CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Introduction

This concluding chapter is divided into six sections. The first four sections discuss the findings of this study, which are based on the four research questions. The fifth section is on the pedagogical implications of the study. Finally, the last section discusses the limitations of the study and suggestions for future research.

This study was designed to examine the effects of OC on the reading performance of ESL students. Secondly, it investigated the patterns of interaction demonstrated by ESL students during OC. In addition, it examined the differences in the patterns of interaction when ESL students work on different reading tasks. Lastly, it looked at the nature of the relationship between the patterns of interaction and the reading performance of ESL students when they collaborate online.

Qualitative and quantitative methods were used to analyze the data. The qualitative process was applied to analyze the online transcripts obtained from three different groups (each group comprising four students of mixed language ability) when they completed the tasks of Previewing and Predicting, Identifying Sentence Patterns and Paraphrasing. These nine sets of online discussions were analyzed qualitatively to identify and code for patterns of interaction using predetermined categories based on an adapted version of the Interactive Analysis Model (Gunawardena et al. 1997; Sringam & Greer, 2001). The data were then quantitatively analyzed to look for patterns of

interaction and the differences in the patterns of interaction when ESL students worked on different reading tasks. In addition, quantitative methods were used to investigate the nature of the relationship between patterns of interaction and the reading performance of ESL students when they collaborate online. Lastly, the pretest and posttest results of the students, and their scores obtained from the nine (9) reading tasks before and after collaboration were quantitatively analyzed to examine the effects of OC on their reading performance.

5.2 Online collaboration and reading performance

There were two major findings pertaining to OC and reading performance of ESL students. The first was that ESL students showed significant improvements in their posttest results at both the individual and group levels. The second was that based on Bloom's Taxonomy of cognitive domains, ESL students showed significant improvements in their performance for questions which were at the lower levels of the cognitive domain. As the questions moved from the lower to the higher cognitive levels, ESL students did not show significant improvements especially in questions which required application, analysis, synthesis and evaluation. This suggests that OC is beneficial to the majority of ESL students, albeit at the lower levels of the cognitive domain.

The first finding was obtained by carrying out paired samples t-tests on the pretest and posttest reading comprehension scores of ESL students at the individual and the group levels. The results show that overall ESL students demonstrated significant

improvements in their posttest results at both the individual and group levels. This was further affirmed by the results of the paired samples t-tests, which compared ESL students' results for the different reading tasks before and after OC. The results reveal that overall ESL students showed significant improvements at the individual and group levels in their reading performance after OC. These results are consistent with a number of studies in which collaborative learning has been found to statistically result in significantly better marks (Eijl, Pilot & De Voogd, 2005; Gokhale, 1995; Hooper, 1992; Webb & Palincsar, 1996).

Moreover, it emerged that the low and average proficiency students gained the most in terms of improved scores from the OC (refer to Table 4.25, p.199; Table 4.26, p.206). These results are similar to studies on heterogeneous pairing which indicated benefits for low ability students (Azmitia, 1988; Hooper & Hannafin, 1988; Tudge, 1989; Webb, 1980). The rationale for grouping of heterogeneous students was prompted by Vygotsky's (1978) ZPD and Piaget's (1928) socio-cognitive conflict. Essentially, both Vygotsky and Piaget believe that the individual's cognitive development can be positively facilitated by collaborating with better able peers.

Although the results show that the low and average proficiency students benefited the most from their better able peers, it did not mean that the high proficiency students did not benefit from the OC. In fact, the high proficiency students did show improvements in their posttest scores although the extent of the increase in their scores was not as high as the low proficiency students. Studies by Bell, Grossen, and Perret-Clemont (1985), Tudge and Rogoff (1989) have also shown that students who are more capable often benefit by working with less capable ones.

The fact that ESL students showed significant improvements in their posttest results, coupled with their improved reading scores after OC at both the individual and group levels, not only indicate that overall OC has a positive effect on the performance of the individual student but it also provides empirical evidence in support of the sociocultural approach to learning.

The sociocultural view of learning (Piaget, 1928; Vygotsky, 1978) emphasizes that learning takes place in a social context and that higher cognitive processes originate from social interactions. Based on this view, cognitive development can be positively influenced by collaborating with better able peers. This was confirmed in the second finding which revealed significant improvements in the performance of ESL groups in their posttest results for questions which were in the comprehension category (Understanding Sense Relationships within and between Sentences, Vocabulary and Identifying Main Ideas). However, the results revealed that ESL students did not show significant improvements in questions which required higher cognitive skills which included questions on application (Making Inferences) and evaluation ((Identifying Writer's Point of View). ESL students tended to achieve improved scores in questions that tested comprehension (lower cognitive levels) as compared to questions that tested application, analysis and evaluation (higher cognitive levels).

The same positive results were found when ESL students showed significant improved performance in reading tasks that required lower levels of cognitive skills like comprehension (Vocabulary, Previewing and Predicting, Identifying Main Ideas, Understanding Sense Relationships within and between Sentences). They did not show significant differences in their performance for questions which required higher levels

of cognitive skills like application (Making Inferences), analysis (Identifying Sentence Patterns) and evaluation (Identifying Writer's Attitude). Therefore, the findings show that in this study, OC was generally favourable to ESL students in that they showed evidence of improved cognitive development. However, the majority who benefited the most were the low and average proficiency students showing improvements mostly in answering questions at the lower levels of the cognitive domain. Thus, it can be inferred that the ZPD that these low and average proficiency students were capable of advancing was dependent on the level of help that the high ability peers were capable of giving. This implies that student-led discussion groups may lack experience in scaffolding, guiding and constructing knowledge (Sringam & Geer, 2000).

Therefore, despite the benefits of peer-led OC, teachers still have an important role to play in the teaching and learning process in that they could help learners to further advance through their ZPD. This is congruent with Vygotsky's (1986) observation that CL either among students themselves, or between students and a teacher, was essential for assisting students in advancing through their ZPD.

5.3 Patterns of interaction during online collaboration

The first major finding concerning the patterns of interaction of ESL students was that the dynamics of interaction was evident during OC. This means that the process of co-construction of knowledge was evident. Qualitative analyses were carried out to identify and code nine sets of the online transcripts for patterns of interaction. The analyses uncovered a total of 756 operations which were generated by the groups A, D and E during their discussions on the selected reading tasks of Previewing and

Predicting, Identifying Sentence Patterns and Paraphrasing. Using the process of content analysis whereby the unit of analysis is 'a unit of meaning" (Henri, 1992), the messages were coded based on an adapted version of the Interactive Analysis Model (Gunawardena et al., 1997; Sringam & Greer, 2001). There were four interactive phases whereby each phase was characterized by operations. There were altogether 15 operations, six of which were in Phase I: Sharing of information, three in Phase II: Discovering the inconsistency of ideas, concepts, or statements, four in Phase III: Negotiating for meaning/ Co-constructing knowledge and two in Phase IV: Making agreement statements/Applying newly-constructed meaning.

The findings show that during OC, ESL students were engaged in all four phases of interaction, which were characterized chiefly by sharing information and clarifying and negotiating for meaning. Moreover, some students moved through several of the phases in a single posting, indicating that knowledge construction was indeed occurring not only at the group level but also at the individual level. This is seen in Excerpt 6 (Chapter 4, p. 229). This excerpt shows Jc3yLiaNa (20:18) moving through Phases I, III and IV. Originally Jc3yLiaNa chose the answer "A" (Excerpt 5, 20:11 p. 227) which was the correct answer. However, later she changed her answer to "B" (Excerpt 5, 20:13). Then after seeing Tarabas' posting (Excerpt 6, 20:15) "encourage not discourage…", she changed her answer to "A" (Excerpt 6, 20:18) again which was the correct answer. The three phases Jc3yLiaNa went through was first, she was able to apply new knowledge prompted by Tarabas to correct herself and chose the correct answer. Armed with her new knowledge, Jc3yLiaNa was able to acknowledge that Mulan's answer was correct, which marked the second phase. The final phase was

when Jc3yLiaNa could identify the source of her error. This clearly shows that Jc3yLiaNa went through several phases in a single posting which indicates that knowledge construction was indeed occurring not only at the group level but at the individual level as well. This suggests that individuals contribute to the co-construction of knowledge. Gunawardena et al. (1997) made the same observations in their study of an international global online debate. They note that **"…** more than one and sometimes three phases within a single message posted by one participant…" (p. 418).

ESL students discussed their reading comprehension tasks on the Reading for Academic Purposes (RAP) website which captured the online discussion. This enabled them to reflect upon each other's ideas as well as their own, which is congruent with the sociocultural view of learning. This was illustrated in Excerpt 4 (p. 224) which shows that group members were able to revisit the online discussions and the RAP notes to reflect upon what was discussed by the other members. Jonassen et al. (1995) posit that by articulating our thoughts, sharing ideas and perspectives with others, as well as arguing and defending our own perceptions, we are engaged in a process of meaning making. This is corroborated by Pena-Shaff and Nicholls (2004) who noted that "it is in the process of articulating, reflecting and negotiating that we engage in meaning making or knowledge construction process" (p. 245). Some argue that this process is even stronger when students are required to communicate their ideas in writing as more effort is needed to organize and explain their thoughts and ideas so that the others can understand what they wish to communicate. Kern and Warschauer (2000) concurred that the written nature of the discussion allows greater opportunity to attend to and reflect on the form and content of the communication. Hence,

theoretically, the online environment seems ideal for students to engage in a dialogical process in which the learning benefits of reading and writing were combined with the benefits of being able to respond to, build on, and argue with each others' ideas. This is in line with the sociocultural approach of learning which emphasizes the importance of the dialogical process whereby meaning is developed during social interaction.

In terms of frequency of operations used by ESL students, descriptive statistics using frequencies and percentages of predetermined instances of interactive phases, reveal that approximately three quarters of the total operations generated by the groups were in Phase I: Sharing of information. This was followed by Phase II: Discovering the inconsistency of ideas, concepts or statements. The least number of operations generated was in Phase IV: Making agreement statements/Applying newly-constructed knowledge. Quantitative analyses of the frequency of operations confirmed that the differences were significant. The fact that the four phases of interaction were evident combined with the confirmation that there were statistical differences in the frequency of operations generated, suggest that ESL students were engaged in interaction and collaboration but not at the higher levels of engagement. Gunawardena's et al. (1997) Interactive Analysis Model began with the lower mental functions (Phases I and II) and moved to higher mental functions (Phases III and IV).

Moreover, the qualitative data seem to indicate that ESL students were chiefly concerned with sharing their understanding of the online task by employing a variety of operations. Excerpts of the qualitative analyses of the transcripts of the online discussion also provide evidence in support of the sharing tendency of ESL students (refer to Chapter 4, Excerpt 1 and Excerpt 2).

Although it is difficult to make comparisons across studies due to differences in the research designs and especially the coding schemes, some general observations can be made comparing the findings of the present study with previous research on CL. Some of the findings of the present study accorded well with previous transcript research. Herring (1996) reported that 67% of the statements in her study expressed points of view. Gunawardena et al. (1997) in their study of an international global online debate among 554 scholars from around the world also coded the greatest portion (92%) of their corpus in Phase 1 (sharing and comparing of information). Zhu's study (1996) also discovered that students' discussion were mainly dominated by expressions of ideas and thoughts, comments or judgments to other participants' ideas, reflection, information sharing and scaffolding messages. Garrison et al. (2001) using the community of inquiry framework, also found mostly triggering events and exploration, but little in terms of integration or resolution. Likewise the results of the study by Pawan et al. (2003) showed that 66% of the posts fell in the phase for exploration, 11% in the phase for triggering and integration respectively. There was no post in the phase for resolution.

A study carried out by Pena-Shaff and Nicholls (2004) found that of the categories identified, clarification statements formed 44% of the total (594) sentences analyzed. Within this category, identifying and stating main ideas and assumptions for discussion accounted for 34% of the sentences, whereas the use of examples and personal experiences represented 50% of the total. This means that students spent a lot of time explaining and elaborating on their ideas. An earlier study by Pena-Shaff et al. (2001) had the same findings as well. Likewise, a study undertaken within a non-formal

education program in Thailand and an undergraduate study at the University of South Australia by Sringam and Geer (2001) found that most of the Thai and Australian students tended to be engaged in group discussion at the sharing phase as well. They were mostly concerned with giving help and feedback, asking/answering questions to clarify details of statements and stating opinions regarding the problem. A study by Hara et al. (2000) also discovered that elaboration and clarification predominated. In their 2005 study, Schellens and Valcke (2005) noticed that the phase for sharing and comparing of information and the phase for negotiation and co-construction were dominant. However, the proportion of messages in the phase for making agreement statements/applying newly-constructed knowledge was very low. These findings suggest consensus that information-related statements are likely to comprise the largest portion of online conferences. These imply that OC allows for interaction and knowledge construction to take place but at the lower levels of interactive phases.

In addition, these studies found that conflict and negotiation were less often seen. In this study, ESL students generated 16.4% of the operations used in Phase II, which was the phase for discovering the inconsistency of ideas, concepts or statements and 7.67% in Phase III which was the phase for negotiating for meaning/co-constructing knowledge. Although the frequency seems small, it nevertheless shows that conflict and negotiation took place. This is illustrated in Excerpts 5 (p. 227), 6 (p. 229) and 7 (p. 230). These excerpts show the process of sharing of information which led to conflicting ideas. This then prompted the members to negotiate for a common understanding. Of primary interest was that all the group members took pains to clarify and explain their answers to those who held differing views. The group members ended

their discussion only when everyone in the group came to a shared mutual understanding. This is congruent with Vygotsky and Piaget's ideas that collaboration facilitates the co-construction of knowledge and mutual understanding. The co-construction of knowledge takes place through one's increasing ability to take account of other people's perspectives. This implies that while the frequency of the operations generated for Phases II and III were small as compared to Phase I, both these phases nevertheless play an important role in enabling the co-construction of knowledge among the members. Tudge (1992) also observes that collaboration is the process whereby two participants in a task who begin with different understandings of it arrive at shared understanding in the course of communication, thus implying that there is mutual agreement of points between the participants. Pellettieri (1996) also found that there were a large number of embedded routines (negotiations within negotiations) indicating that participants went to extensive effort to ensure mutual understanding. This is profitable when there is an eventual pooling or interchange of ideas among the students that broadens each student's perspective on the subject (Tiessen & Ward, 1997).

Apart from the differences in the frequency of operations generated by phase, the patterns of interaction by operations were also varied. An explanation for the varied patterns of interaction can be attributed to the task presented to the students (Appendix H). For the task of Previewing and Predicting, ESL students were instructed to predict the contents of the topic "College Success". No other prompt was provided. For Identifying Sentence Patterns, students were to identify the sentence patterns of five sentences and to explain how they arrived at their answers by highlighting the word(s)

that suggest the pattern(s) they chose. Lastly, for Paraphrasing, students were to choose the option that best paraphrased the original sentence. They were required to explain why they chose their answer. Because each group was to submit one answer, the group members had to come to a consensus before a representative could submit the group answers. This explains why out of the 756 operations generated, the most dominant was "Expressing a statement of observation or opinion" (Phase I A), which made up 22.88% followed by "Expressing a statement of agreement from one or more other participants" (Phase I B) with 14.68%. The third and fourth frequently used operations were "Challenging others to engage in group discussion" (Phase I F) at 11.5% and "Asking and answering questions to clarify details of statements" (Phase I D) at 10.85% respectively. All these top four operations were found in Phase 1: Sharing of information. None of the tasks required ESL students to integrate or accommodate metaphors or analogies and neither were they told to apply new knowledge. Hence, it was not surprising that the least used operation was "Integrating or accommodating metaphors or analogies" (Phase III D) which made up only 0.4%. "Applying new knowledge" (Phase IV B) made up 2.12%.

Schellens and Valcke (2005) had similar findings when they carried out a study involving 230 freshmen taking the course "educational sciences". Students were working in 23 discussion groups on collaboration tasks based on authentic situations and problems. The transcripts were coded based on the models of Veerman and Veldhuis-Diermanse (2001) and Gunawardena, Lowe, and Anderson (1997). Their analyses based on the latter's model is of interest because this study also used an adapted version of this model. They discovered that 51% of the messages were in the

phase for sharing and comparing information. There was minimal message in the phase for testing and adjusting new hypothesis (1.2%) and the phase for statement/application of newly- constructed knowledge (0.4%). It has to be explained here that the interactive model used in this study was an adaptation and thus did not contain the phase for model testing and adjusting new hypothesis because it was not relevant to this reading course. Schellens and Valcke attribute this pattern to the explicit task structure presented to the students whereby they were never asked to test a hypothesis or to come to clear conclusions about newly-developed knowledge. This suggests that the structuring of the task plays an important role in either promoting or inhibiting the use of specific operations during online discussions.

Research based on the community of inquiry framework also found that inquiry has great difficulty moving beyond the information exchange or exploration phase (Celentin, 2007; Fahy, Crawford, & Ally, 2001; Garrison et al., 2001; Kanuka & Anderson, 1998; Luebeck & Bice, 2005; McKlin et al., 2002; Meyer, 2003, 2004; Murphy, 2004; Newman et al., 1996; Vaughan & Garrison, 2005). One of the three elements that the community of inquiry framework places emphasis on is cognitive presence which is defined "in terms of a cycle of practical inquiry, where participants move deliberately from understanding the problem or issue through to exploration, integration and application" (Garrison & Arbaugh, 2007, p. 162). Although the terms used in community of inquiry framework are different from that of the adapted Interactive Analysis Model (used in this study), the categories used for both models are based on different phases that move from the lower to the higher levels of inquiry. The former has a four-phase process characterized by a triggering event, exploration,

integration and resolution which are similar to that of the latter which comprises the Sharing of information phase, Discovering the inconsistency of ideas, concepts, or statements phase, Negotiating for meaning/ co-constructing knowledge phase and Making agreement statements/Applying newly-constructed knowledge phase (Phases I-IV).

Hence, regardless of the differences in research designs and coding system, the common thread running through these researches is that participants in online discussions tended to interact at the lower cognitive levels. For research on the community of inquiry framework, findings show that the community has difficulty arriving at the integration and resolution phase and are often engaged in the exploration phase. The same is observed in this research using the Interactive Analysis Model whereby the participants were engaged at the lower levels of interactive phases which was at Phase I: Sharing of information.

In general, the findings in this study show that for each reading task, all the four phases of knowledge construction (Phases I, II, III and IV) were present although the frequency of operations generated for each phase was varied. Despite the differences in the frequency of operations generated, this study suggests that the process of knowledge construction occurred as evidenced by the presence of the four phases of interaction during each reading task. This can be seen in Excerpts 7 (p. 230) and 8 (p. 235) where a group member whose views conflicted with the others was able to come to a new understanding of the task thus modifying his views based on the contributions of the other members in the group. Therefore, even though the frequency of the operations skewed towards the sharing phase, it did not mean that students were not

reading and analyzing other people's contributions. Instead the sharing of information helped them to develop their own ideas. The results show that ESL students tended to pick up on the ideas presented by the others and then adjusting their own thoughts to accommodate new ideas which conflicted with their pre-existing cognitive schema. Thus, this indicates explicit collaboration between the group members during online discussions.

There is another possible explanation why the frequency of the operations skewed towards the sharing phase. In a study on synchronous computer conferencing, Bonk et al. (1998) found that students appeared to be posting their opinions on an issue, but were not responsive to the postings of their peers. Likewise, the current study found that a large proportion of ESL students' postings were on stating their points of view, ideas, insights and opinions. These contributions would form the catalyst for further discussions especially if the ideas conflicted with the understanding of the other group members. Hence, it naturally meant that at the later stages of the online discussions, the group members would spend time negotiating for meaning and resolving the conflict whether within oneself or between themselves before coming to an agreement. The transcripts of the current study show that ESL students resolved their conflicts quite quickly, i.e. not many postings were required for everyone to come to an agreement. Once an agreement has been reached, the group members needed only to summarize the agreement. This would account for the low frequency counts for operations in Phases III and IV. Pena-Shaff et al. (2004) also found that there were not many messages that provided a summary of the ideas presented in the discussion thread

although students reached conclusions and made generalizations based on their own statements.

In general, the findings of this study show that the phases of knowledge construction occurring most commonly were similar to Pena-Shaff et al. (2004) and Zhu's (1996) studies, whereby information sharing (elaborated exchanges and expression of ideas) and comments on other participants' contributions predominated. The analysis of the online transcripts also revealed another interesting observation. The messages posted appeared to move from a social or interactive sphere to a more individual sphere. After posting their opinions, ESL students then acknowledged the other participants' ideas, either by agreeing, arguing or using the ideas for further elaboration. Subsequently, they reflected on and built upon the ideas of the others to reach their own interpretations. This clearly supports Vygotsky's (1978) view that knowledge construction evolve from a social (interpsychological) level to an individual (intrapsychological) level as participants reflected and elaborated on their ideas and assumptions.

This means that online discussions can provide a platform for students to develop other cognitive skills such as self-reflection, elaboration, and in-depth analysis of the course content which would lead to purposeful knowledge construction. This is made possible because articulating one's argument in a text-based environment encourages students to engage in reflective and analytical action as the purpose is to transmit or to convey their ideas as clearly as possible to others (Pena-Shaff et al., 2001). This is further corroborated by Lotman (1988 as cited in Warschauer, 1997) who

viewed written texts not only as links to convey information but as thinking devices used collaboratively to generate new meanings.

Although the findings of the present study are consistent with the findings of other studies on online learning (Herring, 1996; Gunawardena, Lowe & Anderson, 1997, Pawan et al., 2003; Schellens & Valcke, 2005), still, the fact remains that 71.15% of the total operations generated by the groups were situated in Phase I: Sharing of information. This raised some questions. Fahy, Crawford, and Ally (2001) when looking into the problems of past transcript analysis approaches, noted the 'lack of discriminant capability of instruments' (p. 4). According to them, some previously used analytic approaches and tools have been acknowledged by their developers as failing to discriminate adequately among the types of statements appearing in transcripts. A major problem was that large portions of the transcript were coded into very few interaction categories (Gunawardena et al., 1997; Kanuka & Anderson, 1998; Zhu, 1996), with the result that the transcript's communicative richness may not have been fully revealed.

5.4 Patterns of interaction and reading tasks

The results of the study show that the frequency of overall operations generated by ESL students when completing selected reading tasks was different (refer to Table 4.14, p. 176). The reading task of Identifying Sentence Pattern generated the highest frequency of operations (Freq=299) compared to Paraphrasing (Freq=282) and Previewing and Predicting (Freq=175). Nevertheless, the result of the Friedman

analysis of variance (Table 4.13, p. 173) indicates that the difference in the frequency of overall operations generated by ESL students when they completed the different reading tasks was not significant at p >.05 (χ_r^2 = 4.667, df = 2, p = .097). In addition, the statistical results show that there was no significant difference in the frequency of operations by interactive phase.

Smith in a 2003 study examined task-based, synchronous computer-mediated communication among intermediate-level learners of English. One of the questions he explored was whether task type had an effect on the amount of negotiation that transpired. He had fourteen nonnative-nonnative dyads who collaboratively completed four communicative tasks using ChatNet, a browser-based chat program. Each dyad completed two jigsaw and two decision-making tasks. The chatscripts revealed that task type was found to have a definite influence on the extent to which learners engaged in negotiation.

Blake (2000) carried out a study on fifty intermediate L2 Spanish learners who were paired together for a synchronous chat program to complete different task types. The results showed that jigsaw tasks promoted negotiations, as Pica, Kanagy, and Falodun (1993) had previously predicated.

Pellettieri (1996) also conducted a study on the interactions that took place under a variety of task types, during synchronous electronic discussion between intermediate students of Spanish. She discovered that the total number of negotiation routines generated during each task was different. Different tasks generated different negotiation routines. Out of the five tasks given to the students, Task 2 produced almost double the negotiation routines compared to the others. Task 2 was a closed task with

only one outcome possible. Pica et al. (1993) claim that closed tasks i.e. having only one outcome possible, are expected to generate the largest degree of negotiation.

Even though the instrument of analysis used in this study was different from that of Pellettieri's, the results of the study showed that the quantity of operations generated for the different reading tasks was varied. The task of Previewing and Predicting, was an open task with multiple outcomes possible; Identifying Sentence Patterns and Paraphrasing were closed tasks with one outcome possible (Appendix H). Because a group answer was required, ESL students were required to reach a consensus before a representative could submit the group's answers. Just like Pelliettieri and Smith's studies, the results of this study show that different reading tasks generated the use of varied operations and like Pellettieri's study, the closed tasks generated more negotiations than the open tasks. These studies show that task types influence the amount of negotiation generated.

Literature shows that the level of task difficulty affects the amount of negotiation produced (Anderson & Lynch, 1988; Brown & Yule, 1983; Nunan, 1989; and Pica et al., 1993). Besides discovering that closed tasks spurred more negotiation than open tasks, Pellettieri also noted that tasks that are more difficult required more negotiation than easy tasks. In Pellettieri's study, negotiation routines were identified by means of four main components which were triggers (spur the negotiation routines), signals (the indicators of communication trouble or non-understanding), response (respond to the signals), and optionally a reaction to the response. In this study, for the task of Paraphrasing, three options were given for each of the sentences, whereas none was provided for the task of Identifying Sentence Patterns. In a way, the level of

difficulty for the task of Paraphrasing was made easier (since options were provided) as compared to that of Identifying Sentence Patterns where no help was provided to the students in locating the answers. The fact that the group members had to locate the clues themselves to get the correct answers generated the use of more operations. Hence, more operations were generated for the task of Identifying Sentence Patterns (Freq=299) as compared to Paraphrasing (Freq=282). Furthermore, the subject matter used in the sentences for Paraphrasing (family planning, abortion, immigration, social control) and Identifying Sentence Patterns (nervous system, gross national product, computer system, digestive system, economics) were topics which were outside of ESL students' real world expectations. This could have contributed to the higher number of operations generated as compared to the task of Previewing and Predicting whereby the topic of "College Success" was within their real world experience. Therefore, differences in task types and the level of difficulty of the tasks had an effect the amount of operations generated in this study.

Besides, different task types also influence the patterns of interaction. Sringam and Geer (2001) note that the type of question asked can also impact on the approach adopted by students. In their study, the Australian students were asked to "Consider the issues associated with screening Internet information coming into schools", which required discussion around the topic without necessarily proposing solutions, which are aspects of deeper engagement with the topic. However, the Thai topic, "Problems of natural water and how to conserve it" was more precise and required that solutions to the problem be proposed. Sringam and Geer reported that the Thai students were involved in interaction and collaboration, although not at the higher levels of

engagement. The type of task, therefore, can affect the depth of engagement and elaboration that takes place in the discussion groups.

Likewise in this study, the task of Previewing and Predicting generated the least number of operations compared to Identifying Sentence Patterns and Paraphrasing. This was mainly because ESL students were instructed to share their predictions on what "College Success" meant which was rather general. They were not required to provide a specific solution to a problem as compared to the tasks of Identifying Sentence Patterns and Paraphrasing. Hence, in Phase I for the task of Previewing and Predicting, ESL students tended to generate more of the operation "Expressing a statement of agreement from one or more other participants" (ranked 6th) unlike the operations generated by students for Identifying Sentence Patterns and Paraphrasing, which was "Expressing a statement of observation of opinion (ranked 6th) (refer to Table 4.14, p. 176). This could be because the answer was 'open' meaning that many answers were possible thereby encouraging more expressions of agreement. Another possible reason was that the students were in general agreement with the opinions expressed by group members because they tended to share the same perspective on the topic because they were college students themselves. Whereas the task of Identifying Sentence Patterns and Paraphrasing had only one possible answer, thus, it was likely that students generated more expressions of opinion which needed to be narrowed down to one possible answer. Besides, notes on the RAP website, which listed the "clues" for Identifying Sentence Patterns and Paraphrasing, provided ESL students the knowledge/information needed to state their observation or opinions.

In Phase II, for Previewing and Predicting, students generated more of the operation “Restating the participants' position, and advancing arguments or considerations supported by references” possibly because there was no right or wrong answer for this question. Therefore, students tended to spend more effort restating their stand and providing more references. In Excerpt 2 (p. 217), a lot of exchanges took place regarding the term “facilities’ such as library, air-conditioned classroom, technological enhancement, computer learning and internet services. However, for Identifying Sentence Patterns, ESL students tended to generate more of the operation “Asking and answering questions to clarify the source and extent of disagreement”. This was possibly because it was a closed task with only one answer possible. Hence, students wanted to know why their friends chose a particular sentence pattern as the answer especially when they were specifically instructed to explain the reason for their choices. For Paraphrasing, ESL students generated more of the operation “Identifying and stating areas of disagreement”. Both Paraphrasing and Identifying Sentence Patterns were closed tasks with only one outcome possible. However, options were given for the task of Paraphrasing whereas no choices were provided for identifying Sentence Patterns. It was possible that these options played a role in guiding the students’ discussion. This means that the words used in the options acted as a guide that enabled the students to identify and state the areas of disagreement. For example for paraphrasing, students kept referring to “encourage nor discourage” (refer to Chapter 4, Excerpts 5-7).

In Phase III, for Previewing and Predicting students tended to generate more of the operation “Proposing and negotiating new statements embodying compromise, co-

construction" as compared to both Paraphrasing and Identifying Sentence Patterns whereby students generated more of the operation "Negotiating or clarifying the meaning of terms". A possible explanation for this could be that the closed tasks of Identifying Sentence Patterns and Paraphrasing required students to be more precise in getting the accurate meaning of the terms which was crucial for the successful completion of the tasks. They were enabled by the notes on the RAP website which served as a guide for them to check that they complied with the notes. Excerpt 4 (p. 224) illustrated this when Tsunami said "read the note first…about comparison". For the open task of Previewing and Predicting no such precise and depth of discussion was required to clarify the meaning of terms.

In Phase IV, both Previewing and Predicting, and Identifying Sentence Patterns generated more of the operation "Summarizing of agreement". This could be because, in Phase I for Previewing and Predicting, students generated the most number of expressions of agreements. Hence, they generated more of the operation summarizing agreement. Likewise for Identifying Sentence Patterns, the operation for expressing agreement was ranked 5th which was the second highest operation generated in Phase I. Therefore, it followed that students generated more of the operation summarizing agreement. For Paraphrasing, students generated more of the operation "Applying new knowledge". The reason for this could be that in Phase II and Phase III, students generated the highest frequency of the operation "identifying and stating areas of disagreement" and "negotiating or clarifying meaning of terms" respectively. Thus, to indicate that students came to a new understanding of the task they applied their newly-constructed meaning. This was illustrated in Excerpt 7 (p. 230) when Alexandra gave

the synonyms of the words. All these suggest that in this study, task types not only influenced the amount of discussion but they also influenced the patterns of interaction.

Arnold and Ducate (2006) also note that questions or tasks have an essential role in determining the type of cognitive activity present in discussions. They found evidence of synthesis and resolution phase in discussions where questions specifically asked students to engage in practical applications. They also note the importance of shared goals, which required a collaborative solution as this would help the online discussions to move to the resolution phase. Thus, well-designed tasks are important to see evidence of resolution in a computer conferencing. In a study which focussed on online collaborative problem solving, Murphy (2004) reinforces the importance of designing appropriate tasks to move students through to resolution. Learners specifically were tasked to formulate and resolve a problem and it was found that the participants engaged more in problem resolution than in problem formulation which was the converse of previous studies. This indicates the importance of the purpose and design of the learning activity. Murphy posits that problem or case-based activity whereby the task expectations are clear would aid participants in a computer conferencing to move to the resolution phase.

The results in this study show the presence of all four phases of interaction, which included Phases III and IV (resolution phase). This was because the tasks in this study required collaborative solutions from the students. They had to come to an agreement before they could submit the group answer. Nevertheless, the amount of operations generated for the Phase IV was comparatively lesser than that of Phase I and Phase II, which were the sharing phase and the discovery of inconsistency of ideas

phase. The results of this study show that ESL students were generally engaged in the lower mental functions based on the Interactive Analysis Model, which shows the movement from the lower to the higher mental functions. This pattern of interaction, which was skewed towards the lower mental functions in Phase I and II was observed to be the same for all three different task types albeit with varied frequencies of operations used. Therefore, tasks did to a certain extent determine the type of cognitive activity as suggested by Murphy, and Arnold and Ducate. However, for this study, this pattern could have been caused by the fact that the groups were unable to sustain the discussion toward the higher mental functions. They were able to move to the resolution stage though not many operations were present. Perhaps the assistance given by the more capable peers within the group was inadequate to elevate and sustain the discussion to the higher levels. Nevertheless, what was important was that learning took place as evidenced by the presence of all four phases of interaction.

Arnold and Ducate (2006) also point out that it was the individuals who confirmed or rejected their own solutions and not the group. Interestingly, the same was observed in this study. Excerpts 3 (p. 222) and 4 (p. 224) illustrate how Cokolat rejected her earlier answer of “description” and changed it to “comparison”. Likewise, Excerpt 5 (p. 227) and Excerpt 7 (p. 230) show Alexandra rejecting his original answer “B” to “A”. All these excerpts show that it was the individuals who changed their answers after the group discussion. The group members did not reject the wrong answers but merely pointed out the points of disagreement and gave clarification to their answers. The ultimate decision to accept or reject each other’s solutions lay with the individuals. When students did show that they rejected their own answer it showed

that learning had taken place because the students showed they had internalized what they had learned from OC.

The results of the current study corroborate the results of the studies by Murphy (2004) and Arnold and Ducate (2006) despite the fact that these studies used a different coding scheme (the categories and elements based on the community of inquiry framework).

The above discussed how task types affected the amount of operations generated as well as the patterns of interactions. However, despite the differences in the frequency of operations generated when ESL students completed different reading tasks, statistical analysis revealed that the difference in the frequency of overall operations used was not significant. In addition, the statistical results show that there was no significant difference in the frequency of operations generated by interactive phase. This means that in terms of overall number of operations used, ESL students generated more or less the same number of operations when completing different reading tasks. Moreover, the students generated more or less the same number of operations by interactive phase. It is noted that although Pellettieri's study showed that language tasks affect the quantity and type of negotiation produced, it was unclear if analysis was carried out to show if the results were statistically significant.

Conversely, the results of the study show that the patterns of operations generated were mixed for the four interactive phases. The Spearman rank-order correlation was used to examine the relationship in the overall pattern of interaction demonstrated between the three reading tasks. The results show that there were only two similarities and three differences in the operations used (refer to Tables 4.15-4.17).

Out of these five similarities, three were found in Phase IV. Phase IV only has two operations (N=2) which means that the chances of r = 1 or -1 is greater than if N > than 2. So, the results would either be positive or negative correlation whereby the operations used would be similar or the opposite of each other respectively. In other words if one operation was ranked 1st, the other would be ranked 2nd. Hence, this effectively means that the patterns of operations generated were similar for only Phase I between the tasks of Previewing and Predicting and Identifying Sentence Patterns whereby the rank-orders for the operations were similar. On the surface, this similarity looked surprising because both task types were different for Previewing and Predicting (open) and Identifying Sentence Patterns (closed). Moreover, the frequency of operations generated was different between the former (Freq=108) and the latter (Freq=222). However, upon closer inspection, the percentage of overall operations generated was similar in Phase I for both Previewing and Predicting and Identifying Sentence Patterns (refer to Table 4.13, p. 173). For the task of Previewing and Predicting the percentage of operations used for Phase I was slightly more than 60% (Freq=108) out of an overall 175 operations generated for this task. Similarly, the percentage used for Identifying Sentence Patterns was close to 75% (Freq=222) out of an overall total of 299 operations generated for this task. Although the difference in the percentages seemed large, the difference was statistically not significant. What was evident, however, was that for both tasks the operations were heavily concentrated in Phase I. Therefore, the results showed that there was similarity in the use of the operations.

However, the patterns of operations used were the opposite of each other in Phase II between the tasks of Previewing and Predicting and Identifying Sentence Patterns. The ranking of the three operations used in this phase were in direct opposite of each other (refer to Table 4.14, p. 176). The most used operation for Previewing and Predicting was "Restating the participants' position, and advancing arguments or considerations supported by references" (ranked 3rd) at 58.33% and the least used operation was "Asking and answering questions to clarify the source and extent of disagreement" (ranked 1st) at 8.33%. Conversely, the opposite was true for Identifying Sentence Patterns with "Asking and answering questions to clarify the source and extent of disagreement" (ranked 3rd) at 47.5% and "Restating the participants' position, and advancing arguments or considerations supported by references" (ranked 1st) at 20%. The task for Previewing and Predicting was open, meaning that there was no right or wrong answer. Hence, it was possible that ESL students were more open to accepting a variety of answers and then they advanced their arguments with references (Excerpt 2). In contrast, for the closed task of Identifying Sentence Patterns only one correct answer was possible, which could explain why ESL students asked and answered questions to clarify the source and extent of disagreement. Furthermore, they were also equipped to ask and answer the questions based on the RAP notes, which provided 'clues' to help them to identify the sentence patterns. So, if they disagreed with a message posted which did not fit in with their understanding then they could ask specific questions and support their arguments with the information they obtained from the notes given. Conversely, they could do the same to answer questions to clarify their disagreement (refer to Chapter 4, Excerpts 5-7).

The results show that there was no correlation in Phase II for the tasks between Identifying Sentence Patterns and Paraphrasing; and between Previewing and Predicting and Paraphrasing. This means that the operations used between these tasks were neither similar nor different. One reason for this could be that there was a tie in the use of two of the operations for Paraphrasing (Table 4.14, p. 176). In other words, the patterns of operations used were different for Phases I and III between the tasks of Previewing and Predicting and Paraphrasing; and Identifying Sentence Patterns and Paraphrasing.

Overall, the analyses indicate that the pattern of operations used by ESL students when completing different reading tasks was comparatively different. This seems to imply that different reading tasks tended to have an effect on ESL students' operations use. This accorded with as other studies investigating communication patterns and the knowledge construction process of students which found that tasks or topics for online discussions may place an emphasis on different cognitive processes (Schellens & Valcke, 2006; Shrire, 2006).

5.5 Patterns of interaction and reading performance

The quantitative results show that there was a significant relationship between the reading scores of the three selected reading comprehension tasks, indicating that there was a difference in the performance of ESL students when they worked on different reading tasks. However, quantitative analyses of the frequency data of operations used indicate that there was no significant correlation between the reading

scores and the frequency of overall operations used for Previewing and Predicting, Identifying Sentence Patterns and Paraphrasing (refer to Table 4.20, p. 188). Neither was there any significant relationship between the reading scores and the frequency of operations used in all the four phases of interaction. These quantitative results suggest that the frequency of operations used was not related to the reading scores of all the three reading tasks. Kapur and Kinzer (2007) claim that socio-cognitive conflict is in fact a significant predictor of group performance. However, in this study there was no evidence that Phase II: Discovering the inconsistency of ideas was significantly correlated to ESL students' reading performance.

Nevertheless, in Phase I, there was a significant positive correlation between the reading scores of Previewing and Predicting and the operation "Corroborating examples provided by one or more participants" (Table 4.21, p. 190). Likewise, in Phase 1, positive significant correlations were found between the reading scores of Paraphrasing and the operations "Expressing a statement of agreement from one or more other participants" and "Asking and answering questions to clarify details of statements. This means that ESL students got higher reading scores when they used more of these operations. There was a negative significant correlation between the reading score for Paraphrasing and the operation "Corroborating examples provided by one or more participants." This means that students obtained higher scores when they used less of this operation. No significant correlation was found between the reading scores of Identifying Sentence Patterns and the operations used.

For Phase II, both the scores for Identifying Sentence Patterns and Paraphrasing were significantly correlated to the operation "Identifying and stating areas of

disagreement" although the relationship was positive for the former and negative for the latter (Table 4.22, p. 191). So, better performance was achieved when students used more of this operation for Identifying Sentence Patterns. Conversely better scores were achieved when ESL students used less of this operation.

For Phase III, negative significant correlations were found between the scores of Previewing and Predicting and the operation "Negotiating or clarifying the meaning of terms" (Table 4.23, p. 193). The operations "Identifying areas of agreement or overlap among conflicting concepts" and "Proposing and negotiating new statements embodying compromise, co-construction" were negatively correlated to the scores of Paraphrasing. There was no significant correlation between the scores of Identifying Sentence Patterns and operation used.

For Phase IV, there was only one significant correlation, which was between the scores of Previewing and Predicting and the operation "Summarizing of agreement" (Table 4.24, p. 194). All these show that the scores of the respective reading tasks improved when ESL students generated more of certain sets of operations. It can be concluded that ESL students employed a different pattern of operations when working on different reading tasks.

The quantitative analyses of the frequency data indicate that the reading performance of ESL students was dependent on the use of different operations which in turn was dependent on the reading task. Therefore, the results suggest that ESL students were flexible in their use of operations i.e. different sets of operations were generated depending on the different reading tasks. Although these findings are based on the operations generated during OC, they seem to concur with literature on successful

comprehension which found that skilled reading does not involve the use of a single potent strategy but the coordination of multiple strategies (Brown et al., 1996). Although this is true of successful reading, the results of this current study point to the same conclusion that being flexible in the generation of operations is crucial for successful learning. Therefore, these quantitative results suggest evidence in support of the contention that the deployment of appropriate operations is essential to successful comprehension.

Studies on collaboration indicate that the rates of participation clearly affect the types, structure and phase of knowledge construction in discussion groups (Harasim, 1990; Hiltz, 1990; Pena-Shaff et al., 2001; Schellens & Valcke, 2004). Schellens and Valcke (2004) note that groups that posted lots of messages (discussion activity) performed at a qualitatively higher level. However, their research did not focus on relationships between reading performance and operations generated. These studies mainly focussed on the knowledge construction among the participants during online discussions. Cook (1982), on the other hand, posits that it is the quality rather than the quantity of exchange transactions that should be the focus of analysis. The findings of this study whereby some of the operations generated were positively correlated to ESL students' reading scores strengthen the argument that the operations generated during OC, is an important factor for successful comprehension. However, unlike strategy use in reading comprehension where the reader has full control over the full use of the reading strategies to aid comprehension, operations generated during OC is very much dependent on the individual and group functioning of the group members. So, the frequency of the operations generated is very much reliant on how the others in the

group respond to the postings of the others. This is illustrated in the following excerpt. The exercise on Identifying Sentence Patterns required the groups to identify the sentence pattern of the sentences given and to highlight the word(s) that suggest the pattern(s). There were altogether five (5) sentences. The example below is taken from the transcript of Group E's online discussion on the first sentence.

Sentence 1: Nervous systems consist of two major types of cells: neurons, which are specialized for carrying signals from one location in the body to another, and supporting cells, which protect, insulate, and reinforce neurons.

Appendix H

Excerpt 1: W9/GrpE/ISP/9.46-9.50pm

User Name	Time	Message	Interactive phases/ Response types
Tudung	9.46	(1) i think no 1 is classification..	Phase I A: Expressing an opinion (1)
Cokolat	9.46	(2) no.1 is classification	Phase I A: Expressing an opinion (2)
Winnie_p	9:46	(3) classification	Phase I A: Expressing an opinion (3)
Tsunami	9.47	(4) why u said so? (5) what is ur poof? proof	Phase I D: Asking question to clarify details of statement (4) Phase I F: Challenging others to engage in discussion (5)
Winnie_p	9:47	(6) normally \'types\' refers to category or in other word, we classify it into several groups..	Phase I D: Answering question to clarify details of statement (6)
Tudung	9.48	(7) coz the word consist	Phase I D: Answering question to clarify details of statement (7)
Winnie_p	9:48	(8) any arguement?	Phase I F: Challenging others to engage in discussion (8)
Cokolat	9.49	(9) the clue words is...nervous system consists of... consists of... (10) tsunami? your answer?	Phase I D: Corroborating examples provided by one or more of the participants (9) Phase I F: Challenging others to engage in discussion (10)
Tudung	9.49	(11) tsunami how about you?	Phase I F: Challenging others to engage in discussion (11)

User Name	Time	Message	Interactive phases/ Response types
Tsunami	9.50	(12) i agree with both of u... it is classification agree	Phase I B: Expressing a statement of agreement from one or more participants (12)

There were altogether 12 operations identified in this online exchange between the members of group E when they discussed sentence 1. There was no disagreement between the participants. All the group members were in agreement that 'classification' was the answer. The excerpt shows that the group members were merely pooling their knowledge which in essence was mutually understood. This suggests that because there was no conflict that required the group members to adjust their pre-existing cognitive schema, the discussion took only four minutes to wrap up.

However, 26 operations were identified when the same group E students discussed the sentence pattern of sentence 3 (Excerpt 3, p. 222). The frequency of operations generated when they discussed the answer for sentence 3, was more than twice that of sentence 1. The main difference between the discussion on sentence 3 and sentence 1 was that for sentence 3, there were disagreements between the group members as to what the correct answer was. Initially Cokolat, Winnie_p and Tudung shared the same answer, which was "description". However, when Tsunami questioned them about their answer and told them that she thought "comparison" was the answer, the others reexamined their answers and agreed with Tsunami after further discussions. Because of the conflict in their answers, the group took 12 minutes to wrap up their discussion on sentence 3. Hence, the frequency of operations generated was twice that of sentence 1. The excerpts above show that if the group members share the same answer and there was no conflict, then they would end their discussion quickly,

meaning less messages were posted. This would mean that the frequency of the operations generated would be less. However, if there were disagreements within the group, then this conflict would energize the discussion further as was observed in the discussion for sentence 3. Hence, more messages were posted thereby increasing the frequency of the operations produced. The findings corroborate Gunawardena et al.'s (1997) observations that 'where there is less argument within a group, negotiation may remain largely tacit and the process may conclude at one of the earlier phases' (p. 413). They further add that when an example cannot be made to fit with agreed-upon boundaries that negotiation must become overt and the co-construction of knowledge becomes visible.

Unlike literature on successful reading (Anderson, 1991; Horiba, 1990; Padron and Waxman, 1998) which suggests the importance of choosing appropriate reading comprehension strategies and knowing how to execute a strategy successfully and coordinating its use with other strategies, the operations generated is subjected to the dynamic interactions within the group. Hence, for this study it is not possible to discover if ESL students were able to choose and use the correct operations for effective reading performance. This is because analysis was carried out on the contributions of the groups and not solely on the individual's contributions. Since online discussion exerts a mediating effect on individual cognitive and conceptual processes, the task of identifying the coordinated use of operations for successful reading performance is quite impossible.

Nevertheless, it may be interesting to compare if there are differences in the operations produced between proficient and less proficient students when they work on

the same tasks. However, it is not the objective of this study to look into this. Also in this study all the groups consisted of students of mixed English language ability. Hence, it is not possible to know if there were differences in the generation of operations between proficient and less proficient students. Neither is it possible to know if the patterns of interaction between the proficient and less proficient students were similar or otherwise.

5.6 Pedagogical implications and recommendations

The findings of this study yielded information that has important pedagogical implications especially on learning and instruction, and the structuring of online courses.

5.6.1 Learning and instruction

This study uses an adapted version of the Interactive Analysis Model in examining the patterns of interaction of ESL students in a reading course during OC. Analyses in this study reveal that OC significantly helped ESL students in their reading performance. Although all the ESL students benefited from OC except for one (no change), the greatest gainers were the low proficiency students followed by the average proficiency students, in terms of improved posttest scores at the individual level. In terms of improvements in results of the pretest and posttest by question, the analysis revealed that the majority of ESL students showed improvements in answering

questions, which were at the lower levels of cognitive domain based on Bloom's taxonomy. The results indicate two things. First, the positive effects of OC on the individual student's improved reading performance provide empirical evidence in support of the sociocultural approach to learning. It underscores the importance of learning in the sociocultural context. Second, the majority of ESL students who participated in this study benefited from the OC although at the lower cognitive levels. The findings of this study are in agreement with the findings of other studies on OC (Eijl, Pilot & De Voogd, 2005; Gokhale, 1995; Gunawardena et al. 1997; Hooper, 1992; Sringam & Greer, 1001; Webb & Palincsar, 1996).

These studies, therefore, validate the fact that OC presents a unique opportunity for students to scaffold each other's learning. Collaboration through peer interaction can be seen to facilitate individual cognitive development thereby leading to knowledge acquisition. When the groups interact, they tend to build upon each other's knowledge. In other words, peer interaction allows the scaffolding of knowledge to take place. Additionally, the nature of OC enables the participants to refer to the online transcripts which permit the participants to reflect on their learning. Other participants may use some parts of the online transcripts as a model to emulate. This can be seen in the assignment submitted by group A (Appendix I) which mirrored the online discussion. Vygotsky (1978) describes peer interaction, scaffolding, and modelling as important means of aiding individual cognitive growth and knowledge acquisition.

Nevertheless, a relevant point that is called into question is the degree to which OC facilitate cognitive growth. The results of this study has shown that OC aids cognitive development but at the lower levels of engagement i.e. as evidenced by the

predomination of the sharing phase of interaction. Other studies on online collaborative learning also show similar results (Gunawardena et al., 1997: Herring, 1996; Pawan et al., 2003, Pena-Shaff et al., 2001; Pena-Shaff & Nicholls, 2004; Schellens & Valcke, 2005; Sringam & Greer, 2000; Zhu, 1996). Despite the differences in research designs and coding schemes of these studies, they show similar results i.e. students tended to engage in the lower levels of engagement such as sharing and comparing of information. Nevertheless, these studies generally conclude that the structuring of the classroom tasks affects the types, structure and the phases of construction of knowledge.

One aspect of the structuring of the task is that of the inclusion of teaching presence in OC. The present study only required the four group members to complete the reading tasks. Although the mixed ability group showed positive results, in terms of reading performance, they were found to be engaged at the lower levels of cognitive domain. In addition, analyses of the online discussions were found to be skewed towards Phase I: Sharing of information. However, there were evidence of the other phases of interaction like Phase II: Discovering the inconsistency among ideas, concepts, or statements, Phase III: Negotiating for meaning/Co-constructing of knowledge, and Phase IV: Making agreement statements/Applying new knowledge although at a much lower frequency of occurrence as compared to the sharing phase.

Vygotsky's (1978) notion of the ZPD posits that an individual's cognitive development can be positively influenced with the assistance of an adult(s) or more capable peer(s). This has been proven true in this study as can be seen in the pretest and posttest results. ESL students who participated in this study have shown improvements

in their reading scores although at the lower cognitive levels. This suggests that the mixed ability group of ESL students were only able to provide limited assistance to one another in advancing through their ZPD. However, since instructors are seen to be more capable of providing assistance to the participants of online discussions, they (the instructors) are, therefore, more able to help these participants to advance further through their ZPD as compared to the group members. Hence, this underlines the importance of having a visible teaching presence during online discussion. Garrison et al. (2001) confirm this when they wrote, "often students will be more comfortable remaining in a continuous exploration mode; therefore teaching presence is essential in moving the process to more-advanced stages of critical thinking and cognitive development" (p. 10). They further assert that the integration phase in the interaction process "requires active teaching presence to diagnose misconceptions, to provide probing questions, comments, and additional information in an effort to ensure continuing development, and to model the critical thinking process" (p. 10).

Pawan et al. (2003) see the instructor as an important model for the other students to emulate. They explain that the instructor “plays the role of clarifier, challenger, and elaborator, perhaps modelling for students through the use of outside references to support her claims and by guiding the discussion…” (p. 22). They further add that instructor interventions should be purposefully framed within the “contexts of integration and resolution that is in Phase 3 and Phase 4 of the practical inquiry model” (p. 24). Phases 3 and 4 refer to the integration phase and resolution phase respectively of the Practical Inquiry Model. Pawan et al. adapted the Practical Inquiry Model from Garrison et al. (2001). These phases are similar to Phase III: Negotiating for

meaning/Co-constructing of knowledge and Phase IV: Making agreement statements/ Applying newly-constructed knowledge of the adapted version of the Interactive Analysis Model used in this study.

Schrire (2006) in examining how the discourse moves underlying the instructor's interventions related to knowledge-building process in online discussion forums, discovered that instructors' postings can influence the direction of the online discussion as well as moving it to "greater depth" (p. 66). Pawan et al. (2003) also acknowledge the importance of the instructor by observing that "Without instructors' guidance and 'teaching presence', students were found to engage primarily in 'serial monologues' " (p. 119). Pawan's definition of "teaching presence" referred to the instructor's role as a facilitator during online discourse. Besides including facilitating discourse, Anderson et al. (2001) further expanded the definition of "teaching presence" to include design and organization and direct instruction.

One of the goals of CL is to shift the focus of classroom authority from the teacher to student groups, so that self-governance can help learners to acknowledge dissent and disagreement and cope with difference (Bruffee, 1993). However, all the studies above show that instructors should maintain an active and visible role so that they can signpost students towards achieving the higher phases of interaction such as synthesising, integrating and application.

This means that in this study, it was insufficient for the researcher to merely provide RAP notes on the web for the students to refer to when they conduct their discussion. Although the RAP notes did provide some form of help to the students to refer to, these notes were static in nature and were not able to provide the kind of

dynamic input that an active participating instructor is able to do, in order to guide the students towards higher phases of interaction. Hence, it is important that proponents of CL pay special attention to the role of the instructors toward making CL more successful. Instructors are a necessary component of CL as they are more capable of helping the students to advance further in their (students') ZPD compared to their peers. In addition, the instructors could signpost the direction of the discussion, which enables them to guide the students towards higher cognitive growth during online learning. The role of the instructors is a very demanding one. First, they have to demonstrate their roles as facilitators overtly. Second, they have to show leadership in order to provide cognitive direction to guide the students.

The results of this study show that tasks have an effect on the pattern of operations used. The quantity and types of operations used are affected by task types, the level of difficulty of the task as well as the task questions (refer to 5.4, p.257). This means that instructors of online learning will have to carefully design the tasks for OC in order to guide students toward higher mental functions. Arnold and Ducate (2006) observe that tasks have an essential role in determining the type of cognitive activity present in discussions. The results of this study show that closed task generated more operations than open task. Moreover, the operations generated were of a higher mental level. The same was observed for more difficult questions which generated more amount of operations which were of a higher mental level.

Wertsch (1991) proposes that learning takes place first via the intermental (social) plane then through the intramental (individual) plane whereby higher cognitive processes were derived from social interactions. However, the higher mental functions

are not direct copies of the social process. Vygotsky (1978) conceptualised cognitive development as the transformation of socially shared activities into internalized processes. Co-construction of knowledge takes place when the participants work with what they have appropriated during social interaction and then internalized by the individual. Therefore, there exists an interdependence of both the individual and social construction of knowledge (Chang-Wells & Wells, 1993; Gunawardena et al., 1997; Salomon, 1993). Internalization involves transforming aspects of the dialogue used during interaction, into inner speech and further into verbal thinking (Vygotsky, 1986). Inner speech is used to guide the individual's thinking and problem solving later. In other words, internalization is the result of intermental processes of the group, which in turn is the result of mutual negotiation during collaboration. This would lead to the formation of new knowledge.

The findings of this study are in line with the interdependent and transformative view of internalization. The qualitative results of this study demonstrate that learning takes place at both the social and individual level (refer to Chapter 4, Excerpts 5-7, p. 227, p. 229, p. 230). These excerpts show evidence of transformation taking place. The group members were discussing the correct paraphrase for a sentence. Initially, Excerpt 5 shows that Alexandra's answer conflicted with the other three members. The three members agreed that the answer was "A" (which was the correct answer) whereas Alexandra thought the answer was "B". However, as the discussion progressed (in Excerpt 7), Alexandra modified his understanding based on the shared constructions with the other three members. He changed his answer from "B" (which was wrong) to "A" (which was the correct answer). The mutual engagement and co-construction of

knowledge among the group members enabled Alexandra to understand where he went wrong. Not only did he understand the source of his error (obtained through the intermental plane), he also could apply the new knowledge (obtained through the intramental plane) to help him get the correct answer when he said, "... paraphrase. u r right. no 2 is a. illegal=agst the law, particularly =especially."

What these excerpts demonstrate is that during discussions, students were able to provide valuable feedback and mentoring during their online discussions, which facilitated the scaffolding of each other's learning to take place. Hence, what they have learnt from their discussions (social learning) is then internalized. Then, they modify their original understanding of the problem and apply their new understanding (individual learning). This underlines the importance of the role of the group in determining their own learning and development especially in terms of providing the opportunity to focus on meaning and on the refinement of their understanding. This process is central to internalization, which facilitates the transformation of knowledge. This is a clear indication that there exists an interdependence of both the individual and social construction of knowledge. What Alexandra learnt from the shared processes was internalized such that he was able to apply the modified understanding to get the correct answer. Therefore, the results of this study support the theory that learning takes place in a social context and that higher cognitive processes originate from social interactions. Chang-Wells and Wells (1993) gave a succinct description of the interdependent and transformative view of internalization in their study of the role of instructional conversations in classroom learning. They wrote, "It is at points of negotiation of meaning in conversation that learning and development occur, as each

learner's individual psychological processes mediate (and at the same time are mediated by) the constitutive intermental processes of the group" (p.86).

Another observation drawn from this study is OC provided a viable platform for students to engage in deep-level discussions outside their classroom. In addition, as was mentioned in the paragraph above, this engagement was conducted in a student-centred environment. It has to be qualified here that although it is advisable for the instructor to have a "visible presence" (in terms of signposting the direction of the discussion), nevertheless, the students themselves are generally entrusted with providing the content and meaning of the discussion. This is corroborated by Bonk et al. (2000) in their study that analyzed discussion in an online conference within a traditional graduate level educational psychology course. They also found that the online discussion was student-centred whereby the instructor was responsible for creating a learning environment that encouraged the students to take charge of their own learning and were responsive to each other. Hence, these studies indicate that OC supports student-centred learning whereby the students themselves are responsible for their own learning, thus allowing them to be more self-directed. Holec (1981) defines self-directed learning (SDL) as the ability of learners to take responsibility for their own learning- i.e. to make decisions about the planning, organizing, monitoring and evaluation of the learning process. Hence, OC can be seen as a viable tool that not only promotes knowledge construction and acquisition but also promotes SDL.

5.6.2 Structuring online discussions

Bonk et al. (1998) in one of their studies noted that asynchronous or delayed conferencing fosters more depth of discussion than synchronous student chatting (as cited in Bonk et al. 2000, p. 24). They found that during synchronous conferencing, students were more interested in posting their opinions on an issue but were not responsive to the postings of their peers. In a later study on asynchronous communication, Bonk et al. discovered that undergraduate students were more responsive to their peers over time. Nevertheless, they found that students were very content focused regardless of the mode of online discussions whether synchronous or asynchronous. The findings of this study on synchronous conferencing corroborated Bonk et al.'s findings that students were indeed content focused as the groups managed to resolve their disagreements and complete their task at the end of their discussion. The results of this study also show that the highest percentage of operation generated by ESL students was "expressing a statement of observation or opinion" which was about one fifth of the overall total number of operation types deployed by the students. This is a high percentage considering that the second highest operation generated was "expressing a statement of agreement from one or more other participants" at 14.68%. Thus, this affirms Bonk at al.'s finding that during synchronous chatting, students were more concerned with sharing their opinions.

However, in terms of being responsive to their peers, the results of this study showed that ESL students were responsive to each other as compared to the subjects in Bonk et al.'s study who were described as being not responsive. This is evidenced by

the fact that the overall percentage of the operations generated by ESL students which indicated “being responsive to their peers” was 53.43%. The figure is derived by adding the percentage of the operations generated by ESL students which indicated “being responsive to their peers”. These included “expressing a statement of agreement from one or more other participants”, “challenging others to engage in group discussion”, “asking and answering questions to clarify details of statements”, “identifying and stating area of disagreement”, “restating the participant’s position”, and “advancing arguments or considerations supported by references” and “asking and answering questions to clarify the source and extent of disagreement” (refer to Table 4.9, p. 153). What this shows is that regardless of whether communication is carried out in real time (synchronous) or delayed (asynchronous) modes, OC is a viable platform that encourages the participants to be content focused and responsive to their peers. Nevertheless, a caveat has to be added as differences in research design and coding schemes may influence the results of the studies.

In this study, the structure of the online conference required the students to discuss the tasks and post their answers at any time convenient to them outside their class hours. There was no restriction to the number of times ESL students could hold their discussions. Nevertheless, it was noted that students in this study chose to make prior arrangements to go online at an appointed time so that they could hold synchronous discussions to complete their task. Therefore, it was noted that all the groups limited their participation to only one online discussion per week. This was in response to the fact that the instructor required that they submit their weekly assignments after their discussions. All the groups managed to complete their task in

one discussion only. Each of the discussions lasted approximately half an hour to forty-five minutes.

The fact that the discussions were conducted synchronously could account for the conversational style of interaction. The exchanges were short and quick not unlike that of face-to-face discussion. In addition, the group members did not seem to pay much attention to the spelling of the words and the grammatical structures of their postings. Another noticeable feature was that the postings were dominated by the use of lower case characters. Examples of the above mentioned characteristics are as follows: "yup.. facilities is another point..should be 'tip-top' at least for students convenient" (Excerpt 2, 15:29, p. 216), "ermmm… how about comparisons? Clue word is \as\" (Excerpt 4, 9.57, p. 224) and "ehehehe sorri.." (Excerpt 6, 20:18, p. 229). Besides that, most of the students used abbreviations in their postings like "ppl" for "people" (Excerpt 5, Jc3yLiaNa, 20.13, p. 227), "imptn"' for "important" (Excerpt 1, Nuraini, 15.14, p. 212), "u're" for "you are", and "tech" for "technological" (Excerpt 2, Cibi, 15.32, p. 216). These are similar to the abbreviations used in sending text messages via mobile phones. Similar to face-to-face discussions, some of the students included in their postings the local Bahasa Malaysia language despite the fact this is an English language course. An example is "aiyaaa… pak cik ni ar…" (Excerpt 7, Tarabas, 20:22, p. 230). What this means is that Tarabas was expressing her dsimay that her point was lost on one of the participants. Other examples of the use of the Bahasa Malaysia language include, "salah" which means "wrong" (Excerpt 7, Mulan, 20:17, p. 230) and "kementerian" which means "ministry" (Excerpt 8, Winnie, 15:27, p. 235). However, despite the use of Bahasa Malaysia (the national language of Malaysia), the completion

of the task itself was not adversely affected. In fact, it helped to enrich the discussion in two ways. First, the student who could not access the word he needed could use the Bahasa Malaysia word, which, therefore, meant that he was able to convey his message across to the other participants. Second, the other students who know the English language equivalent of the Bahasa Malaysia word were able to provide the translation to the rest of the group. This means that everyone benefited from the use of Bahasa Malaysia in the discussion.

Not much attention was paid to the mechanics of writing either. An example of that is the use of punctuation marks. Most exchanges do not have periods and commas. Nevertheless, all these did not seem to interfere with the understanding of the meaning of the message among the group members. Despite the many grammatical, punctuation and spelling errors during the discussion, the groups' final submission of their pieces of assignments were surprisingly error free (Appendix I). This indicates that the group members were more intent on getting the content across during the discussion rather than on paying attention to grammar even though it was an English language course. Despite the use of short conversational style of interaction during synchronous discussion, the length of the messages did not in any way affect the nature of the content as was evidenced by the students' perfectly correct answers when they submitted their assignments.

Another interesting observation derived from the analyses of the online transcript was the choice of words used by the participants in the group. For example in group A, Cibi's choice of word "management of the college" evolved from Winnie's posting about how the students managed the college. The word 'manage' was originally

used by Winnie. Cibi developed it into a different form that is “management”. Another example is Prinze’s use of “admin staff” which was taken from Winnie’s postings of “resident staff” and “administrator”. So, “admin staff” evolved from Winnie’s postings of the words. The examples above, demonstrate that an idea or word from another student can act as a form of trigger that helped the other participants in a discussion to restate and elaborate their points. All these corroborate Vygotsky and Bakhtin’s views. Vygotsky (1978) suggests that aspects of the dialogue used during interaction are internalized by the individuals as inner speech which in turn is used to guide the individual’s thinking and problem solving during subsequent tasks. Bakhtin’s (1986) view is that all utterances (spoken or written) are based on echoes and reverberations of other utterances within a community of practice. Clearly, the postings show that the speech experience of each individual is shaped through constant interaction.

This study shows that real time discussion promoted equity in discussion. Unlike the conventional classroom discussion where discussions may be dominated by certain quarters, real time discussions permitted all to participate equally. Everyone could respond to one posting by keying in his or her thoughts and posting it. In addition, whenever there appeared to be someone whose views contradicted with the rest, the others responded and made sure that that individual’s conflict was resolved and a compromise reached before moving on. This indicates that synchronous discussion did not lack the motivating factor unlike some studies using the asynchronous mode of discussion (Hara et al., 1998; Pena-Shaff & Nicholls, 2004) which found that electronic participation necessitated motivation. One reason why synchronous discussion worked well in this study could be the fact that there were only four members in the group

which enabled the members to keep track of the less active ones. Often, as the excerpts indicate, the active members challenged the less active ones by addressing them personally. Examples of how inclusive the group members were during discussions are "tsunami? yours?" (Excerpt 3, Cokolat, 9:55, p. 223), and "liza what is your answer?" (Excerpt 3, Tudung, 9:56, p. 223). Literature on computer conferencing recommends that groups must be small to enable the individuals to participate (Mason & Bacsich, 1998; Tolmie & Boyle, 2000). Therefore, the results of this study suggest that real time online discussion is able to provide a unique equitable opportunity for students to scaffold each other's learning despite the fact that synchronous online discussions mirror the informality of face-to-face interaction.

Nevertheless, the RAP course was for 14 weeks only, equivalent to one academic semester. There were altogether nine (9) reading skills to cover over the time given. Two weeks were allocated for on-going assessments which meant that only 12 weeks were left to cover the syllabus. This implied that the course schedule was hectic and the students had no choice but to plan for synchronous discussions. Although the RAP website provided the students with the opportunity to consult with the instructor, this did not prove popular as no student took it up. Therefore, the instructor played a limited online role. A reason for this could be due to the fact that the students preferred to complete their assignments during their planned real time discussion. Although the design of the RAP website permitted the instructor to join in the groups' discussion, this was not quite feasible simply because the instructor did not know when the students were planning to have their synchronous discussions. Hence, in this study the role of the instructor during online discussion was severely limited. Hence, the findings

of this study suggest that online discussion has the potential to increase the level of participation and interaction among students, which a traditional classroom would otherwise not be able to provide.

5.7 Limitations and suggestions for further research

The insights provided by the findings reveal the limitations of this study and illustrated three issues for future research namely methodological issues, contextual issues and practical issues.

5.7.1 Methodological issues

The methodological limitations that are discussed in this section include the subjects in this study, instrumentation and coding of the data, and data analyses used in this study.

5.7.1.1 Subjects and online transcripts

This study involves an intact class of ESL students who were registered for a RAP course that used synchronous computer conferencing to supplement regular class discussions. There were 28 students in the class who were divided into seven (7) groups whereby each group comprised four (4) students each. Each group consisted of students who were of low, average and high language proficiency. Of the seven groups, the

transcripts of three groups were selected for the study. Hence, due to the small sample size that covered only one local university-level course, the results of this study could not be taken to be representative of other courses nor can it be taken to be representative of students in other institutions of higher learning elsewhere in Malaysia. This is because different course requirements, which influence the task structure, may generate different results. As was mentioned earlier (refer to 5.6.2), the messages posted for synchronous and asynchronous conferencing are different in terms of quantity and type. Hence, the results of this study should be viewed in the context in which they were obtained i.e. this study was carried out in one intact ESL undergraduate class for a reading course in a local institution of higher learning in Malaysia.

Although the generalizability of the present study may be limited due to the size and nature of the sample, nevertheless, there are elements of the results which may be transferable to other research contexts such as the characteristics of the ESL students, the research design and the course content. Hence, the results of this study may be of benefit to other researchers in helping them to transfer what may be applicable to their study rather than for them to make generalizations. Guba and Lincoln (1989) stated succinctly that transferability, rather than generalizability, is the issue in qualitative-interpretive research.

Another limitation of the study as a result of the small sample size is the use of non-parametric tests in data analysis. These tests included Friedman analysis of variance by ranks, Wilcoxon, signed-rank test, Spearman rank correlation and Kruskal-Wallis test. Although non-parametric tests have the advantage of being “distribution

free", they have a tendency of masking some significant differences that parametric test can reveal (Lapin, 1990).

It is evident from this study that more research on the generation of operations has to be applied to other reading tasks. This study analyzed the online transcripts of three reading tasks of three groups when they worked on the tasks of Previewing and Predicting, Identifying Sentence Patterns and Paraphrasing. Based on Bloom's Taxonomy of cognitive domain they represented comprehension, application and analysis respectively. Perhaps future research should look into the online transcripts of reading tasks that involved the other cognitive categories which were not covered in this study like knowledge, analysis and evaluation.

Further research should be done to discover why the production of certain operations significantly correlated with reading performance but not others (refer to Tables 4.20-4.24). In addition, the operations used that significantly correlated with reading performance should also be further examined because the sample involved in this study was too small. This study was based on an intact ESL class registered for a university-level course that used synchronous computer conferencing to supplement regular class discussions. Replicating the study with a larger number of students is necessary to verify and affirm the findings.

Another important consideration in future research is the inclusion of teaching presence in OC. The results of the pretest and posttest indicate that students showed improvements in their reading scores although most of the improvements were for answering questions that were at the lower levels of the cognitive domain based on Bloom's taxonomy. In addition, the results of the online interaction showed that ESL

students were mainly engaged in the lower phases of interaction i.e. the lower levels of cognitive engagements. As was mentioned in the "Learning and instruction" section (refer to 5.6.1), this suggests that the mixed ability group of ESL students were only able to provide limited assistance to one another in advancing through their ZPD. ESL students may lack knowledge and the experience in scaffolding and guiding each other toward the higher phases of knowledge construction. Since the instructors are more capable of assisting the students, they (the instructors), therefore, should be able to help the students to further advance in their ZPD. Instructor interventions could be geared towards the higher phases of knowledge construction i.e. the phases for negotiating for meaning/co-constructing of knowledge and making agreement statements/applying newly-constructed knowledge.

5.7.1.2 Instrument and coding of the data

One set of questions was used for both the pretest and posttest which comprised a reading passage of 12 questions. The questions were built based on Bloom's Taxonomy which consists of six levels of difficulty. Out of the 12 questions used in the pretest and posttest, there were four questions on comprehension, four on analysis, two on application and one each for synthesis and evaluation. Questions on knowledge were not included in this study because they were deemed too basic for ESL students. Nevertheless, future studies should consider including more questions in the pretest and posttest so that more questions are included in each of the categories based on Bloom's taxonomy. This would provide a fairer view of the cognitive levels of the students.

There were altogether nine reading tasks in this study but the discussions for three of the tasks were used for analyses. They were Previewing and Predicting, Identifying Sentence Patterns and Paraphrasing which comprised one question, five questions and four questions respectively. Although all the three groups spent between 30 to 45 minutes to discuss these questions, it remained that the different number of questions used for the three tasks may have influenced the amount and the quality of discussions generated. This would have affected the frequency of operations used and well as the type of operations generated. Therefore, it would be a good idea for future studies to ensure that all the tasks have the same number of questions to ensure that the amount of discussions generated was not due to the number of questions asked. Furthermore, future research should investigate the patterns of interaction for other reading tasks which were not examined in this study such as Vocabulary, Identifying Main Ideas, Distinguishing between Fact and Opinion, Understanding Sense Relationships within and between Sentences, Making Inferences and Identifying Writer's Attitude.

Despite the fact that the researcher and another rater coded the data (interrater reliability was for the purpose of moderation), there was still a possibility of misinterpretation due to the subjectivity of the task. Therefore, to avoid the possibility of misinterpretation, it is suggested that future research should take into consideration measures to triangulate the interpretation of the students' messages. A good option would be to interview the participants (as a group) as well as to get them to evaluate their own transcripts. These retrospective analyses would help validate the researcher's interpretations of the online transcripts. In addition, this would also provide additional

information on the implicit intentions of the students which is difficult to measure by just looking at the transcripts (Shapard, 1990). However, it has to be noted that such actions should be carried out as soon as possible while the whole discussion is still fresh in the participants' minds. Although including the participants' perspectives would enrich the data and provide a more accurate interpretation, it nevertheless would place a lot of stress on the students. The high demands of the online course and that of their programmes may affect their unfettered participation. Therefore, the course design has to take into account online participation as part of the course assessment as a means to motivate active participation.

Another limitation of this study relates to the instrument used for the coding of the data. Although the adapted version of the Interactive Analysis Model has well-defined categories, it nevertheless did not provide any categories to code the postings which were not related to the tasks. These "extraneous postings" if taken into consideration would have affected the overall patterns of interaction. Pawan et al. (2003) also note that there was no way to code "off-task posts" in their study which used the practical inquiry model. Therefore, future research should look into including other coding categories that could accommodate these "extraneous postings". A more comprehensive coding scheme may provide a better and clearer picture of the patterns of interaction during OC.

Moreover, the number of operations found in each phase of the Interactive Analysis Model has a bearing on the results of the Spearman rank-correlation. The adapted version of the Interaction Analysis Model used in this study comprised four interactive phases whereby there were six operations in Phase I, three operations in

Phase II, four operations in Phase III, and two operations in Phase IV. The fact that Phase IV had only two operations could have affected the results of the Spearman rank-order correlation between the different tasks (Chapter 4, Tables 4.15- 4.17). The significant results for Phase IV for all three different tasks could be due to the fact that there were only two (N=2) operations in this Phase. Hence the chances of r=1 or -1 is greater than if N >2. Hence, it is suggested that future studies could avoid facing this problem by including more than three operations in the various interactive phases.

5.7.1.3 Analyses of data

The role of collaboration is central to the sociocultural perspective of learning, a perspective that under girds much of computer supported collaborative learning research. Therefore, in order to understand the group dynamics and assess the quality of interactions in computer conferencing system, content analysis is crucial. To do this in this study, qualitative analytical methods were used to provide meaningful accounts. The sets of data in this study were first analyzed qualitatively to look for the groups' patterns of interaction during OC using predetermined categories of an adapted version of the Interactive Analysis Model (Gunawardena et al., 1997; Sringam & Greer, 2001). Then, the data were quantitatively analyzed to look for patterns of interactions. There exist some weaknesses in the qualitative aspect of the analysis.

The attempt to understand interactions through content analysis is described as interpretivist by Miles and Huberman (1994). Garrison et al. (2006) argued that:

> … assigning frequencies to the classifications is an aid in understanding patterns, this does not make it a quantitative, inferential statistical procedure. We are in the early stages of understanding and explaining the complexities of online conferencing and educational discourse. The goal is descriptive, not predictive. (p. 4)

Schrire (2006) further adds that a “leap” is necessarily involved when the researcher proceeds from the descriptive to the interpretive level so that the interpretation presented should be regarded as only one of a number of plausible interpretations (p. 66). Henri (1992) also notes that "research in computer conferencing content is usually restricted to the gathering of quantitative data on participation" (p. 122). She argues that as such, it may lead to potential misinterpretation of the phenomenon.

This study employed non-parametric statistical tests in data analysis. Lapin (1990) cautioned that these statistical tests have the advantage of being “distribution free”, but may mask some significant differences that parametric tests reveal. It is therefore, recommended that future research should use a larger sample using the more robust parametric statistical techniques. These include using the t-tests or the analysis of variance (ANOVA) to test the differences in operations generated between different groups and between different reading tasks. Besides that, Pearson product-moment correlation could be employed to check the relationship in the patterns of operations generated between different groups and between different reading tasks.

5.7.2 Contextual issues

So far, this study focused on the interaction patterns of an intact class comprising undergraduate students in a local university whereby English is a second language. The study took into account the students' varying English language background when grouping them into mixed ability groups where each group comprised at least one high, an average and one low proficiency student. The underlying reason for this was the theory of the ZPD whereby the weaker students could benefit from their more able peers. Nevertheless, this study did not address whether language proficiency plays a role in encouraging or limiting participation in computer conferencing. After all content analysis allows only the captured data to be analyzed. Therefore, the more able the participants are in articulating their thoughts or to demonstrate their learning, the more data are captured thus capturing the knowledge construction process. Conversely, if participants are unable to articulate their thoughts, then there is no evidence to show that cognitive processes had taken place within the individual. It would be interesting to know if the data captured only the postings of students who were more explicitly willing to participate due to their better command of the English language or if the weaker students limited their participation. Therefore, future researchers in the field of collaborative interaction should answer the question if language proficiency plays a role in computer conferencing. Future studies could group the students based on their language proficiency and then compare their interaction patterns. The information obtained might shed some light into how best to tailor online learning to the specific needs of these students.

5.7.3 Support issues

Kreijns et al. (2003) suggest that building interactivity into web-based learning environment is important. Despite the fact that the RAP website was designed for interactivity, the results showed that limited interactions took place. By limited, it meant that the participants (the group members) of this study logged in only once a week to discuss the assignment with their friends. This could be due to the fact that students had limited technological support that could facilitate more frequent interaction. Most of the groups mentioned in their postings that they had to go out to cybercafés to carry out their online discussions. Often at the cybercafés, students had to pay to use the computers. It has to be explained that at the time of the study, the university did not have wireless technology and there were only three language laboratories which were often heavily booked throughout the week. This could have resulted in the limited participation of the students as characterized by the fact that they logged in only once a week. Poor technological support coupled with the fact that the online course was to supplement regular class discussion, may have contributed to ESL students' limited participation. In another study conducted in a local university in Malaysia, Ting and Khoo (2006) reported that the participants in their study experienced some challenges which hindered them from participating fully in the online discussions. Some of the challenges faced by these participants were that they had to go to cybercafés to use a computer and problems with the server on their campus.

Hence, future studies should take into account how well the participants are technically supported before embarking on computer conferencing especially when carrying out synchronous discussions. Lipponen (2002) concurs when he suggests that to successfully implement and use computer-supported collaborative learning in natural settings, one has to resolve technical and organizational challenges.

5.8 Conclusion

This study shows that OC was effective in improving the overall performance of the ESL students at both the individual and group levels. The majority of the ESL students benefited from OC, although at the lower cognitive levels. Moreover, in this study, the greatest gainers of OC were the low and average proficiency students.

Furthermore, in terms of patterns of interaction, the results of this study reveal that the process of co-construction of knowledge was evident during OC. However, the results show that ESL students in this study were engaged in behaviour at the elementary phase of interaction. Besides that, the results suggest that different reading tasks influenced the operations used during online discussion. Lastly, the analyses of the results on the relationship between the patterns of interaction and the reading performance show that on the whole, the frequency of the overall operations generated by ESL groups was not related to their reading performance. However, there were some significant relationships between ESL groups' reading performance and the frequency of the operations used.

While this study has provided some insights into OC in an intact ESL classroom in Malaysia, the results cannot be used to make generalizations in other contexts. Factors like the sample population, the learning environment, task types, structuring of the online tasks and teaching presence play an important role in influencing the results of OC. The interplay of learning especially CL with technology is complicated. Therefore, OC has to be implemented with great care and sensitivity while taking into consideration the complexity of the learning environment.