam, 2001; Patton, 1990).

A combination of quantitative and qualitative methods is commonly used in case studies which include the use of multiple sources of data for the purpose of triangulation in which researchers compare, contrast, and confirm the result (Denzin & Lincoln, 2000; Flick, 2009). The key purpose of using a combination of quantitative and qualitative methods is to acknowledge that each type of method has advantages and disadvantages and to allow the strengths of one method to enhance the data from the other methods (Creswell, 2008). In this study, an interpretivist methodology with qualitative methods was regarded as the best means for data collection since it involved an intervention over three month's duration in a Malaysian tertiary classroom context. The researcher also used a combination of quantitative and qualitative data collection methods to help inform the study and answer the research questions. Table 4.2 describes the data collection methods used to answer the research questions at three different levels of analysis. The first level of analysis, performed at the class level, aims to examine the effects of the intervention activities based on the analyses of postings in participative, social, interactive and cognitive dimensions and students' overall perceptions of their experiences of the intervention. Data was collected using multiple sources consisting of online discussion transcripts and the post-course questionnaire and interviews. The second level of analysis was conducted at the group level and examined each group's participation in the online group discussions. Data included pre-post questionnaires, semi-structured group interviews, documents, and online group discussion transcripts. The final level of analysis (the outcomes) evaluated the usefulness of the intervention in facilitating students' learning. Data for the analysis at this level included the post-course questionnaire and interviews, documents, online transcripts, and the online reflective journal.

Table 4.2: Research questions and methods used

Research Questions	Methods
Level 1-The online class (Chapter 6)	
1. What is the nature and effects of students' interactions in online collaborative learning?	• Online discussion transcripts • Post questionnaire • Semi-structured interviews (group and post-course)
Level 2-The online groups (Chapter 7)	
2. What is the nature of student group interactions in online collaborative learning?	• Online group discussions transcripts • Pre and post questionnaires • Semi-structured group interviews • Documents
Level 3-The outcomes (Chapter 8)	
3. How does online collaborative learning affect student learning?	• Online transcripts • Post questionnaire • Semi-structured interviews (post-course) • Online reflective journal

4.4.1 Documents

Documents can include a wide variety of materials relevant to the case under study consisting of public and private records that the researcher can obtain about a site or participant in a study. The documents can include newspapers, minutes of meetings, policy documents, manuals, handbooks, photographs, magazines, books, brochures, and advertisements, from billboards to flyers and television commercials (Olson, 2009; Creswell, 2008; Miles & Huberman, 1994). Documents also can be one of the main forms of data sources for interpretation and analysis in case study research (Olson, 2009). Documentation can provide a window into a variety of historical, political, social, economic, and personal dimensions of the case beyond the immediacy of interviews and observations, and so help the researcher understand important meanings from the texts within a particular context (Olson, 2009; Denzin & Lincoln, 2003).

In this study, data collection through documents was conducted by obtaining documents on the basis of their usefulness or relevance as data for the research. All teaching and learning documents including overall classroom learning task scores, group reports, assignments and final grades were obtained. The assignments, group projects, reports and assessment scores were kept for further analysis by the researcher who was also involved as a lecturer in teaching SPM 2322 Authoring Language, which was the vehicle for the intervention. In SPM2322 Authoring Language, the researcher taught the course for 13 weeks and the remaining weeks 14-15 were taught by the lecturer who, not involved in the research, also handled the course marks and grading. The final grade report for the course was gained from the Head of Department of Educational Multimedia in November 2010 via email after the final course grade was released by the university. In this study, the use of grades of SPM 2322 Authoring Language was for checking and triangulation. No analysis (e.g. statistical analysis) was done on the grades. Consent given from the Dean gave the researcher permission to obtain the final grade report from the Head of Department of Educational Multimedia in November 2010 via email. In this regards, the researcher did not see the need to ask students for permission to see their grades due to the Malaysian cultural context in which the university has ownership of course grades and permission to view the grades had been given by the Dean as gatekeeper.

Olson (2009) argues that knowing the source of documents enables the researcher to validate the source and authenticity of the chosen documents. Merriam (2009, p.151) suggested several questions to determine the authenticity of a document, namely:

- What is the history of the document?
- Is the document complete, as originally constructed?
- If the document is genuine, under what circumstances and for what purpose was it produced?
- What were the maker's sources of information? Does the document represent an eyewitness account, a second hand account, a reconstruction of an event long prior to the writing, an interpretation?
- Do other documents exist that might shed additional light on the same story, event, project, program, context? If so, are they available, accessible? Who holds them?

Merriam (2009) also highlighted the importance of distinguishing between primary and secondary documents. Primary documents are those created by people closest to the phenomenon under study while secondary documents are those created by persons not directly involved in the study. Merriam (2009) argues that it is possible for a document to be either a primary or a secondary document depending on the purpose of the research. Therefore, in this study, all teaching and learning materials produced by students (i.e. assignments, coursework and reports) were considered as primary documents while assessments including learning task scores, marks and final grades were considered as secondary documents because they were obtained from the Head of Department of Educational Multimedia. Once the identified and selected documents were obtained and authenticated, they were copied and sorted into appropriate categories and labeled. However, only documents such as group marks and final grades of SPM 2322 Authoring Language were considered for triangulation of data.

4.4.2 Interview

In this study, interviews were employed to obtain data from lecturers regarding their perceptions of eLearning in teaching and learning (see Appendix H) and students regarding the usefulness of the online collaborative learning intervention (see Appendix F). Interviews are purposeful conversations, usually between two or more people, that are directed by one in order to get information from the other (Maykut & Morehouse, 1994; Bogdan & Biklen, 2007). Interviews are commonly conducted with people whom the researcher believes may add to his or her understanding of the phenomenon being studied (Maykut & Morehouse, 1994). The main strength of an interview is that it allows for greater depth of data collection than other methods and enables participants to use their own language (as in this study where Malay language was used) in collecting in-depth information for the research (Cohen, et al., 2000). Interviews are also based on the view that knowledge is socially constructed between participants which are consistent with the social constructivism and socio-cultural theories (Cohen, et al., 2000; Patton, 2002). The potential advantages of using interviews include privileged access into the participants' experiences, views, feelings, attitudes and preferences in a profound way (Patton, 2002); gathering of spontaneous, rich, and specific answers from participants at an appropriate rate (Cohen, et al., 2000); flexibility of finding out answers to the research questions in mind, and the opportunity to ask probing questions to elicit more complete information (Burns, 2000; Merriam, 2009). Interviews may also be used in two ways; either as the primary strategy for data collection, or they may be used in conjunction with other data collection (Bogdan & Biklen, 2007). Techniques for ensuring the credibility of the qualitative inquiry, include prolonged engagement, member checking, triangulation, and debriefing, were considered in order to affirm the validity of the data (Cohen, et al., 2005).

The interviews with students and lecturers were semi-structured. The advantages of using semi-structured interviews as indicated by Bishop (1997) are “the opportunity to develop a reciprocal, dialogic relationship based on mutual trust, openness and engagement, in which self disclosure, personal investment and equality is promoted” (p.32-33). The semi-structured student group interviews were conducted with a total of nine groups involved after completing learning tasks 1 and 2. The interviews were scheduled according to students’ time availability and were audio-taped with the students’ permission. There were opportunities for clarification and discussion of any emerging issues in the interview. Probing questions were used to bring out more information and elaboration from the students and to allow the researcher to further examine the students’ views about their OCL experiences. The students’ responses provided information about what they had gained through OCL and their feelings about their roles and contributions. The interviews with the students were conducted from 2nd to 11th February 2010 and each interview session lasted between 45 to 60 minutes (see Appendix F for a sample of the semi-structured group interview). Two further post-course semi-structured interviews were also conducted, both with an actively collaborating group and with a less actively collaborating group. These groups were especially selected for the interviews which were held from 28th February to 14th March 2010. Each interview was between 30 to 45 minutes in duration (see Appendix G for a sample of the post-course interviews).

The semi-structured interviews with the lecturers were conducted from 23th February to 3rd March 2010 and each lasted between 30 to 45 minutes (see Appendix H for a sample of the semi-structured interviews with lecturers). For this purpose, the researcher approached all lecturers from the Department of Educational Multimedia who had some teaching experience in SPM 2322 Authoring Language with eLearning participation. All four lecturers who taught SPM 2322 Authoring Language with eLearning previously had agreed to participate while two lecturers from the Faculty of Education with related eLearning teaching experiences (more than two semesters) also volunteered to participate in the interviews. Altogether six lecturers participated in the interviews which were tape recorded with permission. In both sets of interviews (students and lecturers), pilot interviews were conducted to test the questions as well as to check and refine wording and the way the questions were asked. All interviews were transcribed verbatim (including grammatical errors) in order to preserve their authenticity.

4.4.3 Questionnaire

Questionnaires were used at the beginning and the end of the course (SPM 2322 Authoring Language). One of the advantages of using questionnaires is that the data is quantifiable, and so provided the quantitative data for this study. The semi-structured questionnaire conducted at the beginning of the course consisted of open-ended and closed questions. Responses to closed questions are easy to collect and analyse (Creswell, 2008) while responses to open-ended questions can provided authentic, rich and candid responses from participants (Cohen et al., 2000). For this study, a pre questionnaire consisted of open-ended and closed questions; and a post questionnaire consisted of only closed questions; they were specifically administered to obtain students' perceptions regarding their online collaborative learning experiences at the start and the end of the course. The intention of using pre and post questionnaires was for the purpose of triangulation of data on a purposive (or non-probability) basis and not intended to generalise findings. Cohen et al. (2000) argue that the use of a questionnaire for specific target samples can prove adequate when researchers do not intend to generalise findings beyond the sample in question (p.88). Such a strategy in this research was based on a purposive sampling where samples were chosen to conform to the research purpose rather than making a generalization in respect of an entire population (Cohen et. al., 2000; Merriam, 2009).

In this study, the pre and post questionnaires were distributed and administered online. The pre-questionnaire was conducted on 10th January 2010 while the post questionnaire was conducted on 10th March 2010, and pilot testing of the questionnaire was conducted on 24th December 2009. The pilot testing was conducted with different students who were not involved in the research but were enrolled in an ICT education course. The researcher approached the lecturer who taught the course and asked for permission to include her students in a pilot study (see Appendix B). The pilot testing of the questionnaire was conducted in the same computer laboratory as the pre and post questionnaire sessions, with the researcher present. The intention here was to identify potential questions in the questionnaire that might be ambiguous or difficult to interpret by students, and to ensure that the online questionnaire layout and content was user friendly. A total of 28 students participated in the pilot study. The questionnaire was then evaluated for validity and reliability. A Cronbach's alpha reliability coefficient was computed and the widely-accepted social science cut-off alpha of at least 0.7 was applied (de Vaus, 1999; Garson, 2001; Lewis-Beck, et al., 2004). This study reported a 0.91 Cronbach's alpha for the internal consistency reliability measurement which indicated that the items were reliable and consistent. The questionnaire was also checked for content and language clarity before administration.

The pre questionnaire was organised into three parts (see Appendix D). Part A had eight questions on students' demographics. The second part, B, questioned students' previous eLearning (Moodle) experiences and included five open-ended questions. The last part, C, dealt with students' perceptions of online experiences in learning and working in a group through eLearning (Moodle) and included 54 closed questions, structured using a five-point Likert scale from strongly agree to strongly disagree. Information from this survey helped to obtain a better understanding of the students' backgrounds prior to the intervention and also enhanced the interview. The information was also used to gauge how much technical help the students would need during the intervention, as previous research has shown that students exhibited decreased mutual understanding and coherence but increased coordination and accommodation difficulties when they did not receive sufficient training in computer-mediated communication (Cornelius & Boos, 2003).

The post questionnaire included the same 54 closed questions from the pre questionnaire without any modification, but the instruction was adjusted to reflect students' perceptions of online experiences in learning and working in a group through eLearning (Moodle) at the end of the course (see Appendix E). The post questionnaire follows the same structure of the five-point Likert scale from strongly agree to strongly disagree and had 12 questions on general experiences using eLearning, 12 questions on students' feelings about online learning, 11 questions on students' feelings about working within an online group, eight questions on online group work and 11 questions on task distribution within an online group. The questionnaire aimed to obtain students' evaluations and perceptions of the intervention activities. The post questionnaire was also checked for content and language clarity before it was distributed and administered.

4.4.4 Online Transcripts

The online transcripts generated from the OCL intervention activities were the primary source of documentation in this study. This was made possible by the Moodle web system in which is recorded all online activities that occurred (Moodle, 2009). Henri (1992) argues that data recorded in the Moodle-generated transcripts are considered a "gold mine" which can be used to provide information regarding the psycho-social dynamic among students, learning strategies adopted, and the acquisition of knowledge and skills (p.118). The online interactions as evidenced through Moodle transcripts conveyed important information regarding distributed cognition of students' interactions over time in which their interactions affected each other as well as developed from each other (Gunawardena, et al. 1997). In line with social constructivist and socio-cultural theories, the online transcripts generated by Moodle could provide evidence of learning through the OCL intervention because they have been reported to be observable, relatively easy to use, accessible, and safe (von Wright, 1992, Anderson & Kanuka, 1997; Hsiung, 2000). They are also easy to track and are usually administered over an extended timeframe which could give the researchers the flexibility to evaluate and monitor the online forums and, as a consequence, the burden of participation and time pressure is reduced (Im & Chee, 2006). In this study, the online transcripts generated by Moodle for the OCL intervention activities were collected with students' permission (see Appendix C) and they were used to provide the researcher with data and insights into students' interactions for evaluating OCL intervention in the ICT education course.

4.4.5 Online Reflective Journal

The students' reflective journal was an important tool to document students' learning (Nunan, 1992) and was used in this research for the evaluation of the intervention at the end of the course (week 13). Reflective journals have been used widely as a method of data collection in the field of online learning (Andrusyszyn & Davie, 1997; Herrington & Oliver, 2002; Bennett & Pye, 2002; Henderson, et al., 2004; Boulos, et al., 2006; Xie, et al., 2008). In online learning, reflective journals can be divided into four types in terms of cognitive functions, namely, event-orientated journal, meditative reflective journal, critical reflective journal, and conferencing journal (Lê, 2006). Generally, an event-orientated journal is used to record a student's daily events which require their attention or action; a meditative reflective journal is used for reflective writing; a critical reflective journal is used to record a highly intellectual process which may involve hypothesis building, theorizing and problem solving; and a conferencing journal is used for online discussion reflection (Lê, 2006). In this study, the researcher used online reflective journals as conferencing journals to record students' evaluation of the usefulness of the OCL intervention in facilitating learning and their suggestions for course improvement. The process of reflection by students was guided by nine open-ended questions (see Appendix I for a sample of the online journal questions used for evaluating the intervention). Students were also informed that their responses were recorded online through the journal facility in eLearning (Moodle) and their responses would not be judged as right or wrong and thus encouraged them to provide open and honest responses.

4.5 Data Handling and Analysis

Data analysis involves the process of systematically searching and arranging the research evidence through reviewing the research questions so that it could help remind the researcher of the purpose of the research and the research's targeted audience. By bearing this in mind and before the researcher began analysing the data, all participant names were deleted and replaced with pseudonyms. In this study, data analyses were conducted at three levels: the online class (Chapter 6), the online groups (Chapter 7), and the outcomes (Chapter 8). In the first level of analysis, data collected sought to examine the effects of the intervention activities through the analyses of online postings in participative, social, interactive and cognitive dimensions (see below), and analysing students' overall perceptions of experiencing the intervention. It involved the analysis of online transcripts generated by all students within the intervention activities to answer the first research question. Next, it involved analysis of the interview transcripts and questionnaires for students' perception of experiencing the intervention completed at the end of the course. These findings are reported in Chapter 6. The second level was intended to establish an in-depth analysis for each participating group in the intervention, with the intention of describing the way each group worked through participation and interaction in the intervention and to answer the second research question. Particular attention was given to the characteristics of online groups and their ways of working that might contribute to the aspects of online personalised learning in the study. The findings are reported in Chapter 7. The third and final level of analysis was conducted to evaluate the usefulness of the intervention in facilitating students' learning in the SPM 2322 Authoring Language course. The intention here was to examine the outcomes of the intervention in terms of cognitive, social and emotional transformations within its situated context in order to answer the final research question. The contextual levels of analysis adapted from Boer, et al. (2002) were used as an analytical framework to identify the transformative outcomes experienced by students as a result of their participation in the intervention activities. The analysis was conducted at higher, middle and lower contextual levels as suggested by Boer, et al. (2002). The higher contextual level refers to an analysis in a broader cultural institutional context within which the intervention takes place, followed by a middle contextual level of analysis within the intervention, and then an evaluation of the analysis of the intervention as to its outcomes and constraints at the lower contextual level. Boer, et al. (2002) argues that when any intervention was analysed as an activity system in a particular context, its relations with activities at other contextual levels (in this case the university, the intervention within the course and its outcomes and constraints) should also be taken into consideration in order to reveal its "*temporal interconnectedness*" (p.94). Changes in any contextual level may have the potential to affect any or all of the other related activities. A description of the contextual levels of analysis performed in this research to examine the outcomes of the intervention is provided in Table 4.3.

Table 4.3: Analytical Framework for evaluating the intervention

Contextual Levels of analysis	Description of analysis	Evidence of interest
Higher contextual level	The analysis of the intervention on a broader institutional contextual level within which the intervention operates. The affordance of tools, activities and resources for participations in the course and how these affected students' expectations from the course and how they had achieved the goals.	Evidence on a broader cultural context of the course, tools and activities reported to be of value for increasing students' participation in the course and the goals achieved.
Middle contextual level	The analysis of the intervention on the aspects of students' distributed online interactions to the course. How students interact one to another during the intervention to achieve the course goals.	Evidence on different ways of interactions that students exhibited during their interactions in supporting their peers' cognitive, social, and emotional development in the context of the tools and activities used in the course.
Lower contextual level	The analysis of the intervention is discussed in terms of its outcomes and constraints on students' participation in the activities. The outcomes were marked as cognitive, social, and emotional transformations.	Evidence on students' and groups' statements in developing understanding and gaining expertise (cognitive transformation); developing joint commitment and responsibilities (social transformation); and

		developing confidence, attitude and satisfaction (emotional transformation).

Since the three contextual levels of analysis comprised the analysis of the outcomes of the intervention used in this research, the discussion on the findings of each level of analysis was reported together in one chapter rather than in separate chapters so as to provide complementary aspects to each other within the landscape of situated socio-cultural activity. The findings of the outcomes of the intervention in this research are presented in Chapter 8. The following section presents further descriptions of particular types of data analyses conducted in this research.

4.5.1 Quantitative Analysis

Quantitative analysis was performed on quantitative data collected from online questionnaires, together with online data based on the frequency of students' postings in participative, interactive, social, and cognitive dimensions (see Appendix O). All data collected from the online questionnaires and the online data were computed and analysed using the Statistical Package for the Social Science (SPSS) software. Before analysing data from the questionnaire, all negative items were recorded using SPSS.

A descriptive analysis was performed to obtain mean (M) and standard deviations (SD) for both pre and post online questionnaires. In order to determine whether the students' responses to an item in the post questionnaire were at a greater than chance level, the mean Likert scale score on each item for the 42 students who participated in the post questionnaire was computed by running a one-sample, two-tailed t-test with the hypothetical mean score (test value) of 3.5, as a neutral score of the 5-point scale (selected to test whether students' views were above moderately positive) to examine differences in responses (mean scores). These findings were then triangulated by the qualitative data from the interviews in order to develop a complete analysis for students' overall perceptions of the intervention at the end of the course.

Non-parametric analysis was performed on online data counted in participative, interactive, social and cognitive dimensions by running the Kruskal-Wallis test for testing an independent variable with more than two groups (learning task 1, task 2 and task 3) and the Chi-Square test for two independent sample distributions, between male and female students. The Kruskal-Wallis test was performed to examine the difference in terms of mean scores of particular categories within each dimension between the learning tasks and the Chi-Square test to examine the differences in mean scores between male and female students in terms of their mean scores of postings within particular dimensions in learning task 1, task 2 and task 3.

4.5.2 Qualitative Analysis

Qualitative analysis was conducted on the data collected from interviews with students (group and post-course interviews) and lecturers. The verified interview transcripts by participants were analysed using the constant comparative method at two levels: within-case analysis and cross-case analysis, in order to generate meaningful qualitative themes (Maykut & Morehouse, 1994; Miles & Huberman, 2002; Merriam, 2002, 2009). In this method, each individual group transcript was studied and emerging themes from the data were coded and compiled for each group. The emerging themes were then compared across groups and subsequently categorised into similar units of meaning. The categories were continually refined, changed, merged or removed and grouped accordingly. Cross-case analysis within and between groups was undertaken to explore relationships and patterns that emerged from the interactions within each individual group case. In this study, main categories (e.g. tools affordances and constraints, pedagogical rules and shared roles and responsibilities) were framed using Activity Theory which similar to the work of previous researchers (e.g. Mwanza, 2002; Mwanza & Engeström, 2003) that used pre-specified Activity Theory codes that addressed specific components in an Activity System. All coding processes were conducted using NVivo 7.0, qualitative analysis software that facilitated data analysis by coding students' quotes into a node, a term used by NVivo to denote category. All of the data in a node, e.g. eLearning environment, constraining and enabling factors, online group work, and roles and responsibilities, can be later viewed and reviewed in a single window, making it convenient and efficient for the researcher to conduct qualitative analysis on a large amount of data (see Table 4.4).

Table 4.4: Categories and themes coded in NVivo 7.0

<table>
<tr><th>Tools affordances and constraints</th></tr>
<tr><td>
a. Node 1: eLearning environment
  i. eLearning features
    • Downloading notes
    • Discussion with friends
    • Page notification
  ii. eLearning layout and template
    • Personalised layout
    • eLearning layout for academic purposes
    • Surprising in using a different template
  iii. Effectiveness of eLearning environment
    • Can access eLearning anywhere and anytime
    • The effectiveness depends on the users and Internet connection
    • Yes, it is an effective learning environment
b. Node 2: factors constrain students to participate
  i. Internet connection issues
    • Internet availability
    • Internet breakdown
    • Wi-Fi coverage
  ii. Difficulties in using eLearning website
    • Browser incompatibility
    • Log-in issue
  iii. Conflict
    • People are sensitive
    • Couldn’t sense voice intonation
    • Not full use of all senses
    • Misinterpretation of message
    • Language barrier
    • Joined discussion late
c. Node 3: factors enable students to develop
    • Building good relationship
    • Promote critical thinking
    • Independent learning
    • Learning outside the class
    • Sharing information, thoughts and opinions
</td></tr>
</table>

<table>
<tr><td>The pedagogical rules of online collaborative learning</td></tr>
<tr><td>a. Node 4: group task(s)
i. Task(s) guideline
• Helpful with guidance
• Prevent out of topic
ii. Task(s) instruction
• Clear instruction
• Confusing
b. Node 5: online group work
i. Academic discussion(s)
• Active participation
• Copy and paste attitude
• Do not know how to reply
• Feel forced to do it
ii. General discussion(s)
• Personal and idle post
• Feel free to talk about feelings
• Don’t like to read
iii. Inter-group discussion(s)
• Argumentation and negotiation
• Collective ideas
• Contribution of ideas
• Quality of ideas
• Shared topics
• Variation of ideas</td></tr>
<tr><td>Shared roles and responsibilities among groups</td></tr>
<tr><td>a. Node 6: shared roles and responsibilities
i. Group member(s)
• Shared responsibilities
• Shared roles
• Working preferences
• Helping others
ii. Peer(s)
• Positive attitude
• Capabilities
• Level of thinking
• Shared roles
iii. Instructors
• Instructor’s involvement
• Instructor’s creativity</td></tr>
</table>

4.5.3 Online Transcripts Analysis

Content analysis technique was used in analysing online discussion transcripts. It is a technique that enables the researcher to study human behaviour in an indirect way, through an analysis of their communications (Fraenkel & Wallen, 2006) that includes the process of coding, transcribing, analysing and verifying online transcripts before a holistic picture of the intervention can be reported. Anderson et al. (2001) argue that content analysis is a technique that “builds on procedures to make valid inferences from text” (p.10). While content analysis has been frequently distinguished as either qualitative or quantitative, this research used quantitative and qualitative measures of content analysis for analysing students’ online interactions in the intervention activities. Content analysis can be used to qualify and quantify the discourse of online applications especially with educational content (Hara, Bonk & Angeli, 2000; Schwandt, 2001; Neuendorf, 2002; Anderson & Kanuka, 2003; Gerbic & Stacey, 2005; Bélanger, 2006). Anderson and Kanuka (2003) argue that content analysis can be used with “any type of artefact of human discourse or activity” and is “often associated with the analysis of text documents, and in e-research investigations” (p. 174). The purpose of using both quantitative and qualitative content analysis in this research was to reveal “information that was not situated at the surface of the online transcripts”, to be able “to provide convincing evidence about the learning and knowledge construction” (Wever, et al., 2006, p.7) and to “capture the richness of student interaction” (Hara et al., 2000, p.119).

One of issues of content analysis in online learning research is the choice of the unit of analysis (Wever, et al. 2006). Basically, there are five types of units of analysis as distinguished by Rourke, et al. (2001), from large to small units such as message (e-mail or forum contribution), paragraph (section), ‘unit of meaning’ (or thematic unit), sentence (or syntactical unit) and illocution (Rourke, et al. 2001; Stribos, et al., 2006; Wever, et al. 2006). This research employed the thematic unit as the unit for content analysis representing a single idea, argument, topic or information, or event to which they referred regardless of its length in online discussion transcripts (Henri, 1992;

Lally, 2001; Rourke, et al. 2001; Stribos, et al., 2006). Wever et al. (2006) note that there is no real agreement on how a researcher comes to choose the unit of analysis. The choice for a unit of analysis is dependent on the context and on the research purpose and question (Wever, et al., 2006). Furthermore, content analysis is subjective and as a result some interpretations may not be easily justified or validated when challenged (Ho, 2002). Previous research found the thematic analysis unit to be useful in investigating collaborative learning through computer conferencing (Henri, 1992), social construction of knowledge (Gunawardena, et al., 1997, 2001), critical thinking (Newman, et al., 1995; Bullen, 1997), social presence (Stacey, 2005) and group dynamics (McDonald & Gibson, 1998).

Previous research suggests that instead of developing new coding schemes, researchers should use schemes that have been developed and used (Rourke & Anderson, 2004; Wever, et al., 2006). Stacey and Gerbic (2003) argue that applying an existing instrument fosters replicability and validity of the instrument. One of the advantages of applying well-developed coding schemes is that the researcher could support the accumulating validity of an existing procedure, and the possibility to use and contribute to a growing catalogue of normative data (Rourke & Anderson, 2003). According to Wever et al. (2006), many researchers do create new instruments, or modify existing instruments. This research adopted and modified Henri's (1992) analytical instrument to analyse students' interactions within online group discussions. Based on the literature, Henri's (1992) analytical instrument is the most cited instrument in online learning research and is often used as a starting point in many Computer Supported Collaborative Learning (CSCL) studies (Wever, et al., 2006). It can be considered as pioneering work and has been the base for subsequent research (Wever, et al., 2006). The limitation of Henri's model, as pointed out by McLaughlin and Luca (1999), is that it was designed for contexts where there was a strong teacher presence, and is not readily applicable to a learner-centred conferencing environment. However, McKenzie and Murphy (2000) argue that Henri's model could be more easily applied to structured, problem-solving online tasks than to a less-structured online discussion. In accord with the McKenzie and

Murphy (2000) argument, this research used three structured online discussions which were based on the structured online intra and inter-group discussions on solving problems online via eLearning (Moodle).

The original analytical framework of Henri (1992) was based on five dimensions: participative, interactive, social, cognitive, and meta-cognitive. The participative dimension measures overall participation (which is the total number of messages and accesses to the discussion) and active participation (the number of statements directly related to learning made by learners and educators). The interactive dimension is divided into two parts, interactive versus non-interactive (independent) statements, and explicit versus implicit interactions. The social dimension measures all statements or parts of statements not related to the formal content of the subject matter. The cognitive dimension comprises fives categories, namely, (1) elementary clarification: observing or studying a problem, identifying its elements, and observing their linkages in order to come to a basic understanding, (2) in-depth clarification: analysing and understanding a problem which sheds light on the values, beliefs, and assumptions which underlie the statement of the problem, (3) inference: induction and deduction, admitting or proposing an idea on the basis of its link with propositions already admitted as true, (4) judgment: making decisions, statements, appreciations, and criticisms, and (5) strategies: proposing coordinated actions for the application of a solution, or following through on a choice or a decision. Furthermore, surface processing is distinguished from in-depth processing, in order to evaluate the skills identified. The meta-cognitive dimension measured meta-cognitive knowledge and meta-cognitive skills. Meta-cognitive knowledge is declarative knowledge concerning the person, the task, and the strategies, while meta-cognitive skills refer to ‘procedural knowledge relating to evaluation, planning, regulation and self-awareness (Henri, 1992).

Pozzi et al. (2007) argue that the five dimensions of Henri’s (1992) original model do not necessarily imply the use of all five dimensions. Instead, the researcher is free to decide which dimensions are relevant depending on the specific aims of the research and the context of the learning experience. Of the five original analytical dimensions, only four were used and considered to accommodate the data collected in this research; they were participative, interactive, social and cognitive dimensions. The researcher added several categories and examples from the literature to the framework, as previous research (Hara et al., 2000) found that adding several categories to the existing framework would be useful in overcoming the lack of precise evaluation criteria to judge each of the categories. The researcher employed several categories from Pozzi et al. (2007) for analysing participative (level of participation and viewing), interactive (types of interaction), social (types of social presence), and cognitive dimensions (types of cognitive presence); and an analytical framework for deep and surface learning from Gerbic and Stacey (2005) in order to elicit more information about students' participation and interaction during the intervention. The four modified analytical dimensions with added categories are elaborated upon as follows:

- The participative dimension categories were modified to include categories based on the level of participation determined through students' number of postings and viewings (Pozzi et al., 2007). These categories were based on two types of indicator of students' active and passive participation. Active participation was measured through the number of postings students made in the online discussion while passive participation measured the frequency of students viewing particular posts in the online discussion.

- The interactive dimension categories were modified to include categories based on thematic units referring to physical aspects of the online communication such as the frequency of explicit and implicit (or collaborative) interactions, and independent (or cooperative) statements (Ingram & Hathorn, 2004). The research also considered the qualitative aspects of students' interactions by identifying students' ways of interacting online (such as used in this research: providing information, sharing views, sharing experiences, agreeing and disagreeing, posing questions, suggesting new ideas, giving feedback, and clarifying ideas) during the intervention activities (Pozzi et al., 2007).

- The social dimension categories were modified to include categories based on thematic units characterised by affection and cohesiveness exhibited during communication in online discussions (Pozzi et al., 2007). Thematic units characterised by affection include the use of emotional expressions (such as used in this research: emotion icons or emoticons) and thematic units characterised by cohesiveness including the use of social cues (such as used in this research: greetings, salutations, concern, encouragement, apology, jokes and humour, and thanking).

- The cognitive dimension categories were modified to include categories based on cognitive presence revealed by thematic units referring to (1) revelation (renamed as clarification) that is, recognizing a problem, explaining or presenting a point of view; (2) exploration (renamed as judgment) that is, expressing agreement or disagreement, argumentation, exploring or negotiating; (3) integration (renamed as inference) that is connecting ideas, making syntheses and creating solutions; (4) resolution (renamed as strategies) that is, reflecting on real-life application suggestions or references to real-life solutions (Pozzi et al., 2007).

- The information processing (e.g. surface and deep) categories were modified to include categories based on thematic units referring to (1) surface learning that includes reproducing an approach (not wanting to understand the issue or finish with minimum of effort); or staying inside course boundaries (repetition of what is being discussed or required); or an unthinking approach (jumps to a conclusion with an uncritical acceptance of ideas); or fear of failure (focus on negative aspects of the coursework); or extrinsic motivation (more concerned about passing the assessment than learning); and (2) deep learning includes looking for meaning (focus on what is signified, asking questions to understand new information); or relating ideas (relating ideas to previous information or knowledge to generate new ideas); or using evidence (finding alternative ways of interpreting information or justifying with an example); or intrinsic motivation (desiring to learn more about the topics) (Gerbic & Stacey, 2005)

The overall steps of conducting the content analysis in this research began with the postings of the students in online discussions within each group and close reading of each posting was established. Next, the researcher coded each unit of analysis starting with participative followed by interactive, social, cognitive and information processing (surface and deep). The researcher established the counting of the number of postings for each category in each dimension. In order to safeguard credibility and to validate the coding procedures of the modified categories from Henri's (1992) model, intra-rater and inter-rater coding was employed. Intra-rater was conducted by the researcher as 'coder agreeing with his self (coding) over time' (Wever, et al., 2006). This was done by running the coding multiple times before reaching coding stability. In this research the coding was reviewed more than three times by the researcher to compare and contrast in order to achieve coding consistency. The overall coding was also reported for reviewing by other experienced researchers (in this case the researcher's supervisors).

The inter-rater reliability (the ability of multiple and distinct groups of researchers to apply the coding scheme reliably) was also conducted between two independent coders agreeing with each other (Wever, et al., 2006). Guidelines for coding were formulated stating clearly what comprises a unit, and descriptions of all categories. Two Malaysian PhD researchers from Massey University were asked to help with the coding. Before they conducted the coding process, the guidelines and instructions were introduced to them. A one-hour training session was held during which these guidelines were explained. After that, one transcript from each mode of discussion was randomly selected (altogether totalling approximately 10% of online group discussions) and coded separately by the two coders and they then compared their results. The result across all categories reached a Cohen's Kappa value of 0.81 compared with individual categories such as interactive with 0.84, social with 0.74, cognitive with 0.71 and information processing (surface and deep) with 0.72. According to previous researchers (Rourke et al., 2001; Neuendorf, 2002; Wever, et al., 2006) a value above 0.75 (sometimes 0.80) is considered to be excellent agreement beyond chance; a value below 0.40 indicates poor agreement beyond chance; and values from 0.75 to 0.40, represent good to fair agreement beyond chance. This study's 0.81 Cohen's Kappa value for the consistency of inter-raters' agreement can be considered highly reliable (Wever, et al., 2006).

Finally, the analysis of types of engagement within each online group was conducted. Four types of engagement were pre-identified from the literature instead of emerging from the analysis of the students' interactions. However, there was considerable consistency and relationship between the categories of analysis of students' participation level and their ways of interacting online in the online discussion during the intervention based on the overall triangulation of data (interviews, pre-post questionnaire and final grades). An example of the overall analytical process is depicted in Figure 4.2.

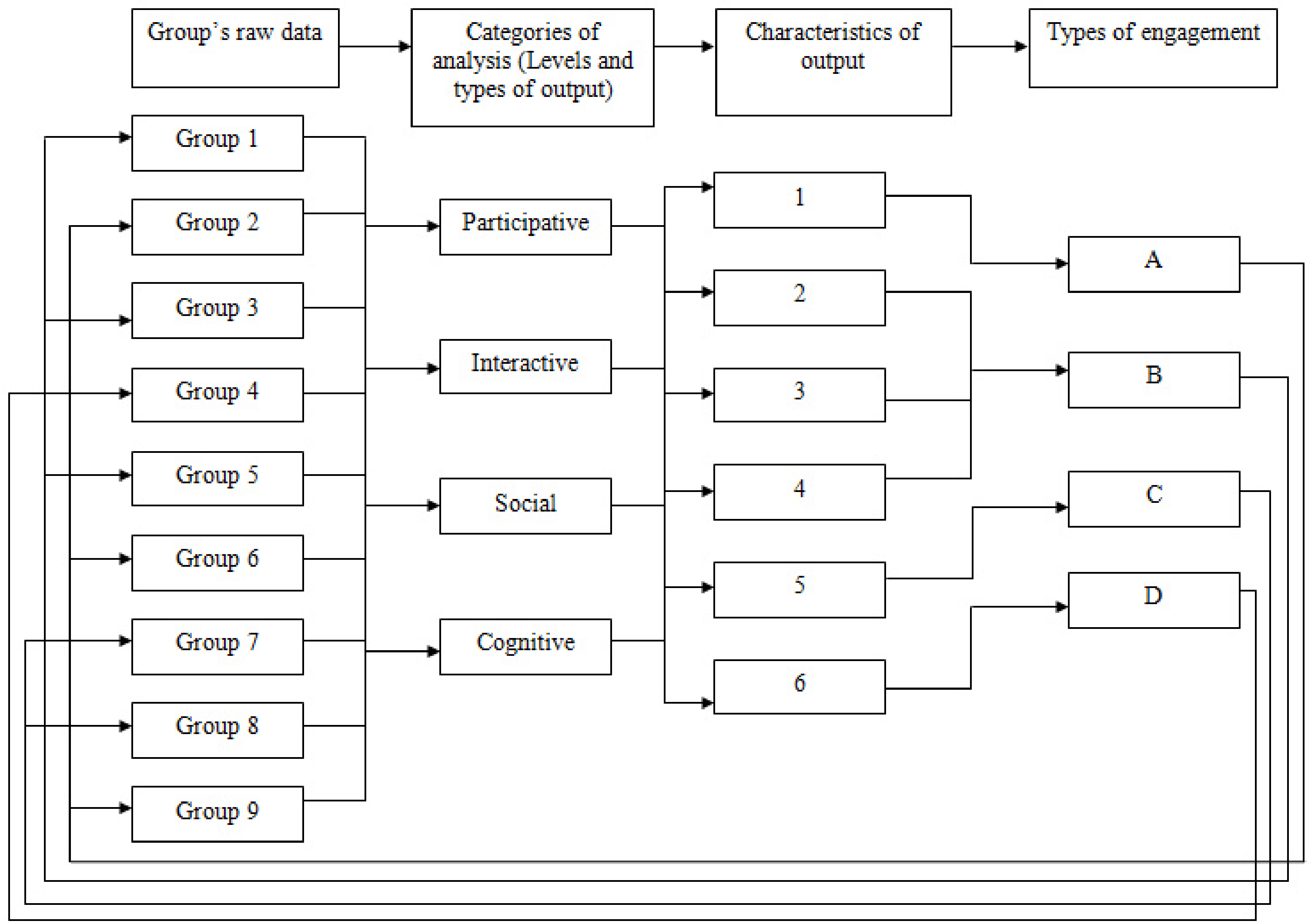


Figure 4.2: The process of analysing the online groups' interactions

4.6 Measures Taken to Enhance the Quality of the Research

In qualitative research, there are many ways in which validity and reliability can be improved. Lincoln and Guba (1985) argue that the trustworthiness of the research could be established through credibility, dependability, transferability and confirmability as measures that could be taken to enhance the quality of qualitative research. There are several strategies proposed by previous researchers (e.g. Denzin, 1978; Lincoln and Guba, 1985, Merriam, 2001; Flick, 2009) such as prolonged engagement, peer debriefing, member checking, and triangulation in order to enhance credibility in qualitative research. In this research, the measures taken to enhance the quality of the research were:

- A "prolonged engagement" includes research activities for increasing the likelihood that credible results would be produced in the research field (Lincoln and Guba, 1985; Flick, 2009). In this research, prolonged engagement involved the conduct of the research in the planning and development of the research intervention and activities (e.g. interviews, questionnaires and online discussion) for the course throughout the semester until its conclusion at the end of week 15 (approximately 4 months).

- Peer debriefing required the researcher to consult other people who were not involved in the research in order to disclose the researcher's own blind spots and to discuss certain results with them (Lincoln and Guba, 1985; Flick, 2009). In this research, the researcher asked for help from one senior lecturer from the Faculty of Education (with vast experience in educational research) to help monitor the conduct of the research. He was asked to check and verify all instruments used in the intervention before they were used in the course. In addition, the researcher is also a member of the Malaysian Auckland postgraduate group, where Malaysian PhD students from the University of Auckland, AUT, and Massey University meet regularly for discussion. The researcher used this discussion platform to share a part of the research findings with other Malaysian researchers in order to get feedback. The group discussion was a good platform for seeking feedback from other PhD researchers within the same field of research, and to share their particular research findings.

- Member checking was used in the sense of communicative validation of data to enhance the quality of the research (Lincoln and Guba, 1985; Flick, 2009). All interview transcripts (transcribed) were returned to all participants to verify; this gave them the opportunity to correct and comment before the transcripts were analysed. Furthermore, two independent researchers from Massey University also helped in inter-raters' validity and reliability coding categories of the research.

- Triangulation, one of the most trustworthy of criteria in qualitative inquiry (Denzin, 1978; Lincoln and Guba, 1985; Flick, 2009) helps to minimise the risks regarding validity and reliability caused by an exclusive reliance on only one method of research. Denzin and Lincoln (2000) categorised triangulation as within-methods and between-methods. Within-methods triangulation refers to the application of a range of either quantitative or qualitative techniques (such as in this research, interviews, questionnaires, documents, online transcripts, and reflective journal) and between-methods triangulation, which refers to the implementation of both quantitative and qualitative procedures. This research adopted both within-methods and between-methods triangulations as pointed out by Denzin and Lincoln (2000) in order to help reduce bias and partiality inherent from any single method of data collection and analysis. The statistical information was compared with the qualitative data in order to check for the consistency of the results (as for the second research question); quantitative data from the online discussion transcripts were first counted and analysed (as for the first research question) and the thematic units were coded qualitatively. These data were then triangulated with data obtained from the questionnaires, interviews, documents and online reflective journal (as for the second and third research questions).

There were three components in this study that could cause possible threats to the reliability of the data analyses: the questionnaires, the interviews, and the online transcripts. For the questionnaires, the items were trialled in a pilot study and the internal consistency reliability measurement reported a 0.91 Cronbach's alpha reliability coefficient which indicated that the items were reliable and that they measured consistently (see Section 4.4.3). For the interviews, the researcher acknowledged the limitations of interviews that could be prone to subjectivity and bias on the part of the researcher (Cohen, et al., 2000). The use of semi-structured interviews is important, yet this aspect may be unintentionally omitted (Patton, 2002). Leading questions should be used carefully with the awareness that they were being used - this should be acknowledged when interpreting responses. Interviewer flexibility in the sequencing and wording of questions could result in substantially different responses, which could reduce the comparability of responses (Patton, 2002). The issue of power in the interview should be considered and steps should be taken to minimise any imbalance during an interview (Cohen, et al., 2000). During the interview sessions, this limitation was borne in mind where the researcher tried to word and sequence questions as similarly as possible for each participant in the group. Finally, the selection of quotes or excerpts from a transcript used as data to support findings should be made clear to the reader (Flick, 2009). By bearing in mind these limitations during the interview sessions, the researcher tried to use phrasing and sequence questions as similarly as possible for each participant. All interview questions were also checked for wording and clarity (see Section 4.4.2). For the online transcripts, intra and inter-coder reliability tests were performed (see Section 4.4.4). The result across all categories reached a Cohen's Kappa value of 0.81, while the following individual category values were attained: interactive with 0.84, social with 0.74, cognitive with 0.71, and information processing (surface and deep) with 0.72. This study reported a 0.81 Cohen's Kappa value for the consistency of inter-raters' agreement which can be considered highly reliable (Wever, et al., 2006).

Dependability and confirmability of the research were established through a process of auditing (audit trail) (Flick, 2009). Thus, an auditing trail for this research was outlined for tracking purposes which included: the recording of the raw data through documentation of how the data was collected, reconstruction of data and results based on the use of the categories (e.g. the analytical categories and themes), and information about the development of the instruments including the pilot version (Flick, 2009). The intention of having an auditing trail here was so an independent auditor could validate the research findings (see Appendix A to O). In this research the strategy to enhance transferability was considered through providing a clear, detailed and thick description (Merriam, 2001; Cohen, et al., 2000) of comparison between groups so that the translation of data (applicable to other situations) into different settings could be made (Cohen, et al., 2000).

In terms of researcher bias, the researcher tried to be objective in all aspects of the research. As the researcher was also a teacher in the course, there was the potential for bias regarding student grades. However, all marking and grading of student work was handled by the original course lecturer. In addition, ethical guidelines were followed (see next section) making student participation voluntary and giving students the opportunity to withdraw or not participate in responding to the questionnaires. The returned rates for the questionnaires were not 100% (only 42 students completed both sets of questionnaires). Although ID code was used as reference code in the questionnaires (see appendix D & E), these were all done by students, themselves. However, the analysis of questionnaires was done manually by the researcher due to the fact that the students did not use the identical ID code they self-created for pre and post questionnaires.

4.7 Ethical considerations

This research was approved by the Human Research Ethics Committee of the University of Waikato on 7th August, 2009. The conduct of this research adheres to the University of Waikato’s Human Research Ethics Regulations, 2000. These guidelines include obtaining informed consent from all participants. All participants in the research were volunteers and all agreed to participate in the study. They also were all informed about the study. Consent was obtained both from the individuals and the institution involved. All information was strictly confidential and no names of participants were used in order to ensure anonymity. Given that the institution in which the research was carried out and course names and dates have been identified within this thesis, it is acknowledged that it may not be possible to completely guarantee participant anonymity. However, no participants have been directly identified within the study (nor reports resulting from it) and all care was taken to make it unlikely that participants could be indentified.

Participant data presented in this thesis used pseudonyms. Efforts were also made to respect a student's privacy and to seek permission prior to collecting samples of their work. Students were also informed of their right to withdraw at any stage of the research and no further information would be gathered about their activities, nor would withdrawal affect their progress in the course or any assessment of their work. Ownership of the raw data collected would belong to the participants and any requests regarding the data would be considered and acknowledged in the research. However, the analysis and interpretation of data belonged to the researcher. Participants were informed that information obtained in the research would be used for a PhD thesis and may be used in publications. As this research was based heavily on online data from eLearning (Moodle), any form of misuse, loss, disclosure, unauthorized access and similar risks (Flick, 2009) was guarded against in case their participation could be still be identified from the online contents.

4.8 Chapter Summary

This study employed an interpretive methodology chosen because it allowed an investigation of the meanings that participants in the Authoring Language course (SPM 2322) gave to their experiences and was used to frame the collection and analysis of the data, which included the collection of both quantitative and qualitative data. Quantitative data were generated from online questionnaires and forum transcripts, and analysed using content analysis based on participative, interactive, social, and cognitive dimensions. Qualitative data were generated via interviews, online transcripts and will be analysed using grounded theory technique (constant comparative method) at two levels: within-case analysis and cross-case analysis. These data were collected and analysed in order to triangulate the findings and to help researcher assess the extent to which the study is successful in promoting students' learning. The design of the study also took into consideration the trustworthiness of the research and adherence to the ethical guidelines was also acknowledged.

The research findings of the study are reported in Chapters Four, Five and Six.

Chapter 5 The Intervention

5.1 Introduction

This chapter describes the design and implementation of an online collaborative learning (OCL) intervention in an undergraduate ICT education course in a Malaysian tertiary classroom. It has four sections and begins by describing the context for the intervention in Section 5.2, followed by the design phase of the OCL intervention in Section 5.3, the development phase in Section 5.4 and the implementation phase in Section 5.5. The chapter ends with a summary.

5.2 Context for the Intervention

In this study, the context for the OCL intervention was the OCL group work, where students worked together on tasks for a shared outcome within (intra) and across (inter) online groups through a shared space of an online learning environment (Moodle) in an Authoring Language course. The OCL group work was aimed to facilitate the interdisciplinary online collaboration and interactions between students from Chemistry, Physics and Mathematics Education majors and to enhance their learning. Previous researchers suggested that the interactions and experiences gained from the online collaborative learning can be considered as 'lived spaces' or equal to a physical classroom, which can facilitate both the opportunities and means for acting (Allen & Otto, 1996; Harasim, 2012). Furthermore, through OCL, students can construct knowledge and negotiate meaning through interactions and collaboration; they are not merely transmitting information or receiving communications (Harasim, 2012). The content for discourse and interactions in OCL were also generated by students through the affordances of OCL group discussion applications (e.g. forums) organised by the lecturer. In this way, the students could enter and navigate the OCL discussions at their convenience, to read and contribute to the group work. In the following section, the design phase of the OCL implementation is elaborated on.

5.3 The Design Phase of the OCL Intervention

This section discusses the pedagogical framework, derived from the literature (see Chapter Two), which was used to inform the processes of incorporating OCL into the ICT education course. The pedagogical framework of OCL was derived from synthesizing the OCL practices (Section 5.3.1), processes (Section 5.3.2) and activities (Section 5.3.3), emphasizing pedagogical considerations in delivering the OCL, and helping inform the design of OCL activities such as intra and inter-group work learning tasks.

5.3.1 The Theoretical Basis of the OCL Intervention

The theoretical basis of the OCL intervention (Harasim, 2004, 2012) was a conceptual framework that emphasizes conceptual change and learning through advancing from the Idea Generating (IG) phase, through an Idea Organizing (IO) phase to Intellectual Convergence (IC), as shown in Figure 5.1. In this process, the teacher or lecturer plays a key and essential role, a role that is neither as “guide on the side” nor “sage on the stage” (Harasim, 2012, p. 94). Rather, the role of the lecturer is to engage students in the collaborative learning activities associated with building and acculturating them into the discourse of the knowledge community. The lecturer is a facilitator and representative of the knowledge community, and as such introduces the students to the appropriate activities as well as their application within their discipline.

Figure 5.1 illustrates the processes of OCL in group discussions and the progress from the IG to IC phase that approximates the knowledge community.

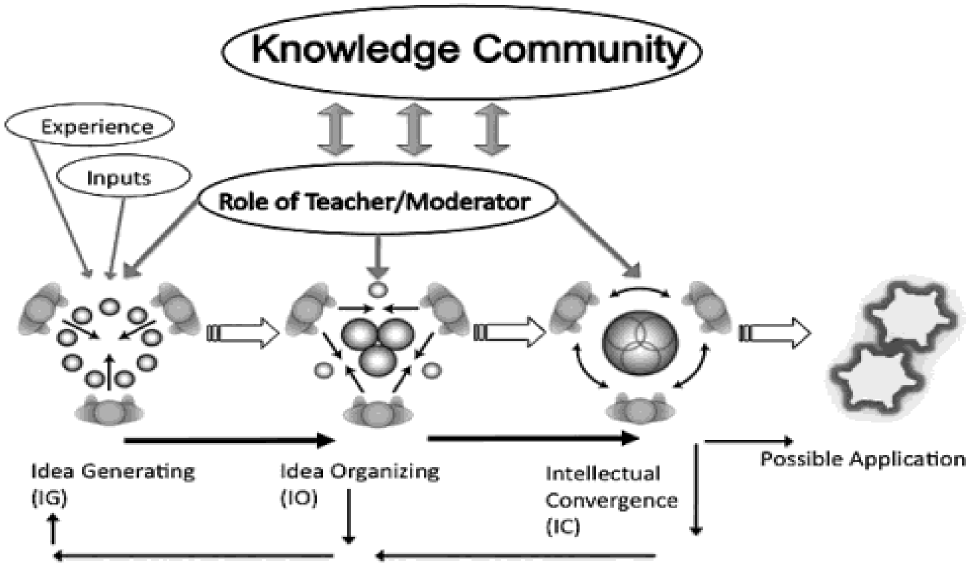


Figure 5.1: The OCL processes, adapted from Harasim (2004, 2012)

In Idea Generating (IG), students engage in a group discussion on a specific topic or knowledge problem assigned by the lecturer through presenting their views in a discussion forum. In this process, students articulate their views and generate a range of divergent perspectives on the topic. The lecturer establishes the processes of discussion and the knowledge problem to be discussed. Students interact with one another in the IO phase and confront new ideas through their engagement in the activities. Information gained from one another in the activities enriches students' awareness and appreciation on the topic. Students begin to organise, analyse and sort out some ideas through a negotiation process. In this process, the lecturer's information on the topic is used as a framework of reference which may be applied by the students to deepen their understanding of the topic. The process of idea organizing is characterised by references to ideas, applying analytical concepts and organizing common ideas into more refined statements. IC is accomplished through informed discussions, particularly when students reach a shared understanding by arriving at a position on the topic or by finding a resolution to the knowledge problem. IC is typically characterised by agreement or disagreement, or in some cases reaching a consensus. It also may be reflected in a co-produced final product (i.e. group report) or summary of the discussion. When a product is the goal (i.e. project or assignment), the intellectual processes aim for a consensus on the shape of the final product. Finally, the ultimate relevance/purpose may be the real-world applications of the outcomes from the discussions in terms of the groups' decisions or strategies; it may also trigger further consideration by repeating the processes of idea generating and organizing (Harasim, 2012).

The incorporation of OCL into student work takes into consideration the process of enculturation to online group discussion activities that students may experience as they come across new perspectives on a particular knowledge problem and learn to apply new analytical processes to problem solving. Through their interactions with peers, and the lecturer and learning resources, the students may arrive at a new and deeper understanding of the knowledge problem and eventually learn to address it in the manner of the knowledge community. This theoretical basis of OCL was used in this study by translating each of the phases into the OCL discussion guidelines to help inform and facilitate the OCL activities (i.e. intra and inter-group learning tasks), as shown in Table 5.1.

Table 5.1: The discussions guideline used in this study

DISCUSS (Brainstorming)	IDEA (Clarification)	CONCLUSION (Shared understanding)
Students discuss the problem with one another in order to generate raw ideas. ⇨	Students relate the idea through the use of external references, or by connecting their own ideas with other students'. ⇨	Students negotiate the outcome of the discussion in terms of comparing their ideas in order to generate shared understanding

5.3.2 The Stages of Online Collaboration

In this study, the stages of online collaboration (Pallof & Pratt, 2005) provided the main structure for conducting the OCL intervention in the course in accord with the OCL phases of Idea Generating (IG), Idea Organizing (IO) and Intellectual Convergence (IC) for a shared outcome. They were also used to inform the planning and coordination of the student activities, as well as the interactions and collaboration between students within a group and across groups. Generally, the initial phase of conducting OCL involves a number of activities, including providing an explanation of the OCL tasks, guidelines and student preparation prior to engagement in the OCL activities; comparable to the IG phase. The preparation includes presenting the learning tasks, objectives or goals as well as ensuring the students are comfortable with the technology. The online collaboration involves the creation of an environment or shared learning space where students can interact and connect with one another regarding their online collaborative activities. It has been argued that a Learning Management System (LMS), for example Moodle, could be used to facilitate OCL activities (Maikish, 2006), and OCL implementation could be made easier by incorporating OCL into the LMS (Harasim, 2012; Pallof & Prat, 2005). The second phase requires the lecturer to allow the students to take charge of their learning process so that they can construct their own learning as they progress through the collaborative activities; this is similar to Idea Organizing (IO). The final phase involves the process of evaluation and reflection of OCL, which requires the lecturer to monitor and gain insight into whether the learning goals of the specific activity are met and encourage students to reflect on their learning experiences; this mirrors Intellectual Convergence (IC).

The OCL intervention depicted in this study was divided into three main phases that are in alignment with the OCL theoretical basis (see Figure 5.1) and ran over 13 weeks of teaching and learning as shown in Table 5.2. The first phase was the start of the course, where the lecturer created the setting and system (Moodle) with pedagogical strategies and activities carried out prior to the class, in class, and online. The intention here was to make sure that the students were informed about the OCL objectives and prepared for OCL work. The second phase was conducted through the use of the OCL discussion guidelines (see Table 5.1), where the lecturer played a facilitator role with minimal interference, but continuous evaluation, in the online discussion. Students continuously reflected and improved in the third phase.

Table 5.2: The OCL phases used in this study

<table>
<tr><th>OCL Phases</th><th>Steps in OCL</th></tr>
<tr><td>Phase 1: Setting up the stage and the system
Creating the environment for OCL activities
Main page, course structure, weekly contents/notes/readings
Discussion and reflection forums
Course assignments, quizzes/tests
Explanation of the OCL learning tasks and guidelines for task completion
Students’ preparation prior to the engagement in collaborative learning activities</td><td><u>Prior to the classes</u>
Establish the online course by setting up the Moodle main page, weekly content, learning resources, forum discussions and course hand-outs/readings
<u>Via face-to-face classes</u>
Introduction of the course - overview of OCL via Moodle
Discussion on OCL mode of learning, assignments and projects
Forming OCL groups
<u>Via online classes</u>
Update personal information and photo
Verify OCL group information
Students start introducing themselves and getting to know one another</td></tr>
<tr><td>Phase 2: Modelling and guiding the OCL discussions
Lecturer takes the role of facilitator and remains involved in the OCL activities
Students are responsible for their OCL activities with little guidance from the lecturer
Students learning activities in OCL involve group work to gather information before they analyse and discuss their findings online
The problem/scenario discussion is guided</td><td><u>Prior to the classes</u>
Establish the intra-group and inter-group discussion forums
Set up the OCL discussion guidelines, online communication (Netiquette) and online participation
<u>Via face-to-face classes</u>
Task problem provided after the initial content is delivered
Students are encouraged to discuss and work together to problem solve after the initial content is delivered
Lecturer as a facilitator monitors students’ progress in groups for each learning task, based on intra-group and inter-group discussions after the initial content is delivered, and gives cognitive guidance to students via online discussions
Each learning task problem has been has been provided, along with a specified time period</td></tr>
</table>

by OCL discussion guidelines (see Table 5.1) and allows students to generate and construct their own discussions with little guidance from lecturer • The problem/scenario is authentic and specifically related to the Malaysian context	for further online group-based discussions <u>Via online classes</u> • Students within online groups research and gather information, analyse and discuss the problem in online discussions • Lecturer as a facilitator monitors students' progress in online group discussions and guides the learning process and to make sure that the discussions do not deviate from the learning topic • In online discussions, students identify the problem, brainstorm and clarify their ideas and eventually generate shared understanding
Phase 3: Evaluating and reflecting the OCL discussions • Online monitoring and moderation is conducted by the lecturer to gain insight into students' performances • Students have the opportunity to reflect on the learning process and improve on their problem solutions • The emphasis is on understanding the strengths and weakness of problem solving rather than on the products of a discussion (i.e. report)	<u>Prior to the classes</u> • Establish the learning tasks summarization and conclusion forum for reflection • Set up coursework submissions and peer-assessment <u>Via face-to-face classes</u> • Students are encouraged to reflect on their discussions on the learning task problems • Lecturer as a facilitator monitors students' progress based on their participative, interactive, social and cognitive dimensions and gives feedback • Students are encouraged to reflect and summarize each of the learning task problems online <u>Via online classes</u> • Students within online groups reflect on what they have understood at the end of the learning process and suggest improvements for their problem solution. • Lecturer as a facilitator will continuously monitor students' progress based on their participative, interactive, social and cognitive dimensions (Section 5.2.3). • Lecturer conducts online peer-assessment

5.3.3 Facilitation of OCL

The facilitation of OCL aimed to provide students with appropriate support by adjusting the activities based on the students' performance in the online discussions. Generally, the students' performance was firstly monitored through the participative dimension, which included students' participation and involvement in OCL discussions. In the participative dimension, the OCL group work was facilitated with authentic and relevant tasks that situated the learning in order to accomplish a shared goal. Secondly, the interactive dimension facilitated students' participation in OCL through interactions with their peers and other students. Through these interactions the students could communicate, interact and collaborate with their peers and others in order to access the knowledge, understanding and expertise distributed across the online groups (Salomon, 1993; Perkins, 1993). Thirdly, the social dimension facilitated students' social interactions between their peers and other students. The facilitation of the social dimension used a variety of social cues and emotional expressions in the online posts (Garrison et al., 2001; Pozzi et al., 2007). Finally, the cognitive dimension facilitated the students' interactions for knowledge construction through their interactions in the OCL discussions (Garrison et al., 2001). The process of facilitation in OCL is highlighted in Table 5.3.

Table 5.3: The Steps of OCL Facilitation

Dimension	Facilitation of OCL	OCL Tools

Participative
Participation in OCL is situated and goal-directed.
	• Introduction of OCL by the lecturer via Moodle and self-introductions by students
	• OCL tasks (intra-group):
	  ○ Introduction to the case or problem for discussion by posting an overview of it
	  ○ Students 'read' the case or problem and identify the learning objectives or goals
	  ○ Students discuss the learning objectives, problems and solutions
	  ○ Students distribute tasks and the workload within the group
	• OCL tasks (inter-group):
	  ○ Introduction to the case or problem for discussion by posting an overview of it
	  ○ All students (Chemistry, Physics and Mathematics) 'read' the case or problem and identify the learning objectives or goals
		• Course and general online activities (i.e. course content, links, resources, general discussion spaces) that invite active participation
		• OCL activities that are authentic, relevant and specific to the Malaysian T & L context that accomplishes particular goals
		• OCL tasks outlined
		• Discussion space for online intra-group and inter-group discussions

	○ Students discuss the learning objectives and problems ○ Students apply information gained within an online group to inter-group discussions ○ Students discuss solutions and reach a shared understanding ○ Students reflect and improve on their group's problem solution	
Interactive Participation in OCL is an interactive process through interacting with students and others.	• Facilitating the OCL via Moodle: ○ lecturer as a moderator to encourage active participation from the students ○ Check and monitor the flow of students' activities (recorded by Moodle) ○ Check and monitor the flow of the OCL discussions (recorded by Moodle) ○ Encourage inputs from group if participation is low ○ Encourage cross-references for other students' information or contributions	• Course and general online activities, OCL activities within online groups and inter-groups • Cross-references of students' messages and consideration of other students' contributions
Social Participation in OCL is mediated through social interaction between students	• Facilitating the OCL discussions (social) via Moodle: ○ Check and monitor the discussion and respond appropriately on the subject ○ Encourage the use of good online communication (Net-	• Online socialization using social comment characters or emotion icons • Welcome, support and

and others.	Etiquette) ○ Encourage students to use an informal communication tone and expression, and students' names in the discussion	encouragement within online groups and inter-groups • The use of good online communication ethics (Net-Etiquette)
Cognitive Participation in OCL is distributed through interaction between students and others.	• Facilitating the OCL discussions (cognitive) via Moodle: ○ Lecturer as a moderator to motivate students to contribute substantively in OCL discussions ○ Check and monitor the discussion and keep the discussion focused and progressing ○ Encourage students to create different perspectives on the discussed topic by contributing new information, negotiating solutions and justifications ○ Remind students to cite all quotations, references and sources ○ Remind students to continuously reflect on problem solutions and make improvements	• OCL discussion guides (Table 5.1) • The use of good online communication ethics (Net-Etiquette)

5.4 The Development Phase of OCL

This section discusses the development phase of incorporating OCL into the ICT education course. The development phase of OCL includes the full description of the ICT course (SPM 2322 Authoring Language) (Section 5.4.1), understanding previous lecturers' experiences in teaching and learning Authoring Language through eLearning (Section 5.4.2), and how OCL was incorporated into the ICT course by adjusting the course teaching and learning outlines and content through curriculum planning, pedagogical strategies and course assessments (Section 5.4.3). Each of these is discussed next.

5.4.1 The ICT Education Course – SPM 2322 Authoring Language

The Authoring Language course (SPM 2322) has been offered at the Faculty of Education, Universiti Teknologi Malaysia, since 1997 and has been through several curriculum revisions (from SPT 3602 to SPM 2322). At its earliest introduction, this course was offered on the basis of conventional face-to-face teaching to cater for the needs of teachers training for ICT and computer use in Malaysia, specifically to equip secondary school teachers with basic ICT and computing knowledge in developing computer-based teaching aids (or courseware) and other related ICT teaching materials.

The Authoring Language course (SPM 2322) is a compulsory paper for the Science and Computer in Education programme; students have to enrol in it once a year during the second semester of the academic calendar and it runs for 13 weeks from December to March. The course objectives are to provide opportunities for students to learn and develop skills in building educational courseware, which focuses on the technical development of software and web pages. It also focuses on the educational theoretical concepts, the basic concepts of authoring language, the authoring process and the types of authoring language used for CD-ROM and web-based development.

The course has incorporated online participation since 1997 (specifically eLearning participation) in response to the university's teaching and learning policy (Aris et al., 2006). However, at the early stages of eLearning (Internet-based), the course offered online access through *CyberDidik,* which allowed limited online interactions. Much of the online interactions were usually about viewing the online course and downloading the lecture notes or materials (Aris et al., 2006). At the beginning of the second semester of 2001/2002, the *Web-CT version 3.5* with online collaborative tools such as discussion forums, chat and whiteboard, were implemented for the university's eLearning management system; it had some drawbacks, especially for the lecturers as they were required to have a minimum level of technical computing knowledge (i.e. html code and html editors) for publishing teaching and learning materials (Aris et al., 2006). From the end of 2004 until today, a new eLearning system, based on *Moodle*, has been used to facilitate better online learning activities (Aris et al., 2006, Maikish, 2006) with easier implementation for teaching and learning that emphasises online interactions between students, students and peers, and students and lecturers (Harasim, 2012; Aris et al., 2006; Pallof & Prat, 2005). The Authoring Language course has been conducted with eLearning (Moodle) participation since then for three programme majors (Chemistry, Physics and Mathematics) with Computer Education background.

5.4.2 Previous Lecturers' Experiences on Teaching and Learning of Authoring Language through eLearning

Six lecturers (four lecturers had previous experiences in teaching Authoring Language with eLearning participation and two lecturers were from the Faculty of Education) were interviewed in order to gain insight into their teaching and learning through eLearning. It was important to understand their eLearning teaching and learning experiences in terms of the need for OCL in Authoring Language, the concerns and challenges they had experienced, and their suggestions for teaching approaches and learning strategies in developing OCL. These are described next.

5.4.2.1 The Need for Teaching and Learning of Authoring Language through eLearning

All lecturers addressed the importance of eLearning in facilitating students' learning in general, and four lecturers specified the need for it for on-going monitoring of students' progress in Authoring Language. An example of the first point comes from Lecturer F, who said:

> Yes, facilitating teaching and learning in eLearning is important, especially when we need to know 'what happens to the students', so I will ask them a few questions and motivate them. If their energy [participation] is low, I will try to [increase] their energy [participation] level by posting some questions on learning regularly, before fading as a facilitator (Lecturer F).

An example of the second point comes from Lecturer D who noted:

> It is actually very difficult for a lecturer to monitor what students discuss in face-to-face discussions, but if they discuss it online [through eLearning] we can see every single detail of their discussion, facts and figures. We can't see these on face-to-face discussions and we don't know the outcome of the discussion if it was not productive and causes problems for learning. That's why we need students to have an on-going online discussion, even if they have face-to-face discussions (Lecturer D).

The need for OCL through eLearning was raised by lecturers as a useful teaching reinforcement, as it helped them connect with students after the classroom period. An example of this point comes from Lecturer E who said:

> I use eLearning as reinforcement especially after I teach a specific AL [Authoring Language] topic; I will post questions about it in order to get insight into students' understanding of the topics. If I find out their understanding is low, I can help them through activities in eLearning after the class hour (Lecturer E).

All lecturers acknowledged that eLearning can help students to learn independently. They also highlighted that eLearning allows for an alternative to traditional teaching, which according to them was effective. This was pointed out by Lecturer F who said:

> SPM 2322 learning, after using eLearning, first of all about student dependency to lecturer is decreased, which means that every time we have activities in the class, the students will carry it out on the discussion in the eLearning system (Lecturer F).

An example of points of eLearning that can help for effective teaching came from Lecturer C, who said:

> I feel eLearning helps my teaching, especially with organizing my work and structuring my teaching online, and students' acceptance [attitude] towards my teaching is more positive. This is evident in my teaching evaluation by the students, which increased after I had implemented eLearning in my teaching (Lecturer C).

All lecturers agreed that students participating in eLearning for learning in the course had been shaped by the university's eLearning culture. An example of this point comes from Lecturer D, who said:

> I feel that eLearning has been a culture for teaching and learning in the university based on two factors: first, the lecturers have to use it in their teaching, and second, students have to use it as a part of learning and their participation is recorded and evaluated (Lecturer D).

The use of eLearning is important for facilitating online teaching and on-going monitoring of students' progress in Authoring Language, as reported by all lecturers; their concerns and suggestions for teaching and learning of Authoring Language through eLearning are reported next.

5.4.2.2 The Concerns and Challenges of Teaching and Learning of Authoring Language through eLearning

Some concerns and challenges faced by the six lecturers, based on their past experiences teaching in the Authoring Language course, were identified.

Students' preferences and attitudes

The lecturers identified that some students enrolled in the Authoring Language course prefered the traditional way of teaching, and reluctantly participate in eLearning; they did so only because it was a compulsory component of the course assessment. They also observed that some student attitudes towards the Authoring Language course were only related to passing the course assessment.

> It is actually about the students' attitude; there's nothing we can do about it, except remind them that they are at the university to learn. Some of the students support the online forum through eLearning but some students just use it because of the assessment to ensure they receive a pass mark for the course (Lecturer D).

Reticence in discussion and passive learners

The lecturers observed that some students had difficulty expressing their opinions in an online discussion forum. These students were described as lacking knowledge and confidence in online discussions, and tended to post their opinions with a short reply, usually using an informal form of communication, and others may not post at all.

> The challenge is that the students do not know how to start the discussion because they lack knowledge and confidence in writing online text, especially lengthy explanations. These students tended to wait, and the discussion tended to freeze; they also used short forms of text, usually informal text, as they do not know how to proceed in the discussion (Lecturer F).

Constraints in online participation

The lecturers also noticed that some students who enrolled in the Authoring Language course did not have serious reservations about participating online, except for some technological and technical constraints where they could not log into eLearning. The technological problem was usually resolved with help from the IT department. The lecturers also pointed out those students were not interested in online activities, and needed to be encouraged and motivated.

> It is actually beyond our control, so we need to look for other alternatives to re-engage and encourage students to log in and re-schedule the activities so that students have access. If students are not interested, I think that it's not a problem because we can make them interested (Lecturer D).

5.4.2.3 Insights and Suggestions for Teaching and Learning of Authoring Language through eLearning

Some insights and suggestions shared by six lecturers based on their experiences teaching in the Authoring Language course were identified.

Technological Strategies

Three lecturers shared some of their technological strategies for teaching Authoring Language in eLearning, such as using the personalised eLearning applications which are in line with students' technological preferences, meaning that students are more likely to generate their own content through eLearning. This could be achieved using forums and blogs in eLearning.

> The students are more likely to generate their own content by having user-generated contents such as forums or blogs where they could post something and their peer could respond to it (Lecturer F).

Pedagogical Strategies

Three of the lecturers shared some of their pedagogical strategies for teaching the Authoring Language course via eLearning. They chose to design the course so that online forums were part of the formal coursework, so students needed to put in effort to participate in the online discussions. Giving marks for participation also motivated the students to contribute to the discussions.

> It always comes back to how we design the course and make the online forum part of the coursework with marks. This way students with attitude issues can be handled because they need to be aware there are marks given for their online forum discussions and contributions (Lecturer D).

5.4.3 Incorporating the Intervention

The process of the incorporation of OCL in the Authoring Language course progressed by obtaining the course syllabus, content and outline from the Head of Department of Educational Multimedia before being introduced to the lecturer who was assigned at the start of the semester to teach the Authoring Language course (SPM2322) (this happened on the 14th of December 2009). The process of meeting with the lecturer of Authoring Language began when the researcher emailed the head of the Department of Educational Multimedia requesting a meeting with him and the lecturer who taught the course. The consent from the lecturer of Authoring Language was obtained (see Appendix B) for the researcher to act as lecturer, and then the course outline was restructured. The lecturer of Authoring Language was also informed that the course outline would be re-structured for the OCL intervention, with the involvement of the researcher as lecturer for 13 weeks (from week 1 to week 13). The remaining topics, week 14 to 15, would be taught by the lecturer of Authoring Language, who would also handle the course marks and grading. The lecturer of Authoring Language also agreed with the incorporation of OCL activities into the course outline, as depicted in Table 5.4.

Table 5.4: The OCL Course Outline

Week	Topics	Notes
Lecture Part 1 - Introduction to Authoring Language Concepts		
1	What is authoring language (AL), programming language (PL), authoring systems (AS) and web authoring (WA)	Task 1
2	Taxonomy and metaphor of AL and WA	

3	Authoring Phase	Task 1 due
Lecture Part 2 - CDROM based Authoring Language		
4	Authoring Language Software	Task 2
5	Text, Graphics and Animation	
6	Audio and Video	
7	Interactivity and Programming in AL	Task 2 due
Semester Break		
Lecture Part 3 - Web-based Authoring Language		
10	Webpage Authoring Software	Task 3
11	HTML Linking Tag And Accessories	
12	Packaging and Distribution of Files	Task 3 due
Course evaluation		
Lecture Part 4 - Issues on Authoring Language Software		
14-15	*Future Development of AL and WA	

*Note.** Topics in weeks 14-15 were taught by another lecturer, who was not involved in the research.

The OCL activities were divided into two modes which were firstly designed to reflect the goal of fostering students' participation through collaboration and negotiations. As described in Table 5.2, students were organised into groups for this work, with groups formed within subject majors. A total of nine groups of four to six students was formed from the 46 students in the class, of which two groups were from the Chemistry (SPK) and Physics (SPP) programmes respectively, while another five groups were from the Mathematics (SPT) programme (refer to Appendix L for full details of the participating groups). Students within their online groups (intra-group) engaged in Task 1 and 3. The second mode of OCL had the goal of fostering students' participation through collaboration and negotiations, as they learnt about different types and processes of Authoring Language across online groups (SPK, SPP and SPT) in Task 2 (inter-group). The goals of task 2 were to produce a report based on a scenario of teaching Science and Mathematics using ICT in Malaysian secondary schools. This task was achieved through inter-group discussions based on collaboration and interaction among Chemistry, Mathematics and Physics students.

In weeks 1 to 3 of the course, students were given Task 1 – the problem-based discussion scenario (see Figure 5.2) – which required them to discuss the concept of authoring language within their online group. The online discussion was conducted with the goal of fostering students' participation through sharing information, negotiating and making decisions as a group to improve their understanding and knowledge in Authoring Language in order to select an appropriate authoring tool, as well as preparing the group for Task 2. In the next four weeks (weeks 4 to 7), students engaged in discussions across online groups based on the knowledge they gained in the previous discussions on authoring language concepts; the discussion also focused on the development of CD-ROM based authoring language. Task 2 was specifically designed to foster collaboration and to build upon knowledge from the previous weekly activities in Task 1. Finally, in weeks 10 to 12, the discussion covered activities for Task 3 which was conducted within an online group and focused on webpage Authoring Language, as well as preparing the students for their final individual course assignment. Task 3's goal was to develop a tool (website) for teaching and learning ICT in Malaysian secondary schools. This task involved the process of re-designing an existing tool into a new and dynamic design which required an online group discussion of this new design before development went ahead. The problem-based discussion scenario, used as the starting point for online discussions within online groups and across online groups is depicted in Figure 5.2 (see Appendix J for details of the problem-based discussion scenario used in this study).

<u>The Problem-based Discussion Scenario: Task 1 and 2</u>

23 December 2009
Dear Sir,
TECHNOLOGY GRANT 2010: AUTHORING LANGUAGE SOFTWARE
Kindly be informed that applications for a Technology Grant for Johor secondary schools are now open for 2010.

2. The following aspects should be considered and addressed for the Technology Grant 2010 application:

a. Software suitability with Science and Mathematics teaching and learning
b. Software compatibility
c. User-friendly aspects of the software
d. The required training duration for the software
e. External resources and references for the software

3. Kindly submit the complete proposal for a Technology Grant for Authoring Language software to the following address:

Ministry of Education
Federal Government Administrative Centre
62100 Putrajaya

4. Should you require any further clarifications, please do not hesitate to contact us.

Instructions:

Your group will assist the class in preparing for the proposal of the Ministry Education Technology Grant 2010. The proposal should make clear **five aspects** of the requirement by discussing how these aspects will affect the Science and Mathematics teaching and learning. For the purpose of the discussion, each group will work on their own within their online group space created in eLearning (**the discussions will be recorded and evaluated**). You are required to discuss all aspects within your group and make a group decision before your group can be involved and participate in the inter-group discussion in Task 2. There is a timeframe for the group discussion before the commencement of inter-group discussion (see below).

Important dates:

For intra-group discussion – discussion start 4/12 and deadline is 3/1

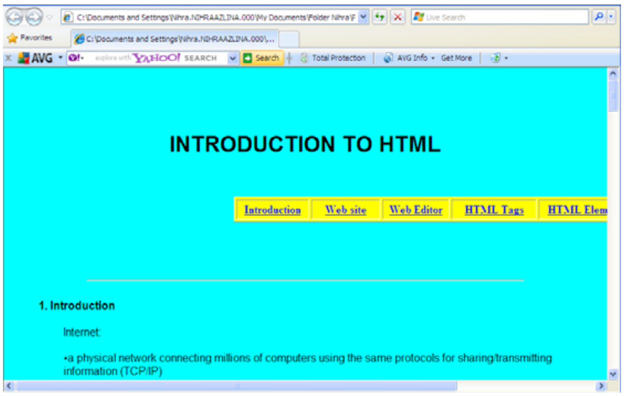
For inter-group discussion – discussion start 4/1 and deadline is 31/1

Reflection and improvement – deadline is 14/2

Each student in the group is expected to contribute substantively to the preparation of the proposal. How you decide who will do what is up to you, but you will be submitting an evaluation of your own and each group member’s contribution at the end of the task. Remember that the learning tasks are not just a chronological report; instead, your discussion should illustrate real problem solving in the school. I will be monitoring each of the group discussions’ progress in eLearning and will help and support your discussion as the task progresses.

<u>The Problem-based Discussion Scenario: Task 3</u>

Cikgu Hamidah has been instructed by her headmaster to transform the old static ICT web page in SMK Zanariah to a new fresh and dynamic web page. The original is shown below:



However, before she can work on the transformation, she needs to understand the concept of static and dynamic web pages, and what elements of the latter need to be included. She finds the task very challenging, since she has a limited knowledge of ICT. She has decided to seek consultation from your group. In a small group, please discuss (online discussion) the above scenario, taking into consideration the following key points:

- The concept of static and dynamic web pages
- The elements of a dynamic web page
- Web page design or template

Produce a report about your group's evaluation of the old static web page that includes overall strengths and weaknesses of the page and your group's solution regarding the aspects of web page elements and template (or design).

The length of report must not exceed 5 pages!

Developing web page:

Use your group's report to transform the old static web page into a new fresh web page. It should be interesting and attractive.

The transformation of the static web page must be congruent with the report!

Figure 5.2: The problem-based discussion scenario

5.4.4 The Assessment of the Tasks

The assessment of Tasks 1, 2 and 3 was based on the assessment of students' contributions in online discussions. All tasks were similar in terms of course assessment specifications, in which each carried 10% of the total score. The students also had other assessment for the course such as in class activities and mid-term test which carried 10% and 20% marks (see Appendix M). The problem-based discussion was developed based on the discussion guidelines (see Table 5.1). Their purpose was to foster students' participation and interaction in online discussions through providing constructive comments and feedback on one another's work, and assisting one another in order to improve their problem solving solutions (see Table 5.5).

Table 5.5: The Problem-based Discussion Form

DISCUSS (Brainstorming)	IDEA (Clarification)	CONCLUSION (Shared understanding)
Important points or facts from the problem-based scenario.	Problem solving ideas generated by group member in brainstorming process.	Evaluating the problem solving ideas before reaching shared understanding.

In the problem-based discussion form, students discussed the problem with one another in order to generate raw ideas, and filled out the DISCUSS section of the form. Each of the members of the group had the same form to fill out prior to the IDEA phase. In this phase, students related their ideas with other students across the OCL groups by justifying the relevancy of their idea. In this phase, each student used a variety of external references or their own idea based on experiences/readings. In the final phase, the student negotiated and evaluated the outcome of the discussion to reach a shared understanding.

5.5 The Implementation Phase of OCL through an eLearning Management System (Moodle)

The implementation phase of the OCL intervention involved incorporating OCL into the eLearning management system (Moodle) and the creation of collaborative groups, which is described next.

5.5.1 The Implemented Learning Interface

With the introduction in tertiary institutions of Learning Management Systems (LMSs), also known as Virtual Learning Environments (VLEs), knowledge building collaboration and communication can be facilitated (Coomey & Stephenson, 2001; Ingram & Hathorn, 2003). An example of an LMS that could be used to facilitate collaborative learning is Moodle (Modular Object-Oriented Dynamic Learning Environment). Unlike other LMSs, namely Blackboard and WebCT, Moodle is an open source software, which gives users the freedom to copy, use and modify the Moodle template without licensing costs (Moodle, 2009). Also, Moodle is designed pedagogically to assist teachers to produce online content tailored to their respective classes in a collaborative, interactive environment (Cornell, 2003; Maikish, 2006). Other useful features of Moodle, as noted by Cornell (2003), are that the use of Moodle can promote social constructionist pedagogy through collaborative learning activities and critical reflection.

The main Moodle page for OCL, as presented to students at the start of the course, is depicted in Figure 5.3 (see Appendix K for some of the key features of the SPM2322 eLearning course and their description). This page contained the title, synopsis and class schedule of the Authoring Language course, page notifications and announcements, online discussions (OCL), course handouts, weekly learning notes and resources, a live feeder, news and general forums, *Mari Berkenalan* (self-introduction), and reflective journal and feedback.

The main page of the Authoring Language course was designed to inform students of the course title and synopsis as well as to provide the course's weekly learning notes and resources. The page notifications and announcements were used to remind students about important dates and for messages from their lecturer on their assignments and online group discussions. The news forum was designed for the students to post their announcement regarding the class activities. The Mari Berkenalan (self-introduction) was for students to post a brief self-introduction about themselves, their contacts and background. The course handout contained information regarding the course, learning objectives, weekly schedules and course outlines, and course assessment. The contact details of the lecturer, as well as coursework grading and suggested course readings were also included in this section.

Figure 5.3: The main page of the OCL eLearning web page.

The online discussions for the groups formed the majority of the course's teaching and learning, and contained learning tasks for the intra and inter-group activities. In this section, the students could only view their own group's discussion for intra-group activities, and viewing the collaborative group work under a sub-section of online discussion for inter-group activities (see Figure 5.4). The established groups could decide to contribute their posts locally, which could then only be viewed by their group members, or globally, which could then be viewed by other established collaborative groups as shown in Figure 5.4.

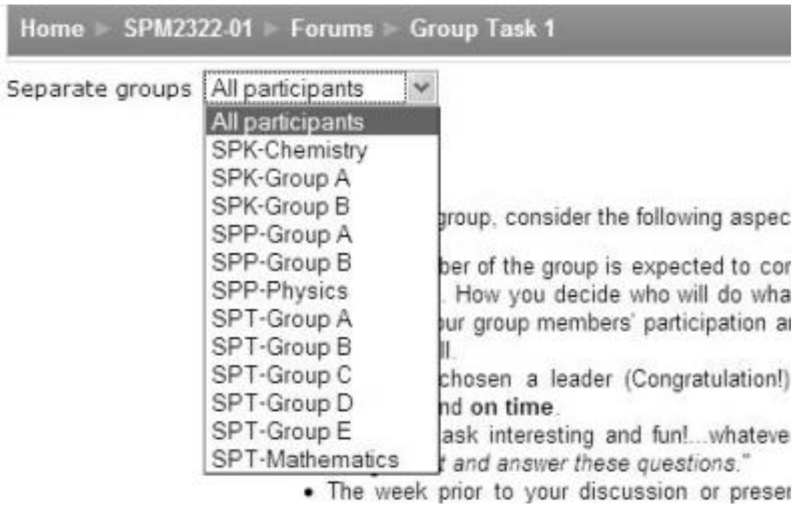


Figure 5.4: The creation of collaborative groups.

The eLearning page for the Authoring Language course was made available a week before the formal class began. However, the students were informed about the OCL intervention in the course at the first face-to-face class, and were asked to log on to familiarise themselves with the course features and structure. The students were also informed about their OCL groups and were asked to post about themselves and get to know their group members online as well as other students in the course. Nine OCL groups were formed consisting of four to six students for online intra and inter-group discussions which were structured according to Task 1 and 3 for intra-group discussions, and Task 2 for inter-group discussion.

5.6 The Evaluation of OCL Activities

The evaluation of OCL for research purposes was also performed through evaluation of online group discussions, guided by four learning dimensions known as participative, interactive, social and cognitive (Henri, 1992; Hara et al., 2000; Lipponen et al., 2003; Gerbic & Stacey, 2005; Pozzi et al., 2007) (see Chapter Four for details of these dimensions and Chapter 6 for the results). Generally, the students' performance was monitored through the participative dimension, which included their level of participation determined through their number of posts and views; this gave an indication of their involvement in OCL discussions (Henri, 1992; Pozzi et al., 2007). Secondly, the interactive dimension describes the types of interactions that students demonstrate during OCL discussions (Dillenbourg et al., 1999; Pozzi et al., 2007), and measures the collaborative and non-collaborative interactions (Ingram & Hathorn, 2004). Thirdly, the social dimension refers to the students' ability to project themselves as real persons using social cues and emotional expressions in their online posts (Garrison et al., 2001; Pozzi et al., 2007). Finally, the cognitive dimension is described as the extent to which the students are able to construct and confirm meaning through sustained reflection and discourse in OCL discussions (Garrison et al., 2001; Pozzi et al., 2007); this included measures of types of cognitive presence as well as information processing (i.e. surface and deep) (Henri, 1992; Gerbic & Stacey, 2005; Pozzi et al., 2007). The evaluation of the OCL for research is depicted in Table 5.6.

Table 5.6: The Evaluation of OCL for Research

Evaluation of OCL	
Participative Dimension	• Online presence: ○ Contributions (number of posts) ○ Viewings (number of viewings) • Types of activities that students participate in via eLearning (i.e. upload and download resources, messaging, discussion forum and quiz/test)
Interactive Dimension	• Online reciprocity: ○ Explicit and implicit interactions (Collaborative) ○ Independent interactions (Cooperative) • Types of interactions
Social Dimension	• Social presence: ○ Social cues (frequency) ○ Emotional expression (frequency) • Types of social comments
Cognitive Dimension	• Cognitive presence: Types of cognitive presence • Information processing (surface and deep)

5.7 Chapter Summary

This chapter employed the OCL group work where students worked together on tasks for a shared outcome within (intra) and across (inter) online groups through a shared space of an online learning environment (Moodle) in an Authoring Language course. The process of incorporating an OCL intervention in the Authoring Language course took into consideration the theoretical basis of the OCL intervention (Harasim, 2004, 2012) that emphasizes conceptual change and learning through advancing from the Idea Generating (IG) phase, through an Idea Organizing (IO) phase to Intellectual Convergence (IC), and involved student-centred learning activities through establishing online intra and inter-group collaborative discussions. It also took into consideration the wider institutional cultural factors influencing teaching, learning, planning and assessment of the course. This is consistent with the formal requirement of the course with eLearning participation, which emphasizes students' active participation in learning. The next chapters present the findings from incorporating OCL in the Authoring Language course.

Chapter 6 The Online Class Findings

6.1 Introduction

This chapter presents the research findings from incorporating online collaborative learning (OCL) at the classroom level. It is made up of three sections, but begins by providing a map of the chapter structure. This is followed in Section 6.3 by a description of the class, and the activities that students undertook during this research. Next, Section 6.4 reports on the nature of the students' interactions during OCL. Finally, students' perceptions of their OCL activities are discussed in Section 6.5. Overall, this chapter aims to examine the effects of online group discussions on OCL based on analyses of posts in participative, social, interactive and cognitive dimensions, and to answer the first research question: 'What is the nature of students' interactions in online collaborative learning?' The final section is the chapter summary.

6.2 The Research Map of Analysis: The Class

Figure 6.1 depicts this study as an activity system that is connected within the landscape of situatedness of an activity (Boer et al., 2002, p. 90). Within this landscape, the class level, as indicated by the grey area (outside the triangular area of grouped participants and the outcome), represents the influence of the broader classroom context (institution), and the cultural tools and activities of the OCL intervention. These are described in the next section. Similarly, within the landscape of situatedness of activity, the student groups' interactions within each programme major, which are connected online through OCL, are described in Chapter 7, and the outcome of the OCL intervention is discussed in Chapter 8.

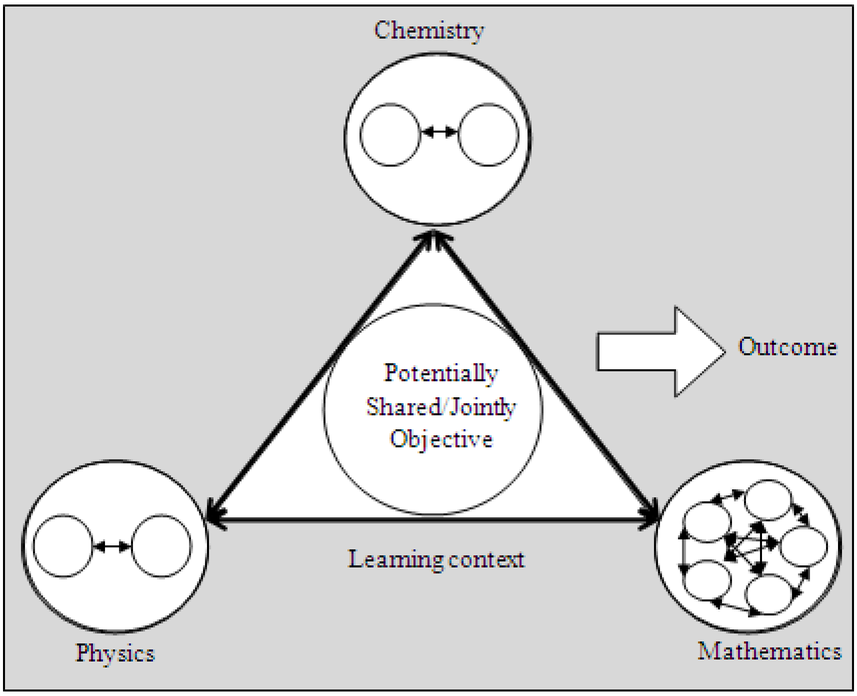


Figure 6.1: The class level

6.3 Class Description

The students participating in the research were Malaysian undergraduate pre-service teachers from three different programmes of Science and Mathematics, with specialisation in Computer Education, namely, Science and Computer with Education (Chemistry), Science and Computer with Education (Physics), and Science and Computer with Education (Mathematics). The students in each programme were in the second year of their study and were enrolled in a Computer Education course known as Authoring Language, which was conducted under the Department of Educational Multimedia, Faculty of Education at the Universiti Teknologi Malaysia. The teaching and learning in the Authoring Language course consisted of conventional face-to-face teaching lectures together with online participation through the university's virtual LMS. The course ran for 15 weeks, comprised of 13 weeks of lectures, and one week each of mid-semester break and study week. The following sub-sections provide a description of the participants (Section 6.3.1), followed by how the participants were grouped for the course (Section 6.3.2), the course outline (Section 6.3.3) and the learning tasks (Section 6.3.4).

6.3.1 Description of Participants

A total of 46 students took the course and all agreed to participate in the study. Table 6.1 details the demographics background of the students according to the student's online profile.

Table 6.1: Students' Demographic Characteristics (n=46)

Characteristics		N	%
Programme of study	SPK-Chemistry	9	19.6
	SPK-Physics	10	21.7
	SPK-Mathematics	27	58.7
Gender	Female	34	73.9
	Male	12	26.1
Ethnicity	Malay	38	82.6
	Chinese	4	8.7
	Indian	2	4.3
	Other	2	4.3
Age	19-23 years	33	71.7
	24-30 years	13	28.3
Education level	Undergraduate-Year 2	46	100

The student participants were predominantly female (34, 73.9%) and of Malay ethnicity (38, 82.6%). The other ethnicities were Chinese (4, 8.7%), Indian (2, 4.3%) and other (2, 4.3%). Most students were between 19-23 years of age (33, 71.7%), while only 13 students were in the category of 24-30 years (28.3%).

Next the students' characteristics according to the eLearning survey were elicited. Table 6.2 details the participating students according to the eLearning survey prior to the online work in the course.

Table 6.2: Participating Students (n=43)

Characteristics		N	%
eLearning (Moodle) experience	1	1	2.3
	2-3	8	18.6
	4 or more	34	79.1
Undertaken training for eLearning (Moodle)	Yes	34	79.1
	No	9	20.9

eLearning skills	Expert	3	7.0
	Above Average	20	46.5
	Average	20	46.5

The majority of students who responded to these questions (43 out of 46, 93.4%) had eLearning (Moodle) experience in at least four or more university courses that required eLearning participation (79.1%), while eight students had had those experiences in two or three courses (18.6%), and only one student had had eLearning experience in only one course (2.3%). Likewise, the majority of students had undertaken training for eLearning (Moodle) (34, 79.1%) and only nine students (20.9%) had not. Three students rated themselves as an expert (7.0%) in using eLearning while 20 students rated themselves in the categories of above average and 20 as average (46.5%). These findings indicate that all students had had some experience with eLearning at a university level, and the majority of students were experienced eLearning learners who felt they were quite skilful or adequate at using the eLearning (Moodle) programme for their tertiary learning purposes.

6.3.2 Description of the Participating Groups

A total of nine groups of four to six students were formed from the 46 students in the class, of which two groups were from the Chemistry (SPK) and Physics (SPP) programmes respectively, while another five groups were from the Mathematics (SPT) programme (see Table 6.3) (refer to Appendix L for full details of the participating groups).

Table 6.3: Participating Groups *(*n=9*)*

Course	Semester	Programme/Degree	Group	Number of students
Authoring Language (SPM 2322)	Semester 2, 2009/2010 (13 weeks)	Chemistry with Computer Education (SPK)	One	4
			Two	5
		Physics with Computer Education (SPP)	Three	5
			Four	5
		Mathematics with Computer Education (SPT)	Five	5
			Six	6
			Seven	5
			Eight	5
			Nine	6
Total			9	46

6.3.3 Brief Description of Course Outline

The Authoring Language course (SPM 2322) is a core course of the Science and Computer in Education programme. It is usually conducted once a year during the second semester of the academic calendar and runs for 15 weeks from December to March. The course has incorporated online participation since 2004 in response to the university's teaching and learning policy (refer to Chapter 5 for full details of the course description). The course objectives are to provide opportunities for students to learn and build skills in developing educational courseware and are focused on the basic concepts of authoring language, the authoring process and types of authoring language for CD-ROM and web-based development. It is also focused on the technical development of software and web pages, along with the educational theoretical concepts (refer to Appendix M for full details of the course outline).

6.3.4 Learning Tasks

Three learning tasks were implemented in this course. Learning Task 1 was carried out in weeks 1-3, followed by learning Task 2 in weeks 4-7, and learning Task 3 in weeks 10-12. Learning Task 1 and 3 were conducted within online groups as the mode of discussion (intra-group), while learning Task 2 was conducted across online groups as the mode of discussion (inter-group). All tasks were similar in terms of course assessment specifications, in which each carried 10% of the total score and were assessed using discussion task criteria. The complete description of learning tasks used in this research is shown in Table 6.4 (refer to Chapter 5 for full details of the course and learning tasks).

Table 6.4: Learning Task Descriptions

Task	Descriptions	Type of assessment		Mode	Weeks
Task 1	Task 1 is to create a proposal of appropriate authoring tools to be used in the teaching of Science and Mathematics in Malaysian secondary schools. The task is presented in a problem-based case	Forum discussion	Discussion task criteria	Within online group (intra-group)	1-3
		Group report			

	study, which requires students to research and gather information, analyse and discuss the problem in their group. The discussions are conducted within an online group.	Total (10%)			
Task 2	Task 2 is to produce a report based on a scenario of teaching Science and Mathematics using ICT in Malaysian secondary schools. This task requires inter-group discussion among Chemistry, Mathematics and Physics students.	Forum discussion Group report Total (10%)	Discussion task criteria	Across online group (inter-group)	4-7
Task 3	Task 3 is to develop a tool (website) for teaching and learning ICT in Malaysian secondary schools. This task involves the process of re-designing an existing tool into a new and dynamic design. Students discuss the new design in their group before the development. The discussions are conducted within an online group.	Forum discussion Group report Total (10%)	Discussion task criteria	Within online group (intra-group)	10-12

The course assessment specifications required the students to participate in online discussions before they could complete the group report writing. However, there was no restriction on the students as to whether or not they were also allowed face-to-face interactions while discussing online, since the majority of the students were classmates and knew one another quite well in their programme of study.

This study was concerned with examining the nature of online collaborative discussions within and between groups of students engaged in three learning tasks. To elicit the overall nature of OCL posts during these discussions, the analysis of OCL was divided into two parts: the analysis of overall distribution of students' posts based on participative, social, interactive and cognitive dimension themes (see Appendix O for overall analysis of Moodle data), and the analysis of overall scores of learning tasks and achievements as outcomes of the student work. In the following section, the presentation of data begins with the analysis of the nature of online discussion posts in online learning Task 1, 2 and 3 (Section 6.4.1 to 6.4.4).

6.4 The Nature of Students' Interactions in Online Collaborative Learning

A total of 27 (n=46) online group discussion transcripts were analysed (18 from online intra-group discussion transcripts and 9 from online inter-group discussion transcripts) in order to reveal the nature of students' interactions during OCL, according to the research focus and purpose as participative, interactive, social, and cognitive dimensions. In the following section, the participative dimension is presented first, followed by the interactive, social and then cognitive dimensions.

6.4.1 The Participative Dimension

The participative dimension measured students' overall participation based on the number of posts and views which were divided into active and passive participation (Henri, 1992; Pozzi et al., 2007). All the students' posts from the three learning tasks were categorised into *contribution*, which represents the total number of student participations based on posts they made directly related to the learning tasks, and *viewing*, which represents the total number of student participations based on the viewing of the learning tasks, including viewing posts other students had made. Table 6.5 presents the distribution of the participative dimension according to each of the learning tasks. The number of contributions ranged from the highest being 259 posts (41.5%) in Task 1 to lowest and similar post numbers in Tasks 2 and 3 (183 and 182 posts respectively). The mean score indicates the average posts per student. The views ranged from the highest of 1820 views (38.1%) in Task 1 to the lowest of 1283 views (26.9%) in Task 3 with the highest mean score of total views found in Task 1 (see Table 6.5)

Table 6.5: Participative Dimension (n=46)

Themes	Task 1		Task 2		Task 3		Overall Total
	Posts	Mean	Posts	Mean	Posts	Mean	
Contribution	259 (41.5%)	5.6	183 (29.3%)	3.9	182 (29.2%)	3.9	624
Views	1820 (38.1%)	39.5	1283 (26.9%)	27.8	1673 (35.0%)	36.3	4776

The overall percentages of students' posts in Tasks 1, 2 and 3, based on their contributions and views, were mapped out for comparison as shown in Figure 6.2; it indicates that students' post contributions were slightly higher than their views in Task 1. The level of contributions decreased to below 30% in Task 2 and remained constant at that level in Task 3. Students' viewing of the posts also declined in Task 2, but rose again in learning Task 3, and the views were proportionately higher than the contributions. This indicates that students' made a lot of effort at the beginning to contribute, but efforts decreased for Task 2 and then remained constant until the end; however there was still high levels of participation as evident in the post views in Task 3. The high number of views at the end of learning tasks indicated that students were interested, but lacked the technical knowledge and explanations to contribute to the posts.

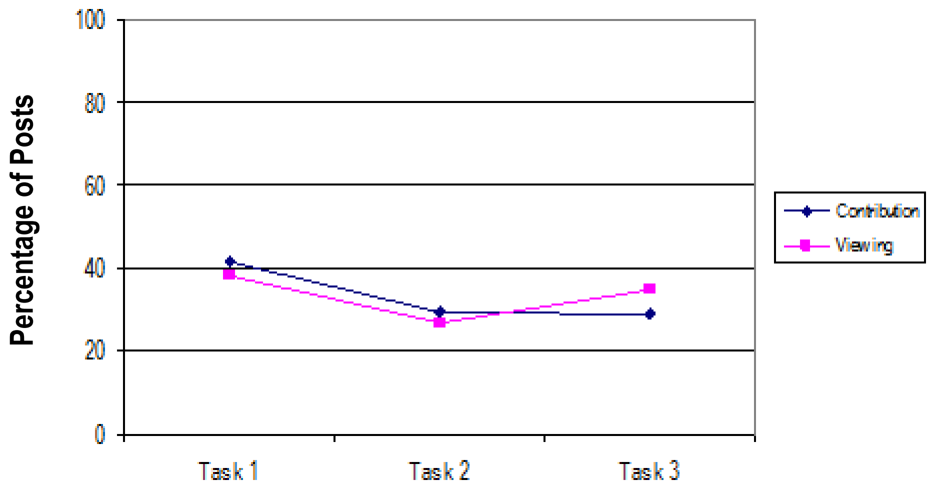


Figure 6.2: Participative dimension themes

Further non-parametric analysis on the overall posts made was conducted to examine if the difference between contributions and views in the learning tasks was significant. Table 6.6 shows the mean, the mean ranks and the statistics values for the participative dimension using the Kruskal-Wallis test for testing an independent variable with more than two groups (Tasks 1, 2 and 3). There were no significant differences ($\rho<0.01$) found using the Kruskal-Wallis test mentioned above.

Table 6.6: The Means and Mean Ranks and the Statistics Values of Participative Dimension Themes (n=46)

Themes	Task 1	Task 2	Task 3	Statistics values
Contribution	5.6 (81.2)	3.9 (67.7)	3.9 (59.4)	χ^2=7.124, *df*=2, ρ=0.03, n.s.
Views	29.5 (78.4)	27.8 (58.0)	36.3 (71.9)	χ^2=6.272, *df*=2, ρ=0.04, n.s.

Note. χ^2 = Chi-Square, df= Degree of freedom, * Significant at ρ<0.01

Differences were also looked for between male and female students in terms of the numbers of posts and views in Tasks 1, 2 and 3, and no significant differences (ρ<0.05) using the Chi-Square test in terms of gender were found.

6.4.2 The Social Dimension

The social dimension measures all statements or part-statements not related to the formal content of the subject matter (Pozzi et al., 2007). Table 6.7 presents the overall *social* and *emotional* comments made by the students related to Tasks 1, 2 and 3. The total number of social comments ranged from the highest posts (41.3%) in Task 1 (101) to the lowest posts (25.4%) in Task 3 (62), with the highest mean score of total social themes in Task 1. Emotional comments ranged from the highest posts (81 – 46.0%) in Task 1 to the lowest posts (42 – 23.8%) in Task 2, with the highest mean score of total emotional themes in Task 1.

Table 6.7: Social Dimension (n=46)

Themes	Task 1		Task 2		Task 3		Overall Total
	Posts	Mean	Posts	Mean	Posts	Mean	
Social	101 (41.3%)	2.2	81 (33.2%)	1.7	62 (25.4%)	1.3	244
Emotion	81 (46.0%)	1.7	42 (23.8%)	0.9	53 (30.1%)	1.1	176

Based on the percentages of social and emotional comments in Task 1, 2 and 3 shown above, the overall percentages of social and emotional themes were plotted as shown in Figure 6.3, which illustrates that students' social comments were slightly lower than emotional comments in Task 1 but steadily decreased to approximately 25% in

Task 3. However, students' emotional comments fluctuated from slightly above 45% in Task 1 to below 25% in Task 2, before rising to approximately 30% in Task 3. This indicates that students' social comments were high in Task 1, possibly due to it being at the beginning of the course when students were getting to know one another; its steady drop to 25% in Task 3 possibly reflected students' development of on-task attitude. On the contrary, students also began developing relationships in Task 3, as indicated by the increased emotional comments. The difference in the pattern of the social comments in Tasks 1, 2 and 3 as shown in Figure 6.3, may occur because Tasks 1 and 3 were designed to foster intra group works which may have afforded particular types of social interactions compared to Task 2 which fostered inter group work, involved different students across the online groups.

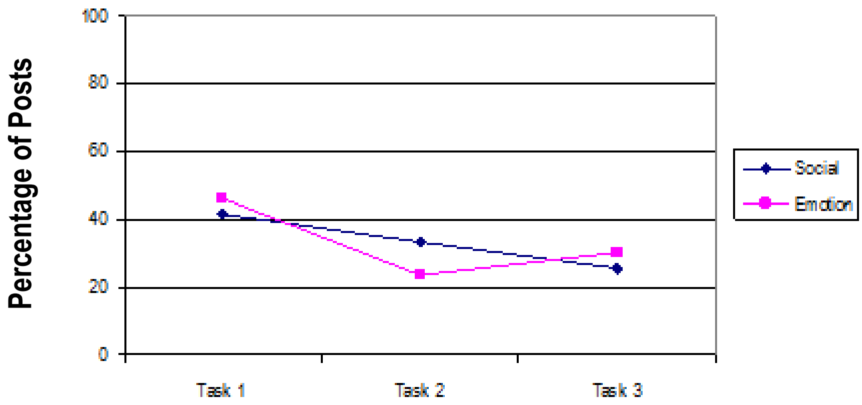


Figure 6.3: Social dimension themes

Further analysis of students' social comments from the overall posts of Tasks 1, 2 and 3 showed that seven types of social comments were used by the students in the online discussions. The types of social comments as indicated by students' ways of interactions were greetings (54 of total posts), name addressing (65 of total posts), concern (16 of total posts), encouragement (22 of total posts), apologies (13 of total posts), jokes and humour (65 of total posts) and thanking (9 of total posts). Details of types of social comments according to each of the learning tasks are illustrated in Figure 6.4. From Figure 6.4, it is interesting to note that no or few concern and encouragement posts were made in Task 2, which was inter group work, compared to Tasks 1 and 3 which were intra group work.

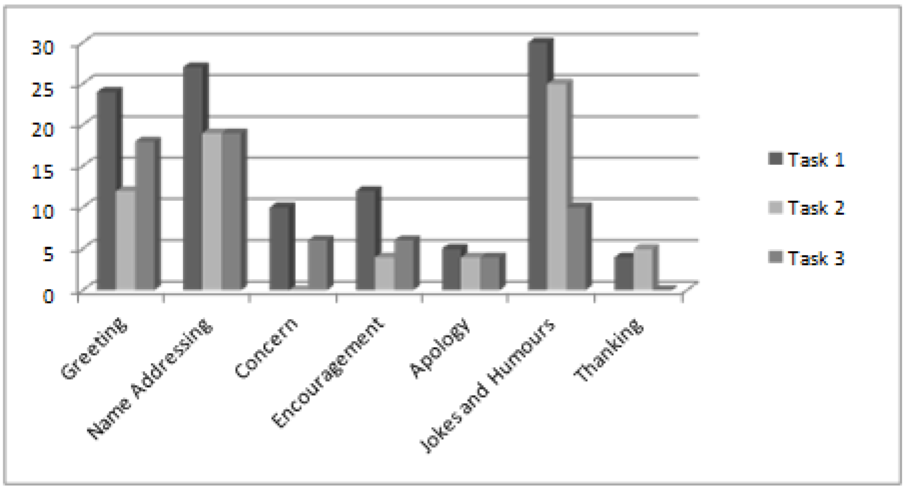


Figure 6.4: The types of social comments

Further non-parametric analysis was performed on the overall social dimension posts to examine if the difference in social and emotional themes between the learning tasks was significant. There was no significant difference ($\rho<0.01$) found in social themes using the Kruskal-Wallis test for testing an independent variable with more than two groups (Tasks 1, 2 and 3). However, the Kruskal-Wallis test showed statistically significant differences at $\rho<0.01$ in emotional themes as shown in Table 6.8. This signifies that the use of emotional comments by the students varied significantly as the learning tasks progressed.

Table 6.8: The Means and Mean Ranks and the Statistics Values of Social Dimension Themes (n=46)

Themes	Task 1	Task 2	Task 3	Statistics values
Social	2.2 (77.8)	1.7 (71.8)	1.3 (58.8)	χ^2=6.055, *df*=2, ρ=0.04, n.s.
Emotion	1.7 (86.2)	0.9 (59.8)	1.1 (62.4)	χ^2=0.048, *df*=2, ρ=0.001, ρ<0.01

Note. χ^2 = Chi-Square, *df*= Degree of freedom, * Significant at $\rho<0.01$

Additionally, there were also no significant differences ($\rho<0.05$) found, using the Chi-Square test, between male and female students in terms of the numbers of social and emotional comments that the students made in Tasks 1, 2 and 3.

6.4.3 The Interactive Dimension

The interactive dimension describes and measures the types of collaborative and non-collaborative interactions (Ingram & Hathorn, 2004) that students demonstrated during OCL discussions (Dillenbourg et al., 1999; Pozzi et al., 2007), which measures the interactions. Table 6.9 presents the overall distribution of the interactive dimension exhibited in the posts about the learning tasks by types of interactions, namely, *explicit* and *implicit* (collaborative interactions) and *independent* (cooperative interaction). The total number of explicit interactions ranged from the highest posts (93 – 50%) in Task 1 to the lowest posts (40 –21.5%) in Task 3, with the highest mean score of explicit interactions in Task 1. Implicit interactions ranged from the highest posts (131 – 36.4%) in Task 1 to the lowest posts (104 – 28.9%) in Task 3, with the highest mean score of implicit interactions in Task 1. The independent interactions were much fewer than the other two types and ranged from the highest posts (26 – 76.5%) in Task 1 to the lowest posts (5 – 14.7%) in Task 2.

Table 6.9*:* Interactive Dimension (n=46)

Themes	Task 1		Task 2		Task 3		Overall Total
	Posts	Mean	Posts	Mean	Posts	Mean	
Explicit	93 (50.0%)	2.0	53 (28.5%)	1.1	40 (21.5%)	0.9	186
Implicit	131 (36.4%)	2.8	125 (34.7%)	2.7	104 (28.9%)	2.3	360
Independent	26 (76.5%)	0.6	5 (14.7%)	0.1	8 (23.5%)	0.1	34

Based on the percentages of types of interactions in Tasks 1, 2 and 3 shown above, the overall percentages of the interactive dimension themes were plotted in Figure 6.5, which indicates that students' explicit and independent interactions were relatively high in Task 1 but were quite reduced in Tasks 2 and 3. The implicit interactions, on the other hand, remained relatively constant throughout all tasks. This indicates that students' online contributions from the postings were mostly accumulated without specifically mentioning students' names.

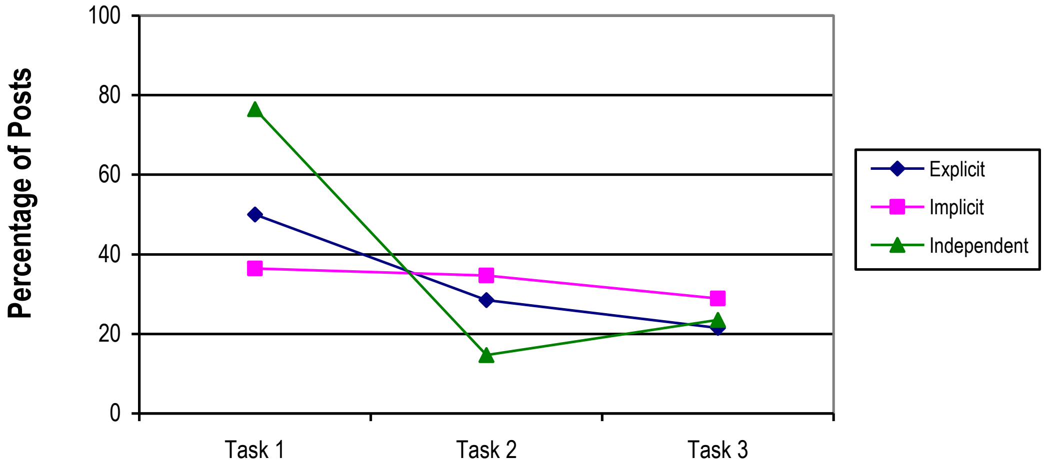


Figure 6.5: Interactive dimension themes

Analysis of students' online interactions from the overall posts of all learning tasks indicated eight types of interactions used by the students in the online discussions: providing information (102 of total posts), sharing views (120 of total posts), sharing experiences (75 of total posts), agreeing or disagreeing (67 of total posts), posing questions (50 of total posts), suggesting ideas (59 of total posts), giving feedback (63 of total posts) and clarifying ideas (49 of total posts). Occurrences of these types of students' interactions in each of the learning tasks are illustrated in Figure 6.6, which showed little difference in terms of the distribution of interactions.

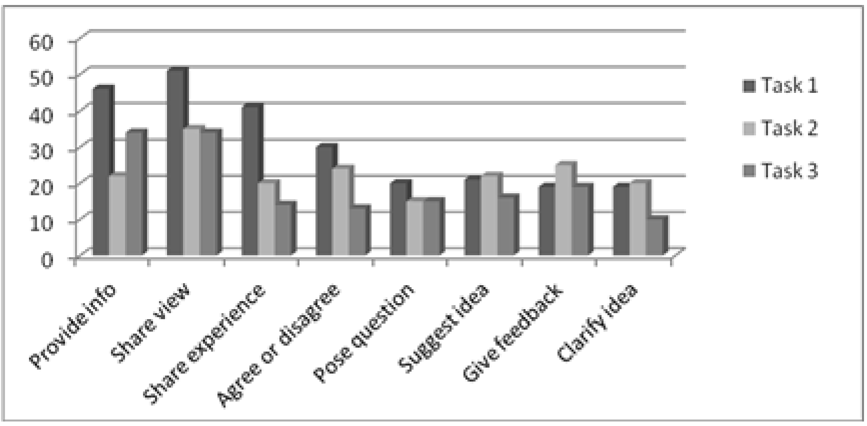


Figure 6.6: The types of interactive comments

Differences in the interactions (explicit, implicit and independent) were also looked for between the learning tasks using the Kruskal-Wallis test. There was no significant difference ($\rho<0.01$) found in the implicit interaction theme, but the Kruskal-Wallis test showed a statistically significant difference at $\rho<0.01$ in explicit interaction as shown in Table 6.10. This indicates that the total explicit interactions varied (decreased) significantly as the learning tasks progressed.

Table 6.10: The Means and Mean Ranks and Statistics Values of Interactive Dimension Themes (n=46)

Themes	Task 1	Task 2	Task 3	Statistics values
Explicit	2.0 (89.2)	1.1 (64.4)	0.9 (54.8)	χ^2=20.044, *df*=2, ρ=0.0001, $\rho<0.01$
Implicit	2.8 (72.7)	2.7 (77.0)	2.3 (58.6)	χ^2=5.520, *df*=2, ρ=0.06, n.s.

Note. χ^2 = Chi-Square, *df*= Degree of freedom, * Significant at $\rho<0.01$

Additionally, no significant differences ($\rho<0.05$) were found, using the Chi-Square test, between male and female students in terms of the numbers of interactions that the students made in Tasks 1, 2 and 3.

6.4.4 The Cognitive Dimension

The cognitive dimension measures the types of cognitive interactions as well as the information processing occurring (e.g. surface and deep) (Henri, 1992; Gerbic & Stacey, 2005; Pozzi et al., 2007). Table 6.11 presents the overall distribution of the cognitive dimension exhibited in the online posts in the learning tasks, split into three categories: *cognitive indicators*, and *deep* and *surface processing*. The total number of cognitive indicators ranged from the highest posts (186 – 37.4%) in Task 1 to the lowest posts (149 – 30.1%) in Task 3, with the highest mean score in Task 1. The deep processing, on the other hand, ranged from the highest posts (115 – 37.1%) in Task 3 to the lowest posts (94 – 30.3%) in Task 2, with the highest mean score in Task 3. Surface processing ranged from the highest posts (84 – 45.2%) in Task 1 to the lowest posts (35 – 18.8%) in Task 3, with the highest mean score in Task 1.

Table 6.11: Cognitive Dimension by Type of Cognitive Skills and Groups

Themes	Task 1		Task 2		Task 3		Overall Total
	Posts	Mean	Posts	Mean	Posts	Mean	
Cognitive indicators	186 (37.4%)	4.0	160 (32.3%)	3.5	149 (30.1%)	3.2	495
Deep processing	101 (32.5%)	2.2	94 (30.3%)	2.0	115 (37.1%)	2.5	310
Surface processing	84 (45.2%)	1.8	67 (36.0%)	1.5	35 (18.8%)	0.7	186

The overall percentages of cognitive dimension themes, as shown above, were plotted in Figure 6.7 and indicate that students' posts with cognitive indicators reduced slightly from below 40% in Task 1 to a fairly constant level around 30% in Tasks 2 and 3. However, the deep processing posts were relatively constant, around 30% in Tasks 1 and 2, rising to 37% in Task 3. Furthermore, the surface processing posts illustrated a gradual decline from below 45% in Task 1 to slightly above 35% in Task 2, before a sharp decline to below 20% in Task 3. This indicates that students appeared to be contributing posts that showed deeper levels of processing, involving a range of cognitive indicators, as the learning tasks progressed.

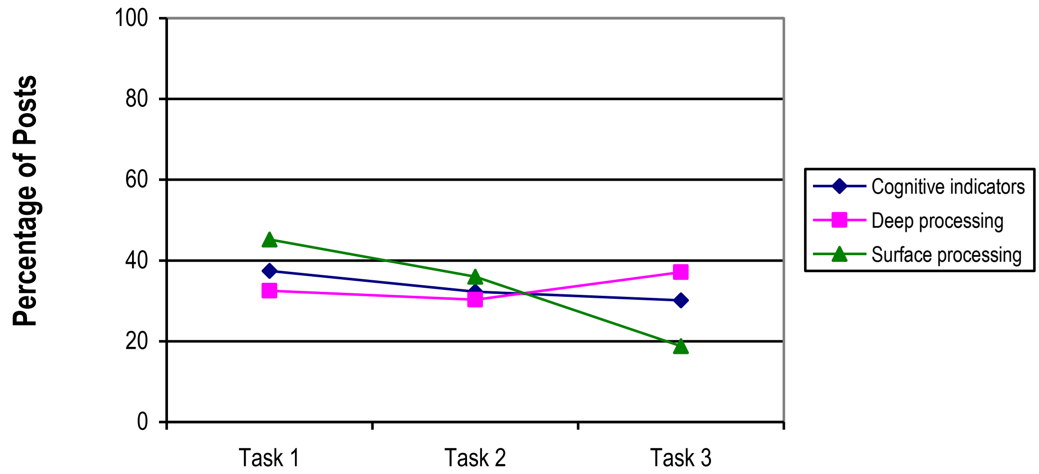


Figure 6.7: Cognitive dimension themes

Further content analysis of students' cognitive dimension posts was performed and indicated four types of cognitive indicators: clarification (264 of total posts), inference (66 of total posts), judgement (68 of total posts) and strategies (97 of total posts). Occurrences of these types of cognitive indicators in each of the learning tasks are illustrated in Figure 6.8. The majority of students' cognitive interactions focused on clarification, which indicates that students developed their learning through developing and gaining understanding.

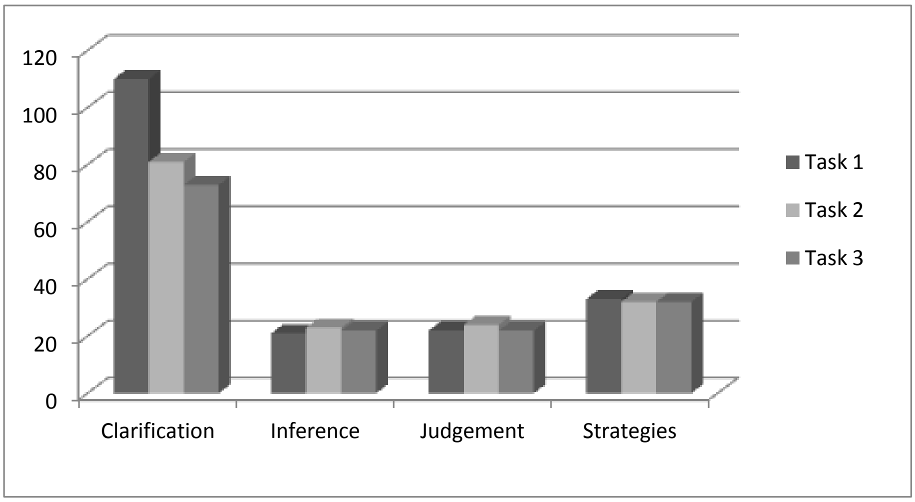


Figure 6.8: The types of cognitive indicators

Differences were also looked for in cognitive dimension themes (cognitive indicators, and deep and surface processing) between the learning tasks using the Kruskal-Wallis test. There was no significant difference ($\rho<0.01$) found in cognitive indicators and deep processing, but the Kruskal-Wallis test showed a statistically significant difference at $\rho<0.01$ in surface processing, as shown in Table 6.12. This indicates that the amount of surface processing varied significantly as the learning tasks progressed.

Table 6.12: The Means and Mean Ranks and the Statistics Values of Interactive Dimension Themes (n=46)

Themes	Task 1	Task 2	Task 3	Statistics values
Cognitive indicators	4.0 (77.7)	3.5 (71.6)	3.2 (59.17)	χ^2=5.242, *df*=2, ρ=0.07, n.s.
Deep processing	2.2 (72.3)	2.0 (69.9)	2.5 (66.18)	χ^2=0.576, *df*=2, ρ=0.07, n.s.
Surface processing	1.8 (85.7)	1.5 (67.1)	0.7 (55.6)	χ^2=14.671, *df*=2, ρ=0.001, ρ<0.01

Note. χ^2 = Chi-Square, *df*= Degree of freedom, * Significant at $\rho<0.01$

Additionally, no significant differences ($\rho<0.05$) were found, using the Chi-Square test, between male and female students in terms of cognitive dimension themes in Tasks 1, 2 and 3.

6.4.5 Summary

In summary, the analysis of the overall distribution of students' posts, based on participative, social, interactive and cognitive dimensions themes (Section 6.4.1 to 6.4.4), revealed that students' participation efforts were high at the beginning (Task 1), lowered and then remained constant in the middle and towards the end (Task 3), but that high amounts of viewing and checking of other students' works remained throughout. Their social comments were also high in Task 1 but decreased as the learning tasks progressed, particularly because Tasks 1 and 3 were designed to foster intra group work, which required particular types of social interactions compared to Task 2 (inter group work). However, the students developed relationships between one another as the learning tasks progressed. It is also noted that no or few posts were made in Task 2 (inter group work) relating to concern and encouragement, compared to Tasks 1 and 3 which were intra group work. The students' types of interactions according to the interactive dimension showed little difference in terms of the distribution of interactions. Nonetheless, students' cognitive interactions were shown to have higher numbers of posts focusing on clarification, indicating that students developed learning through developing and gaining understanding. Moreover, the result of the cognitive dimension analysis also showed that the majority of the posts were classified as deep, which is an important indicator for deeper levels of understanding in discussions.

6.5 Students' Perceived Experiences of Online Collaborative Learning: Tools, Rules and Division of Labour

This section aims to examine and describe students' perceptions of their online collaborative learning experiences based on their reflections of the use of tools, rules and division of labour. The use of tools referred to the eLearning environment and its components such as tasks or course content, forums, chat, instant messaging, coursework and assessment. Rules referred to any informal or formal instructions regarding how students were to work on the learning tasks in groups, and division of labour referred to how the tasks were shared or distributed by the groups. Data for analysis included the online questionnaire that participants completed at the end of the course, consisting of 28 5-point Likert scale items. The analysis was conducted using a one-sample, two-tailed t-test with the hypothetical mean score (test value) of 3.5 (which was selected to examine if students' views were above moderately positive). Further analysis of data based on the post-course semi-structured interviews was conducted as well, regarding the students' perceptions of their OCL experiences through their reflections on the same foci of tools, rules and division of labour. Data for analysis included the interview transcripts of nine face-to-face group interviews and reflections. In the following section, the presentation of data begins with the analysis of students' reflections on tools first, followed by rules and division of labour. Data from the questionnaire is reported on first, followed by data from the interview.

6.5.1 Students' Perceived Experiences of Online Collaborative Learning: Students' Reflection on Tools

The findings from the questionnaire of students' perceptions of OCL, based on their reflections on tools such as Moodle, the tasks and the use of computer, are shown in Table 6.13. In general, the students' responded with mean scores that ranged from the lowest of 3.80 (moderately positive) to the highest 4.55 (positive), regarding their perceptions of how eLearning helped their learning in general and learning in groups. Likewise, the students' also responded positively by commenting that they had enjoyed learning online. However, the last three items, 'I enjoy learning within an online group', 'I prefer to work online within a group rather than work alone' and 'I can connect with lecturers and other students outside the classroom at anytime and anywhere' were varied in terms of responses from the students (ρ values were more than 0.001).

Table 6.13: Students' Perceived Experiences of Online Collaborative Learning: Students' Reflection on Tools (n=42)

Tools	Mean	S.D.	*t*	ρ*
eLearning helped me to learn on my own	4.03	0.69	4.76	.000*
eLearning helped me to learn online	4.18	0.54	7.76	.000*
eLearning helped me to learn in my group	3.98	0.80	3.75	.001*
eLearning helped me to share ideas or communicate within an online group	4.55	0.67	9.80	.000*
eLearning provided me with an easy way to get course learning materials	4.55	0.82	3.24	.000*
eLearning provided me with an easy way to get additional information and material for my assignment	3.93	0.79	5.59	.001*
I enjoy learning online	4.15	0.86	4.75	.000*
I enjoy online discussions about my studies	3.90	0.90	2.81	.000*
I enjoy learning within an online group	3.80	0.91	2.08	.044
I prefer to work online within a group rather than work alone	3.83	0.81	2.52	.016
I can connect with lecturers and other students outside the classroom at anytime and anywhere	3.85	1.05	2.10	.042

*Significant at $\rho<0.05$

Data from the students' interviews revealed the opportunities and the affordances of the Virtual Learning Environment (Moodle) as a tool to support learning. Students described that this VLE provided them with accessibility to a wide range of online tools (e.g. forums, chat, instant messaging, quizzes and wiki), course content (e.g. course outline, lecture notes, readings/references and interactive resources), coursework where students are able to upload their coursework assignments, and assessment where students are able to track their learning progress by doing online quizzes and tests.

Through the technology, the students felt they were given the flexibility to learn not only in the class but also outside the classroom. This is reflected in the following student quote: "through e-learning, we are not only learning in the class but also outside the class. For example, for my class, we use e-learning to get the notes and have the discussion in the forum" (Heng). Students also felt closer to their fellow peers and instructor because of the connectivity provided by the technology. They felt that through technology they were able to build good relationships with their peers and instructor in an environment which was conducive to learning. Hida explained:

"in this situation, we can build good relationships with our lecturer and friends. When we know each other, it gives a positive environment so we enjoyed the class".

In forum discussions, the communication delay between student posts gave them time to think and reflect before answering, as Hana commented: "it is not like the report that the students do in the assignments, it is more like their reflection from the discussion in the forum which they conclude what they understand from the forum". The discussions were also retrievable at any time by students, because all posts made by students were stored in the system, which could then be viewed by all students in the class. Amin stressed:

> The advantages of using group discussions in e-Learning are that all information that has been contributed will not be missing from the system. For example, if we discuss the topic among ourselves outside the system, there might be one or two points that we may leave out, but if we discuss it in e-Learning we can refer back the discussion by scrolling through the forum.

Despite the affordances of technology, serious issues were raised about Internet failure and availability, the remoteness of communication, the use of informal language and the impersonal nature of technology. These could potentially hinder students' participation in an OCL environment. Students reported that when the Internet connection was lost while they were posting their feedback, it affected their motivation to re-type it again. Dhah highlighted: "things will get worse when suddenly the Internet is disconnected. Then, we feel reluctant to type it out again". Similarly, students felt ignored when their peers were not online to answer questions. Fareha expressed: "I like to discuss in the e-Learning environment, but when there is no one [online] to give feedback or comment on what we have posted, I feel like there is no point to post on the topic".

The frequent use of colloquial language and informal local word abbreviations in discussions sometimes made it hard to understand what was being discussed, as reported by Soh:

> Because the words are different from the formal words, when you pronounce them it sounds ok for us to understand, but when it is written, they become informal language and informal words which we totally don't understand and this is discouraging.

The lack in online work of voice intonation and body language available in face-to-face interactions was seen to possibly result in misunderstandings. As Azie commented: "I couldn't sense the voice intonation from the lecturer and I didn't know whether he was angry or not, but if it is in face-to-face, I can feel out the particular situation".

A further tool in this study was the learning tasks, and the students were also asked about their experiences of completing and accomplishing these tasks via an OCL environment. The students' perceived benefits of learning tasks after they had completed them were: gaining new ICT knowledge, improved ICT knowledge, and changed attitudes towards the ICT subject. Zuwan suggested that he gained ICT knowledge: "I learn a lot of things, for example, before this I only know about the [Microsoft] PowerPoint but after having task discussions, I know about Authorware". Busyra reported a developed awareness of ICT*: "*I felt this subject [tasks] gave impact to my ICT knowledge…I am not very good in computer subjects but now it has opened my mind into the ICT world". Finally, Kho reported a changed attitude towards learning with ICT: "when I came across this subject, I was totally frustrated…however, after completing my first task assignment, I realized that I love this subject very much".

On the other hand, students also reported feeling that the learning tasks were confusing and complicated. Brian was concerned at the start of the course, as he noted his response upon receiving the tasks, "quite confusing, maybe because task 1 and task 2 come together, and I am confused about what I should do". Amin was also unsure of how to begin the tasks: "when we got the task, at first, we didn't understand it and we didn't know how to start". Lastly, Zaki found the task requirements complicated initially, as he said it was, "a bit complicated because we thought that both tasks were related and the same, but actually they were totally different.

This section described how students perceived the use of tools that included technology (e.g. Moodle, eLearning and online, and the computer) and learning tasks that were the resources for their participation in activities designed for an OCL environment in a Malaysian tertiary classroom. The findings reported showed that in general most students enjoyed learning online but some of the students were less enthusiastic about online group learning in learning ICT. The next section describes students' perceptions of the rules used in these activities.

6.5.2 Students' Perceived Experiences of Online Collaborative Learning: Students' Reflection on Rules

Students' perceptions of OCL based on their reflections on rules, referred to any informal or formal instructions on how they should work on the learning tasks in groups. The results from the questionnaire are shown in Table 6.14. In general, the students responded with mean scores ranging from the lowest of 3.55 (moderately positive) to the highest of 4.03 (positive), regarding their participation in online discussions, interactions with peers and lecturers, and their satisfaction of collaborating online. The lowest mean score of 3.55 indicated that students generally had responded positively towards their participation in an online collaborative group but some of the students were not used to this approach in sharing their ideas in an online group.

Table 6.14: Students' Perceived Experiences of OCL: Students' Reflection on Rules (n=42)

Rules	Mean	S.D.	*t*	ρ*
I like participating and sharing my ideas in online discussions	3.98	0.92	3.26	.002*
My ideas were acknowledged by other students in discussions within an online group	4.03	0.57	11.23	.000*
I am willing to share and contribute my ideas in online discussions	3.55	0.95	-3.62	.001*
I was satisfied with the quality of work as a result of collaboration in my online group	4.03	0.57	11.23	.000*
Lecturers helped me in learning online	3.95	0.71	8.41	.000*
Lecturers guided me in working within an online group	3.95	0.67	8.86	.000*
In my online group work, the lecturer made the instructions for the task clear	3.96	0.77	7.67	.000*

In my online group work, the instructions given by the lecturer about how to work as a group facilitated the group task	4.00	0.63	10.46	.000*

*Significant at $\rho<0.05$

Data from students' interviews revealed that the pedagogical rules of OCL were expressed through their participation in an online learning environment and mutual peer interaction in sharing information, following others' arguments and justifying ideas. Zuwan explained: "it is the process on how to generate ideas because each group member's free to give their opinions on particular issues; since each group member can give their own opinions on a particular issue or topic, we can see the positive and negative side of it. Then, we can choose which point is relevant to everyone". Students also stressed that their participation in an online eLearning environment was an integral part of the institutional teaching and learning culture and that their participation was driven by assessment requirements of the course, as Chris reported:

> We have to accept the fact that participation in eLearning is written in the university learning policy. Also, the use of e-Learning has been a part of this university culture, so we have to participate in it. In my opinion, it will encourage more students to participate in it and contribute their ideas.

The rules involved the process of negotiation in which students negotiated by comparing the advantages and disadvantages of solutions. There was also opportunity for students to contribute towards the co-creation of solutions. Izzatie said:

> Sometimes, we cannot get all the information on one particular topic, so by combining all the information that we get from other people, we can get extra information about the topic. Even sometimes, when we couldn't get the exact info about something, we could somehow relate it to the topic.

A further rule in this study was the online collaboration. Students were asked about their experiences of collaborating online to complete the learning tasks in an OCL environment. The students felt that sharing academic content through collaborating online with other students built up their confidence through exchanged ideas and opportunities for active learning. Ruhi reported gained confidence: “we have to think critically on how to do the task together because when the lecturer asks to discuss in the classroom, we feel shy to do it, but if in e-Learning, we have a little bit of confidence”. Fadi reported exchanged ideas or shared expertise: “when we discuss and collaborate with other people that come from different majors, we can exchange our ideas”, while Chris highlighted: “capability and expertise that are shared benefit us”. Finally, Hana reported on the opportunities for active learning: “for me, the approach used in this course gave me some form of active learning… to learn the software in interactive activity”.

Nevertheless, students also felt the negative aspects of learning through collaborating online with other students, such as other students not contributing their ideas, some not getting involved in serious thought and others dominating the discussion. Izzanie reported that not all students contributed ideas: “in my opinion, it depends on the students themselves. Most of the students access the e-learning and might only read through the forum without contributing their ideas”. Ain reported that not all students gave the topics serious thought: “when the discussion is getting serious, there are some people who start talking idle. They don’t think much actually”. Hasma highlighted the fact that some students dominated the discussion: “for me, it is not fair because there are more SPT students than us and they give a lot of opinions, which we just have to agree with”.

This section described how students perceive the use of rules in activities designed for an OCL in a Malaysian tertiary classroom. The findings reported that students in general were comfortable and accepting of the need to work online through OCL, but that they had some reservations about sharing ideas where some of the students were not used to the approach of sharing their ideas in an online group. The next section describes students’ perceptions of the division of labour used in activities designed for an OCL environment in a Malaysian tertiary classroom.

6.5.3 Students' Perceived Experiences of Online Collaborative Learning: Students' Reflection on 'Division of Labour'

Students' perceptions of OCL, based on their reflections on division of labour, referred to how the tasks are shared or distributed by the groups. The results from the questionnaire are shown in Table 6.15. In general, the students responded positively regarding collaboration and working together within an online group with mean scores of 4.0 and above. Students commented that it helped them learn more, learn efficiently, accomplish a higher quality work and build confidence. Likewise, the students also responded positively to their online group work, where they decided on their roles and responsibilities together.

Table 6.15: Students' Perceived Experiences of Online Collaborative Learning: Students' Reflection on Division of Labour (n=42)

Rules	Mean	S.D.	*t*	ρ*
Working together within an online group helped my learning	4.00	0.80	9.87	.000*
Working together within an online group helped me learn more efficiently than if I were working alone	4.00	0.64	11.23	.000*
Working together within an online group helped me accomplish higher quality work than if I were working alone	4.05	0.59	8.01	.000*
Working together within an online group helped me to build my confidence in expressing my ideas and thoughts	4.00	0.81	7.74	.000*
In my online group, the group decided how to work together	4.03	0.62	10.46	.000*
In my online group, the group members agreed about how to work together	4.10	0.67	8.20	.000*
In my online group, the way the group decided to work together encouraged group members to contribute	4.08	0.76	10.46	.000*
Knowing my role and responsibilities in the group task helped me feel that I was contributing to the group	4.27	0.59	13.47	.000*
Knowing my role and responsibilities in the group task helped me feel a part of the group	4.30	0.68	11.97	.000*

*Significant at $\rho<0.05$

Data from students' interviews revealed that the division of labour in an online collaborative environment was seen by students as a way to learn to develop shared roles and responsibilities in a cooperative manner. Diana explained: “we point out our opinions and we explain them. Then we ask one or two people to comment on it and the others will do the same”. Students also supported each other through their willingness to share information and to remind other students to do the same. Ruhi said: “when we discuss we need feedback, so, by reminding them to participate in the discussion, we can get the feedback especially from those [students] who are always online”. The frequent use of sociable words (e.g. idle and local talk), emoticons (or emotion icons) and personal posts which were not related to the topic of discussion, showed that students became more informal as they got to know each other. Zilah stressed “in the discussion, when people get to idle talk, they will contribute their opinion in a pleasurable way where they can enjoy the discussion and cheer up discussion”.

A further note on the division of labour was the online group discussion roles, and the students were also asked about their perceptions on their roles in an OCL environment. Generally, students felt that through online group discussions they could help one another and have more focused discussions. Afi reported on the roles of helping each other: “some people do help, because we did the discussion in a group. Yes, there are people who contribute great ideas that can help us in our studies”. Fareha highlighted the aspects of concentration in online group discussions: “online group discussions allow us to give more concentration on discussion because there are only a number of us. If there are only three of the members who replied to the post, it is easy for us to know”.

On the other hand, students reported the negative aspects of online group discussion, such as their working preferences, conflict among groups and inter-dependency issues. Nad reported on the group work preferences:

> We prefer to work outside eLearning because if we do the online group discussion we need everyone to get connected with the Internet at the same time. Usually, we do the group discussion outside eLearning, like what we did today, sit and gathered in this room and having a discussion.

Afi reported on the conflict among groups: “for them, we are like kids. They sometimes cannot accept our ideas or opinions if they are better than theirs”. Kho highlighted the inter-dependency issue: “for me because we less interact with other groups because we only discuss it in our group. That’s why our group just focused on our group work without thinking about other group opinions”.

This section described how students perceive the use of division of labour in activities designed for an OCL environment in a Malaysian tertiary classroom which they believed benefitted them in terms of helping one another complete the online collaborative learning tasks.

6.6 Chapter Summary

This chapter presents data on the first research question examining the effects of online group discussions for OCL, based on the analyses of posts in participative, social, interactive and cognitive dimensions and students’ perceptions of their OCL activities in a Malaysian tertiary classroom. In general, the findings indicated the overall positive effects of OCL discussions on students’ participation and contribution, reciprocity, sociability and cognition. The students’ cognitive interactions were shown to have higher numbers of posts focusing on clarification through developing and gaining understanding and also showed that the majority of the posts were classified as deep understanding in discussions. Additionally, students’ views were also generally positive towards the technology and tools used in the OCL intervention, pedagogical rules in being involved in eLearning, and their roles in the online collaborative learning environment. Data from interviews depicted that generally most students enjoyed learning online but some of the students were less enthusiastic about online group learning in learning ICT. The findings also reported that students in general were comfortable and accepting of the need to work online through OCL, but that they had some reservations about sharing ideas where some of the students were not used to the approach of sharing their ideas in an online group. However, students perceived they benefited them in terms of helping one another complete the online collaborative learning tasks - a way to learn to develop shared roles and responsibilities in a cooperative manner.

Chapter 7 The Online Groups' Findings

7.1 Introduction

This chapter presents the findings from the nine groups participating in the online group discussions followed by a summary of the findings and the chapter summary. The purpose is to examine the nature of student group interactions in online collaborative learning and to answer the second research question, 'What is the nature of student group interactions in online collaborative learning?' However, the inter-group discussion data was not included in this chapter as the data provided little further insight and contributed little to the construction of this chapter. The missing inter-group discussion data is included in Appendix O.

7.2 The Research Map of Analysis: The Online Groups

This section discusses the group level of analysis as depicted in Figure 7.1, by grey area within the student groups (Chemistry, Physics and Mathematics) and the triangle connecting them through the affordances of the online collaborative learning environment.

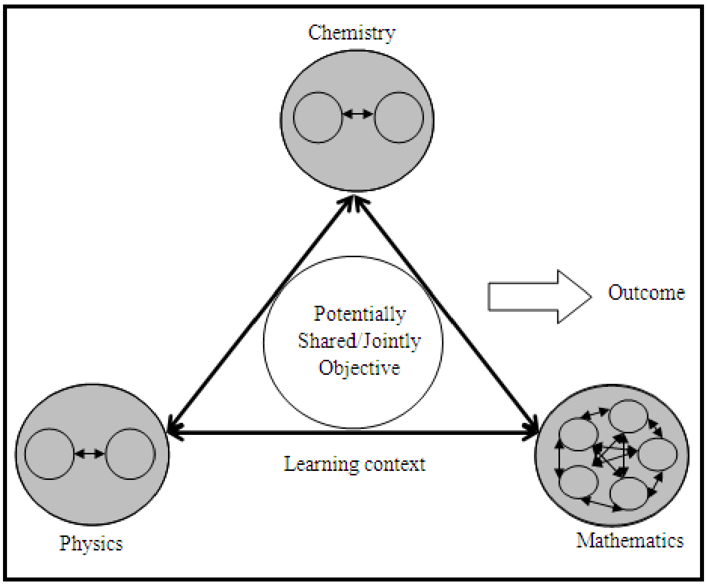


Figure 7.1: The group level

The grey areas in Figure 7.1 represent the analysis of the nature of student groups' interactions in the online collaborative learning (OCL) based on their participative, interactive, social and cognitive dimensions. The findings from each of the nine participating groups in the online discussions are presented by providing a description of the group, and then summarising the findings about the online group discussions in participative, interactive, social, and cognitive dimensions. Each section concludes with some reflections on the learning process from the group and a short summary.

7.2.1 Online Group One

Online Group One was comprised of four students from the Chemistry and Computer Education programme (SPK), all of whom were Malay, one male and three female (see Appendix L for full details of the participating groups). The following sections describe the key characteristics of Group One's learning within online group discussions based on the overall classroom findings in participative, interactive, social and cognitive dimensions (see Chapter Six for full details of these learning outcomes).

7.2.1.1 The Participative Dimension: Active and Task-Directed

The participative dimension reveals the level and type of participation that the students from Group One displayed during the online discussions based on the contributions and viewings of the postings. The findings indicate that the overall average of participation in Group One, compared to the groups' overall average, was about 8% above for contributions and about 17% below for viewings, which suggests that the students' participation in the online discussions was active and task-directed. There was evidence that the students' engagement was dialogical during the early stages of discussion, particularly in learning Task 1 when the students were trying to establish the discussion and brainstorm ideas. This was particularly apparent in Fareha's postings, which constituted more than 57% of the total of Group One's postings. Most of her postings were dialogues, starting new threads, requests for more factual information from a previous post, and replying to other group members' postings. However, at the end of the discussions, the students' engagement was more responsive towards the work of the group rather than towards the group social dynamics (such as social activity and humour). It was evident that the students' engagement at the end of the discussions was directed towards achieving the task's goals, particularly when the group re-organised the discussions to be "related to the topics" (Student 1/ Group 1 (S1/G1)). Moreover, the students' perception that an effective discussion can be achieved when "the topic is discussed deeply and not going off topic" (S2/G1), reflected Group One's working orientation towards the learning tasks.

7.2.1.2 The Interactive Dimension: High Reciprocity

The interactive dimension reveals the nature and the types of interactions that the students from Group One exhibited during the learning process. Initially, providing information (14, 23.3% of interactive postings in Group one) to the discussion topic was a primary focus of interaction, followed by sharing views (9, 15%) and sharing experiences (7, 11.7%), which together reflected the group's sharing perspective (30, 50%). There were also a number of interactions around negotiation (16, 26.7% of total), including agreement or disagreement (4, 6.7%), posing questions (5, 8.3%) and suggesting new ideas (7, 11.7%). Finally, there were fewer interactions in justifying meaning (9, 15%), including giving feedback (5, 8.3%) and clarifying ideas (4, 6.7%). The findings also indicate that the overall average of interactions in Group One was about 7% above the average of all groups' total interactions, which suggests that the students' engagement in online discussions was high and interactive, with more than 77% of the interactions being implicit (without directly referring to other students' names). There was evidence that the students' interactions were divergent during the early stages of discussion, particularly during the brainstorming and negotiation phases in learning task 1, in which the group interactions were split into two directions, taking a stance either as PowerPoint or Flash software contents but without a clear conclusion at the end of the discussion. However, in learning task 3 the observed interactions in Group One exhibited less divergence of ideas and more responsiveness towards the postings of other group members, in other words more task-focused. The students appeared to be able to better align their responses to one another in an organised way when structuring the information in the discussion during learning task 3 compared to learning task 1.

7.2.1.3 The Social Dimension: High Sociability

The social dimension reveals the types and the nature of social interactions that the students from Group One developed during the learning process. The findings indicate the types of social cues (43, 71.7% of total) exhibited during the discussions including emotional expression (19, 31.7%), jokes or humour (9, 15%), concern (5, 8.3%), apologies (4, 6.7%) and greetings (4, 6.7%). The findings also indicate that the overall average social scores for Group One was about 7% above the average of all groups' total scores, which suggests that Group One's social engagement in online discussions was high and socially facilitated. There was evidence that online communication was used by Group One to augment their current bonds and relationships due to the number of responses contributed to one another. Izzanie highlighted this:

> When there are many people participating in the forum discussion, some of them may only be posting their opinion rather than replying to our post. When there are only four of us in the group, we can really interact and respond to each of us. (S3/G1)

The thought of bonding within online group discussions was further echoed by Fareha, who said "It gives us focus because there are only three people that can reply to our post, so it is easy for us to know" (S4/GI). Similarly, the data also suggests that Group One increasingly developed a joint sense of responsibility and accountability through developing group-assigned roles of reader and contributor to one another in order to better manage the discussion and to keep it on topic. As one student commented:

> We have to look at the student's background knowledge on the topic to be able to contribute in the discussion. For example, when in a group of four people we have to make sure at least two of the group members have knowledge of the topic. In this situation, two group members will contribute information and the others as readers. (S1/G1)

The findings also revealed that Group One's use of social cues during the discussion, such as emotional expressions, greetings, concern and apologies, jokes or humour, was supportive of the learning process. It was evident that these social cues supplemented Group One's cognitive dimension (presented next) and helped students collaborate effectively within an online group in order to attain and maintain joint understanding and interdependence.

7.2.1.4 The Cognitive Dimension: A Mixture of Surface and Deep Learning

The cognitive dimension can be defined as "the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (Garrison, 2001, p.11). The cognitive dimension in this study is revealed through thematic units referring to the types of cognitive skills and approach to learning strategies that the students from Group One exhibited during the learning process. The findings indicate that there was a wide range of cognitive skills exhibited during the discussions, including clarification (33, 55% of total), inference (8, 13.3%), judgement (7, 11.7%) and strategies (7, 11.7%). The findings also indicate that the students from Group One embraced a mixture of surface and deep learning strategies in the discussions, with more than 72% of the cognitive postings could be classified as deep in learning task 3. There was evidence that the discussions helped the students gain knowledge and develop an understanding of the content. As Izzanie said, "for this subject, yes, I found it something new because of the discussion in which I did gain knowledge by participating in it" (S2/G1). Likewise, there was also evidence that the students learnt from one another through the online discussions, as Fareha explained:

> Someone who has knowledge on the topic will contribute his/her opinion than someone who does not know about the topic. For example, in this group of four, two of group members knew about the topic and the other two group members could get the knowledge from them. (S4/G1)

7.2.1.5 Group One's Reflections on the Learning Process

Responses from the questionnaires revealed that generally the students from Group One agreed both before and after the intervention that the use of eLearning (Moodle) technology helped their learning. There was less agreement about this in regards to some aspects after the intervention, justified by the students in the interview due to the Internet connection (or Wi-Fi) to access the eLearning programme around the campus. The students felt it was problematic to constantly stay online without frequent interruption in the Internet connection, as one student complained: "I am not satisfied with the university Wi-Fi for frequent eLearning access due to slow and hard to get Internet connection" (S4/G1). However, when the students were specifically asked to indicate whether their eLearning experiences contributed positively to or hindered their learning, all students reported that the contribution was positive. The majority of the students from Group One enjoyed the learning process, exhibited by responding positively in the questionnaire after the intervention that they enjoyed interacting and learning online. In addition, the students also enjoyed online learning as they were able to access a wide range of learning tools, course content, coursework and quizzes. Izzanie reported how eLearning helped her learning: "I can look at the notes, downloading the weekly course contents especially the updated weekly notes and participating in the forum" (S3/GI). Like Izzanie, Helmy highlighted how the constant sharing and viewing of the discussion with the lecturer and peers helped him extend his knowledge:

> Discussion is important where the students can share their opinions and thoughts about one topic. For example, the lecturer posts one topic of the subject that he taught, and the students reply to the post by contributing their opinions. (S1/G1)

The students felt that the online discussions, as part of their learning, helped them to come together and collaborate as a group: "it is more like, when there are a lot of people involved or participate in it, and then we feel interested to participate" (S3/G1). The students also highlighted that the online group discussion helped their learning, particularly in developing a greater depth of knowledge on the topic:

> Sometimes, we cannot get all the information of a particular topic, so by combining all the information that we get from other people, we can get extra information about the topic. Even sometimes, we will not get the exact info about it; somehow we can relate it to the topic. (S2/G1)

The students also remarked that working within an online group helped them produce better quality work: "when we do online group work, we will do the assignment better together. If we do it individually, we might forget about it" (S4/G1). The students from Group One enjoyed developing their knowledge through collaboration with their peers.

7.2.1.6 Group One Summary

Based on the findings from the learning dimensions, Group One's learning was active and interactive, and socially and cognitively facilitated. In other words, the students' learning was achieved through their active participation in situated learning activities, being goal-directed, socially mediated and cognitively enriched through sharing information. Through the online group discussions the students from Group One appeared to accomplish a higher quality of reports for group achievement and obtain improved final grades compared to previous grades (see Appendix N for groups' achievements). Only one student obtained the same grade as in the previous course. The students from Group One also described how their online group discussions helped them learn about ICT and gain knowledge, giving them confidence to engage in learning in a novel collaborative learning context.

7.2.2 Online Group Two

Online Group Two was comprised of five students, one Malay and four Chinese (one male and four female) from the Chemistry and Computer Education programme (SPK) (see Appendix L for full details of the participating groups). The following sections describe the key characteristics of Group Two's learning within online group discussions based on the overall classroom findings in participative, interactive, social and cognitive dimensions (see Chapter Six for full details of the learning outcomes).

7.2.2.1 The Participative Dimension: High and Strategic

Group Two's participative dimension reveals the level and type of participation that the students from Group Two exhibited during the online discussions through the students' contributions and viewings of the postings. The findings indicate that the overall average participation of Group Two, compared to all groups, was about 44% above the average contributions and about 56% above the average viewings, which suggests that Group Two's participation in the online discussions was high and strategic. Group Two's participation strategies were concerned with two aspects of online discussions, which were the quantity and the quality of the postings. In terms of the quantity of the postings, students from Group Two used the combination of face-to-face and online methods for completing their online group discussions. From the interview data, Heng mentioned that their online group discussions were better conducted "when the group sat down face-to-face" (S1/G2), which is important in order to get participation and to get them "connected to the Internet" (S1/G2). The continuity analysis of online postings confirmed that the highest number of participations from all students from Group Two occurred over a few hours on one day, where it seemed that the students "sat down together online and had a good conversation" (S4/G2). This was particularly evident in the online discussion in learning task 3, which recorded the highest number of group postings over 2.5 hours on one day (22/02/2010, from 12.24 pm to 2.56 pm). Data from the interview further verified that Group Two had their online discussion by meeting physically at that computer laboratory so that they could be online and work together. Soh reported: "we have face-to-face discussion for the assignments [online discussions] which usually the group will meet at a place [computer laboratory]" (S5/G2). As for the quality of participation, it was evident that the students from Group Two were concerned with the assessment requirements and criteria of both learning tasks one and three. Hida mentioned how the group had to come with "the best postings in order to get the mark" (S4/G2) by strategically structuring and aligning the posts with the task's criteria and supporting them with "elaborations and references from the Internet, either direct links to the sources or quotes as references" (S3/G2) which was highly task oriented.

7.2.2.2 The Interactive Dimension: High Reciprocity

The interactive dimension reveals the nature and the types of interactions between the students from Group Two during the learning process. Group Two’s main interactions were providing information (18, 22.2% of interactive postings in Group Two), giving a point of view (16, 19.8%) and sharing experiences (7, 8.6%) regarding the discussion topic, which together portrayed the group’s sharing perspective (41, 50.6%). There were also a number of interactions around negotiation (22, 27.1% of total), including agreement or disagreement (9, 11.1%), posing questions (6, 7.4%) and suggesting new ideas (7, 8.6%). Finally, there were fewer interactions in justifying meaning (15, 18.5%), including giving feedback (9, 11.1%) and clarifying ideas (6, 7.4%). The findings also indicate that the overall level of interaction in Group Two was about 52% above the average of all groups’ total interactions, which suggests that the students’ engagement in online discussions was high and interactive, with more than 60% of the interactions being implicit (without using a direct referencing of other students’ names). There was more reciprocity exhibited in learning task 3 compared to learning task 1, which indicated that the students’ collaborative interactions in the discussions became increasingly visible and aligned in agreement with one another. Likewise, the students also appeared to be mutually engaged in the discussions and contributed actively online in order for the discussion to proceed. Soh commented that:

> Participating in very active discussions, sometimes we cannot look at the problem from one angle only; we should look at the problem in various angles from other students’ ideas and views. (S5/G2)

7.2.2.3 The Social Dimension: High Sociability

The social dimension reveals the types and the nature of social interactions that the students from Group Two developed during the learning process. The findings indicate the types of social cues (58, 71.6% of total) exhibited during the discussions, including emotional expression (25, 30.9%), name addressing (11, 13.6%), greetings (7, 8.6%), concern (5, 6.2%) and encouragement (5, 6.2%). The findings also indicate that the overall average of social scores for Group Two was about 25% above the average of all groups' total scores, which suggests that Group Two's social engagement in online discussions was high and socially facilitated. Data from the findings revealed there were quite a number of social and emotional responses exhibited in learning tasks one and three, indicating that Group Two had developed sociable and supportive relationships. Kho highlighted how the group helped and supported one another for the discussions:

> I got a message from my friends [Group Two] saying that I must access the e-Learning [discussion] by five o'clock today and there are marks will be given, I don't have the Internet connection in my room so I had to go to other place to connect to the Internet in order to access the e-Learning [discussion] (S2/G2).

The use of social cues also appeared to supplement Group Two's cognitive dimension (presented next) which enhanced Group Two's learning.

7.2.2.4 The Cognitive Dimension: Deep Learning Approach

The cognitive dimension revealed the types of cognitive skills and approaches to learning that the students from Group Two exhibited during the learning process. The findings indicate that there was a wide range of cognitive skills displayed by students during the online discussions, including clarification (28, 34.5%), inference (14, 17.2%), judgement (14, 17.2%) and strategies (16, 19.7%). The findings also indicate that the students from Group Two embraced an increasingly deep learning strategy, from about 3% above average in learning task 1 to about 74% above average in learning task 3, with more than 87% of the total group postings could be classified as deep. Data from the findings revealed that there were a number of deep learning responses exhibited across learning tasks one and three, which suggests that Group Two had developed a common understanding that working together strategically in online discussions would improve all of their quality of learning. Data from Group Two online questions posted in the final week of discussion task 3 confirmed the value of online group work, as Ong commented; "when we do the group work [online discussion], our ideas may be accepted or rejected by our friends and we even ended up giving up some ideas in order to produce more compact, high quality of reports" (S3/G2/OQ).

7.2.2.5 Group Two's Reflections on the Learning Process

In response to the questionnaires about the use of eLearning, generally there were no major differences between each item in the pre and post questionnaire. The majority of the students from Group Two prior to the intervention (pre questionnaire) saw that eLearning helped them learn on their own and learn within an online group, as well as after it (post questionnaire). Likewise, the majority of students from Group Two also perceived that eLearning provided them with access to course learning materials to the extent that the students could also access the additional information for their assignments. Data from the interview with the students from Group Two verified these opportunities provided by eLearning. The students described how eLearning became one of their "learning resources and references" (S2/G2) where they could "download and read notes" (S3/G2) as well as the updated notifications about the coursework through "the assignment [coursework] application features" (S1/G2), which the students thought "very convenient and user-friendly" (S5/G2). Kho highlighted how she appreciated the convenience of getting the lecture notes and being an independent learner, as she said "when I got the notes, I would feel appreciative because I don't have to get notes in the classroom and I can learn to be an independent learner" (S2/G2). The students also highlighted the flexibility of eLearning as a medium for learning anytime and anywhere, as Heng said "through eLearning, we are not only learning in the class but also outside the class. For example, for my class, we use eLearning to get the notes and have discussion in the forum" (S1/G2). Like Heng, Hida felt that eLearning was a means for the students to build good relationships with their peers and lecturer through an environment which was conducive for learning, as she pointed out: "we can build good relationship with our lecturer and friends. When we know each other, it gives good [conducive] environment so we enjoyed the class" (S4/G2). The students from Group Two further highlighted specific applications of eLearning; particularly the asynchronous forum which helped them communicate ideas comfortably. Soh commented:

> When it is written, we can explain it clearly without worries of the length. Also I feel very relaxed to give my ideas because we cannot force everyone to say

> something they don't want to, because everybody has their own opinion (S5/G2).

In addition, when the students from Group Two were specifically asked to indicate whether their eLearning experiences contributed positively or hindered their learning, all students felt that eLearning experiences contributed positively to their learning. The majority of the students from Group Two responded in the post questionnaire that they did enjoy the eLearning experiences, where they learnt using ICT, online groups and online discussion. However, several issues were also raised by the students from Group Two regarding the constraints of eLearning. The students found "it hard to connect to the Internet to access the eLearning, and if connected, the page loaded slowly" (S4/G2). The frequent use of colloquial Malay language and informal Malay word abbreviations in discussions made it hard for the majority of the students in Group Two, who were Chinese, to understand. Heng said:

> Because the words are different from the formal words, when they pronounce it sounds ok for us [Chinese] to understand, but when they were written; they become informal language and words which we [Chinese] totally don't understand and it is discouraging (S1/G2).

Moreover, the lack of non-verbal cues in the asynchronous eLearning forum could result in misinterpretation of the actual message, as Heng mentioned "because we don't get enough messages [non-verbal cues] from them about what they like to express actually" (S3/G2) and "people might not understand what I am trying to say, whether my points are correct or not, and I'm always scared of that kind of feedback" (S3/G2). Kho highlighted how she had to use her phone in conjunction with writing on the eLearning forum, as she said "if I cannot express my feeling in writing, so I will use the phone to call, which is better…" (S2/G2). There were also difficulties in coping with the delays of the asynchronous eLearning forum, as Ong explained:

> When we were in week six, suddenly there was a person who joined the week one forum, and we had missed out their message, which was very important and we needed to check the message in the week one, which is very troublesome (S3/G2).

In terms of the online group discussions, the students felt that the online group discussions helped them obtain a wide array of ideas and views, as Hida said “we can get a lot of ideas and different views about the topic” (S4/G2). The students also remarked that working together within an online group helped them gain confidence, in that they can “talk more bravely [confident] online” (S2/G2). Also, Kho’s reflection on the course explained how the learning tasks changed her attitude towards the ICT subject, as she reported “when I came across this subject, I was totally frustrated…however, after completing my first task assignment, I realised that I love this subject very much” (S2/G2/SR); Ong felt that the group could improve their ICT knowledge through the course: “I think we are going to improve our computer [knowledge] a great deal after learning the Authorware” (S5/G2).

7.2.2.6 Group Two Summary

Based on the findings of the learning dimensions, Group Two’s learning showed high participation in online discussions, as well as being interactive, socially cohesive and showing a deep cognitive approach to learning. Through their engagements in the discussions, Group Two developed their own strategic ways of working together to achieve the best results from their online group discussions through a synchronous style of chatting. During the online group discussions, the students also developed some supportive online behaviour by encouraging one another to contribute so that they could all benefit from the group learning. The supportive online behaviour was observable in the online discussion through the group’s social engagement with the learning tasks. Through online group discussions, the students from Group Two appeared to accomplish a better quality of reports for their group achievement and obtained an improved final grade compared to their previous grades (see Appendix N for groups’ achievements). These students described how their engagement in online group discussions helped them gain confidence, change their attitudes toward the ICT subject and improve their ICT knowledge. However, students also reported issues in online group discussions such as problems of colloquial language and lack of non-verbal cues.

7.2.3 Online Group Three

Online Group Three was comprised of five students, four Malay and one Indian (four male and one female) from the Physics and Computer Education programme (SPP) (see Appendix L for full details of the participating groups). The following sections describe the key characteristics of Group Three's learning within online group discussions based on the overall classroom findings in participative, interactive, social and cognitive dimensions (see Chapter Six for full details of the learning outcomes).

7.2.3.1 The Participative Dimension: Average and Task-Directed

The participative dimension describes the group's level and type of participation during the online discussions, through the contributions and viewings of the online postings by the group members. The findings indicate that the overall average participation in Group Three compared to all other groups was about the same for contributions and about 40% below the average for viewing, which suggests that Group Three's participation in the online discussions was average for online contributions and task-directed. Data from the findings also reveal most of the discussions were initiated by students recognised by the group as the persons with solid knowledge in ICT. This was particularly evident in the online discussion in learning task 3, when more than 70% of Group Three's total postings were posted by Anwar, who appeared to be the starter for the online discussions and functioned as a key person to ensure that the discussions proceeded. Group Three also reported that their success in online discussions was achieved through help and contribution from knowledgeable peers, as they believed that without adequate knowledge (in this context ICT knowledge); it would be difficult, if not impossible, for the group "to [successfully] contribute to discussions" (S4/G3). Group Three's online discussions also resembled a synchronous chat style as evident in the learning tasks. This is verified through the analysis of online postings in learning task 1, which recorded the highest number of participations by all students from Group Three, but only took place over 2 ¼ hours on one day (04/01/2010, from 12.32 pm to 2.45 pm). Data from the interview further confirmed how Group Three felt that their best way of discussions was through "synchronous chatting where they could get immediate responses" (S2/G3). Sydin said, "Sometimes, when we posted a question in the discussion, none would reply to the post [immediately], even if we are waiting [reply] for a quite long time" (S3/G3).

7.2.3.2 The Interactive Dimension: Average Reciprocity

The interactive dimension reveals the nature and the types of interactions that the group exhibited during the learning process. The thematic analysis revealed that Group Three's types of interactions included providing information (14, 14.7% of interactive postings in Group Three), giving a point of view (15, 15.8%) and sharing experiences (12, 12.6%), which reflected the group's sharing perspective (41, 43.1%). There was also negotiation (28, 29.4% of total), including agreement or disagreement (10, 10.5%), posing questions (7, 7.4%) and suggesting new ideas (11, 11.6%). Finally, there were fewer interactions in justifying meaning (21, 22.1% of total), including giving feedback (10, 10.5%) and clarifying ideas (11, 11.6%). The findings also indicate that the overall level of reciprocity of Group Three was about average compared to all groups, which suggests that the students' engagement in online discussions were average and interactive, with more than 63% of the interactions being implicit (without directly referring to other students' names). Important reciprocity was exhibited in learning task 3 compared to learning task 1, which was driven by the starter of the discussion; this indicated that the students' understanding of the discussions was increasingly organised and supported by their more capable peers in order to ensure that the discussion could proceed.

7.2.3.3 The Social Dimension: Average Sociability

The social dimension reveals the nature and the types of social interactions that the group developed during the learning process. The thematic analysis revealed that Group Three's types of social interactions included emotional expression (24, 25.3% of total), greetings (3, 3.2%), name addressing (8, 8.4%), jokes or humour (12, 12.6%), concern (3, 3.2%), thanking and appreciation (2, 2.5%), and encouragement and apology both with one posting respectively. The findings also indicate that the overall average social scores for Group Three were about the same as all of the groups' social engagement. Data from the interview revealed how Group Three's social discourse in eLearning online discussions was being extended to Facebook by the group and how it affected the group participation in eLearning. Chris reported:

> Like in Facebook you know, we actually posted something in which people actually interact with you to what you posted, so we actually thinking of going back in Facebook to check the post (S1/G3).

7.2.3.4 The Cognitive Dimension: A Mixture of Surface and Deep Learning

The cognitive dimension reveals the types of cognitive skills and approach to learning strategies that the students displayed during the online discussions. The thematic analysis revealed that there was a wide range of cognitive skills exhibited during the discussions, including clarification (48, 50.5% of total), inference (8, 8.4%), judgement (10, 10.5%) and strategies (7, 7.3%). The findings also indicate that the students from Group Three embraced a mixture of surface and deep learning strategies in the discussions, with more than 72% of the postings could be classified as deep in learning task 3. Data from the interview revealed how Group Three thought that participation in eLearning online discussions could help them gain knowledge. Chris said, "Even if the students do not have any ideas about the topic, they will try to find about the topic so that they could join in the forum, and gain knowledge about the topic" (S1/G3).

7.2.3.5 Group Three's Reflections on the Learning Process

In response to pre and post questionnaires about the use of eLearning, the majority of the students from Group Three agreed prior to the intervention that the use of eLearning helped them learn on their own, online, within an online group and also provided them with access to course learning materials which was useful additional information for their assignments. However, there was a decline in agreement about these aspects after the intervention. Those declines were explained by the students from the interview regarding the Internet connection around the campus. Sydin reported:

> We have to be in a certain area or spot if we want to access eLearning through the university's WIFI wherein not every room in the university has the WIFI connection even if the room is located near to other room that has the WIFI connection and if we are using other Internet provider than the university's WIFI, we may have a slow Internet connection to the university's server. (S3/G3)

Specifically, all students from Group Three reported that their eLearning experiences were positive. However, the students had mixed responses when they were asked directly in the interview about whether the eLearning was an effective learning environment. This showed that although the students enjoyed the learning opportunities provided by eLearning, especially in getting "access to learning materials" (S3/G3), discussing the assignments "without meeting" (S5/G3) and allowing the group to "refer back to the discussion" (S3/G3), some of them felt they needed more reminding and motivation to participate in eLearning; Chris said "eLearning is not the best environment, I just log-in to eLearning whenever I received reminder to participate in the forum, get some information and lecture notes" (S1/G3) and he further said "I think we are having difficulty actually to find what is right for us [motivation]" (S1/G3). The students also felt that the discussions in eLearning were giving limited opportunities for real discussions because of the lack of important non-verbal cues:

> I think discussion in eLearning is not finding its true potential because learning does not fully use all senses, in eLearning we are using only eyes, and perhaps hands or something like that, and we don't use our potential of discussion properly (S1/G3).

The students reported that the participation in eLearning group discussions was an integral part of the institutional teaching and learning culture: "we have to accept the fact that participation in e-Learning is written in the university learning policy. Also, the use of e-learning has been a part of this university culture, so we have to participate in the e-learning" (S1/G3) in which it became a motivation that "encourages more students to participate" (S2/G3). The students also acknowledged that working together within an online group enhanced their capability and expertise:

"my capability and his expertise, so I am expert in one field and he is in another, so we shared our skill and idea to benefit both of us" (S1/G3) which the students felt was "encouraging, fun and has an objective, a shared objective" (S1/G3).

7.2.3.6 Group Three Summary

Based on the findings of the learning dimensions, Group Three's participation in online group discussions was average, as was their reciprocity and sociability, while the group's cognitive dimension could be classified as a mixture of surface and deep approaches. Although the result of their engagement in the discussions was average, Group Three's learning was achieved through their participation in situated learning activities in which the discussions were driven by their more capable peer in achieving the goals, involving formal and informal social mediation through the technology; this cognitively enhanced their capability and expertise. However, students also reported issues of Internet access and lack of non-verbal cues. Through the online group discussions, the students from Group Three appeared to accomplish a better quality of reports for their group achievement and maintained good final grades compared to their previous grades (see Appendix N for groups' achievements). These students described how their engagement in online group discussions increased their participation for learning with other students in sharing their capabilities and expertise.

7.2.4 Online Group Four

Online Group Four was comprised of five female Malay students from the Physics and Computer Education programme (SPP) (see Appendix L for full details of the participating groups). The following sections describe the key characteristics of Group Four's learning within online group discussions based on the overall classroom findings in participative, interactive, social and cognitive dimensions (see Chapter Six for full details of the learning outcomes).

7.2.4.1 The Participative Dimension: Low and Disengaged

The participative dimension reveals the group's level and type of participation during the online discussions through the contributions and viewings of the online postings by the group members. The findings indicate that the average participation in Group Four, compared to the average of all other groups, was about 63% below for contributions and about 62% below for viewing, which suggests that Group Four's participation in online discussions was low. The findings also indicate that the students from Group Four exhibited low online engagement in learning task 1 and almost no engagement in learning task 3. This was particularly evident in learning task 3 when only four posts were made by one student, without any responses from other group members. Data from the interview revealed that Group Four's lack of engagement was related to the group's restricted access to the eLearning website. Nahar reported "the Internet connection from the college's wireless connection is difficult to access, even if we use our own broadband and access it from the college, we still cannot access the eLearning and if we could access eLearning but when we click on the subject's link, we lost the connection" (S3/G4). In order to compensate for those constraints, Group Four had taken an alternative approach to conduct the group's discussion from online to offline as Hasma said "we hardly had group discussion in the eLearning because we cannot get through the Internet connection, which forced us to take an alternative to do the discussion outside the eLearning" (S2/G4). Although Group Four's online discussions were very limited due to the group's offline discussion approach, the students still appeared to hardly view the eLearning discussions except to fulfil the group's participation requirement that didn't really require them to actually "participate in the forum but just to log in" (S5/G4).

7.2.4.2 The Interactive Dimension: Low Reciprocity

The interactive dimension reveals the nature and the types of interactions that the group exhibited during the learning process. The thematic analysis revealed that Group Four's limited types of interactions in learning task 1 and 3, only included providing information (4, 22.2% of interactive postings in Group Four), giving a point of view (4, 22.2%) and agreement or disagreement (2, 11.1%). The findings also indicated that the overall level of reciprocity of Group Four was about 77% below the average for all groups, which suggests that the students' engagement in online discussions was very low, with the majority of the interactions being independent (without prior connection), particularly in learning task 3.

7.2.4.3 The Social Dimension: Low Sociability

The social dimension reveals the nature and the types of social interactions that the group developed during the learning process. The thematic analysis revealed that only two posts (11.1%) from Group Four conveyed emotional expressions in learning task 1 and three. The findings also indicate that the overall average of social scores for Group Four was about 94% below the average of all groups' social scores, which suggests that the students' social engagement in online discussions was very low. This was due to the fact that the majority of the students' postings were less dialogic, and many postings exhibited independent or isolated statements without social cues.

7.2.4.4 The Cognitive Dimension: Surface Learning Approach

The cognitive dimension reveals the types of cognitive skills and approaches to learning strategies that the students from Group Four exhibited during the learning process. The thematic analysis revealed that limited ranges of cognitive skills were exhibited during the discussions, and clarification (5, 27.7% of total) was the only cognitive skill exhibited in online discussions task 1 and three. The findings of the overall average scores of surface learning indicate that Group Four was about average but was about 95% below the average scores for deep learning, which suggests that the postings could be classified as surface.

7.2.4.5 Group Four's Reflections on the Learning Process

In response to pre and post questionnaires about the use of eLearning, generally the majority of the students from Group Four agreed prior to the intervention that the use of eLearning helped them learn on their own, learn online, learn within an online group and also provided them access to course learning materials to the extent that the students from Group Four could also access the additional information for their assignments. However, there were some negatives, particularly regarding aspects of eLearning forum discussions within an online group. This was not surprising as these views are consistent with the students' responses from the interview which reported that the group's online discussions "did not run smoothly" (S2/G4) because the majority of the group members had constraints, particularly in accessing the eLearning; some of the students had "limited access to the Internet" (S4/G4), lack of technical knowledge in dealing with "insecure access" (S2/G4) that required an access certificate to the eLearning website, which the students saw as a "computer virus" (S2/G4), and the disruptive Internet connection which resulted in "frequent lost connections to the eLearning website" (S1/G4).

Specifically, when the students were asked to indicate if their eLearning experiences contributed positively or hindered their learning, all students reported that eLearning experiences contributed positively to their learning. However, when the students were asked directly in the interview whether the eLearning was an effective learning environment, they responded that it was ineffective because "they couldn't use the eLearning through the university's wireless Internet connection" (S2/G4), as they felt it was "difficult to get connected" (S2/G4) to it. On the other hand, the students appreciated the opportunities provided by eLearning, as they could experience "the eLearning contents for the subject beforehand" (S3/G4), "download the lecture notes" (S5/G4) and prepare for "the assignments and coursework through the use of information provided by their peers and lecturers" (S1/G4). A student also highlighted how eLearning discussions could be very handy in terms of "referring back to what had been discussed" (S4/G4) and "having eLearning discussions after the class hour" (S4/G4). In terms of online discussions in eLearning, the students from Group Four acknowledged that an effective online discussion for the group was obtained when they were working together through "sharing information" (S3/G4) and "contributing ideas" (S1/G4), in which the students felt that they gained new information as well as expanded their ICT knowledge. Hasma said "the information that we get from our friends that we have no idea about it in which we felt that we had expanded our knowledge about the software" (S2/G4).

7.2.4.6 Group Four Summary

Based on the findings of the learning dimensions, Group Four in online group discussions was low in participation, low in reciprocity and sociability with the group’s cognitive dimension and could be classified as surface learning. The result of Group Four being low in participative, interactive, social and cognitive dimensions was evident in the group’s disengagement, particularly in online discussion task 3, when the majority of the discussion was held offline and not visible through the eLearning forum. The students also verified that their disengagement from online discussions was due to the constraints of the eLearning technology and this may affect their overall postings and opinions. Through the online group discussions, the students from Group Four still appeared to participate in the situated learning activity, though minimally, in terms of sharing info and contributing ideas. Group Four also maintained the same mark for the group report task 1 and three, but showed a decline in online discussion marks (see Appendix N for groups’ achievements). These students described how their engagement in online group discussions, although the majority of the discussions were held offline, helped them as a group to expand their ICT knowledge.

7.2.5 Online Group Five

Online Group Five was comprised of five female Malay students from the Mathematics and Computer Education programme (SPT) (see Appendix L for full details of the participating groups). The following sections describe the key characteristics of Group Five’s learning within online group discussions based on the overall classroom findings in participative, interactive, social and cognitive dimensions (see Chapter Six for full details of the learning outcomes).

7.2.5.1 The Participative Dimension: High and Task-Directed

The participative dimension reveals the level and type of participation that the students from Group Five exhibited during the online discussions through the students’ contributions and viewings of the postings. The findings indicate that the participation in Group Five, compared to the overall average of the groups, was about

57% above for contributions and about 16% above for viewings, which suggests that Group Five's participation in online discussions was high and task-directed. There was evidence that Group Five's engagement was highly dialogic (more than 78% of group's total postings), particularly in learning task 1 when the students started a new thread, requesting information and making suggestions, and giving feedback to other group members' postings. The online transcript analysis confirmed that Group Five's dialogical discussion was achieved when the group adopted the synchronous chatting style for online discussion in which the students' worked and chatted online together. This is evident in learning task 1, which included the highest number of Group Five's postings that took place on one day over an 8 ½ hour period (01/01/2010, from 8.19 am to 4.48 pm).

However, in learning task 3 the students' engagement in online discussion appeared to be more focused on the task, with less social talks and the majority of the students' postings were responses to answer the task. This was evident in the students' postings in online discussion learning task 3, with more than 50% of the group's total postings appearing more structured and organised, and they contained more lengthy text supported with references from the Internet, compared to learning task 1. This change was also reflected in a student response from the interview, which highlighted how effective online collaborative discussion was achieved when it was structured according to a date assigned by the group. Hid commented that "the discussion is held according to the dates assigned by the group member. In this way, the group would know when the other group members access and contribute their idea in the discussion and things that they are missing as well, so no one would be left behind" (S4/G5).

7.2.5.2 The Interactive Dimension: High Reciprocity

The interactive dimension reveals the nature and the types of interactions that occurred during the learning process. The thematic analysis revealed that Group Five's types of interactions included providing information (14, 14.7% of interactive postings in Group Five), giving a point of view (20, 21.1%) and sharing experiences (13, 13.7%), which together reflected the group's sharing perspective (47, 49.4%). There were also a number of interactions around negotiation (25, 26.3% of total) and justifying meaning (15, 15.7% of total), which were including agreement or disagreement (9, 9.5%), posing questions (9, 9.5%) and suggesting new ideas (7, 7.4%), followed by giving feedback (9, 9.5%) and clarifying ideas (6, 6.3%). The findings also indicate that the overall level of reciprocity of Group Five was about 54% above the average reciprocity of all groups, which suggests that the students' engagement in online discussions was high and interactive, with more than 54% of the interactions being explicit (directly referring to other students' names).

7.2.5.3 The Social Dimension: High Sociability

The social dimension reveals the nature and the types of social interactions that the group developed during the learning process. The thematic analysis revealed that social interactions included emotional expression (27, 28.4% of total), greetings (10, 10.5%), name addressing (16, 16.8%), encouragement (6, 6.3%) and jokes or humour (13, 13.7%). The findings also indicate that the average social scores for Group Five was about 78% above the overall average of all groups' social scores, which suggests that the students' social engagement in online discussions was high and socially facilitated.

7.2.5.4 The Cognitive Dimension: A Mixture of Surface and Deep Learning

The cognitive dimension reveals the types of cognitive skills and approaches to learning strategies that the students from Group Five displayed during the learning process. The thematic analysis revealed there was a wide range of cognitive skills exhibited during the discussions, including clarification (29, 30.5%), inferences (9, 9.4%), judgements (10, 10.5%) and strategies (10, 10.5%). The findings also indicate that the students from Group Five embraced a mixture of surface and deep learning strategies in the discussions, with more than 60% of the postings could be classified as deep in learning task 3.

7.2.5.5 Group Five's Reflections on the Learning Process

In response to the questionnaires about the use of eLearning, generally there were no major differences between each item in the pre and post questionnaire. The majority of the students from Group Five perceived that eLearning helped them learn on their own, and learn within an online group prior to the intervention as well as after it. Likewise, the majority of the students from Group Five also perceived that eLearning provided them with access to course learning materials to the extent that the students could also access the additional information for their assignments. Data from the interview with the students from Group Five verified learning opportunities provided by the eLearning forum discussions. Ain commented that “the positive thing about eLearning forum is we can learn more through discussions based on our opinions about particular topic which does not mixed up with other subject” (S5/G5). The students also reported that through eLearning they could focus more on “the assignments” (S2/G5) by following “the updated notes” (S3/G5) from the lecturers. The “information” (S1/G5) from their peers on the eLearning forum enabled them to “always refer back to the forum” (S2/G5). They also acknowledged that they would be able to learn anywhere through eLearning, for instance in their “room” (S1/G5), and access eLearning at “anytime they wanted” (S1/G5).

Specifically, when the students were asked to indicate whether their eLearning experiences contributed positively or hindered their learning, all students reported that eLearning experiences contributed positively to their learning. However, when the students were asked directly in the interview whether the eLearning was an effective learning environment, they responded that the eLearning was “not effective enough” (S5/G5) because of the constraints, such as “Internet connection” being “too slow” (S3/G5) and “Internet access” (S5/G5) being too limited, particularly at the students’ residential college. The other constraints reported by the students were related to the lack of human contact, as Azie stressed that “if everything went online, we just learn from reading the lecture notes without actually learning from the lecturer and the lecturer’s explanation” (S1/G5). Verbal cues were important to the students, to determine the lecturer’s exact instructions, as Azie further stressed: “the lecturer’s voice intonation cannot be received by us and we don’t know whether he is angry or not” (S1/G5).

Regarding online group discussions in eLearning, the students felt that the online group discussion helped them attain a lot of ideas to be further researched on the Internet, as Azie said “we get a lot of ideas which we can do the information searching on the internet" (S1/G5). The students remarked that working together through online group discussions allowed them to get "information and knowledge from their peers" (S1/G5) by "sharing information" (S5/G5) and "expanding information" (S5/G5) from other students, and the students from Group Five felt that it "with their studies" (S2/G5).

7.2.5.6 Group Five Summary

Based on the findings of the learning dimensions, Group Five's learning was high in online discussion participation, which was also high in reciprocity and sociability; the postings could be classified as a mixture of deep and surface learning. In other words, Group Five's learning was achieved through the students' high levels of participation in situated learning activities; these were goal-directed, socially mediated and cognitively enhanced through sharing information and knowledge with one another. Through the online group discussions, the students from Group Five appeared to maintain the same mark for their group achievements and improved their final grade compared to their previous grades (see Appendix N for groups' achievements). The students from Group Five described how their engagement in online group discussions helped them gain information and knowledge about ICT and helped them in their studies. However, students also reported issues of Internet access and lack of non-verbal cues and synchronous style of chatting in online discussion.

7.2.6 Online Group Six

Online Group Six was comprised of six students, five Malay and one Indian (all female) from the Mathematics and Computer Education programme (SPT) (see Appendix L for full details of the participating groups). The following sections describe the key characteristics of Group Six's learning within online group discussions based on the overall classroom findings in participative, interactive, social and cognitive dimensions (see Chapter Six for full details of the learning outcomes).

7.2.6.1 The Participative Dimension: High and Strategic

The participative dimension reveals the level and type of participation that the students from Group Six exhibited during the online discussions through the students' contributions and viewings of the postings. The findings indicate that the overall average of participation in Group Six compared to the overall groups' averages was about 12% above for contribution and about 26% above for viewing, which suggests that Group Six participation in online discussions was high and strategic. Data from the findings indicates that more than 50% of Group Six's postings were about group's workload organisation and distribution in online discussion task 1 and three, particularly in relation to obtaining good marks for the group, as evidenced in Ruhi's posting concerning the assessment of the discussion and ways of achieving it through collective "efforts and responsibilities" (S1/G6). Also, from the interview, the students from Group Six revealed that a beforehand face-to-face discussion in the classroom was conducted before discussion in the eLearning as part of the group's strategic plan to complete the online learning tasks; Sue verified that they had had a "discussion in the classroom before discussion in the eLearning" (S5/G6). Furthermore, the students from Group Six acknowledged the advantages of using both face-to-face and online as complementary and supportive, as Diana said: "we do the discussion [face-to-face] before we post our message in the forum [online]. In this way, we could have support from group members in terms of ideas in the discussion" (S2/G6).

7.2.6.2 The Interactive Dimension: High Reciprocity

The interactive dimension reveals the nature and the types of interactions that the groups exhibited during the learning process. The thematic analysis revealed Group Six's types of interactions, which included providing information (10, 13.3% of interactive postings in Group Six), giving a point of view (16, 21.3%) and sharing experiences (10, 13.3%), which together reflected the group's sharing perspective (36, 48%). There were also a number of interactions around negotiation (23, 30.7% of total) and justifying meaning (15, 20% of total), which included agreement or disagreement (7, 9.3%), posing questions (7, 9.3%), and suggesting new ideas (9, 12%), followed by giving feedback (7, 9.3%) and clarifying ideas (6, 8%). The findings indicate that the overall level of reciprocity of Group Six was about 18% above the average reciprocity of all groups, which suggests that the students' engagement in online discussions was high and interactive, with more than 81% of the interactions being implicit (without directly referring to other students' names).

7.2.6.3 The Social Dimension: High Sociability

The social dimension reveals the nature and the types of social interactions that the groups developed during the learning process. The thematic analysis revealed Group Six's types of social interactions, which included emotional expression (22, 29.3% of total), greetings (5, 6.7%), concern (3, 4%), encouragement (6, 8%), apologies (4, 5.3%), thanking (2, 2.7%) and jokes or humour (12, 16%). The findings indicate that the overall average of social scores for Group Six was about 33% above the average of all groups' social scores, which suggests that the students' social engagement in online discussions was high and socially facilitated.

7.2.6.4 The Cognitive Dimension: Deep Learning Approach

The cognitive dimension reveals the types of cognitive skills and approaches to learning strategies that the students from Group Six exhibited during the learning process. The thematic analysis revealed the cognitive skills exhibited during the discussions, which included clarification (30, 40%), inferences (10, 13.3%), judgement (9, 12%) and strategies (16, 21.3%). The findings indicate that the overall average scores of surface learning for Group Six was about 29% above the average scores of deep learning scores of all groups, which suggests that Group Six's postings could be classified as deep.

7.2.6.5 Group Six's Reflections on the Learning Process

In response to the questionnaires about the use of eLearning, generally there were no major differences between each item in the pre and post questionnaire. The majority of the students from Group Six perceived that eLearning helped them learn on their own, learn online and learn within an online group prior to the intervention (pre questionnaire) as well as after it (post questionnaire). Likewise, the majority of the students from Group Six also perceived that eLearning provided them with access to course learning materials to the extent that the students could also access the additional information for their assignments. Data from the interview with the students from Group Six verified the opportunities provided by the eLearning. The students described how eLearning became one of their “learning resources” (S1/G6) through “eLearning resources and links” (S1/G6) where they could “download and read notes” (S5/G6) and “get connected with their peers and lecturers” (S1/G6) for “fast information and feedback” (S5/G6). Diana reported: “eLearning advantages especially for quizzes, where the students could straight away get their marks and it is also easy to submit coursework through eLearning” (S2/G6).

The students from Group Six further highlighted the application of eLearning, in particular the asynchronous forum, which helped them communicate ideas easily. Ruhi commented “if we do the discussion face-to-face, we don’t know how to say it in words, but if in the eLearning, we can express it in written words with the ideas smoothly out from our mind” (S1/G6). In addition, a student also highlighted how they could always refer back to what had been discussed on the eLearning forums; Shah said “we can always refer back to what we have discussed and what we have did explain in eLearning forum” (S4/G6). Specifically, when the students were asked to indicate if their eLearning experiences contributed positively or hindered their learning, all students from Group Six reported that eLearning experiences contributed positively to their learning. Furthermore, when the students were asked directly in the interview whether the eLearning was an effective learning environment, the majority of the students from Group Six responded that eLearning is an effective learning environment, and they also responded in the post questionnaire that they did enjoy the eLearning experiences, through which they learnt more about using ICT, online groups, and online discussions after the intervention.

However, several issues were also raised by the students from Group Six regarding the constraints of eLearning. The students found difficult to get the Internet connection especially for “those who stay outside the inner ring campus” (S5/G6). The other constraints reported by the students were related to the lack of important non-verbal cues which they were used to in face-to-face interactions; Diana mentioned: “because we are missing the face-to-face interactions that we are used to when we were online” (S2/G6). In this way other people could easily misunderstood their messages, as Ruhi pointed out “when we discuss in the eLearning, we use words that are general to everyone because we do not want to offend anyone but sometimes people misunderstand it” (S1/G6). Regarding online group discussions in eLearning, the students felt that the online group discussion helped them “how to do the task together” (S1/G6) and obtain “diversity of ideas from other people through sharing ideas” (S5/G6). The students also remarked that working together through online group discussions allowed them to “gain new ideas from other peoples’ opinion” (S3/G6) and expanded the students’ “mind on the new ideas” (S3/G6).

7.2.6.6 Group Six Summary

Based on the findings of the learning dimensions, Group Six’s learning was high in participation in online discussions; these discussions were high in reciprocity and sociability, with the group’s cognitive dimension could be classified as deep learning. In other words, Group Six’s learning was achieved through the students’ high participation in situated learning activities; these activities were goal-directed, socially mediated, and distributed through sharing information and ideas from one another. Through the online group discussions, the students from Group Six appeared to achieve a better quality of reports for their group achievement and the majority of the students also appeared to obtain an improved final grade compared to their previous grades (see Appendix N for groups’ achievements). The students from Group Six described how their engagement in online group discussions helped them gain new ideas about ICT and helped them with their studies. The students also reported issues of Internet connection, lack of non-verbal cues and value of face-to-face and online interactions in helping them work together.

7.2.7 Online Group Seven

Group Seven was comprised mainly of five Malay students (all female) from the Mathematics and Computer Education programme (SPT) (see Appendix L for full details of the participating groups). The following sections describe the key characteristics of Group Seven’s learning within online group discussions based on the overall classroom findings in participative, interactive, social and cognitive dimensions (see Chapter Six for full details of the learning outcomes).

7.2.7.1 The Participative Dimension: Passive and Peripheral

The participative dimension reveals the levels of participation and the types of engagement that the students from Group Seven exhibited during the online discussions through the students' contributions and viewings of the postings. The findings indicate that the overall average of participation in Group Seven compared to the groups' overall average, was about 28% below for contributions and about 9% above for viewings, which suggests that Group Seven's participation in the online discussions was passive and peripheral (low contribution but high viewing). Data from the findings indicates that more than 50% of Group Seven's total postings were contributed by the same students (Anis and Dhah), particularly in online discussion learning task 1, while the other three students from Group Seven were active viewers (more than 66% of the group's total viewings). Data from the interview revealed that the lack of responses of Group Seven in online discussions was due to their lack of knowledge. Wani commented that: "some of us do not have much knowledge about some of the discussion topics, which actually resulted into no responses from us because we do not know what to reply" (S2/G7). In addition, Wan also said that: "forum discussions in the eLearning are based on the academic topics [content knowledge], so for some of us would be a little bit difficult because we have to think for the suitable answer before we could response to it" (S5/G7). The students also reported that the lack of responses resulted from the problem of accessing the Internet on campus, as Busyra reported: "the wireless Internet connection is not accessible around the campus" (S4/G7). In order to compensate for the Internet constraints, students from the group used to have an offline discussion for completing the learning tasks as Anis commented: "the reason why some of us seldom access the eLearning discussion because we used to have face-to-face discussion [offline] and upload the discussion points to eLearning forum" (S1/G7).

7.2.7.2 The Interactive Dimension: Low Reciprocity

The interactive dimension reveals the nature and the types of interactions that the groups exhibited during the learning process. The thematic analysis revealed that Group Seven's types of interactions included providing information (8, 16.7% of interactive postings in Group Seven), giving a point of view (12, 23.1%) and sharing experiences (9, 17.3%), which together reflected the group's sharing perspective (25, 48.1%). There were fewer interactions in negotiation (15, 28.8% of total) and justifying meaning (8, 15.3% of total), including agreement or disagreement (8, 15.4%), posing questions (4, 7.7%) and suggesting new ideas (3, 5.8%), followed by giving feedback (4, 7.7%) and clarifying ideas (4, 7.7%). The findings indicate that the overall level of reciprocity of Group Seven was about 21% below the average of reciprocity of all groups, which suggests that the students' engagement in online discussions was low, with more than 54% of the interactions being implicit (without directly referring to other students' names).

7.2.7.3 The Social Dimension: Low Sociability

The social dimension reveals the nature and the types of social interactions that the group's developed during the learning process. The thematic analysis revealed Group Seven's types of social interactions, which included emotional expression (18, 34.6% of total), greetings (5, 9.6%), name addressing (9, 17.3%) and apologies (3, 5.8%). The findings indicate that the overall average of social scores for Group Seven was about 22% below the average of all groups' social scores, which suggests that the students' social engagement in online discussions was low.

7.2.7.4 The Cognitive Dimension: Surface Learning Approach

The cognitive dimension reveals the types of cognitive skills and approaches to learning strategies that the students from Group Seven exhibited during the learning process. The thematic analysis revealed the cognitive skills exhibited during the discussions, including clarification (24, 46.1% of total), inferences (4, 7.7%), judgement (5, 9.6%) and strategies (8, 15.3%). The findings indicate that the overall average scores of surface learning of Group Seven was about 62% below the average scores of deep learning scores of all groups, which suggests that Group Seven's postings could be classified as surface.

7.2.7.5 Group Seven's Reflections on the Learning Process

In response to the questionnaires about the use of eLearning, generally there were no major differences between each item in the pre and post questionnaire. The majority of the students from Group Seven perceived that eLearning helped them learn on their own, learn online and learn within an online group prior to the intervention (pre questionnaire) as well as after it (post questionnaire). Likewise, the majority of the students from Group Seven also perceived that eLearning provided them with access to course learning materials, to the extent that the students could also access the additional information for their assignments. Data from the interview with the students from Group Seven verified the opportunities provided by the eLearning. The students highlighted how the link to "the notes and reading materials" (S1/G7) provided them with "additional information for their references" (S1/G7) and how "the coursework tool" in eLearning allowed them "to submit the assignments multiple times" (S2/G7). The students from Group Seven also acknowledged the opportunities to get new "information and news from the lecturer" (S4/G7) and "communicate with other people in different places" (S4/G7) through the application of eLearning. Likewise, when the students were asked to indicate whether their eLearning experiences contributed positively or hindered their learning, all students from Group Seven reported that eLearning experiences contributed positively to their learning. The majority of the students from Group Seven also responded in the post questionnaire that they did enjoy the eLearning experiences, through which they learnt more about using ICT, online groups, and online discussions after the intervention.

However, several issues were also raised by the students from Group Seven regarding the constraints of eLearning. The students found it difficult to access the Internet, particularly in their residential college (S1/G7) and if they did connect to the Internet, the website page would "loading too slowly and sometimes it took one day to load" (S5/G7). In addition, the students reported that when the Internet was disconnected while they were posting their feedback, it affected their motivation to re-type it. Dhah mentioned, “the written post is disappeared while we are posting it in the eLearning forum while the Internet is disconnected. Then, we feel reluctant to type it out again” (S3/G7). The other constraints that were raised by the students were related to the lack of important non-verbal cues, as Wan mentioned: “we hardly contribute our opinions and ideas in the online discussion because we do not know how to express them in words compared with when we discuss them face-to-face” (S2/G6). Like Wan, Anis further stressed that their inability to express the actual message through written words in the eLearning forum which could easily result in a “misunderstanding” (S2/G7). In terms of the online group discussions, the students from Group Seven felt that the online group discussions helped them obtain other students’ ideas and enabled them to share their ideas as well; as Anis said: “everyone has their own ideas and we can obtain their ideas and share to other students” (S1/G7). The students also remarked that working together through online group discussions enabled them to gain new knowledge about ICT through interactions with their peers, as Dhah said: “we can learn new things when the other students shared their knowledge that I do not know, for example about the phases of authoring which I knew something new from them” (S3/G7).

7.2.7.6 Group Seven Summary

Based on the findings of the learning dimensions, Group Seven’s learning was passive in participation on online discussion forums, and these were low in reciprocity and sociability, with the group’s cognitive dimension could be classified as surface learning. The result of Group Seven’s passive participation, with low interactive, social and cognitive dimensions, was evident in the group’s lack of contribution to the eLearning forums. The students also verified that their passive engagement in online discussions was partly due to the lack of knowledge about ICT and that they were more inclined to wait for other students’ responses before posting their feedback. However, they also reported issue of Internet connection. Throughout the online group discussions, the students from Group Seven appeared to maintain the same marks for group report task 1 and three, but slightly less in their online discussions (see Appendix N for groups’ achievements). These students described how their engagement in online group discussions, although the majority of the students’ participation was passive partly because they did their work offline together and then uploaded it, so they were being collaborative but constrained by the online circumstance.

7.2.8 Online Group Eight

Online Group Eight was comprised of five Malay students (all female) from the Mathematics and Computer Education programme (SPT) (see Appendix L for full details of the participating groups). The following sections describe the key characteristics of Group Eight's learning within online group discussions based on the overall classroom findings in participative, interactive, social and cognitive dimensions (see Chapter Six for full details of the learning outcomes).

7.2.8.1 The Participative Dimension: Passive and Peripheral

The participative dimension reveals the levels of participation and the types of engagement that the students from Group Eight exhibited during the online discussions through the students' contributions and viewings of the postings. The findings indicate that the overall average of participation in Group Eight, compared to the groups' overall average, was about 34% below for contributions and about 11% above for viewings from all groups, which suggests that Group Eight's participation in online discussions was passive (low contribution but high viewing) and peripheral. Data from the findings indicates that more than 50% of Group Eight's total postings were contributed by Fadi. Data from the interview revealed that the lack of active contributions from the students in Group Eight was due to the fact that some students in Group Eight were online just to "read through the content of the forum" (S3/G8). These students reported inconvenience and difficulty in actively contributing to online discussions because of their "lack of knowledge about Authoring concepts" (S3/G8). These students highlighted that they needed more "guide" (S4/G8) in terms of Authoring Language concepts in which they admitted "difficult" (S1/G8). The students also reported that the lack of responses resulted from the problem of accessing the Internet on campus, as Busyra reported: "the wireless Internet connection is not accessible around the campus" (S4/G8). In order to compensate for the Internet constraints, students from the group used to have an offline discussion for completing the learning tasks, as Anis commented: "the reason why some of us seldom access the eLearning discussion because we used to have face-to-face discussion [offline] and upload the discussion points to eLearning forum" (S1/G8). The students also reported that the lack of their contributions to the eLearning forum resulted from their lack of access to the Internet, which they compensated for via "face-to-face discussions" (S4/G8).

7.2.8.2 The Interactive Dimension: Low Reciprocity

The interactive dimension reveals the nature and the types of interactions that the groups exhibited during the learning process. The thematic analysis revealed Group Eight's types of interactions, which included providing information (8, 16.7% of interactive postings in Group Eight), giving a point of view (11, 22.9%) and sharing experiences (7, 14.6%), which together reflected the group's sharing perspective (26, 54.1%). There were fewer interactions in negotiation and justifying meaning (9, 18.7% of total) respectively, which including agreement or disagreement (4, 8.3%), posing questions (3, 6.3%) and suggesting new ideas (2, 4.2%), followed by giving feedback (5, 10.4%) and clarifying ideas (4, 8.3%). The findings indicate that the overall level of reciprocity of Group Eight was about 37% below the average reciprocity of all groups, which suggests that the students' engagement in online discussions was low, with more than 65% of the interactions being implicit (without directly referring to other students' names).

7.2.8.3 The Social Dimension: Low Sociability

The social dimension reveals the nature and the types of social interactions that the groups developed during the learning process. The thematic analysis revealed Group Eight's types of social interactions, which include emotional expression (15, 31.2% of total), greetings (13, 27.1%) and name addressing (6, 12.5%). The findings indicate that the overall average of social scores for Group Eight was about 19% below the average of all groups' social scores, which suggests that the students' social engagement in online discussions was low.

7.2.8.4 The Cognitive Dimension: Surface Learning Approach

The cognitive dimension reveals the types of cognitive skills and approaches to learning strategies that the students from Group Eight exhibited during the learning process. The thematic analysis revealed the cognitive skills exhibited during the discussions including clarification (25, 52% of total), inferences (5, 10.4%), judgement (5, 10.4%) and strategies (7, 14.5%). The findings indicate that the overall average scores of surface learning for Group Eight was about 45% below the average scores of deep learning scores of all groups, which suggests that Group Eight's postings could be classified as surface.

7.2.8.5 Group Eight's Reflections on the Learning Process

In response to the questionnaires about the use of eLearning, generally there were no major differences between each item in the pre and post questionnaire. The majority of the students from Group Eight perceived that eLearning helped them learn on their own, learn online and learn within an online group prior to the intervention (pre questionnaire) as well as after it (post questionnaire). Likewise, the majority of the students from Group Eight also perceived that eLearning provided them with access to course learning materials to the extent that the students could also access the additional information for their assignments. Data from the interview with the students from Group Eight verified the opportunities provided by eLearning. The students highlighted through eLearning that it is "easy to get information" and "notes for study" (S5/G8). They acknowledged that through eLearning they could have "easy contact with the lecturer" and help understanding their assignment, as Hana said "we do understand better the assignment when lecturer uploads the notes in the eLearning" (S1/G8). The students also acknowledged that communication through eLearning allowed them time to think and reflect before answering, as Hana further commented "it is not like the report that the students do in the assignments, it is more like their reflection from the discussion in the forum which they conclude what they understand" (S1/G8).

When the students were asked to indicate whether their eLearning experiences contributed positively or hindered their learning, all students from Group Eight reported that eLearning experiences contributed positively to their learning. The majority of the students from Group Eight also responded in the post questionnaire that they did enjoy the eLearning experiences, through which they learnt more about using ICTs, online groups, and online discussions. However, several issues were also raised by the students from Group Eight regarding the constraints of eLearning. The students found problems with accessing eLearning through a wireless connection (Wi-Fi), as Fadi reported: “the problem is with the Wi-Fi connection which we have to deal with it in order to access eLearning with Wi-Fi connection is slow and many students cannot access it” (S3/G8). The other constraints that were raised by the students were related to not being able to comprehend what other students messages meant, Fadi further commented that “sometimes we are not totally understand what other student thinking [message] in the discussion” (S3/G8). In terms of the online group discussions, the students from Group Eight felt that the online group discussions helped them gain knowledge from interactions with peers in online discussions, as Fadi said “when the students share their knowledge in the discussion we can also gain knowledge from it” (S3/G8). The students also remarked that working together through online group discussions enabled them to produce “good discussions” (S1/G8) and gain ICT knowledge, as Naji highlighted: “we only know about PowerPoint before the discussion but now we learn that Authorware is also good in this discussion” (S4/G8).

7.2.8.6 Group Eight Summary

Based on the findings of the learning dimensions, Group Eight’s learning was passive in participation of online discussions, low in reciprocity and sociability with the group’s cognitive dimension could be classified as surface learning. The result of Group Eight’s passive participation with low interactive, social and cognitive dimensions was evident in the group’s lack of contributions to the eLearning forum. The students also verified that their passive engagement in online discussions was particularly due to their lack of ICT knowledge, and that they were more inclined to read other students’ responses before posting their feedback. However, students also reported issues of Internet access. Through the online group discussions, the students from Group Eight appeared to obtain a better quality of reports for their group achievement, with the majority of the students also appearing to obtain an improved final grade compared to their previous grades (see Appendix N for groups' achievements). These students described how their engagement in online group discussions, although the majority of the students' participation was passive, helped them as a group to gain new ICT knowledge.

7.2.9 Online Group Nine

Online Group Nine was comprised of six male students, four Malay, one Kadazan and one Bajau from the Mathematics and Computer Education programme (SPT) (see Appendix L for full details of the participating groups). The following sections describe the key characteristics of Group Nine's learning within online group discussions based on the overall classroom findings in participative, interactive, social and cognitive dimensions (see Chapter Six for full details of the learning outcomes).

7.2.9.1 The Participative Dimension: High and Strategic

The participative dimension reveals the levels of participation and the types of engagement that the students from Group Nine exhibited during the online discussions through the students' contributions and viewings of the postings. The findings indicate that the overall average of participation in Group Nine compared to the groups' overall average, was about 4% above for contributions and about 1% above for viewings, which suggests that Group Nine's participation in online discussions was moderately high and strategic. Group Nine's participation strategy was to use online discussions in eLearning for reporting their group's discussion progress for lecturer assessment, as Zuwan commented: "[for us] online discussions in eLearning are used to report our group progress which is actually about what we have discussed and what we have done for lecturer action [assessment]" (S6/G9). The students also reported that Group Nine's preference for a combination of working methods (offline and online) meant that the students could meet together to gather information from one another and report the outcomes online; as Amir said: "we prefer to work together outside eLearning and report the discussion progress on eLearning, because when we do online discussion we need everyone to be connected to the Internet" (S4/G9). The students from Group Nine were also concerned with their assessment outcomes of their online discussions, particularly in learning task 3.

The students' postings appeared to be lengthy, with formal written facts and references, as Zuwan commented: "we know that we are evaluated in the online discussion so we have to put our effort seriously and writing it formally" (S6/G9). These students also said that the group developed collective ideas to ensure that online discussions could be expanded. Ami pointed out that "those who contribute idea only give one or two points which is not the full explanation on the topic so that other can contribute their points as well… this is to ensure that the discussion can be expanded with new idea" (S1/G9).

7.2.9.2 The Interactive Dimension: High Reciprocity

The interactive dimension reveals the nature and the types of interactions that the groups exhibited during the learning process. The thematic analysis revealed Group Nine's types of interactions, which included providing information (10, 14.3% of interactive postings in Group Nine), giving a point of view (11, 15.7%) and sharing experiences (7, 10%),which together reflected the group's sharing perspective (28, 40%). There were a number of interactions around negotiation (25, 35.7% of total) and justifying meaning (14, 20% of total), which included agreement or disagreement (9, 12.9%), posing questions (8, 11.4%) and suggesting new ideas (8, 11.4%), followed by including giving feedback (9, 12.9%) and clarifying ideas (5, 7.1%). The findings indicate that the overall level of reciprocity of Group Nine was about 7% above the average reciprocity of all groups, which suggests that the students' engagement in online discussions was high and interactive, with more than 78% of the interactions being implicit (without directly referring to other students' names).

7.2.9.3 The Social Dimension: High Sociability

The social dimension reveals the nature and the types of social interactions that the groups developed during the learning process. The thematic analysis revealed Group Nine's types of social interactions, which included emotional expression (19, 27.1% of total), greetings (5, 7.1%), name addressing (10, 14.3%), encouragement (4, 5.7%) and jokes and humour (2, 4.2%). The findings indicate that the overall average of social scores for Group Nine was about 1% above the average of all groups' social scores, which suggests that the students' engagement in online discussions was socially facilitated.

7.2.9.4 The Cognitive Dimension: Deep Learning Approach

The cognitive dimension reveals the types of cognitive skills and approaches to learning strategies that the students from Group Nine exhibited during the learning process. The thematic analysis revealed the cognitive skills exhibited during the discussions, including clarification (31, 44.3%), inferences (6, 8.5%), judgement (6, 8.5%) and strategies (14, 20%). The findings indicate that the overall average scores of surface learning for Group Nine was about 12% above the average scores of deep learning scores of all groups, which suggests that Group Nine's postings could be classified as deep.

7.2.9.5 Group Nine's Reflections on the Learning Process

Responses from the questionnaires revealed that generally the students from Group Nine agreed both prior to and after the intervention that the use of eLearning helped their learning, although there was a slight decline in agreement about this in some aspects after the intervention. This decline was justified by the students from the interview regarding the Internet connection and the difficulty to log on to the eLearning website even when the Internet was not an issue, as Zaki reported: "we have difficulty to log in to it [eLearning] and when it happened frequently made us felt sick and tired to access it" (S3/G9). However, when the students were specifically asked to indicate whether their eLearning experiences contributed positively or hindered their learning, all students from Group Nine reported that their eLearning experiences contributed positively to their learning.

The majority of the students enjoyed the learning process, by responding positively in the questionnaire after the intervention that they enjoyed learning online as they were able to access a wide range of learning tools and course content. Zuwan reported that he did agree that notes and learning materials in eLearning were important to his learning: "In my opinion, I agreed that notes and learning materials are the important thing in eLearning because they have been uploaded and I can get them without having to make a copy of them from the books" (S6/G9). Like Zuwan, Zaki and Ami highlighted that the eLearning forum was the best tool for interacting with peers: "we have discussion through interaction with friends about the assignments in eLearning" (S1/G9) and lecturers, "In my opinion, the forum in eLearning is the best tool for discussion and also the best medium for lecturers to get to know their students" (S1/G9). The students felt that online discussions helped them learn through generating ideas:

> It is the process on how to generate ideas because each group members free to give their opinions on particular issue since each group member's can give their own opinions in a particular topic so we can see the positive and negative side of it and then choose which point is relevant to everyone. (S6/G9)

In terms of the online group discussions, the students remarked how working within an online group helped their study: "Yes, it [discussion] helps a lot because we can make our conclusion based on the data that we have collected from others" (S5/G9). The students from Group Nine enjoyed developing their knowledge through interacting with their peers.

7.2.9.6 Group Nine Summary

Based on the findings of the learning dimensions, Group Nine's learning was high in participation of online discussion, which was high in reciprocity and sociability, with the group's cognitive dimension could be classified as deep learning. In other words, Group Nine's learning was achieved through their high levels of participation in situated learning activities which were goal-directed, socially mediated, and distributed through sharing information and ideas between one another. Through the online group discussions, the students from Group Nine appeared to achieve a better quality of reports for their group achievements and the majority of the students also appeared to obtain an improved final grade compared to their previous grades (see Appendix N for groups' achievements). The students from Group Nine reported the issues of Internet connection was key and value of mix of face-to-face and online interactions in helping them work together.

7.2.10 Summary of Online Groups' Findings

This section presents a summary of the online groups' findings as reported within each group, based on the overall classroom findings in participative, interactive, social and cognitive dimensions. They are triangulated with data obtained from questionnaires (pre and post), semi-structured group interviews, online transcripts and document analyses (group reports, assessment and marks, and final grades). The summary will cover aspects categorised into online groups' ways of working and discussion characteristics.

7.2.10.1 Online Groups' Ways of Working

Group working and participation methods

The findings of online group discussions in this study have demonstrated several personalised (or unique) forms of discussion that may have been shaped by the social, emotional and cultural processes of each participating group, in which the culture also means and includes the wider context of the learning environment. Although all groups were experienced eLearning forum users, with some understanding of effective online discussions, their participation methods, as depicted in the online group discussions were derived from the combination of face-to-face, online media (e.g. Facebook) and assessment. The ways the groups participated varied depending on the technology, and their social and cognitive efforts. Generally, all groups used a combination of face-to-face and online communication as well as using other media for their online discussions; the latter were being implemented to compensate for the constraints of technology and to fulfil the absence of certain social and verbal cues in online discussions. The use of face-to-face interactions in online discussions was complementary in three groups (Group 4, 7 and 8), which had technological constraints and had more face-to-face than online interactions. On the contrary, three groups (Group 2, 6 and 9) had far more online discussions. The high numbers of these groups' online interactions were driven by their awareness of the 10% (assessment) awarded for online interactions. Although the online interactions were assessment-oriented, students in Group 2, 6 and 9 showed a solid knowledge and understanding of the subject matter and an appreciation of discussing the issues. Much of their efforts were made to manage time for the discussions, and more detailed and lengthy posts were found in these groups compared to others.

Group work and communication styles

The online discussions delivered by nine groups revealed that four groups (Group 2, 3, 5 and 9) developed a synchronous style of chatting in eLearning forum discussions. The asynchronous-synchronous styles of discussions in eLearning forums occurred when the students had virtual or physical meetings, usually at a specific time, which required the presence of all group members to discuss and work together in the online discussions. The synchronous style of chatting, as depicted by online posts during a specific time, usually lasted a day. Many of the main aspects of discussion, such as brainstorming, negotiation and consensus were covered. Follow-ups occurred only when there were changes to plans or new information was obtained. The atypical synchronous styles of chatting in eLearning forums were developed by students partly to gain immediate responses from their peers and to allow them to continue working on the learning tasks, and also partly because of the absence of a synchronous chat tool in the eLearning forum.

Group work and communication roles

The online discussions presented by nine groups also revealed students' participative roles as contributors, viewers and experts. Generally, all students in their respective groups were expected to actively contribute ideas or opinions in the online discussions. However, two groups (Group 7 and 8) were passive. Much of the students' activities in these groups were related to viewing the discussion posts, with them providing few posts, of which most were off-topic. These groups had confidence and lack of knowledge issues which limited their ways of relating to one another in online discussions. On the other hand, six groups showed active contributions with Group 2, 3, 6 and 9 showing the most, with a majority of students who were highly knowledgeable and functioned as key persons to ensure that the discussions proceeded. Much of the details and conceptual explanations were given by the students.

7.2.10.2 Online Groups' Discussion Characteristics

Further mapping of the findings about the online groups' discussion characteristics was conducted within each group, based on the overall classroom findings in participative, interactive, social and cognitive dimensions; this also included the levels and types of participation, levels of reciprocity, levels of sociability and the cognitive approach as shown in Figure 7.2 and Table 7.1. Generally, all groups indicated increased participation in online group discussions over time, although three groups' (Group 4, 7 and 8) participation was low, indicated by the smallest patterns (green and purple) as shown in Figure 7.2. Only one group (Group 4, indicated by the purple pattern) contributed an extremely low number of posts, as the majority of their discussions were made offline. From the findings of the participative dimension, six groups illustrated task-directed engagement indicated by similar patterns (light blue, orange and brown), with three groups (Group 2, 6 and 9, indicated by blue pattern) seen as core progressive groups with strategic engagement. Group 7 and 8 illustrated peripheral engagement through their high levels of viewing posts; while Group 4 illustrated their group's disengagement in online group discussions.

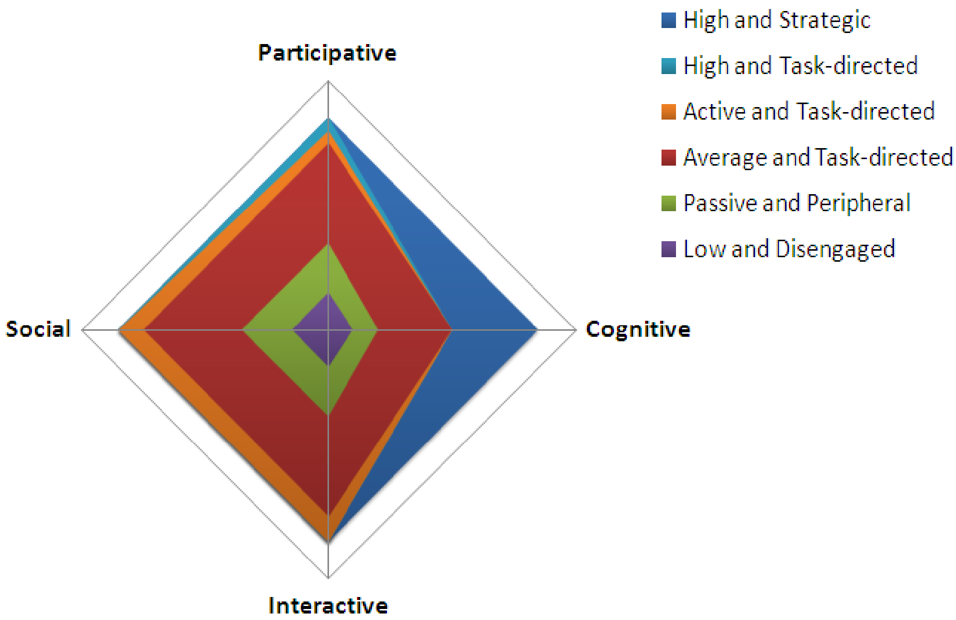


Figure 7.2: Overall Mapping of the Findings

Regarding the interactive, social and cognitive dimensions, eight groups indicated an increasingly high level of reciprocity and sociability over time, with three groups

(Group 2, 6 and 9) showing deep learning and another three groups (Group 1, 3 and 5) showing a mixture of surface and deep learning. Three groups (Group 4, 7 and 8) showed surface cognitive approaches to learning in the online group discussions (see Table 7.1).

Table 7.1: Summary of Online Groups' Discussion Characteristics

Groups (G)	Participative dimension	Interactive dimension	Social dimension	Cognitive dimension
	Levels and types of participation	Levels of reciprocity	Levels of sociability	Types of cognitive approach
G2, G6, G9	High and strategic	High reciprocity	High social cues	Deep learning approach
G5	High and task-directed	High reciprocity	High social cues	A mixture of surface and deep learning approaches
G1	Active and task-directed	High reciprocity	High social cues	A mixture of surface and deep learning approaches
G3	Average and task-directed	Average reciprocity	Average social cues	A mixture of surface and deep learning approaches
G7, G8	Passive and peripheral	Low reciprocity	Low social cues	Surface learning approach
G4	Low and disengaged	Low reciprocity	Low social cues	Surface learning approach

Through the findings of the online groups' discussions, all nine groups developed ways of working within online discussions through their participation in situated learning activities driven by goals which were socially mediated and distributed through interacting with others (albeit low in some groups). These developments were valuable in terms of helping them accomplish higher report quality for group achievements and obtain better final grades (see Appendix N for groups' achievements).

7.3 Chapter Summary

This chapter has detailed the findings of how the nine groups participated in activities designed for online group collaborative learning in participative, interactive, social and cognitive dimensions. It has also highlighted the findings related to participation in situated activity, being goal-directed, distributed and socially-mediated. The findings of online group discussions held within each group were reported based on the overall classroom participative, interactive, social and cognitive dimensions, which are triangulated with data obtained from questionnaires (pre and post), semi-structured group interviews, online transcripts and document analyses (group reports, assessment and marks, and final grades).

The findings of online group discussions revealed that online groups' ways of working were derived from a combination of methods of face-to-face and online discussions, media and assessment, and related to the level of technology, and social and cognitive commitment. The adoption of the methods for communication within an online group and the atypical synchronous styles of chatting in eLearning forums were seen in the majority of the groups' postings, which reflected the groups' working methods for achieving the goals of their learning tasks, as well as their adoptive roles in the online group as contributors, viewers and experts. During the learning tasks, students' engagement within online group discussions illustrated four types of participation: strategic, task-directed, peripheral and disengaged, which described how the nine groups participated in online discussions. Each type of participation corresponded to the four learning dimensions: participative, interactive, social and cognitive.

This study found that a total of six of the nine groups exhibited strategic and task-directed engagement, had high participation and contribution levels, and high reciprocity and sociability; three groups showed deep learning and another three groups showed a mixture of surface and deep learning approaches. These six groups also had better group achievements, with the majority of the students obtaining higher final grades. In sum, all nine groups developed ways of working within online group discussions to complete the learning tasks and accomplish the groups' goals as well as the assessment tasks. Students highlighted that they felt positively towards online learning but that access was an issue, as was lack of verbal cues. Some students had perceptions of collaboration would be good, as well as their perceptions of online collaborative learning. The next chapter reports the outcomes of evaluating the intervention designed for OCL in an ICT education course, in order to answer the final research question.

Chapter 8 Evaluating the Intervention

8.1 Introduction

This chapter presents the findings from the students' perspectives regarding the intervention. It answers the final research question, 'How does online collaborative learning affect student learning?'

8.2 The Research Map of Analysis: The Outcomes

This section discusses the outcomes of the study. The outcomes resulted from the interacting components within the landscape of situatedness of an activity as depicted in the grey area in Figure 8.1.

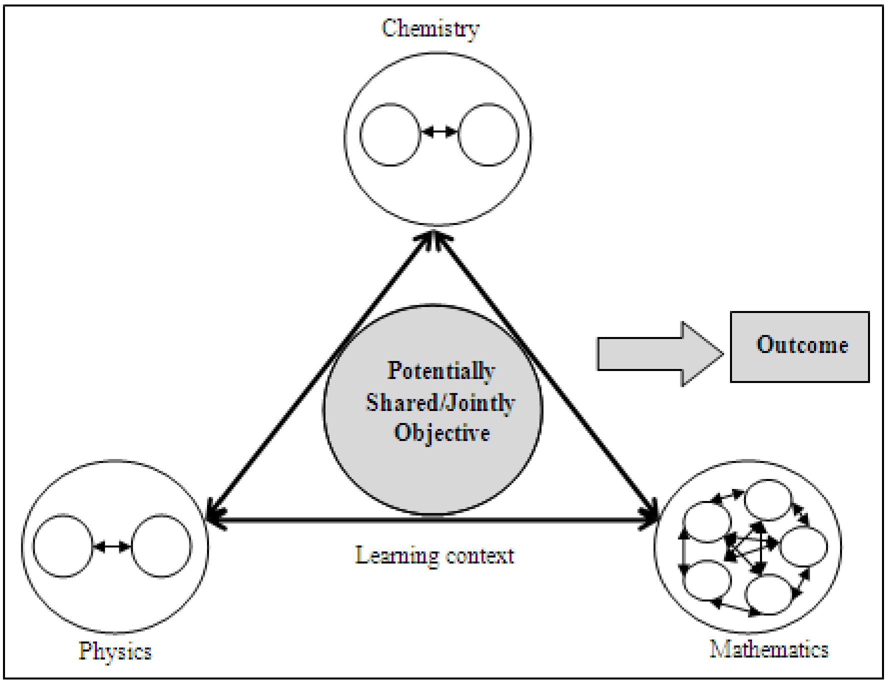


Figure 8.1: The outcome

The activities that are of interest for the purposes of evaluation are those designed and implemented for online group collaborative learning in a Malaysian tertiary classroom as described in Chapter 5. The extent to which the designated activities were helpful in facilitating and improving students' learning in the study is based on students' perspectives as a result of their participation in the course (see Chapter 6) and in particular, the online group learning discussions (see Chapter 7). The analysis of data is guided by an Activity System learning framework (see Chapter 5) and situatedness of an activity (adapted from Boer et al., 2002, p.94) which analyses activities designed for online group collaborative learning as activity system processes at three contextual levels of analysis. Section 8.2 describes the analysis on a broader institutional level within which the intervention operates as an activity system. Section 8.3 reports the analysis of online interactions within an activity system, while Section 8.4 narrows the analysis of an activity system to its outcomes and constraints.

8.3 Mediation of Artefacts: Affordances of Tools, Activities and Resources for Participation

This section reports the broader participation context of online group collaborative learning that includes the overall collaborative learning participation in the course as evidenced through the groups' online postings (Section 8.3.1). This is followed by the affordances of tools and activities that the students found helped or hindered their collaborative learning participation (Section 8.3.2) and the students' expectations or goals from the course and how they have achieved the goals (or shared goals) (Section 8.3.3). Evidence of interest on this level of analysis comes from online transcripts, interviews, questionnaires, and online journal entries. Each is detailed as follows.

8.3.1 Overall Online Learning Participation in the Course

Participation is important because collaboration cannot occur without participation by the group members. Table 8.1 shows the number of postings made by the students in online group collaborative learning forums during ten weeks of discussions.

Table 8.1: Overall Online Learning Participation Rates

Weeks Date	Topics	Activities	Mode	Total Postings

Week 1-3 (14-3/1)	Authoring Language	Learning Task 1	Intra-group	259
Week 4-7 (4-31/1)	CDROM based Authoring Language	Learning Task 2	Inter-group within programme	91
			Inter-group across programme [a]	183
			Total	274
Week 8-9 (1-14/1)	Semester break			
Week 10-12 (15-7/3)	Web-based Authoring Language	Learning Task 3	Intra-group	182
Total				715

Note. [a] The total postings of this discussion were reported as one of the findings of online group collaborative learning.

The ten weeks of online group collaborative learning discussions, conducted from week 1 to week 12, generated a total of 715 online postings. In the first learning task, the number of students' postings was high (259 postings). This was due to the large number of social comments in the students' postings in this learning task as it was introduced at the beginning of the semester and the majority of the students used it as a form of ice-breaking and self-introduction (see Section 6.2).

From week 4 to 7, student postings increased from 91 to 183 with a total of 274 postings in all discussion groups. This was due to the inter-group learning activity used and the design of the activity which fostered inter-group collaboration from within a programme to across all programmes (refer Chapter Five for a full description of the intervention). However, in the final learning task, student postings decreased to 182. This was similar to the number of postings made by the students in inter-group discussions across all programmes as they developed a focus-on-task attitude with many postings and were responsive towards the work of the group rather than towards group social chatting (see Section 6.2).

Overall, students' participation rate in the course increased steadily from the outset but remained constant in the middle and towards the end of the course. This demonstrated the students' endeavours for continuous participation and collaboration in the course. In particular, their participation rates were high in the second learning task where the inter-group learning activity was used. The next section discusses the affordances of tools and activities that the students found helped or hindered their collaborative learning participation.

8.3.2 The Affordances of Tools and Activities

This section discusses the tools and activities that afforded the students' collaborative learning participation. It begins by describing how eLearning technology as a learning environment afforded student participation, followed by a description of the affordances of learning activities, in particular inter-group activities that helped or hindered students' collaborative learning participation.

8.3.2.1 The Tools Affordances and Constraints

The tools affordances in this course relate to the use of eLearning to provide students accessibility to a wide range of online tools and resources for their collaborative learning opportunities. This was observed through the students' interactions with regard to particular eLearning applications. The top two applications were forum and assignments (see Table 8.2).

Table 8.2: Students' Responses to Particular eLearning Applications (n=43)

	Not Familiar (none)	**Low**	**Average**	**High**
Forum	-	-	16 (37%)	**27 (63%)**
Chat	1 (2%)	14 (32%)	20 (47%)	8 (19%)
Journal	4 (9%)	11 (26%)	25 (58%)	3 (7%)
Assignment	1 (2%)	-	16 (37%)	**26 (61%)**
Quiz	5 (12%)	5 (12%)	23 (55%)	9 (21%)
Blog	18 (42%)	18 (42%)	5 (12%)	2 (4%)
Wiki	17 (40%)	11 (26%)	12 (27%)	3 (7%)
Workshop	13 (30%)	13 (30%)	16 (37%)	1 (2%)
Glossary	8 (19%)	17 (41%)	13 (30%)	3 (7%)

These responses, corroborated with interviews from all groups, reported the importance of forum, assignments and learning materials in their studies. For instance, Zuwan from Group 9 reported, “In my opinion, I agreed that notes and learning materials are the important things in the eLearning followed by forum which helps students contribute ideas to online discussion and assignments” (Zuwan, Group 9, Int.). The eLearning also afforded students interactions and help from their peers, lecturers and other students for their studies. The questionnaire findings revealed that the students sought help most from their peers (students within their work group) with 38 responses (42.2%) followed by other students (students outside their work group) 14 (15.6%), lecturers 35 (38.9%) and others 3 (3.3%) that include librarian, ICT officer and administrator. These findings, corroborated with interviews from all groups, show that the eLearning forum afforded sharing ideas through interacting with lecturers, fellow peers and other students from different backgrounds. Amir from Group 5 said:

> Discussion is important where different students can share their opinions and thoughts about particular topics. For example, when a lecturer posts a topic related to the subject that he taught in the class and students reply by contributing their opinions. From there we could know other students’ ideas and opinions. (Amir, Group 5, Int.)

Additionally, all groups thought that eLearning facilitated after-class learning and discussion at any time and place. Azie from Group 5 highlighted this point:

> Because I think when we go online, we can have learning in our own room through downloading lecture notes that have been provided by the lecturer for us in eLearning, and for those students who have their own broadband; they could access eLearning at any time they want at different places. (Azie, Group 5, Int.)

Like Azie, Hida from Group 2 enjoyed not only the flexibility of time and space that eLearning offered but also the connectivity provided by eLearning to connect to fellow peers and lecturers. Hida reported:

> Through eLearning, we are not only learning in the class but also outside the class. For example, for my class, we use eLearning to get the notes and have discussions in the forum so we can build good relationships with our lecturers and friends. When we know each other, it gives a positive environment and we enjoy the class. (Hida, Group 2, Int.)

Amin from Group 3 thought that the eLearning forum was a useful tool for group discussion in terms of the discussion postings being retrievable and all postings made by the students were stored and recorded in the system:

> The advantages of using a forum for group discussion in eLearning are that information that has been contributed will not be missing from the system. For example, when we discuss the topic outside the system, we tend to forget the discussion points that we have discussed among us but if we discuss it in eLearning we can refer back to the discussion. (Amin, Group 3, Int.)

Four groups reported on specific eLearning tools that promoted their learning. In particular, Zaki from Group 9 liked the concept of navigational links in the course that linked to important information; he said "The concept links help us to find information in terms of it giving us the links that direct our queries to the closest possible right options" (Zaki, Group 9). Like Zaki, Hasma from Group 4 found that some links that relate to academic video and resources are fun and useful: "eLearning is fun with some videos and academic links that relate to the subject" (Hasma, Group 4, Int.).

Heng from Group 2 added that the page notification is also useful for saving her time for discussion. She said, "The page notification is useful and without it we have to scroll down and look at the general forum and it is very difficult to do it". (Heng, Group 2, Int.). Last but not least, Zuwan from Group 9 found that hierarchical posts in the eLearning forum were helpful in terms of structuring discussion information; he said, "Discussions are held according to the date that has been assigned by the group member, for example, I have to access on the second day and have idea what the previous person has said". (Zuwan, Group 9, Int.).

Six out of nine groups found that eLearning is an effective learning environment for their learning online. For instance, Usha reported, "Yes, it is an effective learning environment [because]… we can get a lot of information, resources, from the lecturers, notes, the discussion in the forum within and between groups and friends, which I like the most" (Usha, Group 6, Int.). Ami from Group 9 further highlighted how the fresh template and design of the eLearning environment was encouraging and effective. He said:

> ELearning actually does have an effect on our learning and it depends on the lecturers' creativity. From my observation from my first through to my fourth semester, I found eLearning is always the same, the template is very rigid but I'm quite surprised the learning template in this course is different and fresh. It proves that eLearning is not something that is rigid and the good design and decoration in this course has an impact on learning online through eLearning. (Ami, Group 9, Int.)

However, three groups have mixed opinions on eLearning being an effective learning environment. They mentioned some constraints that possibly made learning online through eLearning ineffective. Hasma from Group 4 had to be careful when writing and submitting her posting online:

> It [eLearning] can be ineffective; it depends on the wireless connection. Like what had happened to us where we cannot get connected to an Internet connection easily. Things will get worse when suddenly the Internet is disconnected. Then, we feel discouraged about writing our postings again. (Hasma, Group 4, Int.)

Azie from Group 5 found eLearning is ineffective because it was hard to communicate with the lack of tangible or real emotions and voice intonation:

> For me, eLearning is not effective because we have been missing the voice intonation of the lecturer so that when he teaches we don't know whether he

> angry or not, but in face-to-face, we can feel all those feelings in a particular situation. (Azie, Group 5, Int.)

Chris from Group 3 felt uneasy with the isolation and the remoteness of discussion. He said:

> For me, eLearning is not the best environment. I like to discuss in the eLearning but when there is no one [online] who can give feedback or comment on what I have posted, I feel there is no point in posting the topic, I just log-in for the sake of logging in whenever I receive a reminder to get some information and lecture notes. (Chris, Group 3, Int.)

In summary, eLearning afforded students learning and communication through forum discussions with the convenience of time and place. These affordances clearly mediated and promoted students' participation within online group collaborative learning discussion. However, some constraints observed could have contributed to ineffective eLearning and forum discussion in terms of ease of posting online, lack of emotions and voice intonation as well as the lack of feedback and the feeling of remoteness of online group collaborative learning discussion. In addition to the affordances of the tools, the affordances of activities in this course are related to two intervention activities designed for online group collaborative learning (refer Chapter Five for a full description of the intervention) in mediating students' participation and collaboration within online groups (intra) and across online groups (inter). These activities highlighted in the interviews and students' online reflective journal entries were Learning Task 1 (intra-group) and Learning Task 2 (Inter-group). The general analysis on how these two activities afforded participation and collaboration in online group collaborative learning is detailed next.

8.3.2.2 The Affordances of Situated Activity 1: The Online Group Learning Task 1

The online group learning task 1 in this course was designed with the goal of fostering students' participation through collaboration and negotiations within an online group in producing a proposal of appropriate authoring tools to be used in the teaching of

Science and Mathematics (See Chapter 5). Evidence of interest comes from interviews and online reflective journal entries relating to online intra-group activity.

Eight groups' responses from online reflective journal entries indicated that learning task 1 afforded them the opportunity to get information about the concept of Authoring Language (eight responses), the applications of Authoring Language (five responses), and the products of Authoring Language (two responses). An example of the first point comes from Fadi from Group 8 who said:

> After going through the first and second weeks [learning task 1] of learning about Authoring Language, finally I have come to know the general concept of Authoring Language and the difference between Authoring Language and Programming Language. But I'm a little bit confused about Metaphor. (Fadi, Group 8, Jour.)

An example of the second point comes from Ain from Group 5 who said:

> Prior to this course, I have learned many software applications such as Flash, Dreamweaver and Swish but not Authorware. My early involvement in this course [learning task 1] enable me to learn more about computers and Authorware in particular, which led me to explore and learn more about the application of Authorware. (Ain, Group 5, Jour.)

An example of the third and last point comes from Hasma from Group 4 who said:

> In the second week of the introduction of Authoring Language [learning task 1], I have known about the products of Authoring Language such as interactive video production, and I have come to know that Authoring Language is easier to use compared to Programming Language. (Hasma, Group 4, Jour.)

Two groups reported on the important affordances of online intra-group activity in learning task 1 where the students valued and expanded other group members' contributions. Zuwan from Group 9 highlighted the first point: "The first task is for a small group [intra-group] where actually we gave our opinions to fit with what we want to discuss and what we want to do so that we can achieve our group target" (Zuwan, Group 9, Int.). Azni from Group 6 highlighted the second point: "Task 1 is good where opinions contributed in a small group [intra-group] are shared and expanded as well" (Azni, Group 6, Int.). Fadi from Group 8 thought that learning task 1 within an online group encouraged the group to produce quality discussion for others; she said, "The task 1 is okay because it was conducted in a small group [intra-group] and we did good and quality discussion so that the content of the discussion will be meaningful for others" (Fadi, Group 8, Int.). Hasma from group 4 reported on learning task 1 as being an advantageous task to promote and motivate them to participate:

> I felt like it was an advantageous task because it provided us with ten per cent of the marks for the coursework, meaning that what we do and when we participate in the eLearning forum, we have the opportunity to get that ten per cent of marks. (Hasma, Group 4, Int.)

The general analysis on how the second situated activity afforded participation and collaboration in the course is detailed next.

8.3.2.3 The Affordances of Situated Activity 2: The Online Group Learning Task 2

The online group learning task 2 in this course was designed with the goal of fostering students' participation through collaboration and negotiations as they learn about different types and processes of Authoring Language across online groups (SPK, SPP and SPT). Evidence of interest comes from interviews and online reflective journal entries on online inter-group activity.

Two groups' responses from online reflective journal entries indicated that online inter-group activity afforded them discussion across all groups about the topics of how to choose AL software, and choosing criteria and steps in Authoring Language. For instance, Fadi from Group 8 wrote:

> When the PBL case study that involved discussion from all of us across the group was introduced, I thought it was interesting because we were provided with the scenario analysis form for discussion and the discussion was about the contents of how to choose AL software, and choosing criteria and steps in Authoring Language. (Fadi, Group 8, Jour.)

Sue from Group 6 thought that the PBL case study for inter-group activity was depicting a real teaching context in school and helped her relate the discussion to her teaching assignment. Sue reported:

> The implementation of PBL in learning task 2 was really successful because it functioned like in school with a focus on students' learning contents and skills development which helped us to better understand it [context]. (Sue, Group 6, Jour.)

Hasma from Group 4 reported on the important affordances of online inter-group activity in learning task 2 for collaborative learning:

> Actually, it depends on the topic. For example, if the topic is about the authoring software and SPT students said they prefer Power Point, while SPP like Authorware. So, from here we can get information on both softwares and collaborative learning occurs when we are sharing what we know about the softwares with the other group. For me, collaborative learning happens between groups; for example, SPP groups, SPK groups and SPT groups in one discussion. (Hasma, Group 4, Int.).

Chris from Group 4 thought that the online inter-group activity in learning task 2 helped his group collaborate with other groups from different programmes to share skills and ideas:

> When we discuss and collaborate with other people that come from a different major, we can exchange our ideas. Usually, we like to discuss with people that come from a different course so that we can have exchange capability and expertise. Like I am an expert in this field and he is an expert

in his field so we share our skills and ideas to benefit both of us. (Chris, Group 3, Int.)

Zuwan from Group 9 reported on the important affordances of online inter-group activity in learning task 2 for generating ideas through collaboration and negotiations:

> It [learning task 2] is the process of how to generate ideas because each group member is free to give their opinions on a particular issue; since each group member can give their opinions on a particular issue or topic, we can see the positive and negative sides of it. Then we can choose which point is relevant to everyone. (Zuwan, Group 9, Int.)

The online inter-group activity used during week 4 to 7 in the course involved two types of inter-group activities: within programme and across programme. The inter-group activity across programme was selected for analysis as it had the highest number of online postings (a total of 183) that involved three programmes (SPK, SPP and SPT). Analyses of the nature of interactions with the consideration of other students' contributions in learning products (group report) were also conducted to determine how the inter-group activity was useful in mediating students' learning (see Section 8.3.2).

This section has detailed the important affordances of two situated activities for online collaborative learning by the students in the course. The next section examines the students' expectations or goals from the course and how they have achieved group goals (or shared goals).

8.3.3 Students' Goals from the Course and Goals Achieved

The pre-questionnaire findings revealed that the students' goals for doing the eLearning and online group collaborative learning activities at the beginning of the course were mainly because they were required by the lecturers to work within an online group for the assignments, followed by the fact that they used eLearning only because use of it contributed to the assessment of the course (see Table 8.3).

Table 8.3: Students' Goals for eLearning Activities in the Course (n=41)

Items	Responses					M	SD
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
I was required to work within an online group by lecturer for the course assignment		3 (7.5%)	6 (15%)	28 (70%)	3 (7.5%)	3.78	.69
I use eLearning (Moodle) only because use of it contributed to the assessment of the course	1 (2.4%)	5 (12.2%)	8 (19.5%)	19 (46.3%)	8 (19.5%)	3.68	1.14

Note. Scale: 1-Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree, M=Mean, SD=Standard Deviation

However, as the course progressed the majority of the students from nine groups shared two common goals that they wanted to achieve by the end of the course. First, to improve their knowledge of ICT and computer education, and second, to obtain better course grades. From the interviews, journal entries and groups' achievements (see Appendix N), it was evident that all students were able to attain the first goal, and the second goal to some extent. For instance, Kho from Group 2 said that she was frustrated and discouraged about learning ICT and a computer course at the beginning of the semester but after the online group collaborative learning activities she gained and improved her knowledge on ICT and computer. She reported:

> When I came across this Authoring Language subject, I thought 'Oh my God! It's Computer subject again!' and I expected to be totally frustrated and discouraged by this course. This was what I thought at the beginning of the semester. However, after completing my Authoring Language assignments [online activities], I realized that I love this subject; this actually came from my heart and I don't mean to brag. This was because AL was interesting and an effective instrument for students to enhance their understanding and improve their skills. Finally, now I know how to develop some applications and, do you believe it, I have shown it to my friend from SPC [the other course] and she was impressed and wanted to know more about this course. (Kho, Group 2, Jour.)

One of Zuwan's (Group 9) goals was to obtain an A from the course. However, he only obtained a grade B+. Nevertheless, he had improved his knowledge on ICT and computer. He was not confident at all with his knowledge on ICT and computer at the beginning of the course. However, through his interaction with his friends in online group collaborative learning discussions, he began to develop confidence, especially in interacting with female students in the forum and learning about Authoring Language. He reported:

> To be honest, I am not really fond of a course that is related to computers like this Authoring Language course because my target is just to finish my study and to be a teacher. I learn, not simply to gain knowledge, but just to pass the course. Having said that, I felt that this course changed me in terms of how I felt the impact of this course in so many aspects, especially knowledge of ICT and computer. I also felt that through my interaction with other students, especially female students, gave me opportunities to learn more about Authoring Language and this helped me in my final project courseware. (Zuwan, Group 9, Jour.)

All students were able to achieve two shared common goals, which they had developed through the course, to some extent. The students perceived that they had improved their knowledge on ICT and computer education, and that they had obtained a better final course grade.

This section has presented data on the broader participation context of online group collaborative learning. This includes the overall collaborative learning participation in the course as evidenced through the groups' online postings followed by the affordances of tools and activities that the students found helped or hindered their collaborative learning participation and the students' goals from the course and the goals achieved (or shared goals). Analyses of the nature of interactions with the consideration of other students' contributions in online postings to determine how the online group distributed activities were useful in mediating students' learning is discussed next.

8.4 Mediation of Rules and Roles: Collaboration and Distributed Cognition Through Interaction and Participation

This section reports the findings of the nature of online interactions among students during the intervention to achieve course goals. It also relates to the development of online collaborative interactions through students' participation within online group activities in mediating learning about ICT education or in particular, Authoring Language. Evidence of interest on this level comes from the analysis of interactions that students exhibited during their interactions within an online group (Section 8.3.1) and across an online group (Section 8.3.2).

8.4.1 The Analysis of Interactions during Online Group Task 1

The students' interactions during online group learning task 1 and their postings are summarised in Table 8.4.

Table 8.4: Nature of Students' Interactions in Online Intra-Group Discussion: Learning Task 1

Ways of Interacting	Themes of Interaction	Number of Postings
Explicit referencing to posting contribution	Interactive	93
Implicit referencing to posting contribution	Interactive	131
Independent referencing to posting contribution	Interactive	26
Sharing information, references, opinions and experiences related to discussion topic	Cognitive	136
Agreeing or disagreeing	Cognitive	28
Posing question	Cognitive	21
Suggesting idea	Cognitive	20
Giving feedback	Cognitive	24
Clarifying idea	Cognitive	21
Greeting, name addressing and thanking	Social	55
Encouragement to contribute	Social	12
Concern of other presence and contribution	Social	10
Apology for late participation and contribution	Social	5
Emotional Expression	Emotional	81
Jokes and humour	Emotional	30

Generally, the nature of students' interactions within online group task 1 were of two main types, interactions which are collaborative, particularly when group members are being referred to explicitly (93 postings) and implicitly (140 postings) in prior postings, followed by cooperative interactions when postings were posted independently, which do not lead to further discussion, and they neither respond to a comment nor generate a response (26 postings). From these interactions, 136 postings were observed as sharing information, references, opinions and experiences related to discussion topics followed by interactions ranging from 28-21 postings, namely, agreeing or disagreeing, posing a question, suggesting an idea, giving feedback and clarifying an idea, which are associated with the cognitive theme of interaction to academically support group members in the discussion. Meanwhile, interactions with the highest of 55 postings are greeting, name addressing and thanking; followed by encouragement with 12, concern with 10 and apology with 5 which fall under the social theme of interaction which demonstrates group members' commitment to the group. Finally, emotional expression had 81 postings followed by jokes and humour which had 30 postings indicating an emotional theme of interaction by group members in supporting the groups' social and emotional relationship.

The task goals of online group discussion 1 required students within an online group to research a problem through gathering and sharing information, negotiating and making decisions as a group to improve their understanding and knowledge in Authoring Language and to select appropriate authoring tools for the teaching of Science and Mathematics (see Chapter 5). This task was notably content-related in nature as evidenced through the high level of sharing of information, references, opinions and experiences which reflected the cognitive theme of interactions. The task goals of discussion task 1 also required students to negotiate and clarify their decisions (agreeing or disagreeing, posing questions, suggesting ideas, giving feedback and clarifying ideas).This means that some form of group organisational working together within an online group is developed as evidenced through the social related theme of interactions (greeting, name addressing and thanking, encouragement, concern and apology) which reflected students' commitment in establishing their group for discussion. As they participated in their group, they also began to develop joint responsibilities to collaborate and support one another (reflects emotional theme of interaction) towards achieving the group's goals for completing task 1. This suggests that the task goals and purposes inherent in the online group task 1 discussion helped to frame students' interaction and mediate rules and roles of online intra-group interaction and collaboration, through organising and linking students' interactions to building understanding and knowledge on one another's contributions as well as developing responsibilities and relationships within an online group.

Examples of students' interactions with the consideration of group members' contributions in online postings can be seen from the sample of online discussion group transcripts in Table 8.5. For example, in Group One's discussion theme one, two and five, the collaborative interactions were mostly implicit including sharing information, disagreeing, posing questions, suggesting ideas, giving feedback and clarifying ideas. In these themes of discussion, a rich interplay of sharing perspective, argumentation and clarifying meaning were observed; for instance, Izzatie (Posting#6) initiated the discussion by giving her view about software compatibility which then encouraged Fareha (Posting#8) to provide different information on other software. Izzatie (posting#15) then refused to agree with the suggested software, which led Fareha (Posting#16) to pose a question about it. Izzatie (Posting#17) replied to Fareha's question by giving her feedback about Fareha's suggested software being not user-friendly, especially in creating interesting animation which then encouraged Helmi (Posting#20) to clarify the idea of Fareha's suggested software explicitly.

Table 8.5: Students' Interactions during Online Learning Task 1

Students	Online Postings	Types of Interactions
Theme 1: Software compatibility		
Izzatie (Posting # 6)	I choose macromedia flash… because this software is suitable for all operating system, not only in windows, but also can be used in Macintosh.	Sharing information (Implicit)
[Posting # 7 omitted]		
Fareha (Posting #8)	The reason I suggested PowerPoint because the software is (1) easy to use, (2) easy to learn, (3) can be used for other than science subject, (4) can create interesting presentation, (5) easy to learn from book, (6) teacher expertise, and (7) easy to teach teacher without basic computer.	Sharing information (Implicit)
[Postings # 9-14 omitted]		
Izzatie	I disagree with PowerPoint!!! Huhu…because…PowerPoint	Disagreeing

(Posting # 15)	can not be used in Macintosh…	(Implicit)
Fareha (Posting #16)	Is it? We can not use PowerPoint in Macintosh…is it? ... Weird… I know how to use basic flash only…	Posing question (Implicit)
Theme 2: User-friendly		
Izzatie (Posting # 17)	Besides, animation from PowerPoint is not interesting compared to flash…if we use flash to create simple game the students will like it huhu...	Giving feedback (Implicit)
Fareha (Posting # 18)	I admit it takes long time to create animation using PowerPoint but we haven't created any animation in flash yet.	Agreeing (Implicit)
[Postings # 19 omitted]		
Helmi (Posting # 20)	But Izzatie must understand if we want to use flash we must really know how to use it in order to create simple game.	Clarifying idea (Explicit)
Theme 3: Training duration		
Izzatie (Posting # 7)	There are lot computer classes providing flash training nowadays, so teacher will not have problem to learn this software…the basic can be learned in one month.	Sharing experience (Implicit)
Izzanie (Posting # 30)	Training from the experts and module.	Sharing opinion (Implicit)
Theme 4: External resources and references		
Izzanie (Posting #26)	Currently based on the research, flash is the popular animation web technology and gaining support from various people.	Sharing information (Implicit)
Izzatie (Posting # 29)	It is easy to find reference books for flash.	Sharing opinion (Implicit)
Theme 5: Software suitability		
Izzanie (Posting # 31)	One more things…flash also can be distributed through various media such as Web, CD-ROM, VCD, DVD, television, hand phone and PDA. Amazing isn't it??? After this teacher can provide students with one DVD with all chemistry topics so students can study using the DVD…if the school has website, teacher also can upload presentation…and students can download the presentation using hand phone or PDA.	Giving view (Implicit)
Fareha (Posting # 32)	Yeah, I understand what you are saying miss Izzanie… but we also can burn (record) on CD and upload presentation to the website using PowerPoint as well.	Suggesting idea (Explicit)
Izzanie (Posting # 33-34)	For your information, flash size file is small but produce very good quality file… Flash also requires low hardware requirement…so saving the computer storage and less system processing…	Clarifying idea (Implicit)

However, in discussion theme three and four, the interactions were observed through Izzatie (Posting#29) and Izzanie (Posting#30) respectively about training duration from their experience and the external resources and references. Finally, in discussion theme five, the interactions were rich and varied, starting with Izzanie's (Posting#31) information about the software suitability and her view about the software suitability to be used in learning chemistry topics, which encouraged Fareha (Posting#32) to suggest to look at another software. She then further replied to Fareha's response by justifying her idea regarding the software advantages (Posting#33-34).

In summary, the online intra-group task 1 was designed as a situated activity embedded with particular affordances for fostering intra-group interactions for collaborative learning. This was achieved through sharing information and negotiation to improve and strengthen group members' understanding and knowledge in selecting an appropriate authoring tool as they learn about Authoring Language concepts within an online group. This created a situation where students' knowledge and expertise were distributed to support group members developing understanding in selecting appropriate authoring tools for their teaching of Science and Mathematics. In this process, the inherent task goals and purposes from situated activity task 1 help to frame students' interaction and mediate rules and roles of online intra-group interactions for learning. This is done through interacting cognitively, socially and emotionally, where particular interactions were seen to be more evident and important particularly in developing students' understanding and knowledge of Authoring Language concepts.

The nature of students' interactions for collaborative learning across an online group in the second situated activity follows next.

8.4.2 The Analysis of Interactions during Online Group Task 2

Table 8.6 summarises students' ways of interactions during online group task 2 and their number of postings. The highest numbers of postings related to students' interactions were *explicit* which had 53 postings, and *implicit* with 125 reflecting their collaborative ways of interacting, while independent had five, reflecting cooperative ways of interacting. From these interactions, the highest numbers of postings were sharing information, references, opinions and experiences which had 45 postings, followed by emotional expression which had 42 postings, and greeting, name addressing and thanking which had 17 postings. However, no postings were observed for concern as a way of interacting.

Table 8.6: Nature of Students' Interactions in Online Intra-Group Discussion: Learning Task 2

Ways of Interacting	Themes of Interaction	Number of Postings
Explicit referencing to posting contribution	Interactive	53
Implicit referencing to posting contribution	Interactive	125
Independent referencing to posting contribution	Interactive	5
Sharing information, references, opinions and experiences related to discussion topic	Cognitive	45
Agreeing or disagreeing	Cognitive	12
Posing question	Cognitive	9
Suggesting idea	Cognitive	10
Giving feedback	Cognitive	10
Clarifying idea	Cognitive	5
Greeting, name addressing and thanking	Social	17
Encouragement to contribute	Social	2
Concern of other presence and contribution	Social	-
Apology for late participation and contribution	Social	2
Emotional Expression	Emotional	42
Jokes and humours	Emotional	10

The sharing information, references, opinions and experiences reflecting groups' sharing perspectives are leading features of students' collaborative ways of interacting which are associated with the cognitive theme of interaction while emotional expression supporting a groups' relationship is related to the emotional theme of interaction. Finally, greeting, name addressing and thanking reflect the social theme of interaction where students are keen to develop social interactions as they collaborate and work towards achieving the discussion task common goal.

The task goals of online group discussion 2 required students within an online group to have an online inter-group collaboration across a different programme of studies (SPK, SPP and SPT) for completing learning task 2 (see Chapter 5). In this task, a majority of students' interactions observed were related to interdependent ways of interacting, as evidenced through the interactive theme of interaction (explicit and implicit), particularly when groups are sharing task contents and resources as part of their learning to work together towards achieving task goals (reflecting the cognitive theme of interaction). The purposes and goals of having an online inter-group collaboration reduced the social theme of interaction, which reflected groups' growing responsibilities and commitment for on-task discussion of the scenario and problem used in learning task 2. However, as groups collaborated between and among groups, they began to develop a relationship to one another and to emotionally support and supplement each group's ideas towards accomplishing task 2 goals, as evidenced through the emotional theme of interaction. This suggests that the goals and purposes inherent in the online inter-group discussion task 2 helped to frame students' interactions and mediate rules and roles of online inter-group interaction and collaboration so some kinds of interactions were more evident. This was important for a group developing responsibilities for contributing as well as promoting learning and relationship across other online groups.

Examples of students' interactions in online inter-group discussion are further substantiated by their group contributions as can be seen from the sample of online transcripts in Table 8.7. For example, in discussion themes one, two, three and five, the collaborative ways of interacting were mostly implicit. In these themes of discussion, a rich interplay of inter-group interactions was observed. For instance, Group 3 (Posting#20) initiated the discussion by deciding on a position of selecting authoring software by its compatibility, which then encouraged Group 9 and 8 (Posting#21 and 22) to add on their information. Meanwhile, Group 2 (Posting#26) implicitly discussed the user-friendly aspect of authoring software by suggesting new ideal software from their perspective. However, other groups such as Group 1 and 5 (Posting#27 and 28) implicitly disagreed with Group 2's suggestion by highlighting PowerPoint as being flexible authoring software. Another group, Group 7 (Posting#30), was observed to outline the advantages of PowerPoint from the training duration perspective, which was supported implicitly by Group 2 (Posting#31).

Table 8.7: Students' Interactions in Online Inter-Group Discussion: Learning Task 2

Group	Online Postings	Types of Interaction
Theme 1: Software compatibility		
Group 3-Amin (Posting # 20)	To select appropriate authoring software, we must first look at its compatibility with operating system such as Windows. For my group, we think PowerPoint in Office 2008 is now compatible with Macintosh.	Giving opinion (Implicit)

Group 9-Zuwan (Posting #21)	Yup, we do have to look at the software compatibility with other operating systems than Windows.	Agreeing (Implicit)
Group 8-Nadwa (Posting #22)	That's right Zuwan, how about Linux? Because in my group, we do have lesson like KIG in Linux…but if we use Open Office, can we use it on either Windows or Linux?	Posing question (Explicit)
Group 3-Anwar (Posting # 23)	I would like to confirm operating system uses in school is Windows so no need to fuss over PowerPoint compatibility.	Giving feedback (Implicit)
Theme 2: User-friendly		
Group 2-Oh (Posting # 26)	Hi, by using Microsoft PowerPoint 2008 that means we need to install Windows Vista. However, most of the software and programmes fail to run perfectly with Windows Vista while the latest Windows 7 is yet too unfamiliar with the teachers in school.	Giving feedback (Implicit)
	What our group suggested earlier Flash is easy to handle and understand which also support texts, graphics, audio and video. For more details please refer this link: http://kb2.adobe.com	Suggesting idea (Implicit)
Group1-Helmi (Posting # 27)	Microsoft PowerPoint office 2008 is not necessary run in Windows Vista; it also can run in Windows XP.	Giving feedback (Implicit)
	Our group agreed with Microsoft PowerPoint because flexibility and easy to use should become our first priority for consideration.	Agreeing (Implicit)
Group 5-Hid (Posting # 28)	Hmm, its look like many agreed with the use of Open Office but we also need to think for long term like the duration to learn for the software.	Clarifying idea (Implicit)
Theme 3: Training duration		
Group 7-Anis (Posting # 30)	Our group agreed with Open Office or Microsoft PowerPoint because their functions are same like Microsoft Word which can be learned in short time especially for Mathematics symbols.	Agreeing (Implicit)
Group 2- Heng (Posting# 31)	We need to consider teachers prior knowledge of computer which it is hard on Flash than PowerPoint.	Giving opinion (Implicit)
Theme 4: External resources and references		
Group 4-Izah (Posting #33)	Currently there are many available tutorials for learning PowerPoint.	Sharing information (Independent)
Group 3-Sydin (Posting#35)	Eight unit tutorial show how to use PowerPoint to present many different forms of information.	Sharing information (Independent)
Theme 5: Software suitability		
Group 5-Azi (Posting # 40)	For the conclusion, we from Group 5 Mathematics suggests for selecting PowerPoint Office for proposal of Authoring tools for teaching and learning for Science and Mathematics subject in Sultanah Zanariah school because of the software suitability in fulfilling all the criteria aspects.	Suggest idea (Implicit)
Group 2- Heng (Posting# 41)	Anywhere, our group also agreed for Microsoft PowerPoint suitability for Chemistry subject learning.	Agreeing (Implicit)
Group 4-Azi (Posting # 44)	SPP, Physics groups collectively concurred in the decision for selecting PowerPoint for teaching and learning.	Agreeing (Implicit)

However, in discussion theme four, which presents the availability of resources and references for selected an authoring tool, the inter-group interactions observed were mainly independent which explained the cooperative ways of interacting by Group 4 and 3 (Posting#33 and 35). Finally, in discussion theme five, the interactions were narrowed down and focused on making a decision about the authoring software suitability to finalizing ideas from groups of Mathematics, Chemistry and Physics as evidenced through Groups' 5, 2 and 4 online postings (Postings#40, 41 and 44).

In summary, the online inter-group task 2 was designed as a situated activity embedded with particular affordances for fostering inter-group interactions for collaborative learning through negotiation and making a decision across the online group as they learn about the concept and types of Authoring Language software. This provided a platform where students' knowledge and expertise was observed to be distributed towards achieving shared task 2 goals. In this process, the inherent task goals from situated activity task 2 helped to frame students' interactions and mediate rules and roles of online intra-group interaction for learning cognitively, emotionally and socially. At this point particular interactions were seen to be more evident and important particularly in developing collaborative understanding and knowledge of the Authoring Language concept.

A comparison between online group task 1 and task 2 suggests that the online group task 2 provided more collaborative ways of interacting towards the accomplishing of shared tasks and goals compared to online group task 1. Such differences in collaborative interactions are shaped by the shared tasks and goals which also help to mediate rules and roles of interacting, so that some interactions became more evident. The findings of this section are also consistent with the finding from the online group activities participation which reported students' learning through their online group activities was achieved through their active participation in situated learning activities. These are driven by goals, socially mediated, and distributed through interacting with others and were valuable in terms of helping students accomplish a better group achievement and course grade (see Chapter 7).

The transformative outcomes experienced by students at the end of the semester as a result of participating in the online group collaborative learning activities in the course are discussed next in the analysis of activity system outcomes.

8.5 The Transformative Outcomes of Activities in Authoring Language Course

This section discusses the transformative outcomes of activities as an activity system and its constraints (or tensions) as a result of students participating in the online group collaborative learning activities in the course. The transformative outcomes of activities as an activity system are marked as a cognitive transformation through groups' developing understanding and gaining expertise, as social transformation through groups developing joint commitment and responsibilities, and emotional transformation through groups developing confidence, attitude and satisfaction. Evidence of interest at this level of analysis comes from online transcripts, online journal entries, questionnaire, and interviews.

8.5.1 Cognitive Outcomes: Developing Understanding and Gaining Expertise

All groups' responses from the online reflective journal set-up at the end of the course indicated that students had developed understanding and gained knowledge and expertise about Authoring Language, computer and ICT. All nine groups reported becoming more knowledgeable about authoring software, computer and ICT, as reported by Brian from Group 9:

> As a learner before I have entered this course, I have never heard of Authorware, let alone the processes of building interactive presentations. My weakness is that I am not highly creative when it comes to building interactive presentations. After entering this course, I have learnt not only about building an interactive presentation but also including other media, display, and so on. These are all available in this course and I am glad that I have participated in it. (Brian, Group 9, Jour.)

Six groups highlighted the value of participating in the course in helping them improve their computer-related knowledge, as they responded in their online group journal entries. Ain from Group 5 reported:

> I felt that my involvement in this course had improved my computer knowledge, in a way that I know more about computers, particularly about authoring and web authoring. Before entering this course I didn't have any knowledge about Authorware, and now I would like to learn more about it. (Ain, Group 5, Jour.)

Five groups reported gaining knowledge and expertise about ICT. Three sample quotes were from the semi-structured interviews which reported:

> My capability and his [other group] expertise whereby we shared our skills [expertise] and ideas to benefit both of us. (Chris, Group 3, Int.)

> I felt when we discuss and collaborate with other people that come from a different major [programme]… we can exchange our ideas and gain their ideas. (Fadi, Group 8, Int.)

> We gained new ideas from discussion with other peoples' opinions [different programme] and expanded our mind on ICT. (Ruhi, Group 6, Int.)

Meanwhile, data from the online journal entries and interviews corroborated findings from the analysis of online discussion transcripts and revealed a majority of students' mentions about cognitive skills and abilities (more than 42 per cent) were focused on clarification skills, indicating students developing and gaining an understanding of the Authoring Language as well as computers and ICT in general (see Chapter 6).

This section described how students participating in the course developed and gained expertise and knowledge in Authoring Language, computers and ICT - from that of a novice at the beginning of the course towards becoming more expert-like at the end of the semester.

8.5.2 Social Outcomes: Developing Mutual Responsibilities and Relationships

Students' interactions as a result of participating in online group collaborative learning in the course fostered social outcomes with students changing from competitive and individualistic viewing of learning towards appreciating others' contributions at the end of the course. Ruhi from Group 6 reported how she appreciated her increasing responsibilities for participation in the course:

> One of our responsibilities is to remind them and care about others participating in discussions because when we discuss we need feedback, so, by reminding other students to participate in the online discussion, we can get responses for those who are online. (Ruhi, Group 6, Int.)

Hana from group 8 responded in an online group journal at the end of the course about how her interaction and participation in the course provided opportunities for active learning, which to her were valuable:

> For me, I felt that this course is giving me an opportunity for some form of active learning where, before this, I just learned to use PowerPoint and Flash. But now I am able to use and learn about Authorware software in interactive ways that include other media or in combination with this software. (Hana, Group 8, Jour.)

Hami from Group 9 added that through sharing contrasting ideas and disagreement in the discussion he was able to see valuable ideas for learning and develop a mutual relationship with other students in the course. Hami reported:

> When I disagree with someone's point, it doesn't mean I'm fooling around, but I want to identify what are the points. I want to see the points and the explanation and also the supportive ideas. If there are points that we can support and argue with our ideas, we are free to point out our view. We are university students, so critics and compliments are a normal thing that we should accept. This is my effort to build partial agreement [mutual

> relationship] in the discussion so that we can expand the discussion with new ideas. (Hami, Group 9, Int.)

Fareha from Group 2 added that another social outcome was that students had more focused discussions, and this agrees with findings from the online discussion transcripts which revealed students developing increasing on-task discussion commitments (see Section 8.2). She reported:

> In this course, online group discussions allow us to give more concentration [focus] because there are only a number of us. If there are only three of our group members who replied to the post, it is easy for us to know. (Fareha, Group 2, Int.)

Meanwhile, data from the online journal entries and interviews corroborates findings from students' perceptions of their developing roles and responsibilities regarding online collaboration and online group work (post questionnaire), as shown in Table 8.8 (see Chapter 6). All students generally agreed that their group developed roles and responsibilities towards working together.

Table 8.8: Students' Perceptions of Their Developing Roles and Responsibilities in the Course (n=40)

Items	**M**	**SD**
The group task was well divided and distributed between group members	4.10	0.57
The group members agreed with the individual roles and responsibilities to be held for the group task	4.02	0.51
In my online group, the group decided how to work together	4.03	0.62
In my online group, the group members were agreed about how to work together	4.10	0.67
In my online group, the way the group decided to work together encouraged group members to contribute	4.08	0.76
Knowing my role and responsibilities in the group task helped me think that I was contributing to the group	4.27	0.59
Knowing my role and responsibilities in the group task helped me feel a part of the group	4.30	0.68

Note. Scale: 1-Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree, M=Mean, SD=Standard Deviation

This section describes how students developed mutual responsibilities and relationships in online discussions while learning about Authoring Language, computer and ICT. This is evident through their reports of their increasing mutual responsibilities, relationships and commitment within their group and across other groups.

8.5.3 Emotional Outcomes: Developing Confidence and User Satisfaction

From the interviews and online reflective journals set up at the end of the course, all groups commented on how much they had gained confidence through discussion and learning about Authoring Language in particular and computers in general. Ruhi from Group 6 reported:

> We have to think critically on how to do the task together because when the lecturer asks us to discuss it in the classroom, we will feel very shy to do it, but the case is different when we do it in eLearning where we feel more confident to do [discuss] it. (Ruhi, Group 6, Int.)

Seven groups reported that their participation in the course had changed their attitudes towards learning about Authoring Language, computer and ICT. Busyra from Group 7 reported:

> Before entering this course, I was a person who knew nothing about Authorware but after entering this course, I now know what is Authorware and my participation in discussions through eLearning somehow has changed my attitude to be involved more in eLearning and learn more about computer subjects especially this course where we have to participate in an interactive eLearning forum. (Busyra, Group 7, Jour.)

In addition, six groups responded in the online reflective journal that they would recommend the course to other students. Data from the online journal entries and interviews about students’ satisfaction in the course corroborates findings from students’ perceptions of their satisfaction in participating in the post-questionnaire, as shown in table 8.9 (see Chapter 6). All students generally agreed that they enjoyed learning online in the course and were satisfied with their group work outcomes.

Table 8.9: Students' Satisfaction Participating in the Course (n=40)

Items	**M**	**SD**
I enjoy learning online	4.15	0.86
I enjoy learning within an online group	3.80	0.91
I enjoy online discussion about my studies	3.90	0.90
I was satisfied with the quality of work as a result of collaboration in my online group	4.03	0.57

Note. Scale: 1-Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree, M=Mean, SD=Standard Deviation

This section described how students reported that they developed their confidence and satisfaction by participating in the course.

8.5.4 Constraints and Tensions of Activities in the Course

Two keys constraints and tensions of activities in the course were addressed and shared by students in the semi-structured group interviews. They are summarised and grouped into technology-related contradictions, which are related to desire for synchronous feedback in forum discussions, cut and paste and plagiarism of ideas, and other technological distractions, followed by group discussion contradictions. These refer to repetitive and mixed-up postings, clashes on topics of discussion, and discussions being too formal.

8.5.4.1 Technology-related Contradictions

Desire for synchronous responses in forum discussions

Some students felt that the delay feature of forum discussions did not fulfil their desire for immediate synchronous responses. This tension is revealed through Anwar from Group 3, who said:

> The best way for discussion is through chatting where we can get immediate response. Sometimes, when we ask a question in a forum discussion, there is

> no one person who wants to reply to the post. Even if we wait for a long time there is still no response to our question. The best example of chatting for forum discussion is through Yahoo Messenger [synchronous]. (Anwar, Group 3, Int.)

Fareha from Group 1 added that a consequence of not having an immediate response is that students tended to forget the message and this contradicts the reflective nature of a forum discussion:

> The discussion is best when someone responds to your question immediately, or else they will forget what they want to tell you. (Fareha, Group 1, Int.)

Based on this tension, several students from all nine groups expressed their preference for face-to-face discussion over forum discussion to compensate for its constraint. Hasma from Group 4 reported:

> For me, we can get an immediate response during a face-to-face discussion, but if we discuss it in the eLearning, we only can get the response from our course mates when they log-in. We have to wait for some time and wait for other peoples' responses. (Hasma, Group 1, Int.)

Cut and paste and plagiarism of ideas

Another technology-related issue stressed by students was the direct cut and paste feature. This was reported by Izzanie from Group 1 as irritating as the structure of the posting was difficult to follow and understand. She said:

> In my opinion, not all of us can present their ideas through words and writing. Sometimes we present better in words, but for discussion in eLearning, people who give out their ideas might copy their post from the Internet. In this situation, the idea is that their contribution is not originally from them and sometimes we do not understand the content. (Izzanie, Group 1, Int.)

Because of the ease of cutting and pasting messages in a forum discussion, some students felt that this could lead to plagiarism of ideas. Dhah from Group 7 pointed out:

> There are possibilities of the ideas that have been pointed out by other people. Ideas that have been mentioned in discussion should not be pointed out again. People might say we copy someone's idea. (Dhah, Group 7, Int.)

Other technological distractions

The multi-tasking feature of a computer operating system that allows the user to run multiple applications is another tension that students addressed. Hami from Group 9 stressed:

> There's always a problem during online that we do not focus only at one web page. Even if we log in to eLearning, while waiting for eLearning website page to be loaded, we are prone to visit other website pages like Facebook, YouTube and similar. (Hami, Group 9, Int.)

Some students viewed this tension as hindering their participation in the eLearning forum, as Amin from Group 4 reported:

> Like my own experience participating in the forum, while waiting to be logged-in which took some time, I like to open [visit] other websites which actually ended up by spending my time on that website instead of eLearning forum [laughed]. (Amin, Group 3, Int.)

8.5.4.2 Group Discussion Contradictions

Repetitive and mixed-up postings

Because of the task goals of inter-group discussion to foster online inter-group collaboration across different programmes of studies (SPK, SPP and SPT), some students felt it was frustrating when some groups repetitively mixed-up their postings when completing the task. Fareha from Group 1 said:

> For example, discussions with SPT group, where ideas that have been discussed were mixed-up. The worst part is where they kept discussing the same things over and over. (Fareha, Group 1, Int.)

Hana from Group 8 added her frustration when some students posted repetitive, unrelated mixed-posts which contradict task goals:

> In addition, when someone replies to the discussion in the forum and suddenly there is someone who replies to the post but it is not really related to the topic, such things will continuously happen to the next replies. (Hana, Group 8, Int.)

Clash on topic of discussion

Some Physics students felt some tensions and constraints in finding a suitable shared discussion topic that could accommodate different interests of programmes of studies, especially with Mathematics students, which contradicts task goals. Hasma from Physics Group 4 reported:

> SPT students discuss software that relates with Mathematics that can be used in their teaching, while we discuss software that relates with Physics and it depends on the suitability of the software to accommodate the Maths and Physics subject. (Hasma, Group 4, Int.)

Meanwhile, Fareha from Chemistry Group 1 found this tension occurred when Physics and Mathematics students focused on their related areas and expertise, but not inter-related areas and expertise, which contradicts task goals. Fareha from Chemistry Group 1 reported:

> Like I said just now, SPP [Physics] come out with different ideas that suit their subjects, while SPT come with their subjects, which are not related to SPP [Physics]. (Fareha, Group 1, Int.)

Discussion being too formal

Because discussions were evaluated as a part of the course assessment requirement, some students felt that it was in their interest to discuss it formally which is in line with the academic assessment requirement. However, some students faced dilemmas and tensions to accommodate the interplay between their non-academic identities and tertiary identities. Zuwan from Mathematics Group 9 stressed:

> We would not be able to point out what we want to say actually because we feel forced to do so. When we talk about fact, we feel that way rather than if we discuss it in the idle talk, where we feel free to talk about our feelings. We know that we will be evaluated based upon our opinions and thoughts that we share in a serious discussion. If it is a general topic, I will discuss it normally without feeling forced to do it, and sometimes if I feel I am being forced I tend to pretend to be another person while discussing. Even in writing, I will write it formally, the same as I did while discussing, if that is a fact thing and is going to be evaluated. (Zuwan, Group 9, Int.)

8.5.5 Students' Suggestions and Insights for Improvements

Suggestions and insights for further improvements were shared by nine participating groups through the semi-structured group interviews and they are: personalising an online collaborative learning template, and additional support for collaborating online.

8.5.5.1 Personalising Online Collaborative Learning Template

Five groups from the interviews raised the importance of having personalised and attractive educational layout and communication as supplementary to the course. Anwar from Physics Group 3 reported:

> Attractive layout that students feel familiar with, like general forum with chat style in which students can directly communicate, like Peer-to-Peer (P2P) application which integrated in the forum with different layout style that students find attractive and familiar to them. (Anwar, Group 3, Int.)

Two students from Group 5 and 8 suggested the use of structured postings and concept linkers so that it can help students to locate information if discussion postings were overloaded. The first point is exemplified by Hid from Mathematics Group 5 and the second point by Fadi:

> The discussion will be held according to the date that has been assigned by the group member. For example, I have to access on the second day so I need to know the ideas that the previous person has contributed. (Hid, Group 5, Int.)

> If there are links to these concepts, it will help us to find the information and we can direct our information-seeking in the right direction. (Fadi, Group 8, Int.)

8.5.5.2 Additional Supports for Collaborating Online

All groups raised the importance of establishing additional support for collaborating online. This includes clear guidelines and ways of communicating online. Fadi from Mathematics Group 8 stressed:

> I think the students are not very familiar learning through the eLearning, though they have learnt the eLearning skills during their first year and also because of the attitude of the students towards the eLearning. I think we need to practise the eLearning culture by being active in using eLearning and support others to change bit by bit. (Fadi, Group 8, Int.)

Anis and Nad from Group 7 and 8 with low participations but they also highlighted the importance value of collaboration guidelines and participation as follows:

> Clear instructions for the collaboration and everyone needs to participate. (Nad, Group 8, Int.)

> It should be explained in the classroom and eLearning but should be explained clearly and with details in the classroom. The explanation can be conducted when the students start doing the task or at any time they had problems with it. (Anis, Group 7, Int.)

8.6 Chapter Summary

This chapter has detailed the findings of the study and shown that the learning activities were helpful in facilitating and improving students' learning. Using the situatedness of an activity analysed at three interconnected levels, highlighted the mediation of artefacts on a broader institutional contextual level (Section 8.3). The findings from the broader context of the OCL intervention showed that the OCL tools and activities afforded students' participation and collaboration in the OCL intervention at the class level. The students said that they found the OCL tools and activities helped their collaborative participation, in which they were able to achieve the course goals, improve their knowledge in ICT and computer education, and obtain a good final course grade (see Section 8.3.3). This was followed by the mediation of rules and roles through the analysis of online interactions within the intervention (Section 8.4). The findings from the intervention level showed that the OCL activities (intra and inter-group work) that were designed to foster the OCL collaborations (intra and inter-group interactions) as the students learned about Authoring Language were helpful in framing students' collaborations for learning from the cognitive, social and emotional perspectives (see Section 8.4.1 and 8.4.2). Finally, the analysis of outcomes and constraints of an activity (Section 8.5) showed that students developed understandings and gained expertise (see Section 8.5.1). They also developed more responsibility for their own and others' learning (see Section 8.5.2), and developed positive attitudes, gained confidence and felt satisfaction in the course at the end of the semester (see Section 8.5.3). However, the findings at the outcomes level also revealed some potential constraints and tensions from the OCL intervention such as technology-related contradictions (such as a desire for synchronous feedback in forum discussions, cutting and pasting and plagiarism of ideas, and other technological distractions) and group discussion contradictions (such as repetitive and mixed-up posts, clashes on topics of discussion, and discussions being too formal) (see Section 8.5.4).

The next and final chapter discusses the findings, implications, and proposed recommendation for further research.

Chapter 9 Discussion, Conclusion and Implications

9.1 Introduction

Online learning is a fast growing trend, and recently some Malaysian Higher Education Institutions have been implementing online learning courses. Although there has been a call for stimulating and enhancing online learning and ICT in Malaysian Higher Education Institutions, online learning is still in its infancy at least in terms of research and implementation (Ministry of Higher Education, 2006; Raja Hussain, 2004).

Previous studies have reported that online learning can be used as a tool to enhance and improve students' learning, but its effectiveness depends on how the tool is utilised (Barab, 2004; Jonassen & Murphy, 1999; Mason & Rennie, 2008). Other studies have asserted that online learning can be used effectively if it is implemented within a model of student-centred learning in which learning through collaboration is encouraged, instead of the typical teacher-centred model (An, Kim & Kim, 2008; Garrison & Anderson, 2003; Harasim, 2006). While a number of researchers have cited the benefits of incorporating collaborative learning in face-to-face environments (e.g. Dillenbourg, 1999; Johnson & Johnson, 1996, 2004; Panitz, 1996), there is little research on the benefits of incorporating online collaborative learning, especially in a teacher education context (An & Kim, 2007; An, Kim & Kim, 2008); very little research has been undertaken on online collaborative learning in Malaysian Higher Education Institutions (Embi, 2011; Goi & Ng, 2009; Salleh, 2008).

Therefore, this study aimed to investigate the incorporation of online collaborative learning in pre-service teacher programmes to enhance student learning. To-date, little or no research has been found that examined the incorporation of online collaborative learning within ICT education, nor particularly for interdisciplinary collaboration between subject major programmes that have both face-to-face and online participation components (Aris, et al., 2006); hence this study aimed to fill this gap.

In this chapter, the findings from the investigation are discussed. The focus of this study was to examine the nature and outcomes of online collaborative learning interactions between Chemistry, Physics and Mathematics Education students through their participation in an e-learning environment (Moodle). Three main research questions were investigated:

1. What is the nature and effects of pre-service teacher education students' interactions in online collaborative learning?
2. What is the nature of pre-service teacher education student group interactions in online collaborative learning?
3. How does online collaborative learning affect pre-service teacher education student learning?

In this study, Activity Theory was established as a framework for developing the intervention (see Section 3.5 in Chapter 3). Activity Theory proved to be useful, particularly for the initial configuration of this research, because it provided a structure for conceptualizing human practices (in this case, online collaborative learning activity) in relation to a computer within a context (Barab, Schatz & Sheckler, 2004; Jonassen & Land, 2000; Kuutti, 1996; Mwanza, 2002). In an activity system, a human is portrayed as a subject interacting with an object to attain desired outcomes. The object is the goal of the activity and the interaction is mediated through the use of tools. Similarly, the relationship between subject and community is mediated through rules, prescribed as any formal or informal regulations which could affect how the activity takes place. And the affiliation between community and object is mediated through the division of labour, which refers to how the tasks are shared or distributed.

Activity Theory does not provide specific categories or theories that can be followed by researchers. Rather, it offers the basic principles that constitute a general conceptual system in research, instead of a highly predictive theory, and it allows the researcher to use different components or theories in the research. The focus of this study was to use online collaborative learning (OCL) (Harasim, 2004) and the stages of online collaboration (Pallof & Pratt, 2005) to design and implement the OCL intervention. The OCL (Harasim, 2004) intervention employed the notion of discourse as central to knowledge building and viewed learning as a social, negotiated, consensual process (Harasim, 2002, p. 181) within the context in which the study is situated. OCL highlights the importance of learning as a social process resulting from a students' collaboration with, and relationship to, the knowledge learning community, mediated by the teacher or mentor (Harasim, 2012, p. 90); it draws on the processes of active interactions contributing to intellectual and knowledge building through developing shared understanding. The OCL processes follow the stages of online collaboration (Pallof & Pratt, 2005) in designing the planning, coordination and implementation of the intervention.

The intervention of this study was conducted through an ICT education course in a Malaysian University that required OCL discussions and ran for 15 weeks. The researcher was involved as the instructor of the course for 13 weeks (Mohamad Said, Forret & Eames, 2010; Mohamad Said, 2011). To evaluate the impact of the intervention, an interpretive methodology (Cohen, et al., 2005; Denzin & Lincoln, 2003) was adopted to frame the collection and analysis of the data, which included the collection of both quantitative and qualitative data. In order to contribute to knowledge and understanding about the nature and quality of OCL, three specific objectives were developed and considered. These were related to: the examination of the students' online posts and views of OCL (Chapter 6); the examination of the ways groups participated in OCL (Chapter 7); and the examination of the outcomes of learning in an ICT education course through an e-learning environment (Moodle) (Chapter 8).

The following sections, 9.2 to 9.4, discuss the findings presented in Chapters 6, 7 and 8. Section 9.5 provides some conclusions to this study and Section 9.6 examines limitations to the methodology used and some implications for practice.

9.2 The Nature and Effects of Students' Interactions in the Online Collaborative Learning Intervention

The aims of this study were to examine the nature of students' interactions in online collaborative learning (OCL) and to investigate if an OCL intervention would enhance student learning. While the research focused on the online interactions, students also had opportunities to interact face-to-face and these interatcions will have influenced both their learning and their online discussions. The findings reported in this study showed enhanced cognitive, social and emotional outcomes of learning in an OCL environment. The learning processes and outcomes observed in the OCL intervention were described using Harasim's OCL (2004) framework, with inclusion of socio-cultural views that situated the study. However, the study conforms to Harasim's (2004) notion of OCL characteristics highlighting interactions contributing to knowledge building so as to develop shared understanding. Evidence of the nature of the interactions and outcomes of learning also showed the OCL intervention was successful in achieving student collaboration and student learning outcomes (see Chapter 6, 7 and 8).

In this study, the nature of students' interactions in the OCL intervention was examined through participative, interactive, social and cognitive dimensions to better understand the practice of OCL, and also to improve the use of OCL in a classroom tertiary environment (Pozzi et al., 2007). The data from student participation outcomes in the OCL intervention (see Chapter 8) revealed the importance of students' interactions and contributions for developing students' cognitive, social and emotional development in the OCL intervention. This was consistent with the results of the participative and interactive dimensions, which showed a high degree of participation and interactions from students in viewing and contributing in the OCL intervention (see Section 6.4.1 and 6.4.3). These findings support the work of other researchers (Hara et al., 2000; Harasim, 2004; Ingram & Hathorn, 2004; Pozzi, et al., 2007; Pallof & Pratt, 2005; Tu, 2004; Salmoni & Gonzalez, 2008) that asserted that the participative and interactive dimensions are the crucial aspects of online learning. They believe they are the 'pulse' of learning online and provide an important indication of students' involvement in the OCL discussions based on the level and nature of interactions (Hara et al., 2000; Harasim, 2004; Henri, 1993; Ingram & Hathorn, 2004; Pozzi et al., 2007). The results from the analysis of the participative and interactive dimensions showed that the OCL intervention led to high student participation and interaction throughout the OCL activities. The high volume of posts was evident in the OCL discussion transcripts and posts (see Section 6.4.1), which provided an important indication of the students' participation; it portrayed a high degree of interaction and negotiation of meaning, and an engagement in joint responsibility for collaborative learning online in order to develop knowledge and joint understanding. The findings support Rogoff's (1995) idea of active participation and interaction with joint responsibilities for learning in the OCL intervention as "active individuals participating with others in culturally organised activity that has as part of its purpose the development of mature participation in the activity" (p. 142).

Furthermore, the students' online collaboration in the OCL intervention revealed that students' interactions comprised exploration of conceptual understandings leading to the development of technical knowledge (see Section 6.4.3 and 6.4.4). This was evident through online transcripts and posts which included views and checking other students' comments (see Section 6.4.1). The interactions resulting from online collaboration allowed students to engage in, and to work with one another as they become involved with, and enculturated into, the discourse of the knowledge community (Barab & Duffy, 2000; Jonassen & Land, 2000; Harasim, 2004; Herrington & Oliver, 2002; Tu, 2007). The opportunities provided by the OCL activities, through collaboration and interactions, encouraged students to engage with other students' posts to acquire knowledge, and learn from the posts prior to taking action (Dillenbourg, 1999; Henri, 1992; Garrison & Anderson, 2003; Pozzi et al., 2007). In this study, the OCL activities were designed so that it was a requirement for students to interact with other students and consider their ideas in order to complete the OCL assignments (see Section 5.3).

In a similar vein, the students' interactions within the interactive dimension were consistent with the students' interactions within the participative dimension (viewing and checking one another's work), indicating that a number of collaborative interactions occurred during the OCL activities (explicit and implicit criteria, see Section 6.4.3) compared to non-collaborative interactions (or independent criterion, see Section 6.4.3). The students' interactions in the interactive dimension included diverse online collaboration of sharing information, negotiation of meaning, and clarification of ideas leading to a mutual understanding. This resonates with Harasim's (2004) ideas of intellectual processes comprising idea organisation, idea linking and intellectual convergence. The diverse collaborative interactions in the OCL intervention lie within the constraints of the OCL tools and resources in order to achieve the OCL task goals. Within this collaborative work, particular types of interactions were observed to be more evident than others in accomplishing task goals and in guiding the students towards becoming responsible participants and contributors within the knowledge community. Online collaboration formed the basis of inter-dependence or inter-subjective understandings amongst the students, leading to a high quality of OCL discussions (Harasim, 2012; Johnson & Johnson, 2009; Rogoff, 1990; Yamagata-Lynch, 2010). In this way, the distributed cognition across the knowledge community can be seen as being stretched over, rather than divided up amongst students (Salomon, 1993). The various interactions resulting from OCL activities contributed to the development of the distribution of expertise within the knowledge community, and appeared to contribute to developing the students from a cognitive, social and emotional perspective.

The students' interactions in the OCL intervention can also be seen to be valuable for their social and cognitive qualities, when examined through a more in-depth investigation of discourse within the social and cognitive dimensions of the OCL posts. The social dimension forms an important component in the 'glue' of a knowledge community; however, it is the cognitive dimension that impacts on the quality of the intellectual discourse (Harasim, 2012). The findings within the social dimension showed that a high number of social and non-task focused comments (or posts without any reference to the topic) were produced by the students at the beginning of the OCL intervention in Task 1, but that students became more task-focused, with the production of more cognitive-based posts, as the tasks progressed (see Section 6.4.2). The social indicators found were consistent with the work of previous researchers (see for example, Hara et al., 2000; Harasim, 1999) in a manner that showed that social and non-task focused comments early in an OCL intervention can lead to more substantive cognitive contributions later on, once relationships within the online community have become established. Similar findings by Harasim (1999), in her study of the Virtual-U in GEN (Global Educators Network), indicate that social and humorous discourses are a mechanism for participants to connect with one another, spice up the discussions and reduce anxiety or pressure related to discussions, thereby inviting responses and contributing to a sense of commonality (Harasim, 2012).

In this study, the students' social comments were typically part of a student's message, usually as a prelude to their substantive cognitive contribution. Social and affective comments can be ways for students to connect to one another, even if they have not physically met. However, as revealed by data from the social dimension, it was interesting to note that no, or few, concern and encouragement posts (social criteria) were made in Task 2 (inter-group work) compared to Tasks 1 and 3 (intra-group work) (see Figure 6.4, Section 6.4.2). It appeared that students developed their social relationships more slowly in the inter-group work rather than in the intra-group work. The findings also indicate that students developed emotional relationships and online bonds at the beginning of the OCL intervention, but with growing responsibilities and commitments they progressively developed on-task discussions which then focused more on learning topics and less on off-topics. This rise in on-task interactions indicates an increase in learning focus (Lipponen et al., 2003). The social and emotional relationships formed by students are an important indicator of social interactions mediated by the OCL tools in developing and supporting students' cognition and affectivity. It also reflects the intellectual value of the OCL intervention, which motivates and maintains the students' engagement in the OCL (Harasim, 2012).

The findings from the cognitive dimension showed that students demonstrated a range of cognitive interactions (clarification, inference, judgement and strategies) based on particular affordances of the learning activities (see Section 6.4.4). In this study, the majority of students' cognitive interactions were focused on their clarification skills, which indicates that students were involved in shared opportunities to develop and gain understanding. Moreover, the findings within the cognitive dimension also showed an increasing level of understanding through deep discussions. The evidence of clarification skills and the increased deeper level of discussions were important indicators of knowledge building and socially shared expertise, consistent with other findings (see for example, Garrison et al., 2001; Harasim, 2012; Häkkinen et al., 2004).

Regarding the effects of students' interactions in the participative, interactive, social and cognitive dimensions in the OCL intervention, the study indicates no difference between all tasks (Task 1, 2 and 3) overall for the contribution and viewing criteria in the participative dimension (measured using the Kruskal-Wallis test), although contribution and viewing achieved a higher mean of interactions for Task 1 (intra-group work) than Task 2 (inter-group work) (see Section 6.4.1). However, the explicit interaction criterion showed a difference between all tasks (Task 1, 2 and 3) (measured using the Kruskal-Wallis test) in the OCL with a higher mean of interactions in Task 1 (intra-group) than Task 2 (inter-group). Their explicit interactions were higher in Task 1 than Task 2, particularly because Tasks 1 and 3 were designed to foster intra-group work, which required particular types of interactions compared to Task 2 (inter-group work) (for example, concern and encouragement were less evident in Task 2 than in Task 1 and 3, see Section 6.4.2). These findings were also consistent with the results in the interactive and social dimensions that indicated students were developing on-task discussions as they progressed through the OCL intervention (see Section 6.4.2 and 6.4.3). Moreover, for the social and cognitive dimensions, there were differences for the emotion criterion (social dimension) and surface processing (cognitive dimension) (measured using the Kruskal-Wallis test) between the tasks (Task 1, 2 and 3). These results were consistent with the findings in the social and cognitive dimensions and suggested that in the social dimension, the students were deliberately developing their emotional relationship with one another (Section 6.4.2) in Task 1, with less posts contributing to surface processing (Section 6.4.4) as the tasks progressed in the OCL intervention. Additionally, students' views in both questionnaires (pre and post) and interviews about the OCL intervention were positive regarding the technology and tools, pedagogical rules and learning in the OCL environment (see Section 6.5.1 to 6.5.3). Data from interviews reported that students felt they gained positive benefits from participating in the OCL intervention, which they felt gave them the opportunity to actively gain new knowledge, improve ICT knowledge and change their attitude towards ICT subjects. The students also said that OCL helped them accomplish a higher quality of work and gain more confidence during assignments (see Section 6.5). However, potential constraints from the technology (e.g. poor Internet connection) or the lack of social and verbal cues (e.g. facial expression) were also reported by students during OCL intervention (see Section 6.5 and Section 8.5.4).

By addressing the nature and the effects of student interactions in OCL, this study attempted to contribute to understanding the nature and quality of OCL through examining the four dimensions of online learning underpinned by the OCL ideas:

participative, interactive, social and cognitive (Harasim, 2004). In this study, the use of OCL has enabled the exploration of socio-cultural views of learning. As Pea (1993) noted regarding OCL, students work together on knowledge problems, thus sharing the cognitive load amongst participants and gaining the benefit of distributed expertise across the knowledge community. Interactions are the key of OCL, where information is exchanged and knowledge is constructed socially through joint efforts towards common cognitive goals. However, Harasim (2004) asserted that the essence of collaboration is the construction of shared meaning, whereby people work jointly, especially to create physical, social, cultural and intellectual artefacts (p. 65). Furthermore, the value of online collaboration for knowledge building, mediated by the Internet where learners work together online, emphasises processes that lead to both conceptual understanding and knowledge products (Harasim, 2012, p.88). Therefore, from a socio-cultural perspective, as learners participating and interacting in OCL activities, the students in this study internalised what they learned through collaboration and working together online and thus formed socially shared knowledge and expertise towards knowledge building that is informed by the processes and resources of collaborating online within the knowledge community (Daniels & Gutierrez, 2009; Engeström, 2001; Häkkinen et al., 2004; Harasim, 2012; Vygotsky, 1978). In accord with a socio-cultural orientation, the key components of the student group interactions in OCL are discussed next in Section 9.3; the OCL outcomes, evaluated through the analytical framework of the situatedness of an activity (Boer et al., 2002), are discussed in Section 9.4.

9.3 The Nature of Student Group Interactions in the Online Collaborative Learning Intervention

The study revealed the online interactions of nine student groups as they became involved and engaged in the online collaborative learning (OCL) intervention. The findings revealed that the groups' ways of working in OCL were derived from a combination of tools and methods (e.g., face-to-face and online, tools, and assessment), which related to the nature of student intra-group work interactions within the participative, interactive, social and cognitive dimensions (Task 1 and 3) (see Chapter 7).

In this study, an examination of the nature of student group interactions in the OCL intervention was examined through the evaluation of the OCL discussions held within each participating group; this was based on the analysis of the participative, interactive, social and cognitive dimensions regarding their online posts, transcripts, interviews, questionnaires (pre- and post-) and document analyses (e.g., reports, assessment and marks, and final grades). The analysis of the data revealed that the student groups' participation methods, communication styles and roles contributed to student groups' collaboration characteristics: strategic, task-directed, peripheral and disengaged; this in turn corresponds with the participative, interactive, social and cognitive dimensions of OCL (see Section 7.2.10). For instance, the strategic and task-directed student groups were seen as highly engaged and participated in the OCL discussions. These groups also played an important role in the learning processes that benefited themselves and others.

On the other hand, the peripheral and disengaged student groups appeared to participate less in the OCL discussions. These groups were seen as the groups that lacked knowledge and had problems with the content, as well as adapting to the technology. Nevertheless, all student groups showed increased collaboration over the period of the OCL intervention, which was fostered and guided by the goals and affordances of the OCL activities. The findings in this study also showed that a total of six of the nine groups exhibited strategic and task-directed engagement and these groups had high participation and contribution levels, high reciprocity and sociability; they also had better group achievements, with the majority of the students obtaining high final grades (see Section 7.2).

Additionally, the findings revealed that the groups adopted different working methods of communication to achieve their goals, and different styles of interactions to other groups in order to progress in the OCL intervention, as was evident in their online discussions (see Section 7.2). This supports Rogoff's (1994) idea that interactions may be conflicting or "they may be complementary or with some leading and others supporting, or actively observing and may involve disagreements about who is responsible for what aspects of the endeavour" (p. 213). The findings also support OCL from the socio-cultural perspective on learning communities, which highlights that student group interactions involve different levels of participation, different sorts of responsibility, different sets of role relations, and different interactive involvement (Lave & Wenger, 1991; Wenger, 1998).

The notion of the nature of student group interactions, as based on the participative, interactive, social and cognitive dimensions highlighted in this study, was also a particular case of socio-cultural learning, in which student groups' interactions could be seen to be mediated through the OCL tools (e.g. Moodle, website, online, computer). Although the mediating tools can include anything from physical, technical, psychological or symbolic tools (Vygotsky, 1978; Wrestch, 1998), the study found that student groups' interactions were mediated by the combination of face-to-face tools (e.g., written texts, books, lecture notes), online tools (e.g., Moodle, website, Facebook) and assessment tools (e.g., marks, grades, tests, quizzes) (see Section 7.2.10). The ways the groups collaborated varied depending on their ease of access to the online tool (Moodle), and their social and cognitive efforts, and their participation may have changed as they were being shaped by the members of the knowledge community or shaped by the development of the community (Lave & Wenger, 1991). For instance, all groups used a combination of face-to-face and online communication, as well as using online tools (for example, Facebook and educational websites) for their online discussions; the latter tool (e.g., Facebook and website) was implemented to compensate for the constraints of the Moodle platform and the absence of social and verbal cues in online discussions (e.g. facial expression). The use of face-to-face collaboration to assist in their online discussions was evident in three particular groups (see Group 4, 7 and 8), which had technological constraints and had more face-to-face than online interactions. In contrast, three other groups (see Group 2, 6 and 9) had far more online discussions in completing the assignments which enabled them to acquire higher marks (assessment) for their online interactions. These students even expressed the idea that much of their efforts went into managing time for the discussions, as well as compensating for the constraints of the technology.

The affordances and constraints of the OCL tools led to a variety of types of online collaboration in order to tap into the distributed cognition (Salomon, 1993; Pea, 1993; Perkins, 1993). Within these interactions, the students could communicate, interact and collaborate with one another and access the knowledge, understanding and expertise distributed across the student groups to achieve results that might have been otherwise difficult for an individual to attain (Harasim, 2004; Perkins, 1993; Salomon, 1993). However, the findings revealed that only a small difference in collaboration in the interactive dimension was observed between tasks (Task 1, 2 and 3) for the groups compared to differences between tasks in the social dimension in the development of the distribution of expertise in the student collaborative groups (for example, concern and encouragement in Task 1, 2 and 3, see Figure 6.4). According to Salomon (1993), the distributed cognition within a learning community is important between and among students, peers, teachers and tools in order to achieve particular goals, and is not merely something that occurs inside a learner (p. 112). In this study, the cognition was distributed between students and student groups within the knowledge community, mediated by the lecturer as the representative of the community (see Section 5.3).

The student group interactions within a situated activity in the OCL intervention were important, as they embedded a system of activity, communications, culture and context (Lave & Wenger, 1991; Brown et al., 1989) in an ICT education course in a Malaysian University (see Section 5.2). Situated activity in the OCL intervention means that the students were provided with a context to engage in and to work collaboratively with their peers, and so become involved and enculturated into the knowledge community (Barab & Duffy, 2000; Harasim 2012). The affordances of the situated activity, through the use of authentic and relevant tasks, led to the development of student groups' communication styles. This was partly to gain immediate responses from their peers in order to allow them to contribute and accomplish the task goals, and also partly because of the absence of a specific tool in the eLearning forum (for example, asynchronous tool or chat, see Section 7.2.10). Thus, the affordances offered by a situated activity can encourage learners to contribute to the distribution of cognition in that activity (Slaouti, 2007).

In the OCL situated activity, different goals were embedded in order to support the students to accomplish shared goals. In other words, the student interactions were anchored as 'goal-directed' for participating in the OCL activity (Yamagata-Lynch, 2010). For instance, Task 1 and 3 were designed to accomplish the intra-group goals while Task 2 was designed to achieve the inter-group goals (see Chapter 5).

According to Kaptelinin (2005), goal-directed action is the reason why individuals and groups of individuals choose to participate in an activity, and it is also what holds the elements of an activity together, as evident in this study where particular types of interactions became more prevalent than others (see Section 8.4). The findings from the OCL activities highlighted that the different goals embedded in the OCL Task 1 and Task 2 resulted in some collaborative interactions in Task 2 being more evident than in Task 1. For example, between explicit and implicit interactions (collaborative) and independent interactions (cooperative) (see Figure 6.5); and concern and encouragement (see Figure 6.4) in intra-group and inter-group work. Such differences in collaborative interactions were shaped by the shared goals of the activities, as well as by mediating the adoptive communicative roles of the students as evident in their online posts (see Section 7.2.10). Thus, this suggests that the nature of the student group interactions in the OCL activities was shaped by the goals that were most readily afforded by the student and group within the boundary of the institution and the knowledge community.

This study attempted to address the proposition that the nature of student group interactions in OCL is a particular case of socio-cultural learning. In accordance with a socio-cultural orientation, the OCL outcomes were evaluated through the analytical framework of the situatedness of an activity (Boer et al., 2002). The framework evaluated OCL at three contextual levels: the higher level examined the broader institutional contextual level for OCL; the middle level examined the OCL interactions within the intervention; and the lower level examined the OCL outcomes and constraints. Findings showed that OCL enhanced the outcomes of learning through developing the students' cognitive, social and emotional aspects (see Chapter 8). As the literature recognises the value of OCL (Harasim, 2004; Tu, 2007), the outcomes of this OCL intervention are highlighted next in Section 9.4.

9.4 Outcomes of Learning through the Online Collaborative Learning Intervention

This study examined the outcomes of learning for students who participated in an online collaborative learning (OCL) intervention as part of a blended course that also included face-to-face components. As students reported, they entered the course with one goal – to pass the course (see Section 8.3.3). Over the period of the course, they increasingly participated and became involved in the OCL activities, and became enculturated into the discourse of the OCL within the knowledge community of the class. The students gradually experienced new perspectives on a particular knowledge problem through their interactions with peers; they developed new and deeper understandings and eventually learnt to address their understandings in the manner of the knowledge community. This is consistent with the view that the development of learning in OCL is a process of transformation through people's participation, rather than an acquisition of knowledge (Rogoff, 1995, Wenger, 1999). Furthermore, the students' participation is constantly changing as the knowledge community is shaped by, and in turn shapes, the development of its participants (Lave & Wenger, 1991). In this study, the outcomes of learning in OCL were reported based on the cognitive, social and emotional transformations.

The cognitive outcomes were observed through students achieving shared goals in the OCL intervention over the period of the course, as they participated and developed understanding and gained expertise to become more expert-like by the end of the course in Authoring Language (see Section 8.5.1) (Harasim, 2004; Lave & Wenger, 1991; Palloff & Pratt, 2005). As a result of their participation in the OCL activities, particular students' improvement in Authoring Language understandings and skills was noted. At the end of the course, students reported that they had improved their knowledge of ICT and computer education, and had obtained a good final course grade (see Section 8.5.1). The social outcomes were reported in the form of students' relationships in developing more focused discussions in terms of increasing mutual responsiveness and responsibilities for their own and others' learning in the OCL environment (see Section 8.5.2). Finally, the emotional outcomes indicated that students gained confidence; positive attitudes and satisfaction by the end of the semester in relation to OCL (see Section 8.5.3).

The findings of this study evaluated the OCL intervention through the analytical framework of the situatedness of an activity (Boer, van Baalen, & Kumar, 2002). The framework evaluated the OCL intervention at three different contextual levels, but complementary to each other within the landscape of the situatedness of a socio-cultural activity (Rogoff, 1995).

The higher contextual level considered the analysis of the intervention on a broader institutional level within which the intervention operated. It considered the affordance of tools, activities and resources for participation in the course and how these affected students' expectations from the course and how they had achieved the goals (see Section 8.3). The findings from the broader context of the OCL intervention showed that the OCL tools and activities afforded students' participation and collaboration in the OCL intervention at the class level. The students said that they found the OCL tools and activities helped their collaborative participation, in which they were able to achieve the course goals, improve their knowledge in ICT and computer education, and obtain a good final course grade (see Section 8.3.3). However, the students also indicated some constraints that potentially hindered their online collaboration participation in the OCL discussions, such as the lack of emotions and voice intonation, as well as the lack of feedback and the feeling of remoteness resulting from OCL group discussions (see Section 8.3.2).

The nature of students' online interactions in the course, based on their participative, interactive, social and cognitive dimensions, was examined at the intervention contextual level. This also considered how students interacted with one another in supporting and developing their cognitive, social and emotional skills during the intervention to achieve the course goals (see Section 8.4). The findings from the intervention level showed that the OCL activities (intra and inter-group work) that were designed to foster the OCL collaborations (intra and inter-group interactions) as the students learned about Authoring Language were helpful in framing students' collaborations for learning from the cognitive, social and emotional perspectives (see Section 8.4.1 and 8.4.2). These findings were also consistent with the findings from the previous chapters (see Chapter 6 and 7) that indicated that OCL (intra and inter-group work) was valuable in terms of helping the students accomplish group achievement and course grades that the students were satisfied with.

The outcomes level evaluated the intervention based on its outcomes and constraints with regards to student participation in the OCL activities. The outcomes were marked as cognitive, social and emotional transformations (see Section 8.5). The findings from the outcomes level showed that students developed understandings and gained expertise (see Section 8.5.1). They also developed more responsibility for their own and others' learning (see Section 8.5.2), and developed positive attitudes, gained confidence and felt satisfaction in the course at the end of the semester (see Section 8.5.3). However, the findings at the outcomes level also revealed some potential constraints and tensions from the OCL intervention such as technology-related contradictions (such as a desire for synchronous feedback in forum discussions, cutting and pasting and plagiarism of ideas, and other technological distractions) and group discussion contradictions (such as repetitive and mixed-up posts, clashes on topics of discussion, and discussions being too formal) (see Section 8.5.4).

Boer et al. (2002) suggested that when any intervention is analysed as an activity system in a particular context, its relation to other contextual levels (e.g., the university, the intervention and its outcomes) should also be taken into consideration in order to reveal its temporal interconnectedness. The analytical framework of the situatedness of an activity also resonates quite strongly with the three planes of the socio-cultural framework: participatory appropriation, guided participation, and apprenticeship (Rogoff, 1995); the focus of the socio-cultural activity in this framework is at community/institution, interpersonal and personal levels. Although others have extended and applied Boer et al.'s framework in other contexts such as human-computer interaction, activity-centred design (Gay & Hembrooke, 2004) and the analysis of the situatedness of knowledge sharing (Lichtenstein & Hunter, 2006), none have specifically applied the framework to OCL in the tertiary classroom. Hence, this study applied the use of Boer et al.'s (2002) situatedness of activities in relationship to the development of an analytical framework as relevant and important in the context of understanding the outcomes of OCL. The findings in this study included the outcomes of the OCL intervention at three interconnected levels, highlighted the mediation of artefacts on a broader class contextual level (Section 8.3) followed by the interactions within the OCL intervention (Section 8.4), and the outcomes and constraints of the OCL intervention (Section 8.5). This resonates with Boer et al.'s (2002) idea of the situatedness of knowledge sharing within, and between, different organisational settings (for example the industry at high level, the organisation at middle level and the department at lower level, see Boer et al., 2002).

Additionally, the findings of this study are consistent with current ideas of evaluating the OCL intervention in supporting the students' cognitive, social and emotional development (see Section 4.5), and in particular with the intellectual analysis of OCL (Harasim, 2004). Although Harasim (2004) described three types of intellectual processes (idea generating, idea organising, and intellectual convergence), this research extends its contributions through its analysis of the nature of students' and student group interactions based on the participative, interactive, social and cognitive dimensions in supporting students' cognitive, social and emotional development in the context of an ICT education course in a Malaysian University.

9.5 Conclusion

This study investigated the nature of students' interactions and student group interactions in an online collaborative learning (OCL) intervention that was part of course that also included face-to-face components. In this thesis, OCL was viewed as a socio-cultural activity that focused on supporting the students' cognitive, social and emotional development. The interactions in OCL, in the participative, interactive, social and cognitive dimensions, were a particular case of a socio-cultural perspective and these indicate that students learn from one another, leading to enhanced knowledge and outcomes of learning that can be useful for undergraduate science and ICT education students.

In this study, the socio-cultural learning constructs have been useful in the analysis of the students' interactions in the OCL intervention, based on the participative, interactive, social and cognitive dimensions, and their use has helped broaden the understanding of the nature of OCL. The findings in this study also lend support to Harasim's (2004) idea of OCL intellectual processes, where she recognised the diverse kinds of online collaborative interactions that are beneficial for supporting teaching and learning. This study has contributed to this issue and has identified diverse OCL interactions (see Chapter 6), and the students' group interactions, namely, strategic, task-directed, peripheral and disengaged (see Chapter 7).

At the students' group level of interactions, the affordances of OCL in supporting the students' group work were successful in helping students to engage in a group discussion on a specific topic or problem assigned by the lecturer, through articulating their views and generating a range of divergent perspectives. Through this process, the collaborative interactions were seen to be distributed across all students' groups, rather than divided up among the students (Salomon, 1993; Perkin, 1993). The students' interactions in the OCL groups were in accord with the orientation of the knowledge community (Harasim, 2004; 2012). From the study, it appears that individual students in the OCL groups worked differently and their progress depended on how successfully they interpreted information. Potential constraints from the technology (e.g. Internet connections) or the lack of social and verbal cues (e.g. facial expression) resulted in the students using different working methods of communication for achieving task goals, and using different interaction styles (see Section 7.2.10). The implementation of OCL group interactions into the course also lead to the facilitation of the student group learning process (Graf et al., 2008) as well as supporting the students' cognitive, social and emotional development.

In the OCL intervention, the students' interactions and student group interactions were an important part of the learning process (Bahrami et al., 2007; West-Burnham & Coates, 2005). The central aspect of OCL is the need for a shared space for discourse and interactions, which can be provided by the online learning technologies. Harasim (2012) suggests that an online learning environment equates to a physical classroom, where users can construct knowledge and negotiate meaning through conversation and collaboration, and not just merely transmit information or receive communications (p. 99). The diverse interactions of knowing in this study consisted of sharing and thinking through a process of communication, and by sharing knowledge students could reach a shared understanding of the learning materials under study (Harasim, 2012; Lan, 2009; West-Burnham & Coates, 2005). The findings from this study characterise the nature of the students' interactions in OCL based on the participative, interactive, social and cognitive dimensions in support of the students' cognitive, social and emotional development. From a socio-cultural perspective, the outcomes that arose from the study, therefore, included:

- The socio-cultural learning constructs have been useful as a framework for the analysis of the OCL intervention based on the participative, interactive, social and cognitive dimensions.

- The affordances of the OCL group work helped the students' in their group work.
- The constraints of OCL influence the communication methods, and interaction styles used by students in achieving task goals through group work in the OCL intervention.

In conclusion, through the OCL intervention, the students engaged in an holistic learning process (e.g., problem solving, active learning and collaborative discourse). It appears that OCL has high potential for enhancing learning as it has been shown to help develop students' knowledge, skill and expertise. Using OCL, a student's progress in learning can be monitored as it gives tools for educators, especially the teacher, to shift and customise (or personalise) teaching and learning from the passive form to active form of learning, from a surface learning to a deep learning approach, and from memorising facts and concepts of learning to engaging learning, where the students see the value of learning by participating and interacting in more high level cognitive activity through online collaborative discourse. OCL helps develop student learning (considering cognitive, social and emotional aspects) from that of individualistic and competitive to collective and mutual approaches in valuing contributions of peers as part of knowledge building in the group within the knowledge community. OCL therefore appears to be effective in developing and monitoring student learning by highlighting aspects including:

- Customizing (or personalising) the design of learning online away from acquisition and delivery to focusing on online collaboration within participative, interactive, social and cognitive dimensions.
- Facilitating learning through online collaboration for high level discourse activity.
- Helping students make commitment to learning through joint efforts in order to develop and gain knowledge, confidence and positive attitude towards learning.

This study has shown that OCL can be effective in delivering positive outcomes for learners. The tools used in OCL have particular affordances and constraints and these must be considered in the design of OCL activities. These affordances can be seen through the use of technology, through the design of the learning tasks, and through the pedagogical approach taken in delivering the OCL. The study also showed that OCL can be effective in facilitating online collaboration through customizing (or personalising) the design of online collaboration and learners' interactions within OCL shared goals. OCL shared goals (e.g. intra and inter-group learning tasks) must be designed to foster online collaborations (e.g. intra and inter-group interactions) and to frame learners' online collaboration for learning based on the cognitive, social and emotional aspects. The study revealed positive outcomes for learning were related to learner's cognitive transformation in developing understandings and gaining expertise, learner's social transformation in developing responsibility for their own and others' learning, and learner's emotional transformation in developing positive attitudes, confidence and satisfaction in the course. Students can also develop knowledge and skills and enhance their intra and interpersonal communication skills through delivering ideas, judgments and opinions within the online collaborative discourse. These skills are likely to contribute to their learning which is an important aspect in today‘s challenging world. Graphical representation of a potential holistic approach of the OCL intervention as depicted in this study is shown in Figure 9.1.

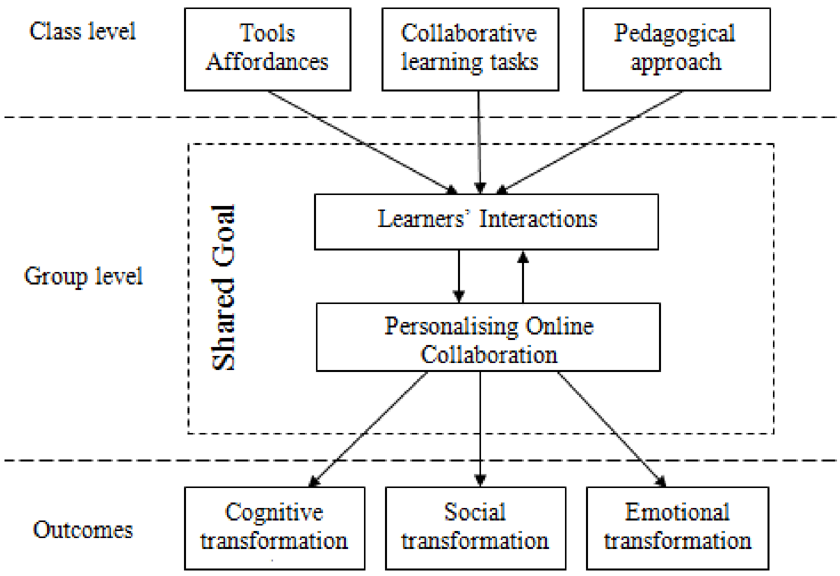


Figure 9.1: The OCL approach: aspects that influence learning and its outcomes

The findings of the study, therefore, have implications for practice especially for the purpose of teaching, for undergraduate science and ICT education students in particular, and pre-service teachers in general. In the following section, the limitations of the study in terms of the methodology used and some practical implications are elaborated upon.

9.6 Limitations of the Study

Any educational studies have some constraints and limitations (Cohen et al., 2000). This study is no exception and has some limitations in terms of the methodology used.

In this study, Activity Theory was used as an initial framework for developing the OCL intervention. Although Activity Theory was useful in providing an initial framework for design, implementation, analysis and evaluation in relation to the context of this study (Yamagata-Lynch, 2010, p.1), Activity Theory did not provide specific categories or theories in a neat and organised manner that the researcher could follow. Instead, Activity Theory provided the researcher with a model with which to organise and understand human activities and interactions within Activity System(s). While it is possible to identify and organise complex, human interactions into organised individual Activity Systems, it is difficult and problematic to organise Activity Systems in a trustworthy and non-arbitrary manner (Yamagata-Lynch, 2010, p. 33), especially for a novice researcher. Thus, this study is limited by the fact that Activity Theory was used for the initial configuration of the research with the aim to provide the structure for the OCL intervention, but not inform the analysis of the evaluation of OCL. The analysis of the OCL intervention used four learning dimensions (participative, interactive, social and cognitive) in supporting students' cognitive, social and emotional development.

In terms of access to participants, this study faced two constraints. Firstly, the researcher was also the instructor of the class for the OCL intervention. While the issues of power and authority were considered (Cohen, et al., 2000), which related to the assessment of the course, it is possible that this position could have influenced the students' interactions in the OCL intervention. Secondly, when the OCL intervention was implemented at the end of December 2009, the researcher had not been notified that the University's Internet and Wi-Fi facilities were undergoing an upgrade which caused frequent interruptions to the Internet connection. It is likely that this situation affected the research outcomes and therefore the study may not have adequately captured the students' full potential interactions in the OCL intervention.

9.7 Implications of the Study

The findings of this study have implications for practice, especially for the purposes of teaching and for undergraduate science and ICT education students, and pre-service teachers to study, together with suggestions for further research.

9.7.1 Implications for practice

The findings from the study indicate and suggest that OCL can be implemented within a Malaysian tertiary classroom. While OCL can help students to learn from one another in the class, it requires preparation in terms of technology and tools, collaborative learning tasks, and the pedagogical approach of OCL.

Since the OCL activities in this study required online collaboration, the technology or the OCL tools that allow for OCL interactions must provide students with quality Internet connections for accessing a wide range of online tools (e.g. forum, chat, instant messaging, quizzes and wiki) and course-related support (e.g. course outline, lecture notes, reading/references and interactive resources, the coursework and online assessment). The Internet provider of the institution (or university) needs to improve and maintain the quality of Internet connection by providing wide coverage of Internet access, high speed Internet access and capacity to download and upload multiple files. The main issue raised by the students in the OCL intervention was related to Internet or Wi-Fi problems. If Internet or Wi-Fi problems cause frequent interruptions for online collaboration, it can hinder students' ability to connect and collaborate. This can also devalue OCL as a valuable learning approach.

The affordances of the OCL tools must be specifically designed to support or host the collaborative learning tasks. The collaborative learning tasks needed to be carefully designed to include an authentic and relevant problem or real-world application and must be able to foster online collaboration (such as intra and inter group collaboration), not just a replication of a problem from an existing source (e.g. textbook). The OCL tasks can also be conducted outside the university and include other actors from a wider setting (e.g. school or industry) to make the online collaboration more interesting and motivating. As commented by some students, this can include off-campus online collaboration that involves various students outside ICT education.

The OCL pedagogical approach embedded in the OCL tasks must be able to encourage students to embrace online collaboration (intra and inter students group collaboration). This can be achieved through training the instructor in facilitating the online collaboration learning process. The instructor plays an important role in engaging students in the OCL activities, and as such introduces them to the OCL process, particularly during reflection. It is important for instructors to be prepared to guide and facilitate students into the learning process. They need to realise that OCL involves learning that focuses less on the acquisition of examination-oriented information and contents and more on social activities for developing student knowledge.

It is suggested that setting up the OCL as an online space for learning can benefit other courses for online teaching and learning. The OCL can add value to learning face to face where the design of online teaching and learning can be customised (or personalised). Students within the OCL space can engage in working with other students by establishing their own interactions in accord with the orientation of the OCL knowledge community. It is proposed that the OCL approach as an online space for teaching and learning can be put into practice across the curriculum at the tertiary level. The sharing of knowledge and reaching understandings resulting from students' online collaborative interactions is an important part of the learning process, through supporting the students' cognitive, social and emotional development.

9.7.2 Suggestions for further research

The findings of this study could be used to facilitate teaching and learning in a tertiary classroom and to enhance online learning. The lack of OCL research in Malaysia, and the Malaysian government's emphasis on the use of online learning and ICT, indicates the necessity for further research.

As this study involved interdisciplinary collaboration between subject major programmes, with both face-to-face and online participation components in a Malaysian university, further research involving various other stakeholders, such as school teachers, instructors, and industry could be conducted. It could even extend to wider global or international stakeholders through technological-based learning (TBL) applications. Different applications of TBL could be adopted at different levels of collaboration in order to further investigate the OCL interactions and their outcomes.

Further possible research includes the design aspects of personalised learning in designing, implementing and evaluating the use of OCL. The different approaches of personalisation, such as a personalised user interface, learning resource, learning activities, guidance and communication (Lan, 2009) could be further investigated. Additionally, approaches to learning, known as learning style, cognitive style, learning strategies, learning patterns or study orchestrations (Case & Marshall, 2009), also bear further investigation in order to understand the effects of personalisation within the context of OCL.

Furthermore add to help understand how to seamlessly integrate OCL into Malaysian tertiary education, further research could be conducted not only into ICT education but also into wider fields including other disciplines of education, such as pure science, technology education, engineering, environments and non-science. These disciplines may require different affordances of OCL and may encourage different types of interactions, as these learning communities may have different characteristics.

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Appendix A

Prof. Dr. Mohd Salleh Bin Abu
Faculty of Education
Universiti Teknology Malaysia
81310 Skudai
Johor, Malaysia 13 August 2009

Dear Prof,

Application for Conducting Research Study in Faculty of Education, Universiti Teknologi Malaysia

I am writing to ask your permission to conduct my research study in the Faculty of Education, Universiti Teknologi Malaysia. This study involves investigating learning through online methods with emphasis on student collaboration within online learning community, and is a PhD project funded by the Ministry of Higher Education, Malaysia. The project aims to investigate online collaborative learning community within the Moodle environment and what this might contribute to student learning. My hope is that the findings from the PhD project can help to facilitate teaching and learning in tertiary education, and particularly in Universiti Teknologi Malaysia.

I would like to research online collaborative learning community in a multimedia education course/class of semester two, 2009/2010 session. I would like to observe and evaluate students' online activities that include discussions (forums & chatting), instant messaging, self-reflection, assessment, collaborative interactions among students and their participations in the online collaborative learning community. I will not be involved in any assessment of work to which the online collaboration would contribute. I would also ask students to complete two anonymous online questionnaires about their experiences and ideas about online learning, one at the start and one at the end of the course, which should take no longer than 30 minutes each to complete. It is expected that at end of my study, students may be asked to participate in a group interview about their experiences in the course that will last no more than 30 minutes. Interviews will be audiotaped and transcribed for analysis purposes.

I would also like to involve up to six colleagues from the Department of Multimedia Education in individual interviews about their experiences and ideas of online collaborative learning community that will last no more than 30 minutes. The interviews would be audiotaped with the lecturer's permission and transcribed. They will be provided with a copy of their own transcript after the interview session for accuracy checking.

Data collected may be used in writing reports, publications or in presentations. I will not use participants' name or the name of the university in any publications or presentations, so all works and ideas will remain anonymous. I will make sure that I store all the information I gather securely. Any invited participant can decline to be involved in the research, and can withdraw from individual involvement in the research at any time. This will mean that no further information will be gathered about their activities and ideas.

I would appreciate you agreeing to grant me permission to conduct this PhD research project in the Faculty of Education, Universiti Teknologi Malaysia. If you need any more details about the project please contact me [email: nihra@utm.my, tel: 0064 021 1568239]. In the event of any issues arising from the research also contact me. If I cannot clarify the issue please contact the chief supervisor supervising this research, Dr. Mike Forret (email: mforret@waikato.ac.nz tel: 64 7 838 4481), or the Director of the CSTER, Dr. Chris Eames at the University of Waikato (email: c.eames@waikato.ac.nz tel: 64 7 838 4357).

If you give consent for this PhD project to be conducted, please sign the attached consent form and please return it to me. Please retain this letter for your information.

Sincerely

Mohd Nihra Haruzuan Bin Mohamad Said

Research Consent Form

I have read the attached letter of information.

I understand that:

1. Participants' participation in the project is voluntary.

2. Participants have the right to decline to be involved and to withdraw at any time.

3. Data may be collected from participants in the Faculty of Education, Universiti Teknologi Malaysia in the ways specified in the accompanying letter. This data will be kept confidential and securely stored.

4. Data obtained from participants in the Faculty of Education, Universiti Teknologi Malaysia during the research project may be used in the writing of reports or published papers and making presentations about the project. This data will be reported without use of my name, the participants' names, or the name of the University.

I can direct any questions to Mohd Nihra Haruzuan Mohamad Said [email: nihra@utm.my, tel: 0127127140]

For any unresolved issues I can contact chief supervisor supervising this research, Dr. Mike Forret (email: mforret@waikato.ac.nz, tel: 0064 7 838 4481), or the Director of the CSTER, Dr. Chris Eames at the University of Waikato (email: c.eames@waikato.ac.nz, tel: 0064 7 838 4357).

I give my consent for this PhD project to be conducted under the conditions set out above.

Name: ______________________

Signed: PROF. DR. MOHD. SALLEH BIN ABU
Dean
Faculty of Education

Date: Universiti Teknologi Malaysia
81310 UTM Skudai, Johor
24/08/2009

Please return this form to Mohd Nihra Haruzuan Bin Mohamad Said.
Thank you.

Appendix B

Participating instructor's consent form

14th December 2009

Dear instructor,

I am writing to ask your permission to include you in my research study. This study involves investigating learning through online methods with emphasis on student collaboration within an online group discussion and is a PhD project funded by the Ministry of Higher Education, Malaysia. The project aims to investigate learning online through collaborative methods within Moodle environment and what this might contribute to student learning. My hope is that findings from the PhD project can help to facilitate teaching and learning in tertiary education, and particularly in Universiti Teknologi Malaysia. The Dean of the Faculty of Education, Universiti Teknologi Malaysia has granted me permission to conduct the research and I would like to involve you.

I would like to involve you in an interview about your experiences and ideas of online learning that will last no more than 30 minutes. The interview would be audiotaped with your permission and transcribed. You will be provided with a copy of your own transcript after the interview session for accuracy checking. Data collected from you may be used in writing reports, publications or in presentations. I will not use your name or the name of the faculty and university in any publications or presentations, so your work and ideas will remain anonymous. I will make sure that I store all the information I gather securely. You can decline to be involved in the research, and can withdraw from individual involvement in the research at any time. This will mean that no further information will be gathered about your activities and ideas.

I would appreciate you agreeing to be involved with this PhD research project. If you need any more details about the project please contact me [email: mnhm2@waikato.ac.nz, tel: 012-7127140]. In the event of any issues arising from the research also contact me. If I cannot clarify the issue please contact the chief supervisor supervising this research, Dr. Mike Forret [email: mforret@waikato.ac.nz, tel: +647 8384481], or the Director of the CSTER, Dr. Chris Eames at the University of Waikato [email: c.eames@waikato.ac.nz, tel: +647 8384357].If you give consent for to be involved, please sign the attached consent form and please return it to me in the envelope provided. Please retain this letter for your information.

Sincerely

Mohd Nihra Haruzuan Mohamad Said

Instructor's consent form

I have read the attached letter of information.

I understand that:

1. My participation in the project is voluntary.

2. I have the right to withdraw at any time.

3. Data may be collected from me in the ways specified in the accompanying letter. This data will be kept confidential and securely stored.

4. Data obtained from me during the research project may be used in the writing of reports or published papers and making presentations about the project. This data will be reported without use of my name.

I can direct any questions to Mohd Nihra Haruzuan Bin Mohamad Said [email: mnhm2@waikato.ac.nz, tel: +60211568239].

For any unresolved issues I can contact chief supervisor supervising this research, Dr. Mike Forret [email: mforret@waikato.ac.nz, tel: +647 838 4481], or the Director of the CSTER, Dr. Chris Eames at the University of Waikato [email: c.eames@waikato.ac.nz, tel: +647 838 4357].

I give my consent to be involved in the project under the conditions set out above.

Name: ___________________________

Signed: __________________________

Date: ____________________________

Please return this form to Mohd Nihra Haruzuan Bin Mohamad Said.
Thank you.

Appendix C

Participating student's consent form

14th December 2009

Dear student,

I am writing to ask your permission to include you in my research study. This study involves investigating learning through online methods with emphasis on student collaboration within an online group discussion and is a PhD project funded by the Ministry of Higher Education, Malaysia. The project aims to investigate online learning through collaborative methods within Elearning (Moodle) environment and what this might contribute to student learning. My hope is that findings from the PhD project can help to facilitate teaching and learning in tertiary education, and particularly in Universiti Teknologi Malaysia. The Dean of the Faculty of Education, Universiti Teknologi Malaysia has granted me permission to conduct the research and I would like to involve you.

I will be researching online learning in this class. I plan to observe and evaluate your online activities that include discussions (forums & chatting), instant messaging, self-reflection (online journal) and assessment, collaborative interactions between you and your classmates and your participation in the online learning environment in this class. I would also ask you to complete two anonymous online questionnaires about your experiences and ideas about online learning, one at the start and one at the end of the course, which should take no longer than 30 minutes each to complete. It is expected that at end of my study, you may be asked to participate in online semi-structured group interviews and face-to-face group interviews about your experiences in the course that will last no more than 30 minutes. Face-to-face interviews will be audio taped and transcribed for analysis purposes.

Data collected from you may be used in writing reports, publications or in presentations. I will not use your name or the name of the faculty and university in any publications or presentations, so your work and ideas will remain anonymous. I will make sure that I store all the information I gather securely. You can decline to be involved in the research, and can withdraw from individual involvement in the research at any time. This will mean that no further information will be gathered about your activities and ideas.

I would appreciate you agreeing to be involved with this PhD research project. If you need any more details about the project please contact me [email: mnhm2@waikato.ac.nz, tel: 012-7127140]. In the event of any issues arising from the research also contact me. If I cannot clarify the issue please contact the chief supervisor supervising this research, Dr. Mike Forret [email: mforret@waikato.ac.nz, tel: +647 8384481], or the Director of the CSTER, Dr. Chris Eames at the University of Waikato [email: c.eames@waikato.ac.nz, tel: +647 8384357].

If you give consent to be involved, please sign the attached consent form and please return it to me in the envelope provided. Please retain this letter for your information.

Sincerely,

Mohd Nihra Haruzuan Bin Mohamad Said

Student's consent form

I have read the attached letter of information.

I understand that:

1. My participation in the project is voluntary.

2. I have the right to withdraw at any time.

3. Data may be collected from me in the ways specified in the accompanying letter. This data will be kept confidential and securely stored.

4. Data obtained from me during the research project may be used in the writing of reports or published papers and making presentations about the project. This data will be reported without use of my name.

I can direct any questions to Mohd Nihra Haruzuan Bin Mohamad Said [email: mnhm2@waikato.ac.nz, tel: +60211568239].

For any unresolved issues I can contact chief supervisor supervising this research, Dr. Mike Forret [email: mforret@waikato.ac.nz, tel: +647 838 4481], or the Director of the CSTER, Dr. Chris Eames at the University of Waikato [email: c.eames@waikato.ac.nz, tel: +647 838 4357].

I give my consent to be involved in the project under the conditions set out above.

Name: ___________________________

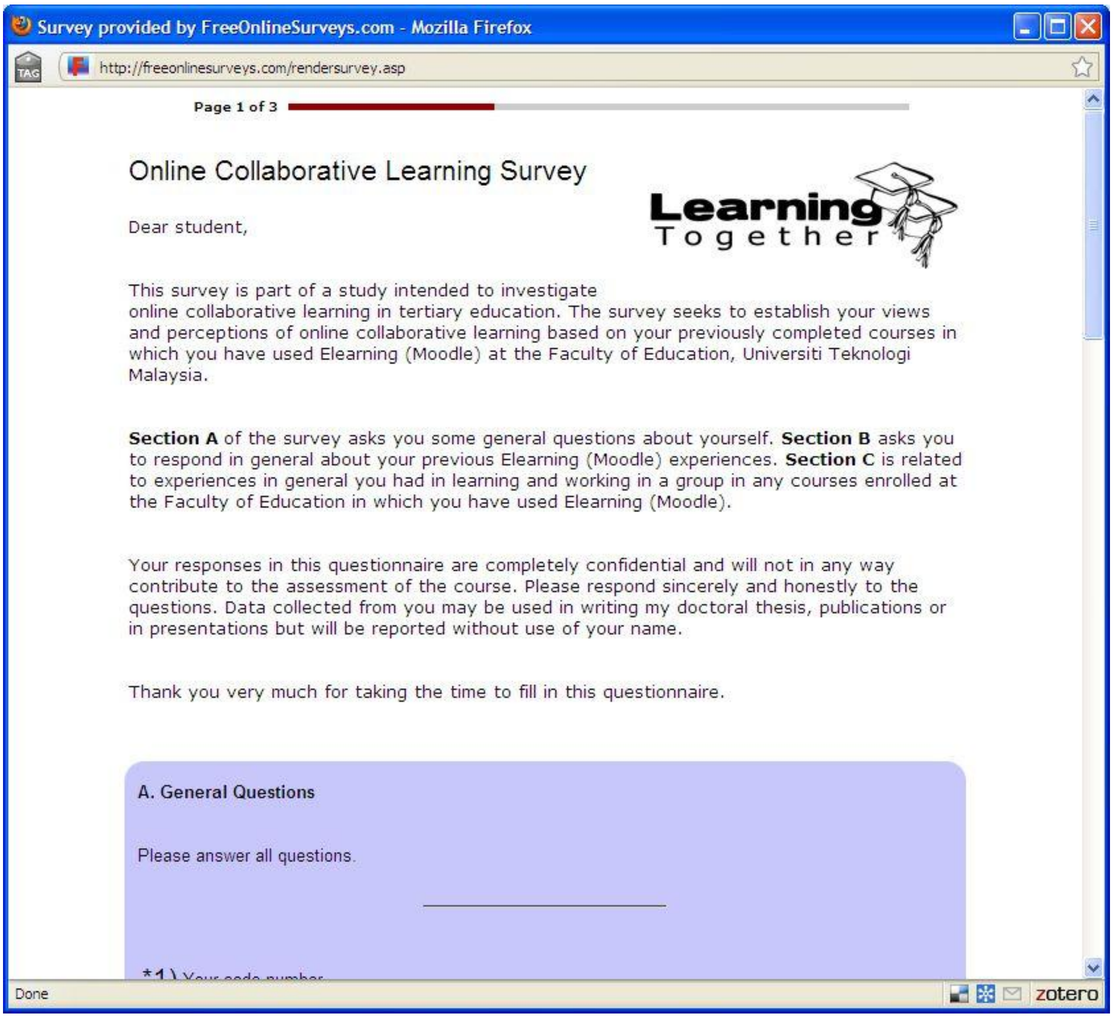
Signed: __________________________

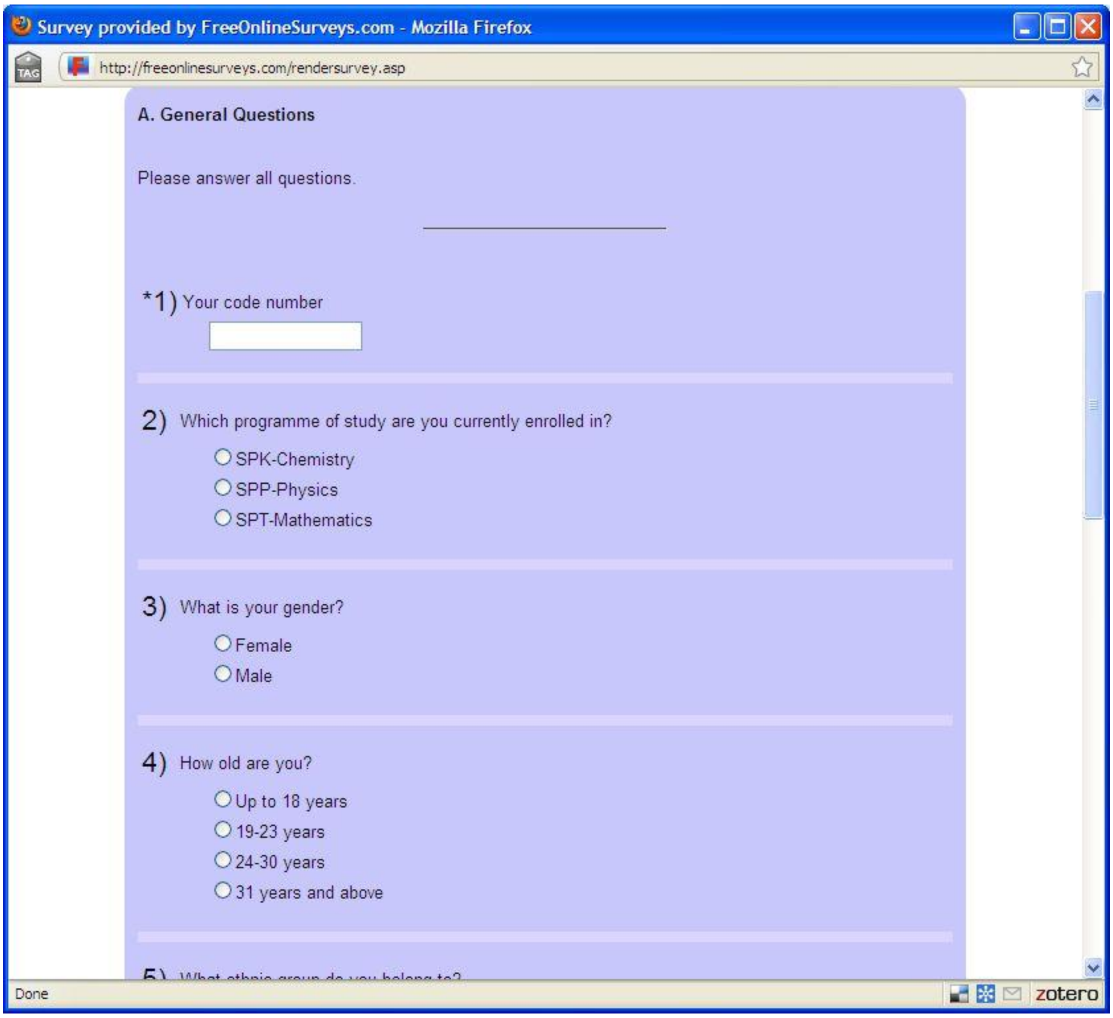
Date: ____________________________

Please return this form to Mohd Nihra Haruzuan Bin Mohamad Said.
Thank you.

Appendix D

Information for student's online survey (Pre)





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A. General Questions

Please answer all questions.

*1) Your code number

2) Which programme of study are you currently enrolled in?

- SPK-Chemistry
- SPP-Physics
- SPT-Mathematics

3) What is your gender?

- Female
- Male

4) How old are you?

- Up to 18 years
- 19-23 years
- 24-30 years
- 31 years and above

5) What ethnic group do you belong to?

Done

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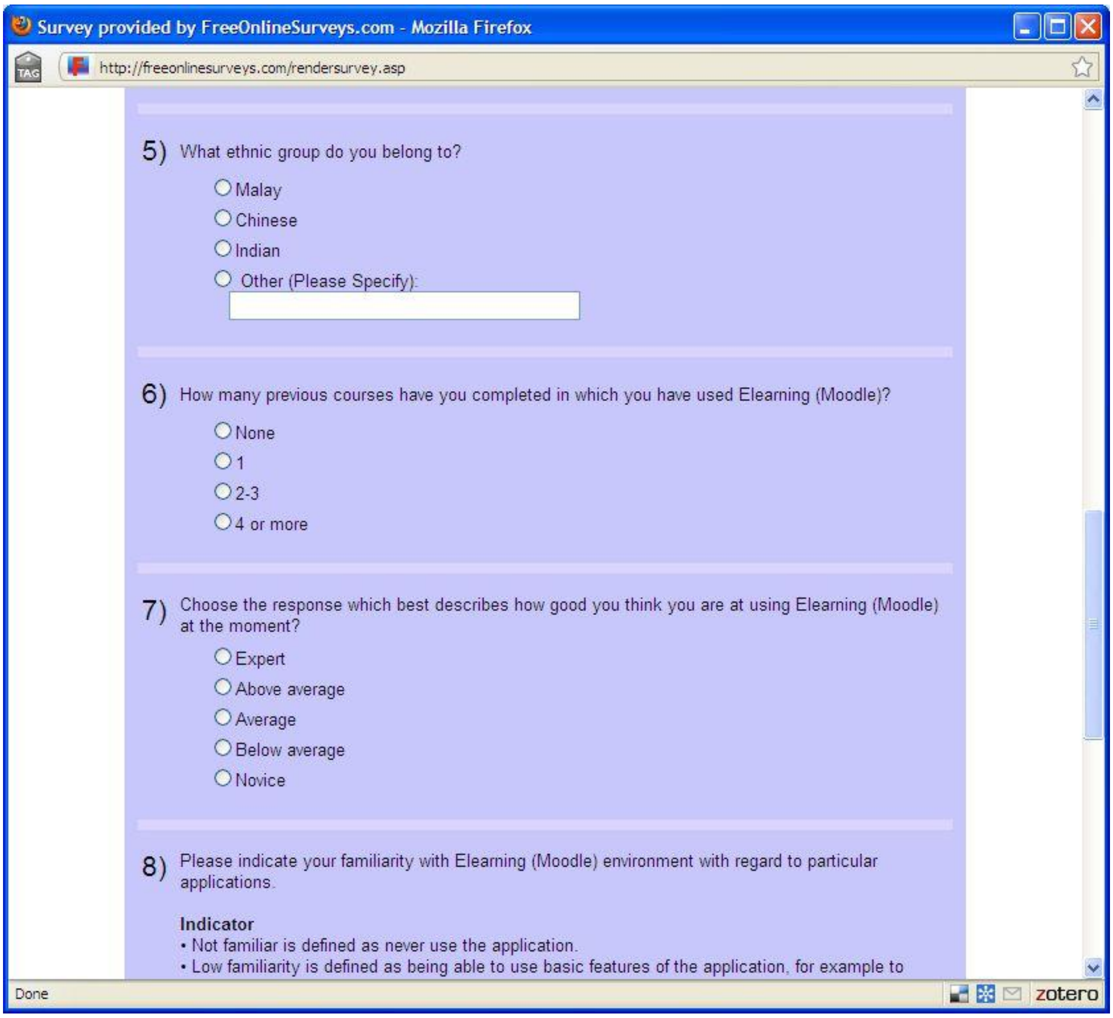

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5) What ethnic group do you belong to?

- ○ Malay
- ○ Chinese
- ○ Indian
- ○ Other (Please Specify):

6) How many previous courses have you completed in which you have used Elearning (Moodle)?

- ○ None
- ○ 1
- ○ 2-3
- ○ 4 or more

7) Choose the response which best describes how good you think you are at using Elearning (Moodle) at the moment?

- ○ Expert
- ○ Above average
- ○ Average
- ○ Below average
- ○ Novice

8) Please indicate your familiarity with Elearning (Moodle) environment with regard to particular applications.

Indicator
• Not familiar is defined as never use the application.
• Low familiarity is defined as being able to use basic features of the application, for example to

Done

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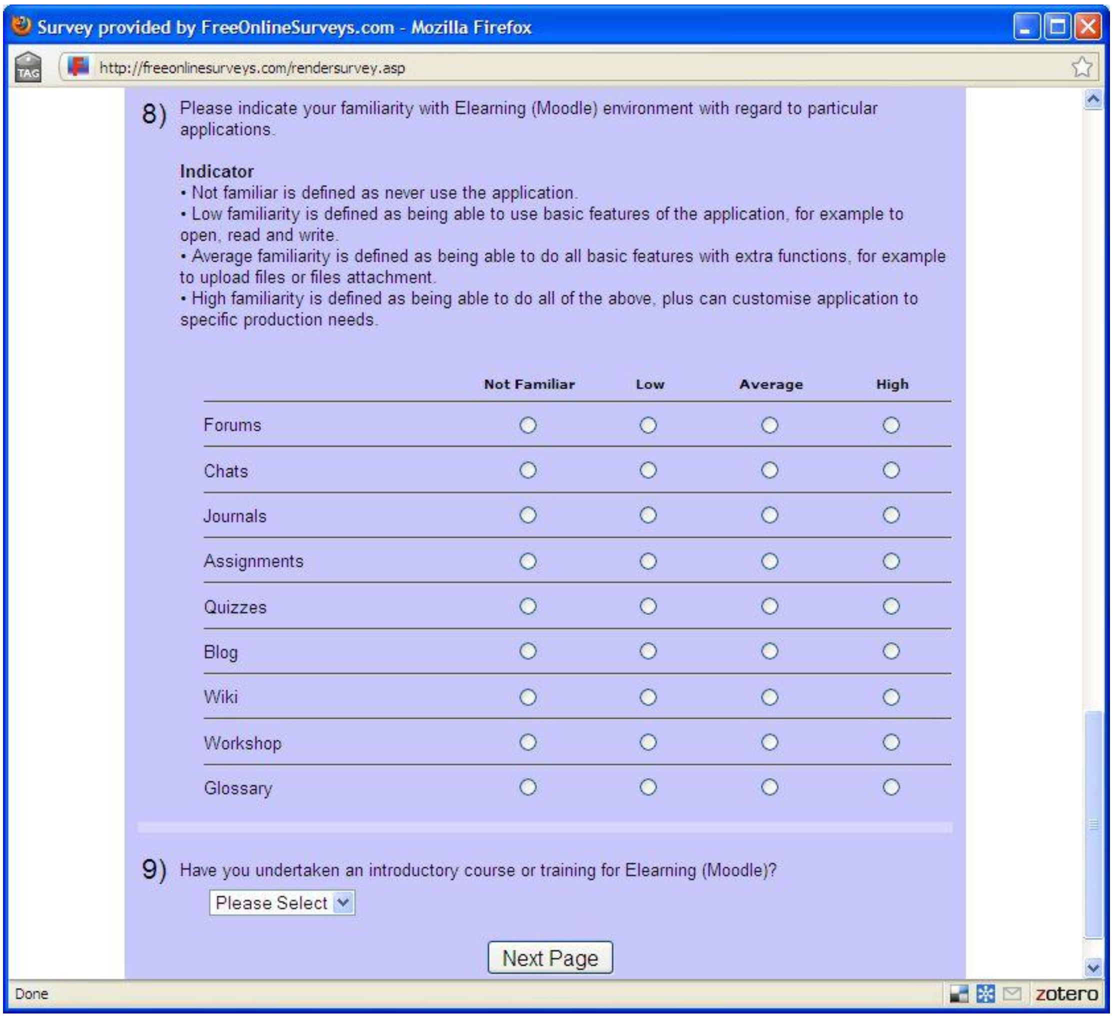

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8) Please indicate your familiarity with Elearning (Moodle) environment with regard to particular applications.

Indicator

- Not familiar is defined as never use the application.
- Low familiarity is defined as being able to use basic features of the application, for example to open, read and write.
- Average familiarity is defined as being able to do all basic features with extra functions, for example to upload files or files attachment.
- High familiarity is defined as being able to do all of the above, plus can customise application to specific production needs.

	Not Familiar	Low	Average	High
Forums	○	○	○	○
Chats	○	○	○	○
Journals	○	○	○	○
Assignments	○	○	○	○
Quizzes	○	○	○	○
Blog	○	○	○	○
Wiki	○	○	○	○
Workshop	○	○	○	○
Glossary	○	○	○	○

9) Have you undertaken an introductory course or training for Elearning (Moodle)?

Please Select

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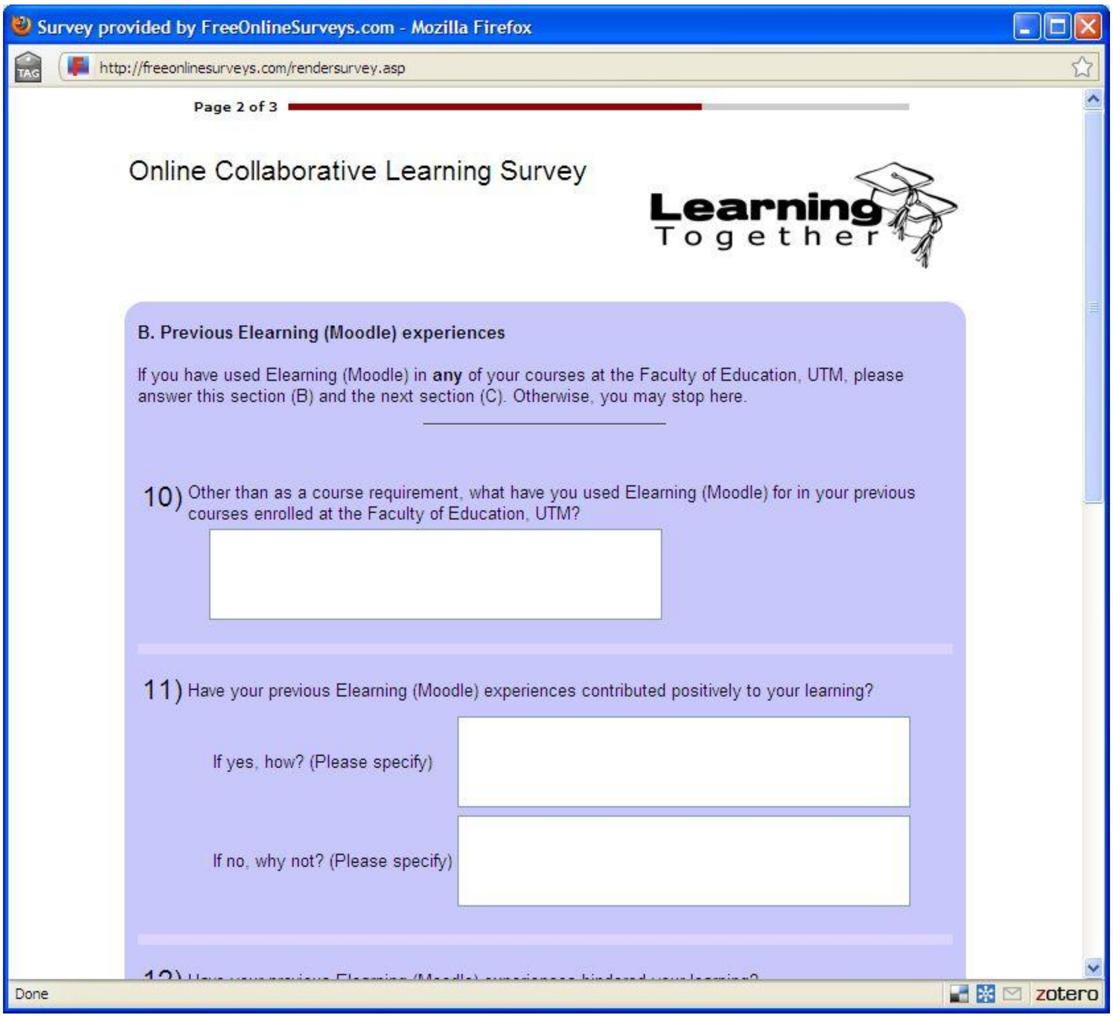
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Online Collaborative Learning Survey

Learning Together

B. Previous Elearning (Moodle) experiences

If you have used Elearning (Moodle) in **any** of your courses at the Faculty of Education, UTM, please answer this section (B) and the next section (C). Otherwise, you may stop here.

10) Other than as a course requirement, what have you used Elearning (Moodle) for in your previous courses enrolled at the Faculty of Education, UTM?

11) Have your previous Elearning (Moodle) experiences contributed positively to your learning?

If yes, how? (Please specify)

If no, why not? (Please specify)

Done

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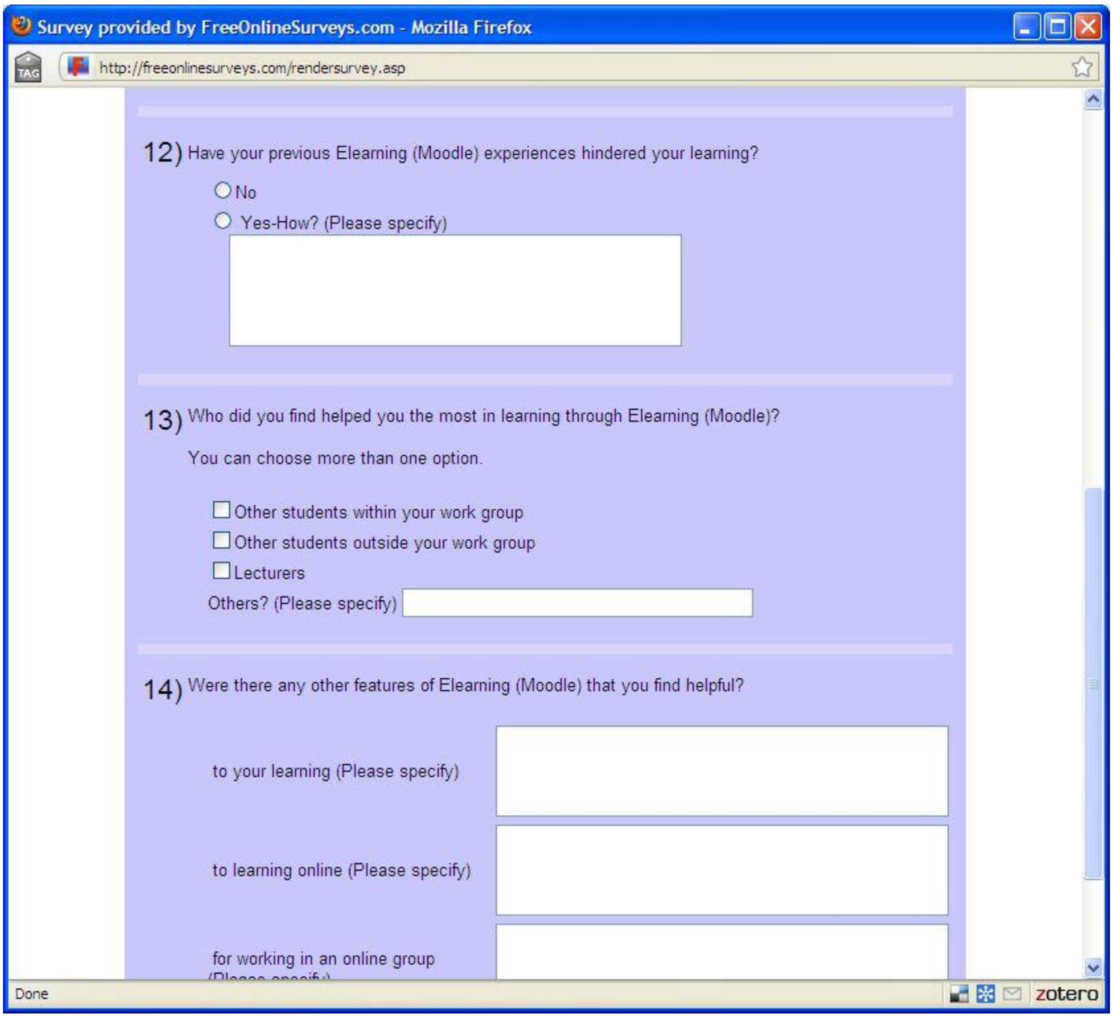

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12) Have your previous Elearning (Moodle) experiences hindered your learning?

- No
- Yes-How? (Please specify)

13) Who did you find helped you the most in learning through Elearning (Moodle)?

You can choose more than one option.

- Other students within your work group
- Other students outside your work group
- Lecturers

Others? (Please specify)

14) Were there any other features of Elearning (Moodle) that you find helpful?

to your learning (Please specify)

to learning online (Please specify)

for working in an online group (Please specify)

Done

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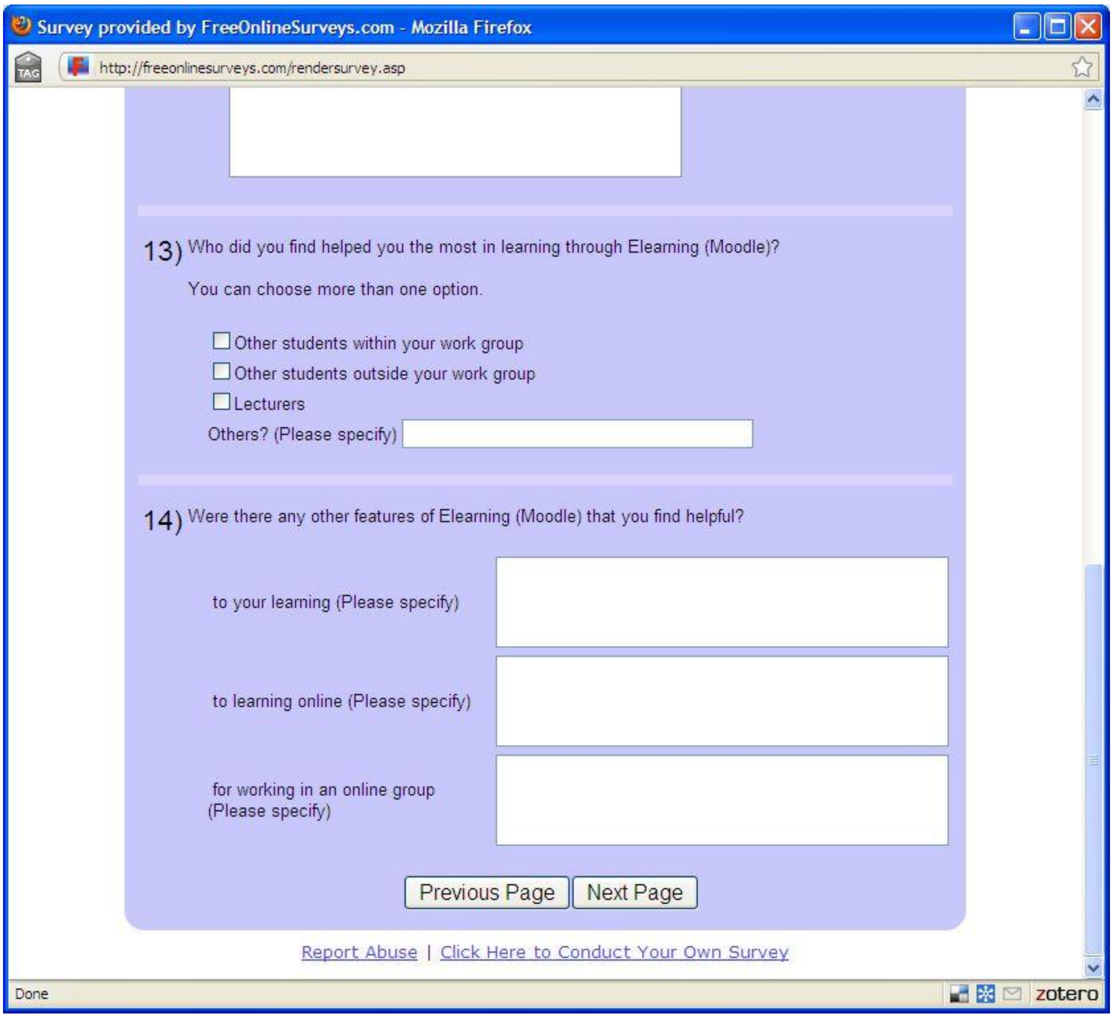
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13) Who did you find helped you the most in learning through Elearning (Moodle)?
You can choose more than one option.
Other students within your work group
Other students outside your work group
Lecturers
Others? (Please specify)
14) Were there any other features of Elearning (Moodle) that you find helpful?
to your learning (Please specify)
to learning online (Please specify)
for working in an online group (Please specify)
Previous Page
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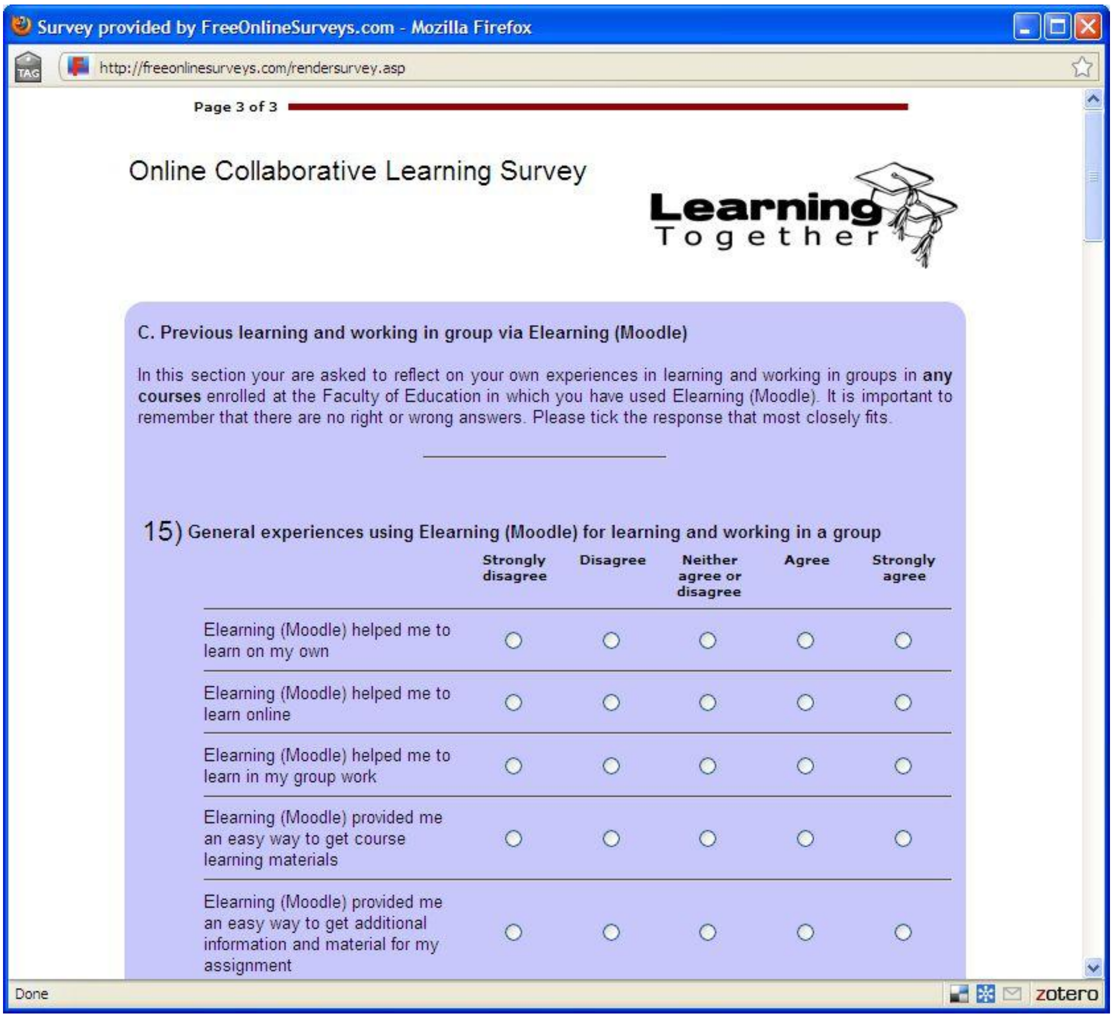

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Online Collaborative Learning Survey

Learning Together

C. Previous learning and working in group via Elearning (Moodle)

In this section your are asked to reflect on your own experiences in learning and working in groups in **any courses** enrolled at the Faculty of Education in which you have used Elearning (Moodle). It is important to remember that there are no right or wrong answers. Please tick the response that most closely fits.

15) **General experiences using Elearning (Moodle) for learning and working in a group**

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
Elearning (Moodle) helped me to learn on my own	○	○	○	○	○
Elearning (Moodle) helped me to learn online	○	○	○	○	○
Elearning (Moodle) helped me to learn in my group work	○	○	○	○	○
Elearning (Moodle) provided me an easy way to get course learning materials	○	○	○	○	○
Elearning (Moodle) provided me an easy way to get additional information and material for my assignment	○	○	○	○	○

Done

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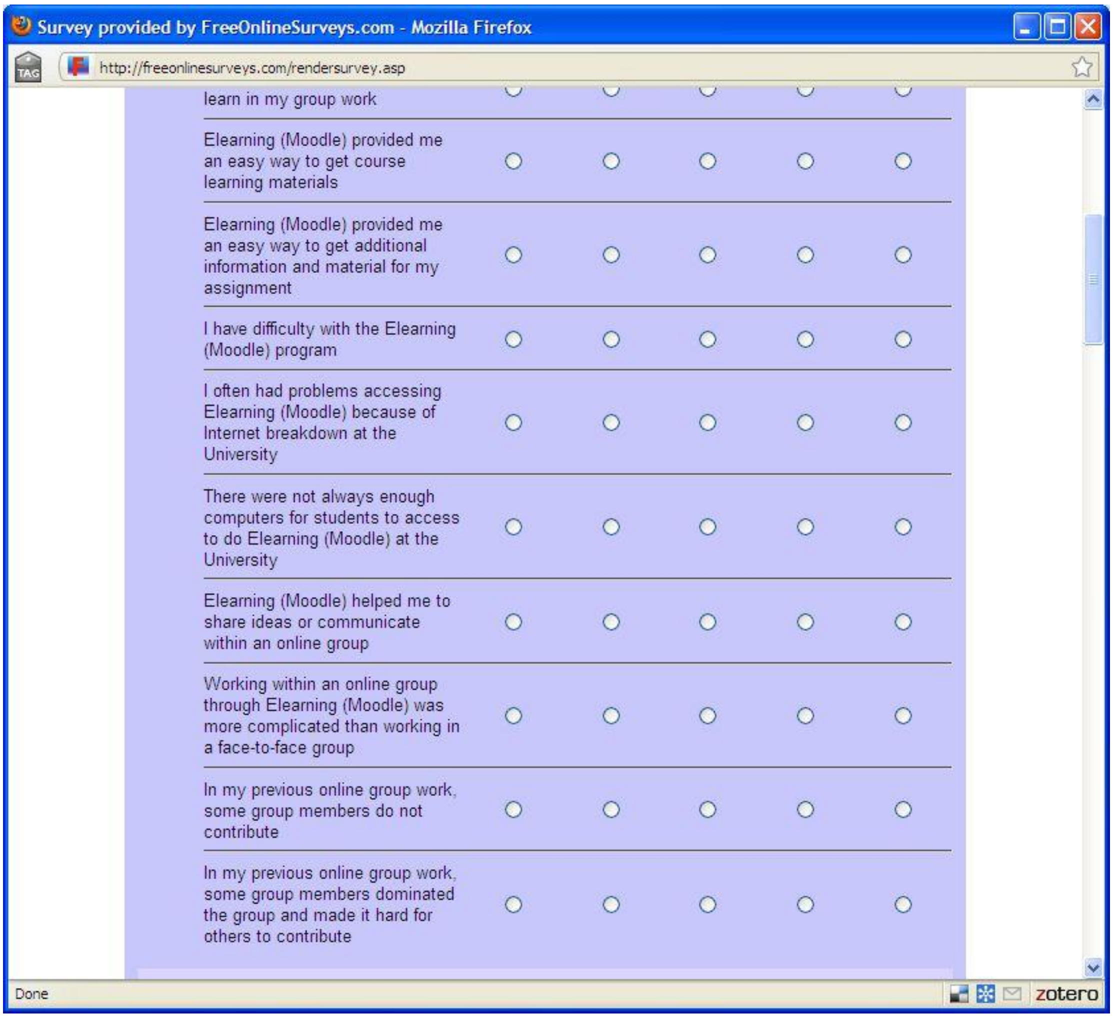
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learn in my group work

Elearning (Moodle) provided me an easy way to get course learning materials

Elearning (Moodle) provided me an easy way to get additional information and material for my assignment

I have difficulty with the Elearning (Moodle) program

I often had problems accessing Elearning (Moodle) because of Internet breakdown at the University

There were not always enough computers for students to access to do Elearning (Moodle) at the University

Elearning (Moodle) helped me to share ideas or communicate within an online group

Working within an online group through Elearning (Moodle) was more complicated than working in a face-to-face group

In my previous online group work, some group members do not contribute

In my previous online group work, some group members dominated the group and made it hard for others to contribute

Done

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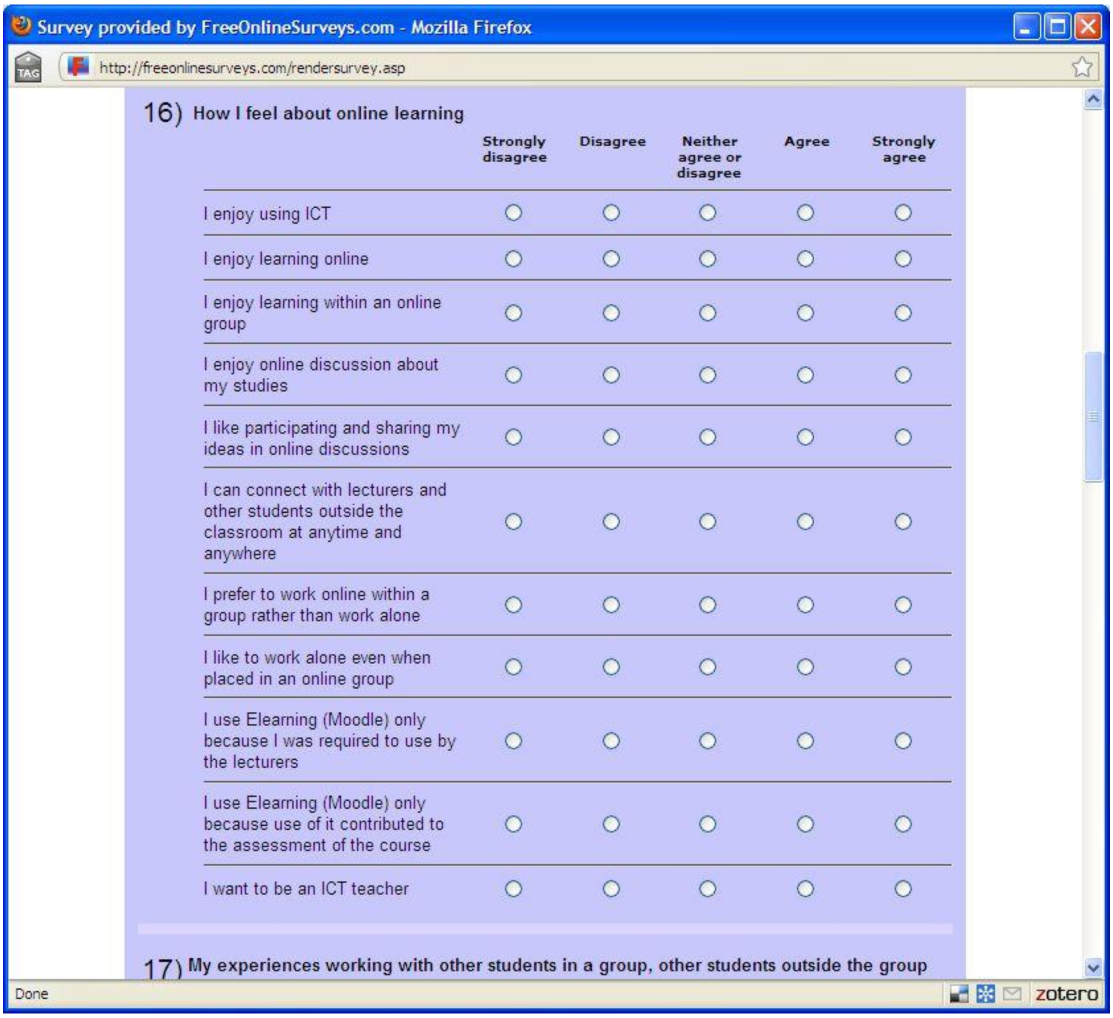

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16) How I feel about online learning

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
I enjoy using ICT	○	○	○	○	○
I enjoy learning online	○	○	○	○	○
I enjoy learning within an online group	○	○	○	○	○
I enjoy online discussion about my studies	○	○	○	○	○
I like participating and sharing my ideas in online discussions	○	○	○	○	○
I can connect with lecturers and other students outside the classroom at anytime and anywhere	○	○	○	○	○
I prefer to work online within a group rather than work alone	○	○	○	○	○
I like to work alone even when placed in an online group	○	○	○	○	○
I use Elearning (Moodle) only because I was required to use by the lecturers	○	○	○	○	○
I use Elearning (Moodle) only because use of it contributed to the assessment of the course	○	○	○	○	○
I want to be an ICT teacher	○	○	○	○	○

17) My experiences working with other students in a group, other students outside the group

Done

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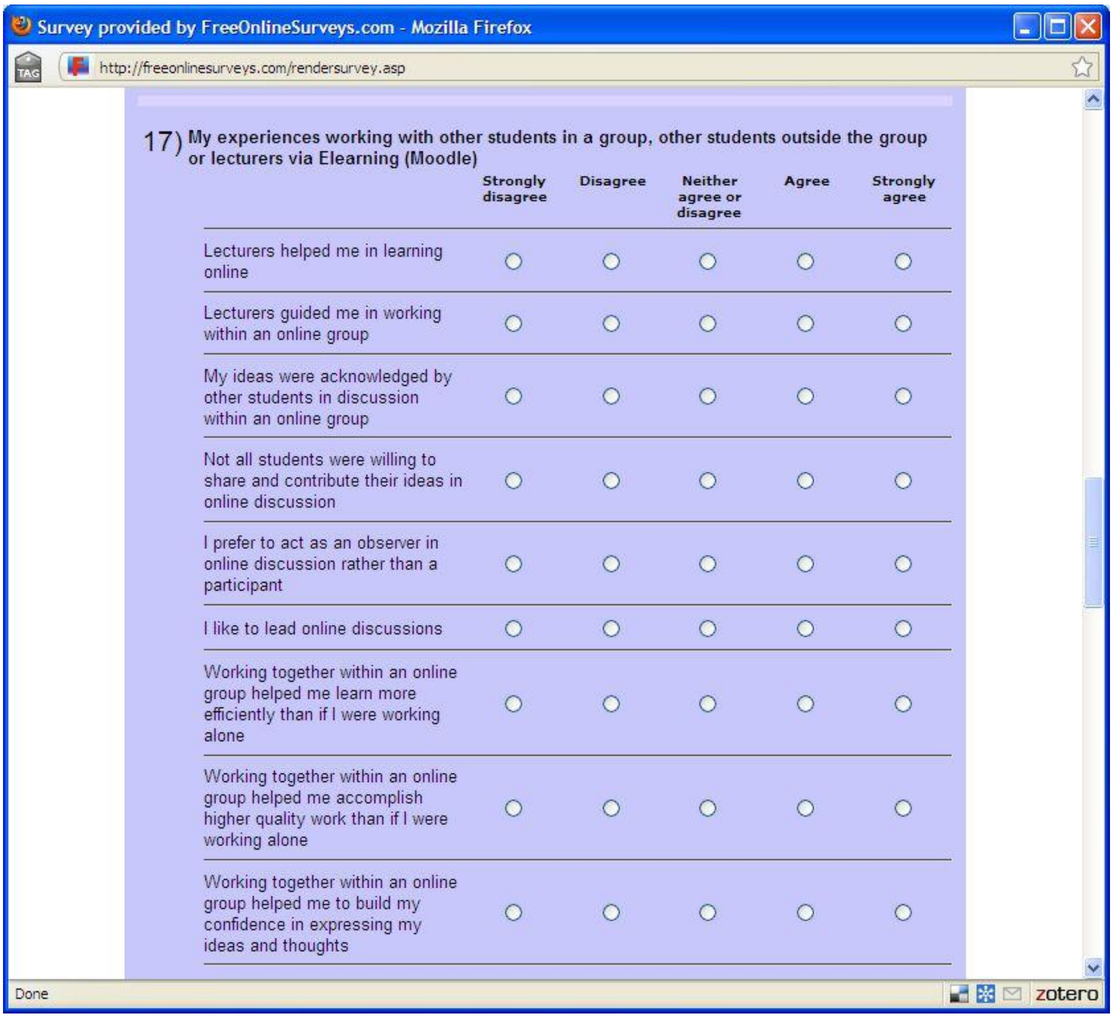
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17) My experiences working with other students in a group, other students outside the group or lecturers via Elearning (Moodle)

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
Lecturers helped me in learning online	○	○	○	○	○
Lecturers guided me in working within an online group	○	○	○	○	○
My ideas were acknowledged by other students in discussion within an online group	○	○	○	○	○
Not all students were willing to share and contribute their ideas in online discussion	○	○	○	○	○
I prefer to act as an observer in online discussion rather than a participant	○	○	○	○	○
I like to lead online discussions	○	○	○	○	○
Working together within an online group helped me learn more efficiently than if I were working alone	○	○	○	○	○
Working together within an online group helped me accomplish higher quality work than if I were working alone	○	○	○	○	○
Working together within an online group helped me to build my confidence in expressing my ideas and thoughts	○	○	○	○	○

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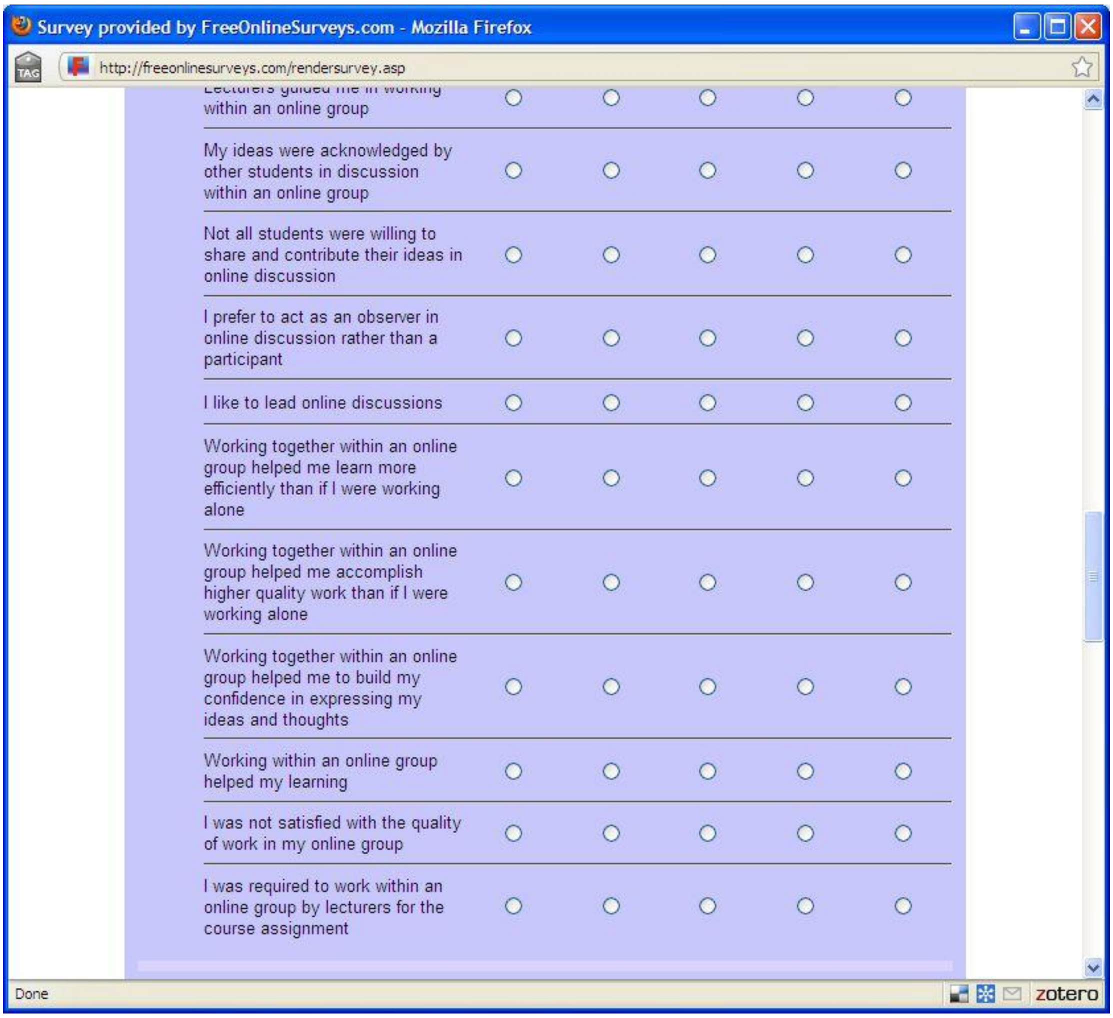
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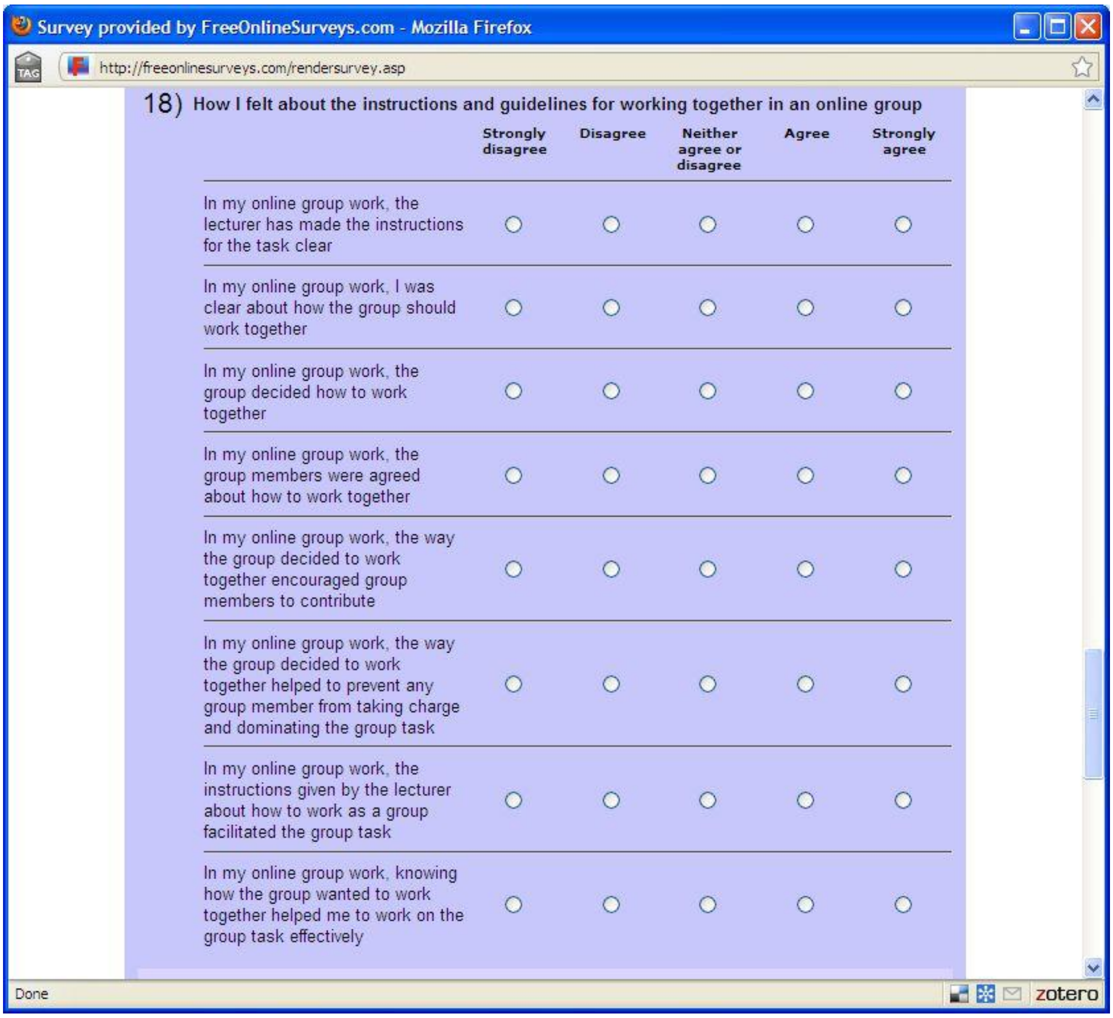
Lecturers guided me in working within an online group	○	○	○	○	○
My ideas were acknowledged by other students in discussion within an online group	○	○	○	○	○
Not all students were willing to share and contribute their ideas in online discussion	○	○	○	○	○
I prefer to act as an observer in online discussion rather than a participant	○	○	○	○	○
I like to lead online discussions	○	○	○	○	○
Working together within an online group helped me learn more efficiently than if I were working alone	○	○	○	○	○
Working together within an online group helped me accomplish higher quality work than if I were working alone	○	○	○	○	○
Working together within an online group helped me to build my confidence in expressing my ideas and thoughts	○	○	○	○	○
Working within an online group helped my learning	○	○	○	○	○
I was not satisfied with the quality of work in my online group	○	○	○	○	○
I was required to work within an online group by lecturers for the course assignment	○	○	○	○	○

Done zotero



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18) **How I felt about the instructions and guidelines for working together in an online group**

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
In my online group work, the lecturer has made the instructions for the task clear	○	○	○	○	○
In my online group work, I was clear about how the group should work together	○	○	○	○	○
In my online group work, the group decided how to work together	○	○	○	○	○
In my online group work, the group members were agreed about how to work together	○	○	○	○	○
In my online group work, the way the group decided to work together encouraged group members to contribute	○	○	○	○	○
In my online group work, the way the group decided to work together helped to prevent any group member from taking charge and dominating the group task	○	○	○	○	○
In my online group work, the instructions given by the lecturer about how to work as a group facilitated the group task	○	○	○	○	○
In my online group work, knowing how the group wanted to work together helped me to work on the group task effectively	○	○	○	○	○

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http://freeonlinesurveys.com/rendersurvey.asp

19) **How I felt about tasks being divided and distributed between group members within an online group**

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
The lecturer clearly explained the way to divide and distribute the task between group members	○	○	○	○	○
The group task was well divided and distributed between group members	○	○	○	○	○
The group members agreed about how the group task was divided and distributed	○	○	○	○	○
The group members agreed with the individual roles and responsibilities to be held for the group task	○	○	○	○	○
Group members were aware of the group task	○	○	○	○	○
Group members were involved in group decision making	○	○	○	○	○
Group members were involved in group task accomplishment	○	○	○	○	○
A group leader took charge of ensuring completion of the group task	○	○	○	○	○
I did not feel involved in a group achievement of the task because other group members took charge	○	○	○	○	○
Knowing my role and responsibilities in the group task	○	○	○	○	○

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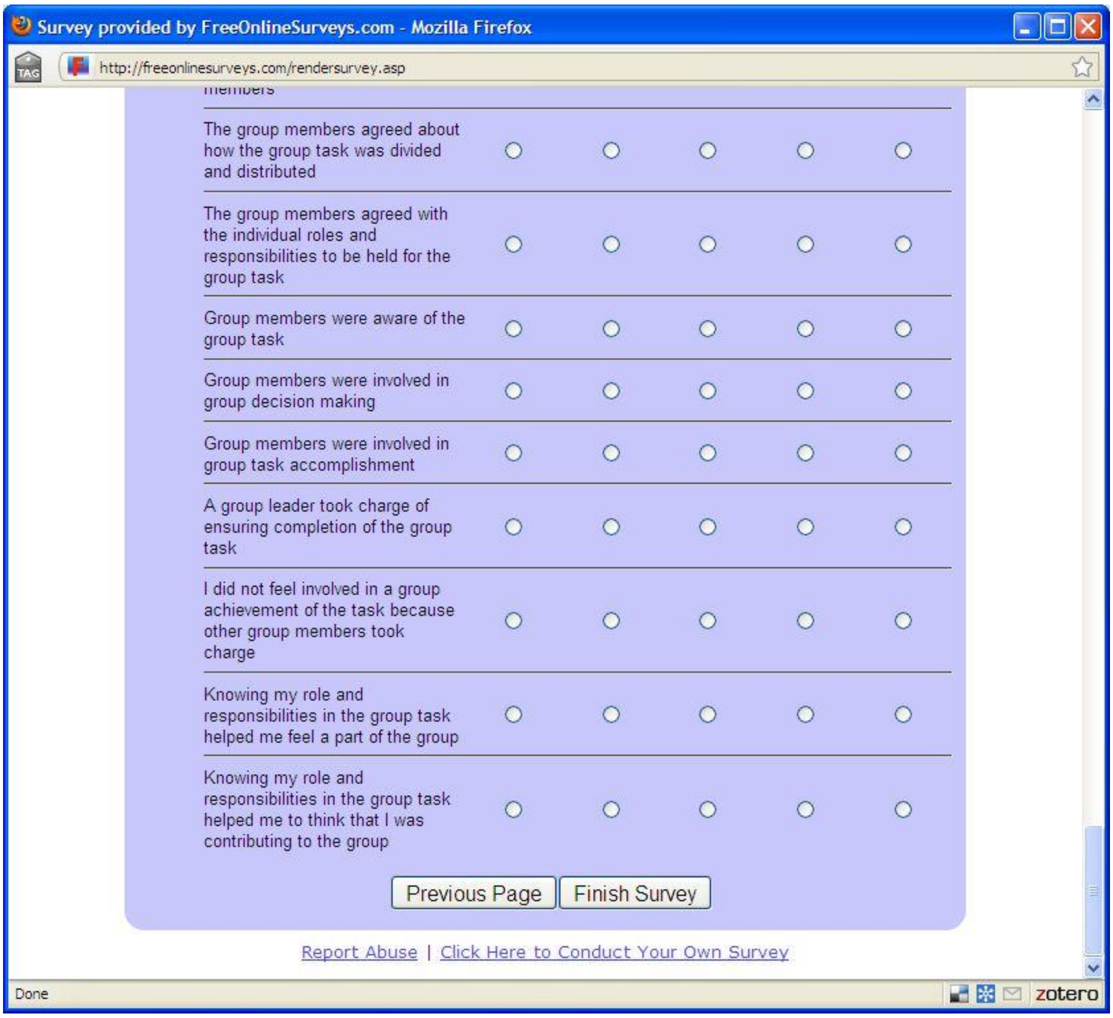
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members

The group members agreed about how the group task was divided and distributed	○	○	○	○	○
The group members agreed with the individual roles and responsibilities to be held for the group task	○	○	○	○	○
Group members were aware of the group task	○	○	○	○	○
Group members were involved in group decision making	○	○	○	○	○
Group members were involved in group task accomplishment	○	○	○	○	○
A group leader took charge of ensuring completion of the group task	○	○	○	○	○
I did not feel involved in a group achievement of the task because other group members took charge	○	○	○	○	○
Knowing my role and responsibilities in the group task helped me feel a part of the group	○	○	○	○	○
Knowing my role and responsibilities in the group task helped me to think that I was contributing to the group	○	○	○	○	○

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Appendix E

Information for student's online survey (Post)

Page 1 of 2

Online Collaborative Learning Survey

Learning Together

Post-Course Online Survey - Learning and working in a group via eLearning (UTM) SPM 2322 Authoring Language

You are asked to reflect on your own experiences in learning and working in groups (Group Task 1, 2 & 3) through eLearning (UTM) in SPM 2322 Authoring Language. It is important to remember that there are no right or wrong answers. Please tick the response that most closely fits.

Thank you very much for taking the time to fill in this questionnaire.

*1) Your code number

2) Which programme of study are you currently enrolled in?

- ○ SPK-Chemistry
- ○ SPP-Physics
- ○ SPT-Mathematics

3) What is your gender?

- ○ Male
- ○ Female

2) Which programme of study are you currently enrolled in?

- ○ SPK-Chemistry
- ○ SPP-Physics
- ○ SPT-Mathematics

3) What is your gender?

- ○ Male
- ○ Female

4) How old are you?

- ○ Up to 18 years
- ○ 19-23 years
- ○ 24-30 years
- ○ 31 years and above

5) What ethnic group do you belong to?

- ○ Malay
- ○ Chinese
- ○ Indian
- ○ Other (Please Specify):

Next Page

6) **General experiences using eLearning (UTM) for learning and working in a group in SPM 2322 Authoring Language**

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
eLearning (UTM) helped me to learn on my own	○	○	○	○	○
eLearning (UTM) helped me to learn online	○	○	○	○	○
eLearning (UTM) helped me to learn in my group work	○	○	○	○	○
eLearning (UTM) provided me an easy way to get course learning materials	○	○	○	○	○
eLearning (UTM) provided me an easy way to get additional information and material for my assignment	○	○	○	○	○
eLearning (UTM) helped me to share ideas or communicate within an online group	○	○	○	○	○
Working within an online group through eLearning (UTM) was more complicated than working in a face-to-face group	○	○	○	○	○
In my previous online group work, some group members do not contribute	○	○	○	○	○
In my previous online group work, some group members dominated the group and made it hard for others to contribute	○	○	○	○	○
I have difficulty with the eLearning (UTM)) program	○	○	○	○	○
I often had problems accessing eLearning (UTM) because of Internet breakdown at the University	○	○	○	○	○
There were not always enough computers for students to access to do eLearning (UTM) at the University	○	○	○	○	○

7) **How I feel about learning through eLearning (UTM) in SPM 2322 Authoring Language**

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
I enjoy using ICT	○	○	○	○	○
I enjoy learning online	○	○	○	○	○
I enjoy learning within an online group	○	○	○	○	○
I enjoy online discussion about my studies	○	○	○	○	○
I like participating and sharing my ideas in online discussions	○	○	○	○	○
I can connect with lecturers and other students outside the classroom at anytime and anywhere	○	○	○	○	○
I prefer to work online within a group rather than work alone	○	○	○	○	○
I like to work alone even when placed in an online group	○	○	○	○	○
I use eLearning (UTM) only because I was required to use by the lecturers	○	○	○	○	○
I use eLearning (UTM) only because use of it contributed to the assessment of the course	○	○	○	○	○
I want to be an ICT teacher	○	○	○	○	○

8) **My experiences working with other students in a group, other students outside the group or lecturers via eLearning (UTM) in SPM 2322 Authoring Language**

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
Lecturers helped me in learning online	○	○	○	○	○
Lecturers guided me in working within an online group	○	○	○	○	○

8) My experiences working with other students in a group, other students outside the group or lecturers via eLearning (UTM) in SPM 2322 Authoring Language

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
Lecturers helped me in learning online					
Lecturers guided me in working within an online group					
I like to lead online discussions					
I prefer to act as an observer in online discussion rather than a participant					
I was required to work within an online group by lecturers for the course assignment					
My ideas were acknowledged by other students in discussion within an online group					
Not all students were willing to share and contribute their ideas in online discussion					
I was not satisfied with the quality of work in my online group					
Working within an online group helped my learning					
Working together within an online group helped me learn more efficiently than if I were working alone					
Working together within an online group helped me accomplish higher quality work than if I were working alone					
Working together within an online group helped me to build my confidence in expressing my ideas and thoughts					

9) How I felt about the instructions and guidelines for working together in an online group via eLearning (UTM) in SPM 2322 Authoring Language

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
In my online group work, the lecturer has made the instructions for the task clear					
In my online group work, I was clear about how the group should work together					
In my online group work, the group decided how to work together					
In my online group work, the group members were agreed about how to work together					
In my online group work, the way the group decided to work together encouraged group members to contribute					
In my online group work, the way the group decided to work together helped to prevent any group member from taking charge and dominating the group task					
In my online group work, the instructions given by the lecturer about how to work as a group facilitated the group task					
In my online group work, knowing how the group wanted to work together helped me to work on the group task effectively					

10) **How I felt about tasks being divided and distributed between group members within an online group via eLearning (UTM) in SPM 2322 Authoring Language**

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
The lecturer clearly explained the way to divide and distribute the task between group members	○	○	○	○	○
The group task was well divided and distributed between group members	○	○	○	○	○
The group members agreed about how the group task was divided and distributed	○	○	○	○	○
The group members agreed with the individual roles and responsibilities to be held for the group task	○	○	○	○	○
Group members were aware of the group task	○	○	○	○	○
Group members were involved in group decision making	○	○	○	○	○
Group members were involved in group task accomplishment	○	○	○	○	○
A group leader took charge of ensuring completion of the group task	○	○	○	○	○
I did not feel involved in a group achievement of the task because other group members took charge	○	○	○	○	○
Knowing my role and responsibilities in the group task helped me feel a part of the group	○	○	○	○	○
Knowing my role and responsibilities in the group task helped me to think that I was contributing to the group	○	○	○	○	○

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Appendix F

Information for student's interview (Group)

1. Background

Tell me about your name and your previous qualification.

What prompted (influenced) you to study in this course (Chemistry/Mathematics/Physics with Computer)?

2. Learning via eLearning

Can you tell me about your experiences in having access to eLearning at this university courses?

[So when you get access to eLearning] What features of eLearning do you particularly like?

Is eLearning an effective learning environment for you?

How useful has eLearning been in supporting your following study components?

- Coursework or assignment
- Assessment (quizzes)
- Peer evaluation
- Discussion

3. Discussion via eLearning

Can you tell me about your experiences in having online discussions in your university courses?

What do you think you learn from participating in these discussions?

How do you think an effective online discussion is obtained?

What do you think influenced an effective discussion?

What do you think hindered an effective discussion?

Have you experienced agreement or disagreement between participants in your online discussions?

How have disagreements been handled in your opinion?

How do you feel about being assessed on what is discussed online?

4. Group work via eLearning

Tell me about your group work (via eLearning) experience to this point?

How do you feel about online group work via eLearning?

What do you think you learn from working together with others when carry out group work online?

How do you feel about working together with other in your group and outside your group?

Do you see yourself as more interested in working together in your group, or outside your group, or both, or is there no difference for you?

How do you feel about group work via eLearning compared with face-to-face?

Which methods of group work allow you to demonstrate your learning the most?

Why you favour face to face or online group work?

How do you feel about assessing other student work in your group?

How do you feel about being assessed by other student in your group?

5. Conclusion

Summarize key points (2, 3 & 4)

Does this summary sound complete? Do you have any changes or additions?

Is there anything else you would like to share?

Appendix G

Information for student's interview (Group)
(Post-course)

1. Online Collaborative Learning via eLearning

Tell me about your group work (via eLearning) experience to this point?

How do you feel about online group work via eLearning to this point?

What does the term collaborative learning mean to you?

Do you think collaborating online can help you in your studies?

How do you feel about the collaborative task (s) in this course (SPM2322)?

How do you feel about the instruction and guidelines for collaboration in this course?

How do you think effective online collaborative learning is obtained?

What do you think influenced (or enable) a group to collaborate effectively?

What do you think hindered (or constrain) a group to collaborate effectively?

2. Actively and less actively collaborating groups

Actively collaborating group

How do you feel about being in an actively collaborating group?

What do you think makes a group actively collaborate?

How would you like to see your online collaborative learning via eLearning in the future subject?

Would you like to see any changes(s)?

Less actively collaborating group

How do you feel about being in a less actively collaborating group?

What do you think makes a group not actively collaborate?

How would you like to see your online collaborative learning via eLearning in the future subject?

Would you like to see any changes(s)?

3. Conclusion

Summarize key points (1 & 2)

Does this summary sound complete? Do you have any changes or additions?

The project aims to investigate learning online through eLearning environment with emphasis on student collaboration within an online group discussion. Have I missed anything?

What advice or further comment do you have for me?

Appendix H

Information for instructor's interview

1. eLearning in Teaching

How long have you been using eLearning in your teaching at this university?

How have you used eLearning in your teaching at this university?

Have you used any particular strategy when you used eLearning in your teaching?

What challenges have you encountered when you used eLearning in your teaching?

What factors do you think constrain students to participate in eLearning?

2. General Discussion via eLearning

How have you used an online discussion forum in your teaching at this university?

What is your main purpose for using an online discussion forum?

How much time do you spend on discussions in eLearning?

Do you require regular discussion participation from students? If yes, why? If no, why not?

Have you assessed what is discussed online?

If so, how have you assessed what is discussed online?

What challenges have you encountered when facilitating students' discussions via eLearning?

3. Group Discussion via eLearning

Have you placed students in group for work discussion in eLearning?

If yes, what is your main purpose of doing it?

What are the differences between general discussion and group discussion?

How have you used eLearning forum for group work discussion?

Do you think inter-group discussion can mediate collaborative group work discussion via eLearning?

> If yes, what do you think mediate meaningful collaborative group work discussion via eLearning?

Do you have any further comments?

Appendix I

Information for online journal (post-course)

Home ► SPM2322-01 ► Journals ► Reflexive Journal

Update this Journal

Separate groups All participants

View 13 journal entries

Please respond to write reflection on your learning, to evaluate the process, and to provide suggestions to the instructor for course improvement.

When writing your reflection as an evaluation of your learning and the course, the following are some questions which you may find useful to consider:

- Who was I as a learner before I entered this course?
- Have I changed? if so, how?
- How has my participation in this course (particularly on online participation via elearning) changed my learning process or my view of myself as a learner?
- What have I gained (or not) by participating in this course (particularly on online participation via elearning)?
- Have I learned anything new about the topic or myself?
- What suggestions do I have for future online participation via elearning (i.e. online group discussion) in this course or for instructor of this course?
- Would I recommend this course to my friends and colleagues? Why or why not?
- How do I evaluate my own contribution to the course? What grade would I give to myself?
- or do I have any further comments to add?

Guideline:
1. To start writing, please click the *start or edit my journal entry* button
2. Do not forget to write **Date** for each of your comment

Thank you.

Start or edit my journal entry

Appendix J

Information for the problem-based discussion scenario

1. The Problem-based Discussion Scenario: Learning Task 1 and 2

BAHAGIAN
KEMENTERIAN PELAJARAN MALAYSIA
ARAS 1, BLOK E13,
KOMPLEKS KERAJAAN PARCEL E
PUSAT PENTADBIRAN KERAJAAN PERSEKUTUAN
62604 PUTRAJAYA

TEL : -603 8841341 / 88841002
FAKS : -603 8886790 / 88841034
LAMAN WEB : www.moe.gov.my

23 December 2009
6 Muharram 1431H

Pengarah Pelajaran,
Jabatan Pelajaran Negeri,

Y.Bhg Datuk / Dato' / Tuan

Dear Sir,

TECHNOLOGY GRANT 2010: AUTHORING LANGUAGE SOFTWARE

Kindly be informed that applications for a Technology Grant for Johor secondary schools is now open for 2010.

2. The following aspects should be considered to be addressed for the Technology Grant 2010 application, and they are:

a. Software suitability with Science and Mathematics teaching and learning
b. Software compatibility
c. User-friendly aspect of the software
d. The required training duration for the software
e. External resources and references for the software

3. Kindly submit the complete proposal for a Technology Grant for Authoring Language software to the following address:

Ministry of Education
Federal Government Administrative Centre
62100 Putrajaya

4. Should you require any further clarifications, please do not hesitate to contact us.

Sekian.

BERKHIDMAT UNTUK NEGARA

JAME BIN ALIP ASDK,BSK
Pengarah
Bahagian
Kementerian Pelajaran Malaysia.

S.k Persekutuan Pengakap Malaysia (Fax 0320709057)

Instructions:

Your group will assist the class in preparing for the proposal of the Ministry Education Technology Grant 2010. The proposal should make clear five aspects of the requirement by discussing how these aspects will affect the Science and Mathematics teaching and learning. For the purpose of the discussion, each group will work on their own within their online group space created in eLearning (the discussions will be recorded and evaluated). You are required to discuss all aspects within your group and make a group decision before your group can be involved and participate in the inter-group discussion in Task 2. There is a timeframe for the group discussion before the commencement of inter-group discussion (see below).

Important dates:

For intra-group discussion – discussion start 4/12 and deadline is 3/1

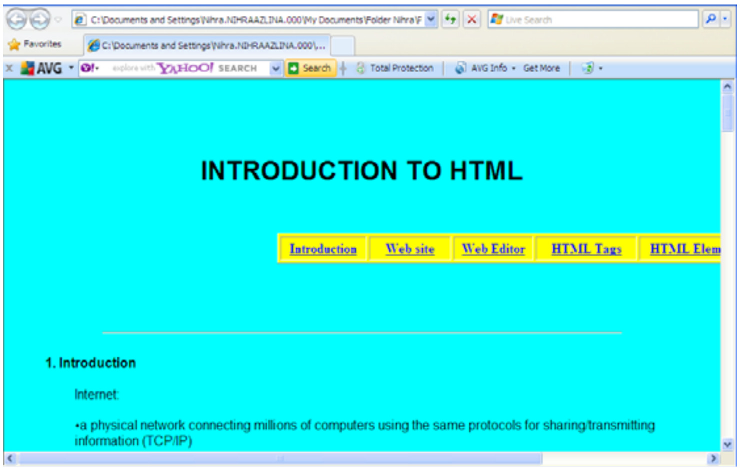
For inter-group discussion – discussion start 4/1 and deadline is 31/1

Reflection and improvement –deadline is 14/2

Each student in the group is expected to contribute substantively to the preparation of the proposal. How you decide who will do what is up to you, but you will be submitting an evaluation of your own and each group member's contribution at the end of the task. Remember that the learning tasks are not just a chronological report, but instead your discussion should illustrate real problem solving in the school. I will be monitoring each of the group discussions' progress in eLearning and will help and support your discussion as the task progresses.

2. The Problem-based Discussion Scenario: Learning Task 3

Cikgu Hamidah has been instructed by her headmaster to transform the old static web page of ICT subject in SMK Zanariah to a new fresh and dynamic web page. The old static web page is shown as follows:



However, before she could proceed to the transformation, she needs to understand the concept of static web page and dynamic web page and what elements of dynamic web page need to be included. She finds the task is so challenging since she has very limited knowledge on ICT. She has decided to seek consultation from your group.

In a small group, please discuss (online discussion) the above scenario with the following key points:

- The concept of static web page and dynamic web page
- The elements of dynamic web page
- Web page design or template

-Produce report that considers your group evaluation of the old static web page that includes an overall strength and weakness of the old static web page and your group solution on the aspects of Web page elements and template (or design).

The length of report must not exceed 5 pages!

-Developing web page:

Use the produced report to transform the old static web page into new fresh web page. It should look interesting and attractive.

The transformation of the static web page must be congruent with the report!

Appendix K

Key Features of SPM2322 Authoring Language Course Page

1. Page Notification: This allows the lecturer to remind students about important dates and messages

2. Online Group Discussion: These are OCL discussion forums for students to respond for the intra and inter-group activities

3. Reflective Journal: This use for students to evaluate the OCL process through SPM2322 eLearning course

4. Class Schedule: This notifies students regarding class and computer laboratory session details

5. RSS Live Feeder: This notifies students about latest technology news and information

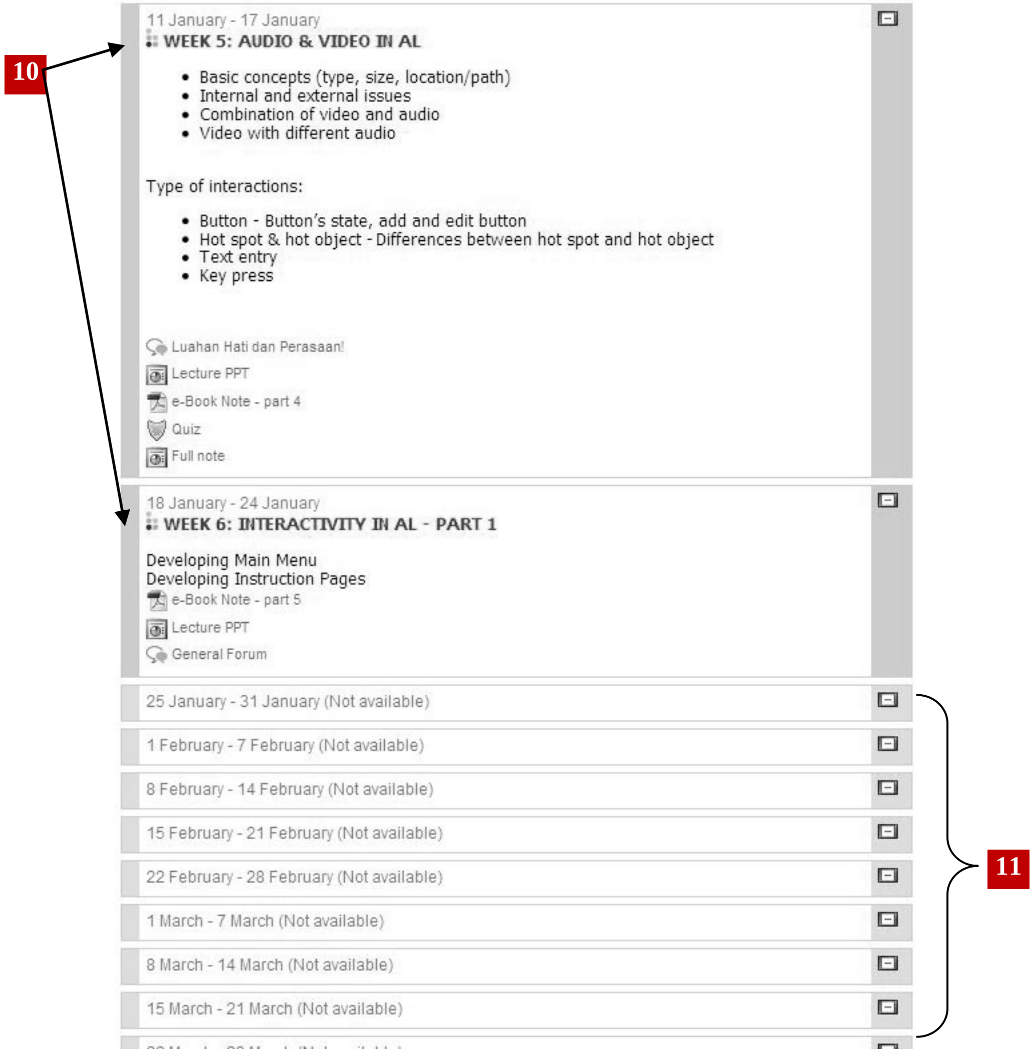
6. Class Activities: This shows class activities and learning resources

7. News and General Forums: This allows students to post their class announcement

8. Course Hand-out: Contains course information for students

9. Introductory Forum: This allows students to post about their self

10. Visible Weekly Contents: This allows students to obtain the course weekly learning materials



11. Invisible Weekly Contents: The course contents only applicable to students on the assigned date

12. This shows the levels a particular discussion forum within SPM2322 Authoring Language Course

13. Online Collaborative Groups: This allows students to view their appropriate forum discusions

14. Students can set up their own discussion thread

Appendix L

Details of the participating group

Group 1	Helmi	Izzatie	Izzanie	Fareha	
Programme	SPK	SPK	SPK	SPK	
Gender	Male	Female	Female	Female	
Ethnicity	Malay	Malay	Malay	Malay	
Age	19-23 years	19-23 years	19-23 years	19-23 years	
Group 2	Heng	Kho	Oh	Hidaya	Soh
Programme	SPK	SPK	SPK	SPK	SPK
Gender	Female	Female	Female	Female	Male
Ethnicity	Chinese	Chinese	Chinese	Malay	Chinese
Age	19-23 years	19-23 years	19-23 years	19-23 years	19-23 years
Group 3	Chris	Amin	Sydin	Anwar	Asma
Programme	SPP	SPP	SPP	SPP	SPP
Gender	Male	Male	Male	Male	Female
Ethnicity	Indian	Malay	Malay	Malay	Malay
Age	19-23 years	19-23 years	19-23 years	19-23 years	19-23 years
Group 4	Farah	Hasma	Nahar	Zilah	Izah
Programme	SPP	SPP	SPP	SPP	SPP
Gender	Female	Female	Female	Female	Female
Ethnicity	Malay	Malay	Malay	Malay	Malay
Age	19-23 years	24-30 years	19-23 years	19-23 years	19-23 years
Group 5	Azie	Liza	Asi	Hid	Ain
Programme	SPT	SPT	SPT	SPT	SPT
Gender	Female	Female	Female	Female	Female
Ethnicity	Malay	Malay	Malay	Malay	Malay
Age	24-30 years	24-30 years	24-30 years	24-30 years	24-30 years

Group 6	Ruhi	Diana	Azni	Shah	Sue	Usha
Programme	SPT	SPT	SPT	SPT	SPT	SPT
Gender	Female	Female	Female	Female	Female	Female
Ethnicity	Malay	Malay	Malay	Malay	Malay	Indian
Age	24-30 years	24-30 years	24-30 years	24-30 years	24-30 years	24-30 years
Group 7	Anis	Wani	Dhah	Busyra	Wan	
Programme	SPT	SPT	SPT	SPT	SPT	
Gender	Female	Female	Female	Female	Female	
Ethnicity	Malay	Malay	Malay	Malay	Malay	
Age	19-23 years	19-23 years	19-23 years	19-23 years	19-23 years	
Group 8	Hana	Ikin	Fadi	Naji	Nad	
Programme	SPT	SPT	SPT	SPT	SPT	
Gender	Female	Female	Female	Female	Female	
Ethnicity	Malay	Malay	Malay	Malay	Malay	
Age	19-23 years	19-23 years	24-30 years	19-23 years	19-23 years	
Group 9	Hami	Brian	Zaki	Udin	Amir	Zuwan
Programme	SPT	SPT	SPT	SPT	SPT	SPT
Gender	Male	Male	Male	Male	Male	Male
Ethnicity	Malay	Other: Kadazan	Malay	Other: Bajau	Malay	Malay
Age	19-23 years	19-23 years	19-23 years	19-23 years	19-23 years	19-23 years

Appendix M

Details of the course outline

Jabatan Multimedia Pendidikan
Fakulti Pendidikan
Universiti Teknologi Malaysia
Skudai
Johor

Homepage Fakulti : http:\\www.fp.utm.my
Elearning : http:\\elearning.utm.my

SUBJECT	:	**AUTHORING LANGUAGE**
SUBJECT CODE	:	SPM 2322
COURSE	:	SPP, SPK & SPT
CREDIT	:	02
SESSION	:	SEMESTER II 2009/2010

LECTURER	:	NAME	:	**EN. MOHD NIHRA HARUZUAN MOHAMAD SAID**
		ROOM	:	C15-408
		TEL	:	012-7127140
		EMAIL	:	nihra@utm.my

:: SYNOPSIS

This subject will give a thorough overview of basic concept of authoring language, authoring process and types of authoring language for CDROM and web-based development. It will also give opportunities for students to learn and build skills in developing educational courseware or webpage using current authoring language software or webpage software. This subject will also emphasize on other aspects such as coding a multimedia program or a webpage, basic programming concept in Authoring Language, packaging and distributing multimedia files for CD-ROM based and web-based applications.

Take notes that the skills attained in this subject will be used in your upcoming subjects known as CD-ROM Multimedia Development (SPM 4332) and Web-based Multimedia Development (SPM4322).

:: LEARNING OUTCOME

After completing this course, students will be able to:

- Identify type of interactions in authoring language software.
- Identify type of authoring language software based on how it works.
- Analyse the appropriate use of certain authoring language software.

- Develop small applications or facilities in multimedia courseware such as a main menu, a multiple choice question, a text-entry question, a drag and drop question, and etc. using authoring language.
- Develop a simple webpage as a learning aid.
- Utilise any authoring language software for developing multimedia courseware.
- Utilise any webpage software for developing webpage for educational purposes.

:: WEEKLY SCHEDULE

Week	Topics	Notes
1	**Introduction and Discussion on syllabus** • Mode of learning • Assignments and Projects	**Questions & Answers (Q&A)**
2	**Introduction to Authoring Language** • What is authoring language(AL), programming language(PL), authoring systems(AS) and web authoring (WA) • Differences between AL, PL & AS, WA • Taxonomy of AL and WA • Metaphor of AL and WA	
3	**How to choose appropriate Authoring Language?** • Factors to consider Authoring phase: • Pre-authoring • Authoring • Post-authoring **Introduction to AL software** - Screen size concepts in Authoring Language project - analysing problems in Authoring Language projects - Setting File Properties	
4	**Introduction to AL software** - Setting Background - Introduction to Authoring Language Interface - Functions of Icons - Basic Concepts of Authoring Language software-how it works **Text Element in AL** - Type Directly in Authoring Language - Copy & Paste from Word Processing Software - Dynamic Text Using RTF File	

5	**Graphics & Animation** • Import animation files (Flash, GIF Animation, 2D & 3D Animation, etc) • Tips in using animation in AL • Internal and external concept **Audio & Video in AL** • Basic concepts (type, size, location/path) • Internal and external issues • Tries and time limit • Combination of video and audio • Video with different audio	

6	**Interactivity in AL-Part 1**
	Type of interactions:
	• Button
	  - Button's state
	  - Add and edit button
	• Hot spot & hot object
	  - Differences between hot spot and hot object
	• Text entry
	• Key press
	
	Developing Main Menu
	Developing Instruction Pages
		Midterm

7	**Interactivity in AL - Part 2** Type of interactions: • Target area - Target are dropping (snap to center) • Pull down menu • Tries and time limit • Conditional • Combination Concept of Library in Authoring Language	
8	***Semester break***	
9	**Developing Several Types of Questions** • Multiple Choice • Text Entry • Drag and Drop • Combinations Developing Test with Time and Tries Limit Facility Looping Concept in Authoring Language Randomization of Questions in Test	

10	**Programming in AL** • Programming Concept in Authoring Language • Introduction to Internal & External Functions & Variables - TotalCorrect - PercentCorrect - GoTo Knowledge Object in Authoring Language	
11	**Introduction To Webpage Software** • HTML Markup Tags • Organise All The Files • Editing And Formatting Web Pages • Designing Tables And Positioning • Insert Pictures & Modifying Background	
12	**HTML Linking Tag And Accessories** • Insert Link to Files, Webpage, Email, Bookmark • Using Frames • Adding Multimedia Elements into Webpage • Creating Themes	
13	Using Web Components • Comments And Dates Dynamic Effects • Hover Buttons, Marquees, Counting Hits Introduction to Forms • Buttons , Textbox, Checkbox, Radio Button, Drop-Down Boxes Etc	
14	Packaging and Distribution of Files (CD-ROM / Web-based) Issues on AL/webpage software – Future Development	
15	Issues on AL/webpage software – Future Development	

:: EVALUATION

Tasks	**Percentage (%)**
Task 1	10%
Task 2	10%
Task 3	10%
In Class Participation & Activities	10%
Midterm Test	20%
Final Exam	40%
Total	100%

:: INFORMATION ON COURSEWORKS

Task 1 (10%)
Task 1 is to create a proposal of appropriate authoring tools to be used in the teaching of Science and Mathematics in Malaysian secondary schools. The task is presented in a problem-based case study, which requires students to research and gather information, analyse and discuss the problem in their group. The discussions are conducted within an online group. Task 1 will focus more on basic skills in authoring language software that students have learned in week 1, 2 and 3.

Task 2 (10%)
Task 2 is to produce a report based on a scenario of teaching Science and Mathematics using ICT in Malaysian secondary schools. This task requires inter-group discussion among Chemistry, Mathematics and Physics students. Task 2 will focus more on basic skills in authoring language software that students have learned in week 4, 5, 6 and 7.

Task 3 (10%)
Task 3 is to develop a tool (website) for teaching and learning ICT in Malaysian secondary schools. This task involves the process of re-designing an existing tool into a new and dynamic design. Students discuss the new design in their group before the development. The discussions are conducted within an online group. Task 3 will focus more on basic skills in using webpage software that students have learned in week 10, 11 and 12.

Class Participation & Activities (10%)
Class participation and activities will involve face-to-face discussion and participation in class.

Midterm Test (20%)
This midterm test is a standardized test across other class sections. It is an individual test and usually it will focus on basic concepts on authoring language and skills in using authoring language software.

:: REFERENCES

Jamalludin Harun & Zaidatun Tasir (1999), **Siri Modul Pembelajaran : Bahasa Gubahan dan Pengaturcaraan,** Fakulti Pendidikan, UTM Skudai.

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Roberts, N., (1997), **The Official Guide to Authorware 4**, California: Peachpit Press.

Hooper, S., (1997). **Authorware: An Introduction to Multimedia**, New Jersey: Prentice Hall.

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Appendix N

Details of the participating groups' achievements

1. Chemistry

Group 1				**Group 2**			
Programme: Chemistry (2nd year)				Programme: Chemistry (2nd year)			
Number of student: 4 (3 Female, 1 Male)				Number of student: 5 (4 Female, 1 Male)			
Ethnicity: Malay (All)				Ethnicity: 1 Malay, 4 Chinese			
Name	Ethnic	Gender	SPM 2322	Name	Ethnic	Gender	SPM 2322
Helmy	Malay	Male	A-	Heng	Chinese	Female	A-
Izzati	Malay	Female	A	Kho	Chinese	Female	A
Izzanie	Malay	Female	B+	Oh	Chinese	Female	A-
Fareha	Malay	Female	B-	Hida	Malay	Female	A-
				Soh	Chinese	Male	A-

***Note: SPM 2322 refers to Authoring Language**

2. Physics

Group 3				**Group 4**			
Programme: Physics (2nd year)				Programme: Physics (2nd year)			
Number of student: 5 (4 Male, 1 Female)				Number of student: 5 (All Female)			
Ethnicity: 4 Malay, 1 Indian				Ethnicity: Malay (All)			
Name	Ethnic	Gender	SPM 2322	Name	Ethnic	Gender	SPM 2322
Chris	Indian	Male	A-	Farah	Malay	Female	B-
Amin	Malay	Male	B+	Hasma	Malay	Female	B
Sydin	Malay	Male	A	Nahar	Malay	Female	A-
Anwar	Malay	Male	A-	Fadzilah	Malay	Female	B+
Asma	Malay	Female	B	Shahizah	Malay	Female	B+

3. Mathematics

Group 5				Group 6			
Programme: Mathematics (2nd year)				Programme: Mathematics (2nd year)			
Number of student: 5 (All Female)				Number of student: 6 (All Female)			
Ethnicity: Malay (All)				Ethnicity: Malay (5 Malay, 1 Indian)			
Name	Ethnic	Gender	SPM 2322	Name	Ethnic	Gender	SPM 2322
Azimah	Malay	Female	A-	Ruhi	Malay	Female	A
Liza	Malay	Female	A	Diana	Malay	Female	B+
Asilah	Malay	Female	B+	Azni	Malay	Female	A-
Hidayah	Malay	Female	B+	Aishah	Malay	Female	A-
Nurul	Malay	Female	B+	Suhaila	Malay	Female	A-
				Usha	Indian	Female	B

Group 7				Group 8				Group 9			
Programme: Mathematics (2nd year)				Programme: Mathematics (2nd year)				Programme: Mathematics (2nd year)			
Number of student: 5 (All Female)				Number of student: 5 (All Female)				Number of student: 6 (All Male)			
Ethnicity: Malay (All)				Ethnicity: Malay (All)				Ethnicity: 5 Malay, 1 Iban			
Name	Ethnic	Gender	SPM 2322	Name	Ethnic	Gender	SPM 2322	Name	Ethnic	Gender	SPM 2322
Anis	Malay	Female	A-	Farhana	Malay	Female	B+	Brian	Iban	Male	B+
Zawani	Malay	Female	B+	Ashikin	Malay	Female	A-	Hamizan	Malay	Male	B
Haafidhah	Malay	Female	B	Fadilah	Malay	Female	B+	Mahyudin	Malay	Male	A-
Busyra	Malay	Female	B+	Najikhah	Malay	Female	B	Al-Amin	Malay	Male	B-
Noranis	Malay	Female	B	Nadwa	Malay	Female	B	Zaki	Malay	Male	B+
								Azuwan	Malay	Male	B+

Appendix O

Overall analysis of Moodle data

Participative Dimension Analysis

Task	Descriptions	Number of Postings																		
		G1	%	G2	%	G3	%	G4	%	G5	%	G6	%	G7	%	G8	%	G9	%	Total
Task 1	Task 1 is to create a proposal of appropriate authoring tools to be used in teaching of Science and Mathematics in Malaysian secondary school. The task is presented in problem-based case study. The discussions are conducted within an online group.	35	13.5	18	6.9	38	14.7	14	5.4	67	25.9	30	11.6	25	9.7	23	8.9	9	3.5	259
Task 2	Task 2 is to produce a report based on a scenario of teaching Science and Mathematics using ICT in Malaysian secondary school. This task requires inter-group discussion among Chemistry, Mathematics and Physics students.	7	3.8	10	5.5	46	25.1	30	16.4	18	9.8	20	10.9	17	9.3	16	8.7	19	10.4	183
Task 3	Task 3 is to develop tool (website) for teaching and learning ICT in Malaysian secondary school. This task involves the process of re-design the existing tool into new and dynamic design. Students discuss new design in group before the	18	9.9	53	29.1	11	6.0	4	2.2	10	5.5	25	13.7	10	5.5	9	4.9	42	23.1	182

	development. The discussions are conducted within an online group.																			
	Total	60	9.6	81	12.9	95	15.2	48	7.7	95	15.2	75	12.0	52	28.5	48	7.7	70	11.2	624

Social Dimension Analysis

Descriptions	Task	Number of Postings																		
		G1	%	G2	%	G3	%	G4	%	G5	%	G6	%	G7	%	G8	%	G9	%	Total
Statement or part of statement related to social comment (Social).	Task 1	13	12.8	10	9.9	6	5.9	0	0	34	33.7	15	14.9	8	7.9	10	9.9	5	4.9	101
	Task 2	5	6.2	9	11.1	22	27.1	8	9.8	6	7.4	8	9.8	8	9.8	6	7.4	9	11.1	81
	Task 3	6	9.7	14	22.6	3	4.8	0	0	5	8.1	11	17.7	4	6.4	5	8.1	14	22.6	62
Total		24	9.8	33	13.5	31	12.7	8	3.3	45	18.4	34	13.9	20	8.2	21	8.6	28	11.5	244
Statement or part of statement related to emotional expression (Emotion).	Task 1	11	13.5	5	6.1	10	12.3	2	2.5	20	24.7	9	11.1	10	12.3	10	12.3	4	4.9	81
	Task 2	2	4.7	7	16.7	7	16.7	5	11.9	6	14.3	4	9.5	4	9.5	3	7.1	4	9.5	42
	Task 3	6	11.3	13	24.5	7	13.2	0	0	1	1.9	9	17.0	4	7.5	2	3.8	11	20.8	53
Total		19	10.8	25	14.2	24	13.6	7	4.0	27	15.3	22	12.5	18	10.2	15	8.5	19	10.8	176

Types of Social Comment																										
Group	Greeting			Name Addressing			Concern			Encouragement			Apology			Jokes and Humours			Thanking			Total Social	Emotional Expression			Total Emotion
	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3		T1	T2	T3	
G1	2	0	2	0	2	0	4	0	1	0	0	0	2	1	1	5	2	2	0	0	0	24	11	2	6	19
G2	2	2	3	5	1	5	2	0	3	1	1	3	0	0	0	0	3	0	0	2	0	33	5	7	13	25
G3	2	1	0	4	2	2	3	0	0	0	1	0	0	1	0	6	4	2	2	1	0	31	10	7	7	24
G4	0	2	0	0	1	0	0	0	0	0	0	0	0	1	0	0	3	0	0	1	0	8	2	5	0	7
G5	4	1	5	13	3	0	0	0	0	6	0	0	0	0	0	11	2	0	0	0	0	45	20	6	1	27
G6	2	1	2	0	2	0	1	0	2	4	1	1	0	1	3	6	3	3	2	0	0	34	9	4	9	22
G7	2	1	2	3	4	2	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	20	10	4	4	18
G8	8	2	3	2	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	21	10	3	2	15
G9	2	2	1	0	2	8	0	0	0	1	1	2	0	0	0	2	3	3	0	1	0	28	4	4	11	19
Total	24	12	18	27	19	19	10	0	6	12	4	6	5	4	4	30	25	10	4	5	0	244	81	42	59	176

Interactive Dimension Analysis

Explicit interaction Any statement referring explicitly to another message, person, or group																				
	Number of Postings																			
Direct response	Task	G1	%	G2	%	G3	%	G4	%	G5	%	G6	%	G7	%	G8	%	G9	%	Total
Any statement responding to a question, using a direct reference.	Task 1	2	3.2	4	6.3	9	14.3	4	6.3	25	39.7	6	9.5	3	4.8	7	11.1	3	4.8	63
	Task 2	1	3.4	0	0.0	15	51.7	4	13.8	2	6.9	2	6.9	2	6.9	1	3.4	2	6.9	29
	Task 3	0	0.0	15	53.6	1	3.6	0	0.0	0	0.0	2	7.1	2	7.1	2	7.1	6	21.4	28
	Total	3	6.6	19	59.9	25	69.6	8	20.1	27	46.6	10	23.6	7	18.8	10	21.7	11	33.1	120
Direct commentary	Task 1	1	3.3	2	6.7	3	10.0	2	6.7	8	26.7	4	13.3	2	6.7	6	20.0	2	6.7	30

Any statement taking up and pursuing an expressed idea, using direct reference.	Task 2	1	4.2	0	0.0	8	33.3	5	20.8	2	8.3	2	8.3	2	8.3	2	8.3	2	8.3	24
	Task 3	0	0.0	5	41.7	0	0.0	0	0.0	0	0.0	1	8.3	2	16.7	1	8.3	3	25.0	12
	Total	2	7.5	7	48.4	11	43.3	7	27.5	10	35	7	30	6	31.7	9	36.7	7	40	66
Implicit interaction Any statement referring implicitly to another message, person, or group																				
Indirect response Any statement obviously responding to a question, but without referring to it by name.	Task 1	16	16.0	7	7.0	13	13.0	5	5.0	24	24.0	13	13.0	14	14.0	5	5.0	3	3.0	100
	Task 2	3	3.3	6	6.7	16	17.8	13	14.4	9	10.0	12	13.3	10	11.1	10	11.1	11	12.2	90
	Task 3	6	9.5	16	25.4	3	4.8	0	0.0	5	7.9	11	17.5	4	6.3	1	1.6	17	27.0	63
	Total	25	28.9	29	39.1	32	35.5	18	19.4	38	41.9	36	43.8	28	31.5	16	17.7	31	42.2	253
Indirect commentary Any statement taking up and pursuing an expressed idea, but without referring to the original message.	Task 1	5	16.1	2	6.5	8	25.8	2	6.5	2	6.5	5	16.1	4	12.9	2	6.5	1	3.2	31
	Task 2	2	5.7	4	11.4	5	14.3	5	14.3	5	14.3	4	11.4	3	8.6	3	8.6	4	11.4	35
	Task 3	7	17.1	12	29.3	2	4.9	0	0.0	2	4.9	6	14.6	1	2.4	0	0.0	11	26.8	41
	Total	14	38.9	18	47.1	15	45.0	7	20.7	9	25.6	15	42.2	8	23.9	5	15.0	16	41.5	107
Independent interaction Any statement does not lead to any further statements																				
Independent posting Any statement relating to the subject under discussion, but which does not lead to any further statements.	Task 1	6	23.1	2	7.7	5	19.2	1	3.8	8	30.8	1	3.8	1	3.8	2	7.7	0	0.0	26
	Task 2	0	0.0	0	0.0	2	40.0	3	60.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5
	Task 3	0	0.0	2	25.0	0	0.0	0	0	0	0.0	2	25.1	1	12.5	1	12.5	2	25.0	8
	Total	6	23.1	4	32.7	7	59.2	4	63.8	8	30.8	3	28.8	2	16.3	3	20.2	2	25	39
Total		50	8.5	77	13.2	90	15.4	44	7.5	92	15.7	71	12.1	51	8.7	43	7.4	67	11.5	585

Types of Interactions																										
Group	Sharing perspective									Negotiation									Clarifying meaning							
	Providing information			Sharing view			Sharing experience			Agreeing or disagreeing			Posing question			Suggesting new idea			Giving feedback			Clarifying or justifying idea			Total
	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	

G1	7	2	5	5	1	3	7	0	0	2	1	1	3	2	0	4	0	3	3	1	1	4	0	0	55
G2	4	3	11	2	3	11	1	1	5	4	1	4	1	0	5	2	1	4	2	1	6	2	0	4	78
G3	8	4	2	6	7	2	6	6	0	4	6	0	3	3	1	4	7	0	2	7	1	5	6	0	90
G4	4	2	0	4	6	0	0	3	0	2	5	0	0	1	0	0	5	0	0	5	0	0	3	0	40
G5	8	2	4	16	3	1	11	2	0	7	2	0	6	2	1	4	3	0	6	2	1	4	2	0	87
G6	6	2	2	6	5	5	5	2	3	3	2	2	3	2	2	3	3	3	2	2	3	2	2	2	72
G7	4	2	2	5	4	3	6	2	1	4	3	1	2	2	0	1	1	1	2	1	1	1	2	1	52
G8	4	2	2	6	3	2	4	2	1	2	2	0	1	1	1	1	0	1	1	3	1	1	3	0	44
G9	1	3	6	1	3	7	1	2	4	2	2	5	1	2	5	2	2	4	1	3	5	0	2	3	67
Total	46	22	34	51	35	34	41	20	14	30	24	13	20	15	15	21	22	16	19	25	19	19	20	10	585

Cognitive Dimension Analysis

Category	Task	Number of Postings																		
		G1	%	G2	%	G3	%	G4	%	G5	%	G6	%	G7	%	G8	%	G9	%	Total
Clarification Statements or part of statements that is recognizing a problem, explaining or presenting a point of view.	Task 1	21	19.1	5	4.5	19	17.3	5	4.5	18	16.4	12	10.9	13	11.8	13	11.8	4	3.6	110
	Task 2	4	4.9	4	4.9	23	28.4	11	13.6	7	8.6	9	11.1	7	8.6	7	8.6	9	11.1	81
	Task 3	8	11.0	19	26.0	6	8.2	0	0.0	4	5.5	9	12.3	4	5.5	5	6.8	18	24.7	73
	Total	33	12.5	28	10.6	48	18.2	16	6.1	29	11.0	30	11.4	24	9.1	25	9.5	31	11.7	264
Inference Statements or part of statements that is connecting ideas, making synthesis or creating solution.	Task 1	3	14.3	3	14.3	3	14.3	0	0.0	5	23.8	3	14.3	1	4.8	2	9.5	1	4.8	21
	Task 2	1	4.3	2	8.7	4	17.4	2	8.7	3	13.0	4	17.4	2	8.7	2	8.7	3	13.0	23
	Task	4	18.2	9	40.9	1	4.5	0	0.0	1	4.5	3	13.6	1	4.5	1	4.5	2	9.1	22

	3																			
	Total	8	12.1	14	21.2	8	12.1	2	3.0	9	13.6	10	15.2	4	6.1	5	7.6	6	9.1	66
Judgement Statements or part of statements that is expressing agreement or disagreement or negotiating idea.	Task 1	3	13.6	3	13.6	3	13.6	0	0.0	6	27.3	3	13.6	1	4.5	2	9.1	1	4.5	22
	Task 2	1	4.2	2	8.3	6	25.0	2	8.3	3	12.5	3	12.5	3	12.5	2	8.3	2	8.3	24
	Task 3	3	13.6	9	40.9	1	4.5	0	0.0	1	4.5	3	13.6	1	4.5	1	4.5	3	13.6	22
	Total	7	10.3	14	20.6	10	14.7	2	2.9	10	14.7	9	13.2	5	7.4	5	7.4	6	8.8	68
Strategies Statements or part of statements that is connecting ideas with external references, resources or real-life applications.	Task 1	3	9.1	4	12.1	5	15.2	0	0.0	5	15.2	6	18.2	3	9.1	4	12.1	3	9.1	33
	Task 2	1	3.1	2	6.3	8	25.0	4	12.5	4	12.5	4	12.5	3	9.4	2	6.3	4	12.5	32
	Task 3	3	9.4	10	31.3	2	6.3	0	0.0	1	3.1	6	18.8	2	6.3	1	3.1	7	21.9	32
	Total	7	7.2	16	16.5	15	15.5	4	4.1	10	10.3	16	16.5	8	8.2	7	7.2	14	14.4	97
Total		55	42.1	72	68.9	81	60.5	24	16.2	58	49.6	65	56.2	41	30.8	42	31.6	57	44.1	495

Cognitive Processing								
Group	Surface				Deep			
	Task 1	Task 2	Task 3	Total	Task 1	Task 2	Task 3	Total
G1	15	3	5	23	15	4	13	32
G2	2	2	4	8	13	8	43	64
G3	12	19	3	34	17	27	8	52
G4	5	22	0	27	0	8	0	8
G5	15	4	1	20	19	9	6	34

G6	6	5	4	15	18	11	17	46
G7	13	4	4	21	5	8	4	17
G8	13	4	5	22	8	8	3	19
G9	3	4	9	16	6	10	21	37
Total	84	67	35	186	101	93	115	309

Surface Processing	Task	Number of Postings																		
		G1	%	G2	%	G3	%	G4	%	G5	%	G6	%	G7	%	G8	%	G9	%	Total
Reproducing approach Not wanting to think about or understand the issue, finish with minimum of effort.	Task 1	2	16.7	1	8.3	2	16.7	1	8.3	3	25.0	0	0.0	2	16.7	1	8.3	0	0.0	12
	Task 2	0	0.0	1	9.1	4	36.4	4	36.4	0	0.0	0	0.0	0	0.0	0	0.0	2	18.2	11
	Task 3	1	14.3	1	14.3	1	14.3	0	0.0	0	0.0	0	0.0	1	14.3	1	14.3	2	28.6	7
	Total	3	10.0	3	10.0	7	23.3	5	16.7	3	10.0	0	0.0	3	10.0	2	6.7	4	13.3	30
Stay inside course boundaries Focus on what is required and repetition.	Task 1	3	17.6	1	5.9	3	17.6	1	5.9	2	11.8	3	17.6	2	11.8	2	11.8	0	0.0	17
	Task 2	1	5.9	1	5.9	6	35.3	5	29.4	2	11.8	1	5.9	0	0.0	0	0.0	1	5.9	17
	Task 3	0	0.0	1	11.1	0	0.0	0	0.0	0	0.0	3	33.3	1	11.1	1	11.1	3	33.3	9
	Total	4	9.3	3	7.0	9	20.9	6	14.0	4	9.3	7	16.3	3	7.0	3	7.0	4	9.3	43
Unthinking approach Jumps to conclusions with little evidence, uncritical acceptance of ideas and nothing extra	Task 1	8	17.0	0	0.0	6	12.8	1	2.1	9	19.1	3	6.4	8	17.0	9	19.1	3	6.4	47
	Task 2	1	2.9	0	0.0	8	22.9	12	34.3	1	2.9	4	11.4	4	11.4	4	11.4	1	2.9	35
	Task 3	3	16.7	2	11.1	2	11.1	0	0.0	1	5.6	1	5.6	2	11.1	3	16.7	4	22.2	18
	Total	12	12.0	2	2.0	16	16.0	13	13.0	11	11.0	8	8.0	14	14.0	16	16.0	8	8.0	100
Fear of failure	Task	1	16.7	0	0.0	1	16.7	1	16.7	1	16.7	0	0.0	1	16.7	1	16.7	0	0.0	6

Focus on negative aspects of coursework, and assessment pressure or concern about passing the course/assessment.	1																			
	Task 2	1	25.0	0	0.0	1	25.0	1	25.0	1	25.0	0	0.0	0	0.0	0	0.0	0	0.0	4
	Task 3	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1
	Total	3	27.3	0	0.0	2	18.2	2	18.2	2	18.2	0	0.0	1	9.1	1	9.1	0	0.0	11
Extrinsic motivation Views task as an external imposition, more interest in completing the task to get a pass than to learn	Task 1	1	50.0	0	0.0	0	0.0	1	50.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2
	Task 2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Task 3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	1	50.0	0	0.0	0	0.0	1	50.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2
Total		23	108.6	8	19.0	34	78.4	27	111.8	20	48.5	15	24.3	21	40.1	22	38.7	16	30.6	**186**

Deep Processing	Task	Number of Postings																		
		G1	%	G2	%	G3	%	G4	%	G5	%	G6	%	G7	%	G8	%	G9	%	Total
Looking for meaning Focus on what is signified, asking questions to understand new information	Task 1	3	9.4	3	9.4	3	9.4	0	0.0	7	21.9	8	25.0	2	6.3	3	9.4	3	9.4	32
	Task 2	3	8.8	5	14.7	5	14.7	2	5.9	4	11.8	4	11.8	3	8.8	5	14.7	3	9.4	34
	Task 3	2	5.3	15	39.5	2	5.3	0	0.0	2	5.3	6	15.8	2	5.3	1	2.6	8	25.0	38
	Total	8	7.7	23	22.1	10	9.6	2	1.9	13	12.5	18	17.3	7	6.7	9	8.7	14	43.8	104
Relating ideas and seeking coherency Relating ideas to other/previous knowledge, using new info and generating new ideas.	Task 1	9	24.3	2	5.4	7	18.9	0	0.0	6	16.2	7	18.9	2	5.4	2	5.4	2	6.3	37
	Task 2	1	2.5	1	2.5	15	37.5	4	10.0	4	10.0	6	15.0	3	7.5	3	7.5	3	9.4	40
	Task 3	5	12.5	12	30.0	4	10.0	0	0.0	2	5.0	7	17.5	1	2.5	1	2.5	8	25.0	40
	Total	15	12.8	15	12.8	26	22.2	4	3.4	12	10.3	20	17.1	6	5.1	6	5.1	13	40.6	117
Use of evidence and logic	Task 1	2	8.0	6	24.0	5	20.0	0	0.0	5	20.0	2	8.0	1	4.0	3	12.0	1	3.1	25

Finding alternative ways of interpreting information, justifying with an example.	Task 2	0	0.0	2	12.5	5	31.3	2	12.5	1	6.3	1	6.3	2	12.5	0	0.0	3	9.4	16
	Task 3	5	17.9	11	39.3	2	7.1	0	0.0	2	7.1	3	10.7	1	3.6	1	3.6	3	9.4	28
	Total	7	10.1	19	27.5	12	17.4	2	2.9	8	11.6	6	8.7	4	5.8	4	5.8	7	21.9	69
Intrinsic motivation Desire to learn more about subjects of interest, finding out more about interesting topics with curiosity or satisfaction.	Task 1	1	14.3	2	28.6	2	28.6	0	0.0	1	14.3	1	14.3	0	0.0	0	0.0	0	0.0	7
	Task 2	0	0.0	0	0.0	2	66.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.1	3
	Task 3	1	11.1	5	55.6	0	0.0	0	0.0	0	0.0	1	11.1	0	0.0	0	0.0	2	6.3	9
	Total	2	10.5	7	36.8	4	21.1	0	0.0	1	5.3	2	10.5	0	0.0	0	0.0	3	9.4	19
Total		32	41.2	64	99.3	52	70.3	8	8.2	34	39.6	46	53.6	17	17.7	19	19.6	37	115.6	309