

**EXAMINING COLLABORATIVE LEARNING PROCESSES
IN AN ONLINE COURSE**

by

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ABSTRACT

The purpose of this dissertation research was to examine collaborative learning processes during a project-based small group activity in a graduate online course. The specific research questions were: (1) How can group collaboration be assessed quantitatively? (2) What factors hinder or facilitate small group collaboration? (3) Which participation behaviours in whole group discussions before entering small groups are associated with small group collaboration?

I developed an analytical framework, the Small Group Collaborative Learning Model (SGCLM), for assessing small group collaboration during project-based activity by modifying the Community of Inquiry model (Garrison, Anderson, & Archer, 2000) in combination with the online interaction learning model (Benbunan-Fich, Hiltz, & Harasim, 2005) which used the input-process-output (IPO) framework (McGrath, 1964, 1984; McGrath, Arrow, & Berdahl, 2000). Based on the SGCLM, I analyzed 2,029 messages (732 messages from small group forums and 1297 messages from the whole group discussions by twenty four students enrolled for 13 weeks). The data were coded into three communication categories (cognitive, social, and managerial) as well as communication directions (sender and receiver). For the data analysis, multiple methodological approaches (content analysis, social network analysis, and qualitative analysis) were employed.

Collaboration in six small groups was assessed by three quantitative indices in terms of a group's communication *quantity*, group members' participation *equality*, and a group's information *sharedness*. Following the quantitative assessment, a qualitative examination of the collaboration processes was conducted to identify the specific problems indicated by the quantitative indices. Finally, statistical analyses were performed on students' participation behaviours before entering the small groups to discover whether these behaviours were related to more/less collaboration in the context of the small groups.

I conclude that the three indices can be helpful for researchers, instructors, and course designers who aim at assessing and facilitating project-based small group collaborations in terms of more active communication, more democratic contributions, and more open communication. The collaboration indices can be a useful rubric for instructors to capture potential problems during small group activities and to provide support for the groups. Limitations and suggestions for future research are discussed.

PREFACE

This research was approved by the UBC Behavioural Research Ethics Board (BREB NUMBER: H07-01447).

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DEDICATION

This dissertation is dedicated

to

my Lord, my God for His glory,

to

my husband, my best friend, Dr. Zakil Koo,

to

my lovely son, Warren Bonyoung Koo.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Research Problem

Collaborative learning has well-known benefits in terms of higher achievement and more positive attitudes toward learning when compared to competitive or individualized learning (Alavi & Dufner, 2005; Johnson, Johnson, & Stanne, 2000). In order to practice collaborative learning, small group activity is frequently employed as a major component of online courses in higher education (Wang, Sierra, & Folger, 2003). Because a small group setting fosters a socially and emotionally safer climate, students may be more active and have more equal opportunity to participate in collaborative learning processes (Davis, 1993; Springer, Stanne, & Donovan, 1999). Oftentimes, when students are required to work collaboratively for a group project, they must communicate intensively to accomplish the group project as a team (Curtis & Lawson, 2001). Throughout the collaborative learning processes, they acquire identity as a member in the small learning community (Stacey, 1999; Wenger, 1998).

In order to accomplish a project-based small group activity collaboratively, members should be engaged in constructive arguments by sharing ideas/information, negotiating conflicting opinions, evaluating their own and other members' prior knowledge, and synthesizing the content to reach consensus as a group (Duffy & Jonassen, 1992; Stacey, 1999). Group members need to build up social/emotional bonds among themselves in order to freely challenge peers' opinions without concerns of offended-feelings or

misunderstandings (Thompson & Ku, 2006). Additionally, they have to manage group procedures for scheduling meetings and offer support to each other to solve problems during collaboration (Haythonthwaite, 1998; Mabrito, 2006). Chidambaram & Bostrom (1997) say that a collaborative group signifies “(1) being cohesive, (2) managing conflict effectively, (3) balancing task and socio-emotional needs, (4) communicating effectively, and (5) being involved actively in group activities” (as cited in Haythonthwaite, 1998, p. 179).

However, experiencing group collaboration with high levels of student satisfaction and/or perceived learning does not seem to be accomplished easily in online courses (Richardson & Swan, 2003). Research studies reveal that small group members often face technical problems and emotional frustrations during online collaboration processes because of diverse personalities, different levels of expertise, and different geographical areas or time zones in which they take their courses (Brindley, Walti, & Blaschke, 2009; Wang, et al., 2003). In addition, asynchronous text-based communication, which is a major communication channel in current online courses, has limitations that can cause anxiety and misunderstandings, including late responses and an absence of social cues and facial expressions (Thompson & Ku, 2006). When group members fail to overcome these problems and frustrations, they may forego sophisticated debates and avoid deep engagement in collaboration processes (Curtis & Lawson, 2001). As a consequence, group collaboration remains at a superficial level and members may experience poor quality learning, alongside negative attitudes towards group collaboration (Francescato, Porcelli, Mebane, Cuddetta, Klobas, & Renzi, 2006; Thompson & Ku, 2006; Ubon & Kimble, 2004).

In this regard, research studies have emphasized the critical role of the instructor in online courses in influencing collaborative learning processes. Brindley and colleagues (2009) identify the instructor's skill as an important factor that can positively contribute to the effectiveness of small group collaboration by enhancing the sense of community and allowing for better learning outcomes. Hill, Song, and West (2009) argue that "simply assigning students to work in groups does not necessarily guarantee that there will be collaboration among group members" and claim that the instructor should know "how to promote collaboration" (p. 99). Garrison, Anderson, and Archer (2000) ascribe a failure of computer conferencing to the lack of a responsible 'teaching presence.' They claim that "In fact, when education based on computer conferencing fails, it is usually because there has not been responsible teaching presence and appropriate leadership and direction exercised" (p. 96).

Collaboration, however, is a complicated process for which it is difficult to know "when it is occurring, how effective it is, how to encourage it or what is preventing it" (Ingram & Hathorn, 2004, p. 216). Serious problems hindering collaboration in a project-based group, in particular, may arise without the instructor's awareness because the instructor rarely intervenes in a project-based small group process unless a group requests help (Thompson & Ku, 2006). As Weston, McAlpine, and Bordonaro (1995) claim, instructors should be able to ensure that students are achieving the goals of the activity and remediate problems through assessing learning processes. Therefore, being able to assess a group collaboration process to identify problems is an important step in providing appropriate support and timely interventions. Such interventions may prevent serious

troubles that can lead to failure of collaboration resulting in a low quality of learning and negative attitudes toward online learning overall (ibid).

Content analysis can be a useful method to assess and diagnose group collaboration processes. For the last two decades, many researchers have conducted content analysis for describing learning processes, evaluating quality of learning, and/or identifying factors affecting the quality of learning process (Hara, Bonk, & Angeli, 2000; Penny & Murphy, 2009; Rourke & Kanuka, 2009). Henri (1991) urges instructors to use the content analysis method “as a pragmatic instructional tool to yield practical results which can be used immediately to coach and facilitate learning” (p. 134). She claims that content analysis provides information on the participants and thus the informed educator is better able to offer immediate support to both the individual and the collaborative learning process (ibid). However, Penney and Murphy (2005) note that content analysis may be “a technique more suited for researchers than for instructors” (p. 805) because its process is “difficult, frustrating, and time-consuming” (Rourke, Anderson Garrison, & Archer, 2001, p. 2).

Recognizing the importance of the instructor’s role as a mediator/facilitator who should diagnose problems, and provide timely guidance and appropriate support during small group collaboration, this dissertation research conducts a transcript analysis that can be used as an instructional tool for facilitating group collaboration process. The basic assumption of this research is that problems such as technological troubles and emotional frustrations will be reflected in the network structure of the communication transcript that is the record of collaboration process in small groups. I employ a content analysis method

to categorize text communication and analyze group's communication structure by employing a social network analysis approach.

1.2 Research Purpose, Questions, and Assumptions

The purpose of this research is to investigate collaborative learning processes during a project-based small group activity in a graduate online course. It aims to describe individuals' participation behaviour and to examine interpersonal relationships in small groups in terms of communication quantity. I do not attempt to evaluate the quality of collaboration, but rather try to demonstrate how to capture the potential problems of collaboration by looking at the volume and connection of student communication.

For the research, I develop an analytical model, the Small Group Collaborative Learning Model (SGCLM), for a project-based small group collaboration, based on the theoretical construct of the Community of Inquiry model (Garrison, et al., 2000) and the online interaction learning model (Benbunan-Fich, Hiltz, & Harasim, 2005) which used the input-process-output framework (McGrath, 1964, 1984; McGrath, Arrow, & Berdahl, 2000). I assess collaborations according to three quantitative indices and qualitatively analyze groups' communication scripts to identify specific factors that influence collaboration processes. Furthermore, I examine students' participation behaviours, communication relations, and membership changes that these are associated with more or less collaboration.

The research questions governing this research are as follow:

1. How can group collaboration be assessed quantitatively?
2. What factors hinder or facilitate small group collaboration?

3. Which participation behaviours in whole group discussions before entering small groups are associated with small group collaboration?

For research question #1, I employed three indices for more/less collaboration which are: a group's communication *quantity*, group members' participation *equality*, and a group's information *sharedness*. These three indices are based on the findings reported in existing research studies and theoretical assumptions of less or more collaborative groups. First, it is assumed that active participation, in terms of higher volume of communication *quantity*, may indicate members' engagement with the group task as reported in many studies (e.g., Dennen, 2005; Fahy, Crawford, & Ally, 2001; Hara et al., 2000). Second, it is assumed that a balanced communication structure in terms of members' participation *equality* may indicate democratic contribution to the group task without the group being dominated by one or two members (Cummings & Cross, 2003; Lipman-Blumen & Leavitt, 2001; Katz, Lazer, Arrow, & Contractor, 2004; Shaw, 1964, 1971). Third, it is assumed that a well-connected communication structure in terms of high information *sharedness* may signify the small group community is well established. When a group member tends to send messages all the members (one-to-group) instead of sending them to one member (one-to-one), the group may have established or tries to establish a responsible and inclusive community (Barry & Stewart, 1997; Hyatt & Ruddy, 1997; Wheelan & Kesselring, 2005). Detailed descriptions of how each of the indices is calculated are presented in Chapter 4 of this dissertation.

Research question #2 looks into actual communications to examine whether the quantitative indices can capture any problems experienced in the small groups examined in this study. By conducting an in-depth qualitative analysis on the group collaboration

processes, I intend to show that the use of the indices is a reliable method that can be employed by educators. As well, the communication characteristics identified in less or more collaborative groups in this case study can provide useful information for online researchers and instructors.

Research question # 3 explores students' communication behaviours and the extent to which they are influenced by the whole group community. I test communication network variables on the whole group discussions, which might be related to less or more collaborative groups and to individuals' participation behaviour. This question is intended to identify any variables revealed in whole group discussions that can be used for forming more collaborative small groups.

1.3 Research Method

Multiple methodological approaches are employed in this dissertation research. I employ content analysis on 'a gold mine of information concerning the psycho-social dynamics at work among students' (Henri, 1991, p. 118) in combination with a social network analysis approach to examine group communication structure. The quantitative indices are based on the concepts of content analysis and social network analysis in terms of categorizing communication and analyzing the communication patterns and structure, respectively.

Since this research is not evaluating the quality of learning in terms of such areas as higher order thinking, the coding scheme and procedures are not for rating text communications, rather they are designed for sorting text communications into three

categories, which is a much simpler process than is generally used in existing studies. By categorizing communication transcripts into cognitive, social, managerial categories, I analyze the quantity of communication in terms of the number of words in use, which is a routine approach for studies in which participation is described quantitatively (Rourke, Anderson, Garrison, & Archer, 2001). A message unit could have been used, but I believe a message unit is inappropriate for use in this research because one message usually contains communication that can be coded into more than one category. A message unit is also inappropriate because messages may range in length from very short (e.g., a few words) to very long (e.g., hundreds of words).

After the coding procedure, the data were transferred into a database system using MySQL. Data analyses were performed in uses of Ucinet 6.0 (a social network analysis program), Statistical Package for the Social Science (SPSS), and Microsoft Excel.

1.4 Significances and Scope of the Study

This research will make some significant contributions to existing theories and practices concerned with online collaborative learning in small groups in higher education. Overall, this research uncovers the complexity of collaboration processes by thoroughly analyzing communication structures and relations during project-based small group activity in an online course. This provides a more comprehensive and detailed understanding about small group collaboration processes.

First of all, this research demonstrates how transcript analysis can be useful for both researchers and instructors. The concept of the indices can be used by instructors to

diagnose potential problems of collaboration in a small group and thus to provide appropriate support for the group. The collaboration indices used in this research should also be useful in designing online courses, particularly in equipping software programs to analyze a group's communication pattern and structure.

Another contribution of this research is the analytical model for project-based small group collaboration in online courses, the Small Group Collaborative Learning Model (SGCLM). This model clearly illustrates the relationships among variables in the process of teaching and learning in the online course context. Relying on the constructivists' perspectives on teaching and learning, the model presents how the variables of input, moderator, and outcome are associated with students' collaborative learning processes in a small group community nested within a whole group community. The model will be useful for researchers in designing research studies and analyzing text communication, and also for educators in improving support for group collaboration during online courses.

The multiple methodological approaches employed in analyzing text communication can be a third contribution of the research reported in this thesis. The methodological design, combining content analysis methods with social network analysis methods, offers an example for researchers who aim at conducting transcript analysis.

Recognizing the significant contributions of this research, I also limit the scope of generalizability of the findings of this research. Data analyzed in this research were retrieved from an educational technology course for Masters' degree delivered through WebCT Vista course management system. The course was selected because it is a typical type of asynchronous text-based online course in higher education. The students were

either teachers or professionals in the field of educational technology. However, I do not attempt to make a statistical generalization of the research findings to a larger population. Rather, as Yin (2003) explained, I make an “analytical generalization” of the findings that can be used to expand theoretical understanding of small group collaboration (p. 37).

1.5 Structure of the Dissertation

This dissertation consists of eight chapters. In Chapter One, the research background has been presented to introduce the research problems. The chapter has also presented the purposes of the research and research questions as well as the significance of the research.

In the following chapter, I provide a literature review on the learning theories related to collaborative learning in order to ground the research in social constructivism and group learning theories. I propose an analytical model for project-based small group collaboration, the Small Group Collaborative Learning Model (SGCLM), by adopting the construct presented in Community of Inquiry model (Garrison, et al., 2000) and the input-process-output framework that is used in Benbunan-Fich, Hiltz, and Harasim’s (2005) model for online interaction learning.

Chapter Three presents a systematic literature review of empirical studies that analyzed the text communication of small groups in online courses. The purpose of the systematic review was to establish a comprehensive understanding of the body of current research that has been conducted with similar data in similar settings as my dissertation research. To identify relevant studies to review, I undertook a step-by-step systematic approach to the review. After performing comprehensive searches through databases and carefully

screening for studies that are particularly relevant, I located a total of eighteen journal articles as a data set for this review. The studies were coded based on the Small Group Collaborative Learning model. Findings from the studies are reported by categorizing them according to their research focus. Chapter Three closes with a discussion of some limitations and gaps found in the review of research studies as they relate to my research questions and methods.

Chapter Four describes the research design and methodological approaches that are employed for data analysis in this research. First, I describe the course context, the sample, and the data processing procedures. Next, I explain the research design and methodological approaches undertaken to answer the specific research questions.

Detailed procedures and key issues in conducting content analysis, qualitative analysis, and social network analysis are discussed.

Chapters Five, Six, and Seven report the findings of data analyses answering each of the research questions. Chapter Five investigates research question #1: “How can problems be diagnosed by quantitative indices for more/less collaboration during project-based small group activity?” The chapter contains the coding results of text communications exchanged in six small groups. With the coded data, the collaborations in six groups are assessed by three quantitative indices (i.e., quantity, equality and sharedness). Based on the assessment, groups are ranked from the most collaborative group (ranking 1) to the least collaborative group (ranking 6). The group rankings are discussed by comparing group membership changes before and after the small group activity that were revealed during whole group discussions.

Chapter Six presents the findings of an in-depth review of the text communications to answer research question # 2: “What factors hinder or facilitate small group collaboration?” In order to confirm whether the quantitative assessment is valid, I investigate the problems and facilitating factors that groups actually experienced by scrutinizing the communication scripts of the less and more collaborative groups.

Chapter Seven presents the findings for research question #3: “Which participation behaviours in whole group discussions before entering small groups are associated with small group collaboration?” This is based on the assumption that students’ participation behaviours in the whole group setting before entering small group activity might be related to group collaborations. First, I examine factors that differentiate less or more collaborative groups. Next, I examine how an individual’s participation is determined. I report that 70% of a student’s small group participation can be explained by his/her own whole group participation before entering the small group and other group members’ participation in the small group. Finally, I investigate peripheral students’ participation behaviours in small groups, examining those who were inactive during whole group discussions.

Chapter Eight draws overall conclusions based on the key findings of the research. I discuss limitations of the study and make some suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW I: THEORETICAL BACKGROUND

This research examines the collaborative learning processes in project-based small groups in an online course by analyzing the members' communication. This chapter begins with definitions of key terms used throughout this dissertation. Next, it presents a literature review of constructivism to ground the research in theoretical foundations of collaborative learning. Lastly, it presents an analytical framework of project-based group collaboration, called a Small Group Collaborative Learning Model (SGCLM) that has been developed for this dissertation research based on existing theoretical models, i.e., Community of Inquiry model (Garrison, Anderson, & Archer, 2000) and the input-process-output model for online interaction learning (Benbunan-Fich, Hiltz, and Harasim, 2005).

2.1 Definition of Key Terms

Online courses: While various similar terms for online courses are used in the area of distance education, I use Bates' (2005) illustration of technology-based learning modes to define online courses (Figure 2.1). As indicated by the shaded area in the figure of his continuum model below, online courses are located on the far right, referring to a fully e-learning mode delivered for distance education learners as a type of distributed learning. In this research, therefore, an online course refers to a type of distance education that is delivered completely through the Internet and computer-mediated communication

technology without including any face-to-face classes (Tallent-Runnels et al., 2006).

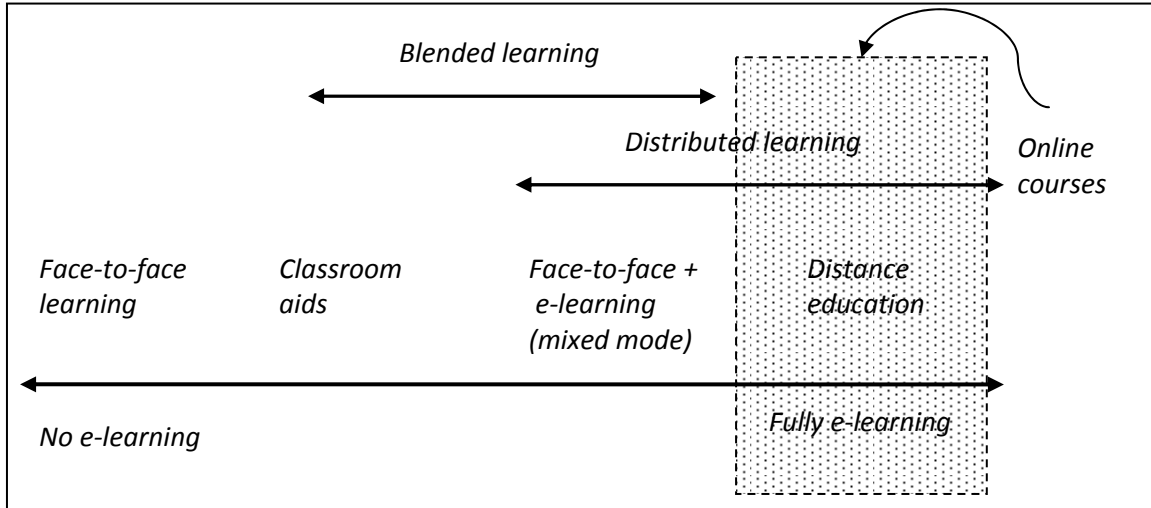


Figure 2.1 Definition of an online course based on Bates' model (2005)

Course management systems (CMS): Online courses may utilize many different types of technologies to support communication and deliver content more efficiently. A CMS includes a software package to support teaching and learning processes. It also provides convenience to instructors for updating/editing the course content, grading assignments, forming groups and tracking students' participation. Current online courses are largely designed and delivered using CMSs such as WebCT/Blackboard or Moodle. Students can view and/or download all course materials from a website supported by a CMS, track their learning progress, and submit assignments electronically.

A course website may be viewed as a virtual classroom where a student interacts with peers and instructors and participates in different learning activities. Class participation is a key component of online learning and occurs mostly through three types of communication channels: asynchronous (time-delayed) forums, synchronous (real-time)

conferences, and e-mails. Asynchronous discussion, in particular, is a major component of an online course. The online course investigated in this research was delivered through WebCT.

Whole group discussion activity is a major component of current online courses (Brindley, Waltin & Blaschke, 2009). For whole group discussion activity, all the students in a given course are expected or required to participate in weekly discussions on a topic drawn from suggested reading materials using a course discussion board (also called a bulletin board), posting messages and responding to classmates' opinions. The instructor is also a key participant in the whole group discussion and, as an expert in the area of knowledge, clarifies any confusion and misunderstandings that may arise, or sometimes acts as one of the discussants to challenge and provoke students' thoughts.

The benefits of whole group discussion activity in text-based conferencing are well-reported in the literature. The benefits are mostly associated with the time-delayed nature of text communication which allows students time to think reflectively before responding (Rovai & Jordan, 2004), leading to deeper discussions of ideas and concepts (Palloff & Pratt, 2005); promoting critical thinking (Bullen, 1998), and higher-order cognitive learning (Garrison, Anderson & Archer, 2000; Kanuka, 2005). The postings become permanent records for learners to read and re-read, alleviating some of the pressures for fast reading. Furthermore, the non-linear structure of threaded discussions allows students to add new ideas anytime by revisiting the prior discussions (Ingram & Hathorn, 2004).

A small group activity is another popular method that encourages students to work together in a small group to complete a team task (Benbunan-Gich, Hiltz, & Harasim, 2005). A small group usually consists of 2-5 members. The purpose of a small group activity is to allow learners more opportunities for active involvement in the group communication by receiving more attention and feedbacks from team members (Graham & Misanchuk, 2004). A small group can be a discussion group or project-based assignment group (the latter is the type of small group activity that is investigated in this dissertation.) During a project-based small group activity for a course assignment, members are expected to communicate intensively as they share information and ideas, compare their perspectives, identify cognitive knowledge gaps amongst themselves, and resolve disagreements to work as a group toward a common goal (Tuckman, 1965). Unlike a whole group discussion where an instructor takes a role as a key member of the learning process, a small group rarely includes the instructor as a member of the group project unless the group requests help (Thompson & Ku, 2006). The learners are expected to plan and manage their group strategies to overcome conflicts and obstacles throughout the learning processes.

Collaborative learning is an instructional method that is an underlying principle in the design and delivery of current online courses (Brindley, et al., 2009). Collaborative learning is often defined by comparing its characteristics with cooperative learning (see Table 2.1). Although some researchers use the two terms interchangeably (e.g., Johnson, Johnson, & Stanne, 2000), other researchers differentiate the two terms (e.g., Alavi & Dufner, 2005; Dillenbough, Baker, Blaye, & O'Malley, 1996; Ingram & Hathorn, 2004;

Stacy, 1999). In this dissertation, I differentiate collaboration from cooperation based on the following definitions provided by previous researchers.

Alavi and Dufner (2005) identify the commonalities of cooperation and collaboration along the lines of how the group task is divided into individual parts and how the team interacts to complete the task. However, they see differences in the underlying assumptions behind how group work is designed and facilitated between cooperation and collaboration. They define collaborative learning as “more learner centered and less structured” for more mature learners who are expected to bring high levels of prior knowledge, autonomy, and intrinsic motivation to learn” (p. 194). Cooperative learning, on the other hand, is for relatively younger learners who need more structured instruction by teachers. Dillenbough and colleagues (1996) argue that learners in collaborative learning processes should make continued attempts to construct and maintain a shared conception of a problem to go beyond cooperative learning where members simply split a task into sub-tasks, later assembling the various parts completed by individual members. Stacy (1999) emphasizes the importance of a collaborative group process to seek a solution ‘as a group’ throughout the group process through members’ exchanging diverse perspectives and resources, negotiating conflicting opinions, and synthesizing them. Graham and Misanchuk (2004) also note a higher level of interdependence among group members in collaborative learning than cooperative learning. Instead of a “divide-and-conquer” approach to tasks in the cooperative learning style, collaborative learning demands “a more complex working together” (Ingram & Hathorn, 2004, p. 216).

Table 2.1 Comparisons between cooperative and collaborative learning

Studies	Cooperative learning	Collaborative learning
Dillenbourgh, Baker, Blaye, & O'Malley (1996)	- split a group task into independent sub-tasks - assemble the partial results	- divide the group task into intertwined layers - continued attempt to construct and maintain a shared conception of a problem
Alavi & Dufner (2005)	- instructor assign students' role/responsibility - relatively structured group process by teachers	- more student-centred structure - assumption of relatively high level of prior knowledge, autonomous intrinsic motivation
Graham & Misanchuk (2004)	-lower level of interdependence among members	- higher level of interdependence among members
Stacey (1999)	- depend individual members' expertise	- seek a solution as a group

Less or more collaboration during small group activity: It is difficult to determine whether a group is collaborative or non-collaborative (Ingram & Hathorn, 2004). Instead, groups can be understood along a continuum from barely collaborative to highly collaborative (ibid). In this dissertation I assess whether small groups are comparatively more or less collaborative groups in a continuum. I employ three quantitative indices to assess collaboration: group's communication quantity, members' participation equality, and members' communication sharedness.

Quantity of communication among members can be an indicator of whether active participation is occurring during collaboration processes in a group. Higher amounts of communication in quantity may not be a direct indicator of a higher level of quality of learning in a group (Dennen, 2005). However, communication among members is a

necessary and fundamental requirement for collaborative learning processes in order for members to share their own ideas and to negotiate disagreements to reach the common goal of the group task (Alavi & Dufner, 2005; Graham & Misanchuk, 2004). We can assume that a group is more collaborative when they communicate often compared with another group where communication is rare.

Another index of collaboration can be members' equal participation in group process. As Ingram and Hathorn (2004) argued, a group cannot be identified as a collaborative group if one member does the bulk of work while others barely contribute at all. On the other hand, exactly equal levels of contribution cannot be necessarily a sign of more and better collaborative learning. However, a group may undergo some problems in the group process if members' participation is extremely skewed toward one or two members by their domination of the communication. Research studies have confirmed that groups outperform when the groups' communication structure is decentralized to distribute information to solve complex tasks (Cummings & Cross, 2003; Katz, Lazer, Arrow, & Contractor, 2004; Lipman-Blumen & Leavitt, 2001; Shaw, 1964, 1971). Therefore, participation that is more equally distributed among group members in terms of quantity can be an important indicator of more collaboration in a small group.

The third index of collaboration used in this research is the communication sharedness among members. The sharedness index is intended to identify how well-connected members are in sending and receiving amounts of communication. It is based on the assumption that the group's work proceeds smoothly if they share most of the communication without isolating one or two members. On the other hand, a group may

experience challenges in their collaboration if communication is mostly one-to-one instead of one-to-group. Even though the nature of the group forum space allows any member to read all the postings, a member may not feel any obligation to respond to or think seriously about the messages where his/her name is not included. According to Vaughan and Garrison (2006), sharing communication is necessary to establish a sense of community. In a well developed group, the communication structure among members is more open to enable information- sharing without isolating or excluding some members (Wheelan & Kesselring, 2005), which is, in turn, related positively to group performance (Barry & Stewart, 1997; Hyatt & Ruddy, 1997). Therefore, this sharedness index can be used as an index measuring relative collaboration because learning occurs through social processes as individuals become members of a learning community (Wenger, 1998).

2.2 Theoretical Framework

2.2.1 Theoretical Background for Collaborative Learning

The theoretical foundation of collaborative learning is rooted deeply in constructivism (Alavi & Dufiner, 2005; Garrison, 2009; Hammond, 2005). While there have been many theorists and strands of constructivism, three significant constructivists affecting collaborative learning can be recognized: Jean Piaget (1896–1980), a representative of cognitive constructivism; John Dewey (1859-1952), a pragmatist and collaborative constructivist; and Lev Vygotsky (1896–1934), a leader of socio-cultural constructivism (Davis & Sumara, 2002). Although their theoretical perspectives differ slightly in terms of emphasizing specific aspects of teaching and learning, the constructivists share a common view of ‘a learner as an active constructor of knowledge’ and ‘a teacher as a

facilitator/moderator for learning' (Dillenboug, Baker, Blayer, & O'Malley, 1996; Jonassen, 1999).

Cognitive constructivism pioneered by Jean Piaget focuses primarily on the cognitive development of an individual (Alavi & Dufuner, 2005). For Piaget (1967), *learning* is a process of constructing and creating knowledge within an individual's mind, while *knowledge* is not an objective entity and cannot exist outside of the human mind or be transferred or taught by a teacher. Thus, Piaget and his fellow cognitive constructivists called for 'learner-centred instruction' as opposed to the objectivists' 'teacher-centered' methods because learning emerges from direct interaction between an individual and information (Alavi & Dufner, 2005; Garrison, 1993). From the cognitive constructivists' perspective, individual learners constantly revise and re-construct their own knowledge system through interaction with other individuals and information in a real world (Glasser & Bassok, 1989; Leidner & Jarvenpaa, 1995; Stahl, 2005).

Social constructivists, led by Lev S. Vygotsky, are often differentiated from cognitive constructivism in terms of their emphasis of learning through group processes in a social and cultural context rather than individual's internal cognitive process (Cole & Wertsch, 1996). For Vygotsky (1978), learning occurs through continual interplay between the individual and others in the zone of proximal development (ZPD), identified as "the distance between the actual development levels as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p.14). He emphasized

the important role of peer learners and teachers/moderators in the socio-cultural context of learning.

John Dewey (1938) asserts that meaningful experience arises through authentic activities in a social learning environment, such as in a school classroom. For Dewey, knowledge emerges from real-life experiences wherein individuals participate in or share in practical problem-solving experiences. Dewey's emphasis on 'learning from collaboration and experience' influenced the evolution of 'learning-centred education' in higher education (Hubball & Poole, 2003, p. 12). A learning-centred approach focuses on 'a community of learners' while a learner-centred education focuses on the 'individual learner' (ibid). The collaborative learning activities investigated in this research can be viewed as a contemporary approach to a learning-centred education.

Dewey identified two sides of educational processes, 'psychological and sociological processes,' that cannot be subordinate to one another (as cited in Garrison et al., 2000, p. 92). These two concepts of learning processes are adopted as 'cognitive presence and social presence' in the Community of Inquiry (CoI) model (ibid). In order to complete the CoI model, 'teaching presence' is added as a third element of educational experience.

For the last decade, the CoI model has been used in a substantial number of studies that analyzed asynchronous discussions to evaluate quality of learning in terms of higher order thinking and critical thinking in higher education (Rourke & Kanuka, 2009). The reason for the popularity of the CoI model in this area may have been because Garrison and his colleagues have provided a series of empirical and theoretical studies that can be employed in analyzing text communication through the use of the CoI framework (see

the lists of publication in a recent review of the CoI framework by Rourke & Kanuka, 2009, Table 1). In these publications Garrison and his colleagues have provided coding frameworks with detailed definitions and examples of the indicators for the three presences as well as advice for resolving methodological issues in employing quantitative content analysis (e.g., Anderson, Rourke, Garrison, & Archer, 2001; Arbaugh, 2007; Garrison & Arbaugh, 2007; Garrison, Anderson, & Archer, 2001; Garrison, Cleveland-Innes, & Fung, 2004).

For this dissertation research I devise an analytical model, the Small Group Collaborative Learning Model (SGCLM), for project-based small group collaboration by expanding the CoI model in combination with the input-process-output (IPO) model presented by Benbunan-Fich, Hiltz, and Harasim (2005).

2.2.2 Analytical Model for Project-based Small Group Collaboration

Garrison and his colleagues (2000) present the Community of Inquiry (CoI) model as a theoretical and conceptual framework that can be used in analyzing computer-mediated-communication to evaluate the quality of learning in higher education. In the CoI model, learners and teachers are the key participants who are engaged in collaborative discussion (Rourke, Anderson, Garrison, & Archer, 2001). While teaching and learning transact, a meaningful educational experience occurs where three crucial presences overlap: *cognitive, social, and teaching presence* (Figure 2.2).

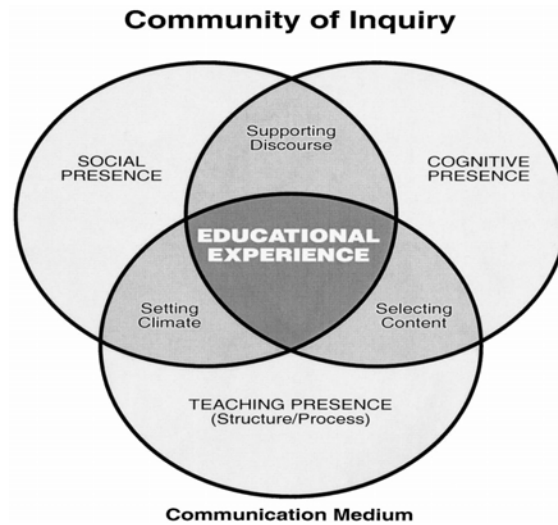


Figure 2.2 Elements of an educational experience (Garrison, et al., 2000, p. 88)

The cognitive and the social presences are about *learners'* development in the learning processes and the teaching presence is mainly about the *instructor's* role including direct instruction, facilitating discourse, and designing courses (Garrison et al., 2000). The cognitive presence, the most basic element to success in higher education, refers to “the extent to which the participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication” (ibid, p. 89). They assert that the cognitive presence can be best understood in relation to ‘critical thinking’, which is seen as four phased processes, namely, *a triggering event, exploration, integration, and resolution.* (p. 98).

The social presence is defined as “the ability of participants in the Community of Inquiry to project their personal characteristics into the community, thereby presenting themselves to the other participants as *real people*” (ibid, p. 98). The importance of the social presence is stressed because it functions as “a support for cognitive presence,

indirectly facilitating the process of critical thinking carried on by the community of learners” (ibid). Garrison and his colleagues argue that cognitive presence is more easily sustained when a significant degree of social presence has been established. They claim that collaborative messages in a true community of inquiry should be “questioning but engaging, expressive but responsive, skeptical but respectful, and challenging but supportive” to go beyond a simple process of transacting information (ibid, p. 96). They identify three subcategories of social presence: *emotional expression*, *open communication* (risk-free expression), and *group cohesion* (indicators of encouraging collaboration).

In the CoI model, the teaching presence is identified as ‘the binding element’ of cognitive presence and social presence (Garrison et al., 2000). Two general functions of teaching presence are: *the design of the educational experience* and *facilitation*. Teaching presence is defined as ‘the primary responsibility of the teacher’ in the educational environment although any one participant may also provide it (ibid, p. 89). Looking at the definition and coding scheme for teaching presence presented in Anderson, Rourke, Garrison, and Archer (2001), teaching presence in the CoI framework is for a whole group discussion activity rather than for a small group activity. While the teaching presence defined as “having three categories - design and organization, facilitating discourse, and direct instruction,” the indicator examples are likely not for small group communication analysis but for whole group discussion analysis. For example, teacher’s postings such as “Thank you for your insightful comments.” or “I think Joe and Mary are saying essentially the same thing” may be common on the whole group discussion board, but would be rare in a small group forum (ibid, p. 8).

For this dissertation research, I modify the CoI model into an analytical model more suited to my research purpose and context. As Rourke states, theoretical models have been modified frequently and substantially because: “the deployment of these conceptual frameworks across various *authentic settings* reveals the difficulty in modeling constructs, processes, outcomes, and relationships in teaching and learning online” (as cited in Rourke & Kanuka, 2009, p. 41). The ‘authentic activity setting’ that is the focus of this dissertation research is a project-based small group activity. As I reviewed the CoI framework, I recognized that the CoI model has been used mostly for analyzing ‘bulletin board discussions’ (whole group discussions). As I indicated in the terms defined above, in whole group discussions and small group collaboration, the roles and responsibilities of the instructors and the students are different. Unlike whole group discussion activities where both students and the instructors were the key *participants* in the collaborative learning process (Garrison et al., 2000), a project-based assignment group rarely includes instructors during the activity (Thompson & Ku, 2006). Instead, the instructor takes the responsibility as an observer, moderator, and resource person to provide any assistance when a group requests help (Wenger, 1998). Wenger states that “Communities of practice are mostly *self-sufficient* [italics added], but they can benefit from some resources” (p. 9).

Another rationale for modifying the CoI model in developing an analytical model for this research is to place small group collaboration within the context of a whole group community. I decided to expand the CoI model to locate small group activity nested within a whole group setting. My dissertation research focuses on students’ small group collaboration and also explores potential variables influencing small group collaboration processes. In this respect, I wanted to have a more comprehensive model that illustrates

all the potential variables influencing small group community across the group collaboration processes. As Archer (2010) recently acknowledged, the CoI model has been largely restricted to analysis of ‘discussions’ (p. 69). Archer talks about a group of researchers’ (Garrison and his colleagues) current efforts to expand the CoI framework from discussion activity to an entire course. Archer says the research group hypothesizes that “students reserve their best thoughts for the term papers and other course assignments” (ibid, p. 69).

In order to expand the CoI model, I employ the input-process-output (IPO) framework (McGrath, 1964, 1984) which is used as a basis for the online interaction learning model presented by Benbunan-Fich, Hiltz, and Harasim (2005). As Benbunan-Fich and colleagues state, the IPO framework is beneficial for identifying the relationships among variables, allowing for researchers’ conceptual ideas investigating the association between variables (ibid). I adopted the idea of presenting variables associated with small group collaboration within a framework of inputs, collaboration process, and outcomes.

In the Benbunan-Fich IPO model, ‘the input factors,’ also referred to as ‘moderator variables,’ include the characteristics of the participants (the students and the instructor) and the educational setting (group, class, university) (p. 23). The learning processes include mediator or intervening variables associated with the amount or type of interaction. Lastly, the output of the learning processes include faculty and student satisfaction, student learning, as well as considerations of cost-effectiveness and access.

The Small Group Collaborative Learning Model in Figure 2.3 illustrates potential variables of *inputs* and *outcomes* that may be associated with small group collaboration

across the timeline. The *inputs* include members' prior knowledge, a group task as a 'catalyst' for collaboration, other elements such as members' experiences, personalities, pre-existing friendship in a whole group community before entering small groups, and instructional design. A small group inquiry community is nested within a whole group community. This means that the students keep participating in whole group discussion activity as they are doing small group activity simultaneously. Thus, the relationship among small group members (called 'membership' here) is assumed to be influenced by, and exert influence on, whole group community. Some groups may have built up friendships among members while other groups may not have known or ever have communicated with each other before entering a small group. A group whose members have exchanged communication during whole group discussions before entering the small group activity may have developed stronger social and/or cognitive presence when compared to other groups whose members have rarely responded to other small-group members' postings during the whole group discussions.

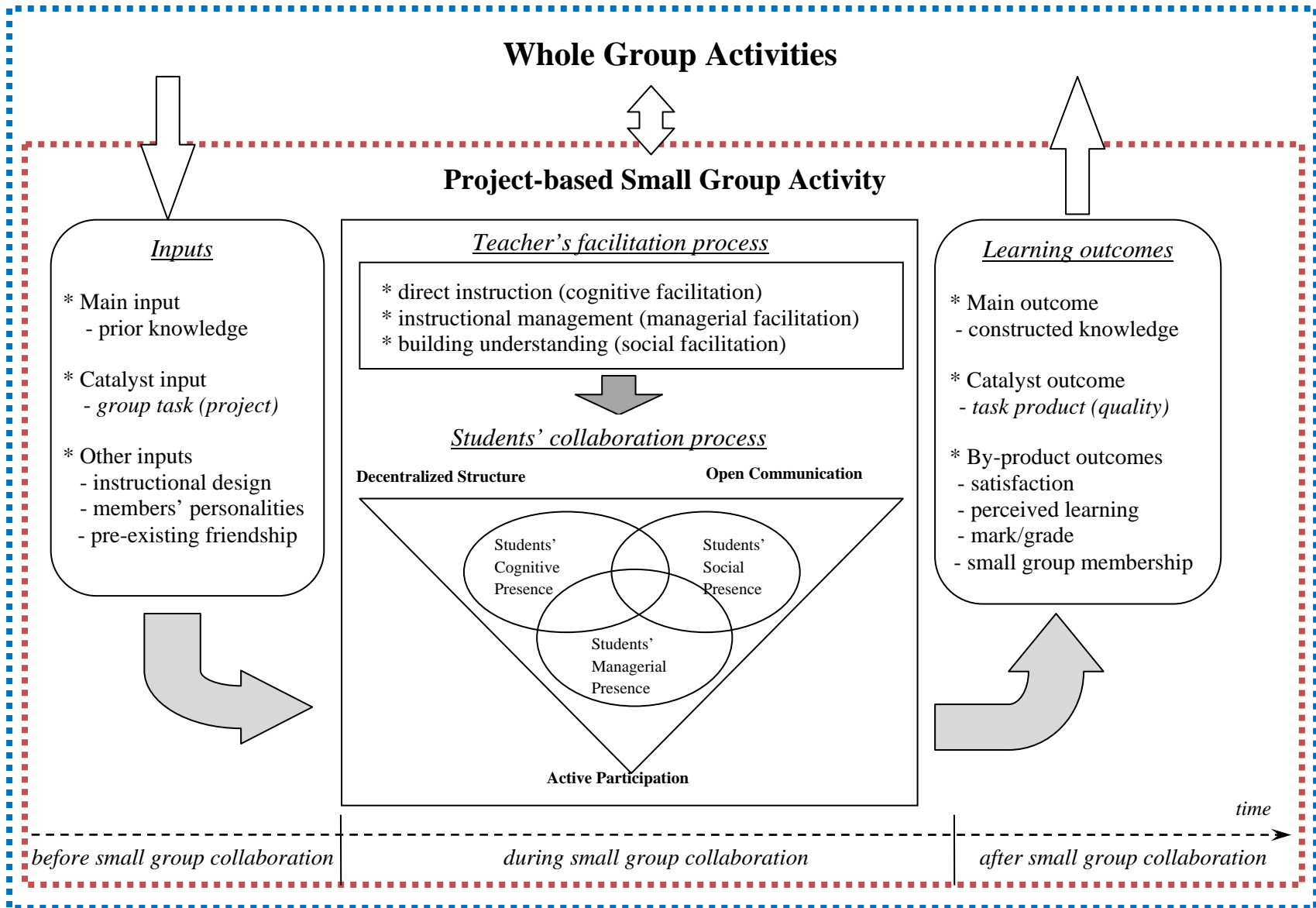


Figure 2.3 Small Group Collaborative Learning Model (SGCLM) for an online project-based small group activity

According to the IPO model (McGrath, 1964, 1984), the collaboration process transforms the *inputs* into *outcomes*. The goal and genuine outcome of a collaborative learning process can be said to be members' constructed knowledge. Throughout the collaboration process, group members presumably have contributed to members' constructing knowledge as well as establishing group membership. Examples of outcomes of group collaboration, therefore, can be learner satisfaction, perceived learning, the quality of the product of the task, and group membership. When the students experience deep and meaningful learning through a collaboration process, the outcomes would naturally be positive with higher student satisfaction and higher levels of perceived learning, higher quality of the group work product, and improved membership in the larger community. Wenger (1998) asserts that learners develop group membership as they engage in the collective process of learning in a community of shared practice. According to Wenger's stages of membership development, group members tend to keep in touch, communicate, and call for advice in a larger community after leaving the small group community (ibid).

For the small group collaboration process, I basically adopt theoretical constructs from the CoI framework in terms of cognitive, social, and teaching presences. The relationships between teaching presence and students' cognitive and social presences, however, are visualized differently from the CoI model. I relocate teaching presence as a facilitator/moderator influencing directly on a group's learning processes. I specify the teaching presence consisting of three sub-dimensions, i.e., cognitive, social, and managerial facilitation. These three dimensions of facilitation are consistent with the list of instructor's roles recommended by Zane Berge (1995), which are pedagogical (intellectual; task), social, managerial, and technical facilitation. I include the technical facilitation within the managerial facilitation dimension.

Detaching teaching presence from students' cognitive and social presences in a small group process and locating it as an influencing factor on a group's learning process should not be misunderstood to depreciate the value of the teacher's role. Rather, it is intended to highlight the teacher's role as a critical factor depending on a group's need. The degree of teacher involvement in small group activities may differ in every course depending on the teacher's teaching philosophy, course design, activity purposes, academic levels, subject area, and so on. Even in one course each group may require different levels of a teacher's attention and facilitation. The model suggested in this dissertation is specifically designed for project-based small group activity in a graduate course. Although motivated autonomous adult learners are expected to preside over their own group learning processes to produce positive learning outcomes including deep and meaningful learning, high satisfaction, and strong membership, some groups may struggle more than other groups. These struggling groups will need more careful facilitation by their teacher.

Students' cognitive and social presences are adopted from the CoI model. The students' managerial presence, which is added to this model, refers to members' facilitation and coordination of their group collaboration processes. The members' managerial presence is assumed to emerge while group members project themselves as a core member or a leader of the group toward controlling and operating collaboration procedures in the learning community. Indicators of the managerial presence range from simple statements, such as questions and answers for technological trouble-shooting, to group strategies for accomplishing the team task. Examples of such statements include planning, scheduling, assisting each other with technological problems, clarifying confusion, and suggesting individual or group strategies to complete the task. For the specific small group activity involved in this research, managerial

presence can be defined in terms of ‘how’ to conduct the task while cognitive presence is identified in relationship to ‘what’ to include in the group paper. I present the coding scheme of the examples in the Methodology section (Chapter 4).

Looking at the overview of my Small Group Collaborative Learning Model, individual learners enter into a small group learning community with different characteristics as *input* variables. While group members exchange cognitive, social, and managerial communication to work for completing group task, they will learn with and from each other as a group (called *student’s collaboration process*). Teachers facilitate the collaboration process providing cognitive, social, managerial facilitation/support (called *teacher’s facilitating process*). It is assumed that a group would produce more positive learning *outcomes* if the group members participate actively in the collaboration process (*active participation*); if their communication shows decentralized structure without being dominated by one or two members (*decentralized structure*); and if members communicate openly by sharing messages with all group members instead of isolating some members (*open communication*). Based on these assumptions, I devise quantitative indices to assess the collaboration process in project-based small groups.

CHAPTER THREE

LITERATURE REVIEW II:

A SYSTEMATIC REVIEW OF THE EMPIRICAL STUDIES

3.1 Introduction

This chapter reports the results of a systematic review of current studies that analyzed text communication during small group activities in online courses. The purpose of the literature review was to establish a comprehensive understanding of current research that has been conducted in a manner similar to my dissertation research. Instead of taking a random approach to identify the relevant studies for the review, I decided to undertake a comprehensive and systematic approach for this process.

In the following review method section, I describe how I conducted the searching, screening, coding, and synthesizing of the studies included in this review. A total of eighteen journal articles were identified, representing the final data included in the review. I coded the studies based on the theoretical framework (Small Group Collaboration Learning Model) that was presented in Chapter 2. After reporting the results of the review findings, I conclude this chapter by discussing some of the gaps found in the research studies, to connect to my research questions and methods.

3.2 Review Method

This review employed a systematic review method, which is defined by *explicit planning and transparent procedures* (Gough, 2004; Gough & Rees, 2008; Chalmers, 2005). A systematic review employs precise, step-by-step review procedures: (1) searching for potentially relevant studies; (2) screening the discovered, potentially relevant studies to include only those studies that meet criteria for inclusion; (3) coding the included studies; (4) categorizing/grouping the studies; (5) an in-depth review; and (6) reporting the findings (Badger, Nursten, Williams, & Woodward, 2000). Details of the procedure for each step will be explained in the following sub-sections.

3.2.1 Searching

Electronic Database Searches

I searched the education-related academic databases through the University of British Columbia's online library service. These databases include the following resources: Education Resources Information Center (ERIC), Education Index Full Text, Academic Search Premier (ASP), and PsycINFO, all via the EBSCOhost platform. Keywords for searching the databases were gathered for three domains: data type, course setting, and research focus (Table 3.1). Keywords were located by querying the thesaurus in electronic databases. The terms were connected using "OR" and each of the domains were connected using "AND". Through this procedure, a total of 1,083 publications were identified and transferred to RefWorks, an online citation management system.

Additional Manual Search for Reference Lists of Recent Reviews

The reference lists of previous reviews were searched. Five recent review articles were identified as a secondary data source: Abrami et al., 2006; Bannan-Ritland, 2002; Johnson, 2006; and Tallent-Runnels et al., 2006.

Table 3.1 Domains and search terms used for electronic databases

Data Type	Course Setting	Research Focus
bulletin board OR message OR post* OR asynchronous communication OR chat* OR computer mediated communication OR CMC OR text OR post*	distan* course* OR distan* learning OR distan* instruction OR distan* education OR distan* program OR online course* OR online learning OR online instruction OR online education OR online program OR web-based course* OR web-based learning OR web-based instruction OR web-based education OR web-based program OR electronic course* OR electronic learning OR electronic instruction OR electronic education OR electronic program OR e- course* OR e-learning OR eLearning	participation OR relationship OR critical thinking OR quality learning OR knowledge building OR achievement OR outcome OR collaboration OR collaborative learning OR interact* OR social presence OR cognitive presence OR community of practice OR membership OR group activity OR content analysis

3.2.2 Screening

First and Second Inclusion/Exclusion

This phase involved four steps: removing any duplicate studies that had been retrieved; screening the remaining articles based on titles and abstracts only; retrieving those articles that were included after the initial screening; and the full-text screening of those articles. A total of 301 duplicated publications were deleted from the RefWorks database

system, leaving 882 items to be screened in the first inclusion/exclusion. During the initial screening process, inclusion/exclusion criteria were applied to titles and abstracts only. Since this did not constitute a thorough application of the criteria, articles for which there was insufficient information to exclude with certainty were automatically included for the second screening process. For the second screening stage, full-texts of 139 articles were retrieved and screened, resulting in 51 articles about whole group discussions and small group discussion. Eighteen articles, which analyzed small group communication, were the final data of this review.

Table 3.2 Inclusion/Exclusion criteria

Criteria	Inclusion	Exclusion
<i>publication type</i>	Published articles in English in peer reviewed journals	conference papers, book chapters, dissertations, publications in other languages
<i>publication year</i>	2000 ~ 2009 January	Before and after the inclusion period
<i>academic level</i>	post-secondary	K-12 students
<i>course type</i>	pure online courses as distance education courses delivered via Internet Students' text	Mixed-mode courses (e.g., online discussions to support face-to-face courses)
<i>data type</i>	communication messages during small group activity in online courses	interview scripts, survey/questionnaire, observation, grade/achievement scores
<i>method</i>	primary research-quantitative/qualitative analysis of text messages	reviews of other studies, opinion or discussion papers that do not include any analyses of text data

As presented in Table 3.2 above, the screening process was conducted according to six inclusion criteria. To be included in the review, studies had to meet all of the criteria. The

criteria were developed so that only publications closely related to the subject of this dissertation would be included.

This review was limited to a post-secondary level, so studies involving K-12 students were excluded. K-12 online learning is mostly referred as ‘virtual schooling’ which is fundamentally different from online learning at the post-secondary level in terms of its theoretical foundation as well as the instructional methods employed (Cavanaugh, Gillan, Kromrey, Hess, & Blomeyer, 2004). While mature students tend to be autonomous learners who take responsibility for their own learning, younger students often times need more careful guidance from teachers to acquire the skills of self-regulation and motivation for learning (Cavanaugh, Barbour, & Clark, 2009).

To be included, a study must also have involved analyses on actual text-communication messages. Quite a few studies that analyzed interviews or surveys asking students’ perceptions or experiences were excluded. Also, many studies were excluded because the data were not from a purely online course. For example, some of the studies were about communication in hybrid/blended courses that were a mixed mode of face-to-face and online learning. As I defined online courses in a continuum from face-to-face courses to blended courses to complete online courses (Figure 2.3 in Chapter 2 of this dissertation), communications in hybrid courses can be fundamentally different from those in purely online courses because they include face-to-face classes and communication. In order to focus on examining communication in online courses without face-to-face meetings, the scope of the review was narrowed to online courses. A few face-to-face meetings for

orientation purposes at the initial stages of the course, however, were not considered to contravene the definition of an online course.

Other limitations to the scope of the review include: the publication type (journal articles); language (English only); and date of publication (2000 to 2009). In terms of research methods, the review sought to include only primary research studies and therefore reviews and opinion or discussion papers were excluded.

3.2.3 Coding

Coding refers to extracting information from data. I developed coding guidelines containing lists of categories and detailed descriptions of variables in each category. There were nine categories for twenty-four variables: Administrative information (review name, date), Document Information (RefWorks ID, author, year, journal name, article title), Theoretical Framework, Sample Description (number of subjects, gender breakdown, country), Course Description (course format, communication tools, course subject area, course name, academic level, assessment criteria, whole/small group activity), Research Focus (purposes, hypotheses, questions), Methods (data analysis/synthesis), Results (findings/conclusions), and Reviewer Comments.

At this stage, two coders (myself and another coder) thoroughly reviewed the articles and came to agreement regarding final exclusions. (The second coder is an experienced researcher in education.) The final studies included in the dataset (n=18) were coded by two independent reviewers. The coding agreement rate was 92%. Any discrepancies were resolved by agreement through discussions.

3.2.4 Mapping

Categorizing the coded results: Figure 3.1 below presents the coded results of 18 articles included in the final data in the review. The studies were mapped by their research foci and major findings into four domains (inputs, learning process, facilitating process, and outcomes) based on the Small Group Collaborative Learning Model (SGCLM) (see Chapter 2, p. 29). The four domains were used as the main categories to group the studies according to their research foci. Next, the studies were sub-grouped depending on the concepts or variables within each domain.

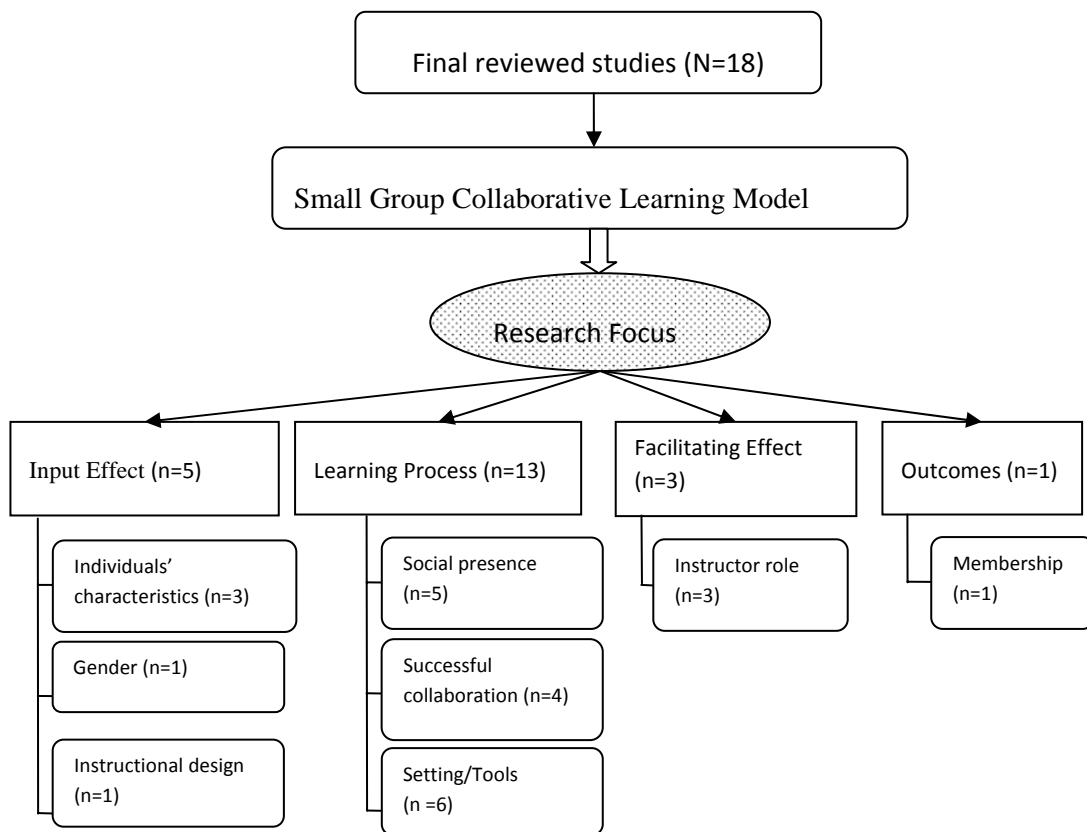


Figure 3.1 Mapping results

3.3 Results

A total of 18 studies were categorized, as presented in Table 3.3. Some studies are included in more than one category because of their multiple research foci. As a result of the categorization process, it was revealed that the majority of the studies (n=13) investigated learning process revealed in text-communication. Five studies examined input variables and their effects on learning process and/or outcomes, and three studies investigated the facilitation effect by focusing on the instructors' role or involvement. As shown in Figure 3.1, one study was identified that focused on examining outcomes (e.g., membership construction, grade, satisfaction, perceived learning).

3.3.1 Studies Focused on Inputs

Identifying variables that influence effective collaborations can provide useful information for group-forming methods and facilitating group learning processes. Five studies aimed to investigate the effects of input variables (e.g. instructional design, group forming, individual characteristics, and gender) on small group collaboration processes. Rose (2004) found that students in a structured-group design revealed higher levels of dialogue than an open-ended group design. Sun et al. (2008) experimented with a group-forming method by using individuals' attributes for better collaborations. Individuals' cognitive styles (Liu et al., 2008) and genders (Wang et al., 2003) were reported as non-significant factors influencing their participation.

Table 3.3 List of studies in categories of research focus

Research focus main-category	Research focus sub-category	Study
Inputs (n=5)	Individuals' characteristics (n=3)	Liu, Magjuka, & Lee (2008), Wresch, Arbaugh, & Rebstock, (2005), Sun, Cheng, Lin, & Wang (2008)
	Gender (n=1)	Wang, Sierra, & Folger (2003)
	Instructional design (n=1)	Rose (2004).
Learning Process (n=13)	Social presence (n=5)	Beuchot, & Bullen (2005), Curtis, & Lawson (2001), Goertzen, & Kristjánsson (2007), Orvis, Wisher, Bonk, & Olson (2002), Wang, Sierra, & Folger (2003)
	Successful collaboration (n=4)	Curtis, & Lawson (2001), Lee, & Gibson (2003), Makitalo-Siegl (2008), Thompson, & Ku (2006),
	Communication Tools (n=6)	Curtis (2004), Maushak & Ou (2007), Mabrito, (2006), Schweizer, Paechter, & Weidenmann, (2003), Curtis, & Lawson (2001), Vonderwell (2003)
Facilitating Process (n=3)	Instructor role (n=3)	Painter, Coffin, & Hewings (2003), Rose (2004), Vonderwell (2003).
Learning outcomes (n=1)	Community membership established (n=1)	Wang, Sierra, & Folger (2003)

* Note: Some studies are included in more than one category due to their multiple research foci.

Instructional design: Rose (2004) compared two types of small groups: cooperative (more structured) versus collaborative (more open-ended) groups. Three groups in each type followed specific guidelines for their small group activity. In cooperative groups the instructor assigned specialist roles to each member and closely monitored group communication every two or three days. In collaborative groups the instructor

encouraged group members to employ a critical dialogue themselves without assigning any specific roles and sporadically monitored their discussions every four days. The study reports that the cooperative groups had significantly higher levels of dialogue than the collaborative groups. Communication messages were highly interconnected with an average cohesion of 90.68% for the cooperative groups, in comparison to 81.34% for the collaborative groups.

Rose's definition of cooperative versus collaborative groups was different from that employed in this dissertation. Her definition was based on instructional design and the instructor's role. She referred to 'cooperative groups' as more structured in instructional design, more carefully facilitated, and more frequently monitored by the course instructor. In collaborative groups, on the other hand, the instructor let the students do their own group work in a more open-ended design. However, I defined cooperative and collaborative groups based on "the level of interdependence among members" (in this thesis Chapter 2). In my definition, a collaborative group would seek a solution as a group, while a cooperative group would try to split the group task into individual parts and subsequently assemble them into a whole. Therefore, Rose's findings should be interpreted differently from the findings of this dissertation.

Group forming: Sun et al. (2008) suggested a systematic group forming method for better small group collaboration. By identifying students' attributes (e.g. time, region, age, value types) from members who worked in high-interaction and high-satisfaction groups, the authors developed a systematic grouping method. In order to test the effectiveness and practicality of the grouping method, the study compared students' communication in

20 groups in experimental conditions with 20 randomly selected control groups. The experiment also included monitoring systems for instructors to receive notification of students' participation patterns and structures. The study found that the experimental groups performed better in all measures such as satisfaction level, system usage, rate of successful interaction, and interaction content.

Effect of individual characteristics: Liu et al. (2008) examined group members' cognitive styles in relationship to their participation and found no significant effect of personal characteristics on participation or achievement. With groups of 4-5 members in 208 MBA students, the study focused on the influence of individuals' cognitive styles (scopes - internal, external, or flexible; levels - local, global, or flexible) on group teamwork (trust and conflict management). The authors' quantitative analysis of conference postings, team satisfaction, and performance revealed that cognitive style did not have an impact on the participants' learning achievement or overall class participation. Rather, cognitive style had predictive power over the students' satisfaction with their teamwork experience, as well as the level of trust they exhibited in their team members.

Gender effect: Wang et al. (2003) examined gender differences in participation in small group activity. They found that female participants tended to continue socializing and to remain connected after the class while male participants tended to initiate more task-related thoughts and ideas (i.e. presentations) and did not stay too long once the session was over. Nonetheless, the authors did not find any direct impact of interaction styles on levels or equality of participation, as well as no significant difference in frequency of

postings although female participants posted messages more frequently (57% of total exchanges) than the male participants (43%).

New member effect: Wresch et al. (2005) examined participation trends across the course period and how an online small-group community accepted new participants. The participation trend showed significant declines in the average number of weekly group comments between the first and second halves of the course. When a new member joined in the middle of the course the number of comments significantly increased.

3.3.2 Studies Focused on Learning Outcomes

Group membership construction was reported by Wang et al. (2003), who found ample evidence of community forming in terms of: active participation, the forming of shared identity, and the establishment of social networks. They measured active participation by the frequency of message exchanges and found a great majority of the students consistently attended webcasts and chat sessions. The remaining two factors were qualitatively examined by describing some incidences that appeared in text. For example, frequent uses of ‘we’ were identified as presentation of shared identity, and social-emotional expressions were identified as evidence of the establishment of a social network.

3.3.3 Studies Focused on Learning Process

The quality of learning in small groups was evaluated to understand its benefits and effectiveness in terms of students experiencing self-directed learning (Lee & Gibson, 2003), achieving shared understanding (Makitalo-Siegl, 2008) and revealing equal contributions (Curtis & Lawson, 2001). The importance of social factors was emphasized in four studies. Social communication is seen to enhance collaboration (Goertzen & Kristjansson, 2007; Orvis et al., 2002), is associated with cognitive presences (Beuchot & Bullen, 2005), and strengthens supportive group membership (Wang et al., 2003; Curtis & Lawson, 2001). In comparison, students struggled with problems during collaboration through asynchronous communication because of its ineffectiveness (Thompson & Ku, 2006) and their uncomfortable feelings while talking with unfamiliar members (Curtis & Lawson, 2001).

Participation: Lee and Gibson (2003) analyzed 1,333 messages posted by 21 graduate students, who were divided into four small groups. Their study explored self-directed learning in three dimensions: control, critical reflection, and responsibility. The study concluded that students exhibited highly learner-centred characteristics and were interdependent with peers for collaborative learning. This was due to the fact that they had constructed knowledge by judging diverse opinions and resources based on their own experience and knowledge, while selectively accepting or rejecting others' comments. Similar findings were reported by Makitalo-Siegl (2008). This study qualitatively described how group members manage group procedures by analyzing 144 messages collected from 3 students in one group. The authors reported that team members achieved

‘shared understanding’ through actively exchanging their own perspectives and a variety of resources. During small group collaboration, students reflectively compared their own knowledge with personal experiences of interaction and collaboration with other students.

Equal contribution: Evidence of collaboration during group activities was also examined by Curtis and Lawson (2001). Analyzing 198 email messages and 24 postings by 13 students in five groups, the authors found that each member made an approximately equal contribution to discussions, suggesting there were no ‘lurkers.’ All members were actively participating in group activities and revealed many collaborative behaviours in terms of planning, contributing, seeking input, reflecting, monitoring, and social interaction.

Social factors: The importance of social factors influencing small group process is unanimously confirmed by the studies included in this review. Social presence is positively related to cognitive presence in Beuchot and Bullen (2005). Social interaction boosts effective collaboration (Goertzen & Kristjansson, 2007; Orvis et al., 2002) and helps to build a supportive learning community (Wang, et al., 2003). Therefore, online courses should be designed to encourage more social interaction (Curtis & Lawson, 2001).

Beuchot and Bullen (2005) examined Garrison and Anderson’s (2003) proposition for the importance of ‘social presence’ associated with ‘cognitive presence’. They assessed the relationship between *interpersonality* (social or personal interaction or informal communication) and *interactivity* (more engagement and true interaction). They found interactive messages were more likely to contain self-disclosure, and suggested that

encouraging social interaction might lead to increased participation and expand the depth of discussion. The authors concluded that social issues in learners' communicative processes may have a direct impact on their educational outcomes.

Goertzen and Kristjansson (2007) also aimed to understand the place of social presence in collaborative efforts. They examined *interpersonality* by analyzing social interactions revealed in data from group discussions in six groups of graduate students (n=24) enrolled in a collaborative online master's program in Teaching English to Speakers of Other Languages (TESOL). The results of content analysis found that 76.3% of the social interactions were expressions of appreciation and 26.6% were affective expressions. The study concluded that an effective collaborative process is deeply intertwined with the nature of interpersonal engagement among participants.

Building a supportive learning community requires respect for other members' ideas. Wang et al. (2003) reported students used chat functions frequently in order to establish a pleasant social milieu. The study found that higher performing teams tended to use 'nicknames' to refer to their teams, and posted public comments to openly express their positive feelings about one another.

Trends of social interaction were reported by Orvis et al. (2002) who looked at social interaction in small groups during synchronous chat sessions with 41 male students enrolled in a military training course. Social interactions were higher at the start and end of the course, while on-task discussions peaked in the middle months. The authors asserted that social interactions in this setting were similar to trends often observed in face-to-face settings.

In line with these results Curtis and Lawson (2001) suggested that online courses should be designed to encourage more social interactions, perhaps through more structured self-introductions. They found that unfamiliarity between members was a constraining factor to successful collaboration.

Problems with collaboration: Problems associated with asynchronous text communication, however, were noted as a major source of challenges during group collaboration. By analyzing group discussions of four small groups with 3 members in each group, Thompson and Ku (2006) found ineffective communication, conflict among group members, and negative attitudes toward group work. Based on Hathorn and Ingram's (2002) coding scheme, Thompson and Ku measured the degrees of collaboration in each group in terms of four attributes: *participation* (number of messages), *interdependence* (interaction patterns), *synthesis* (number of statements with new ideas), and *independence* (number of messages sent to the instructor).

While collaboration levels were different for each group, some students felt offended when their opinions or ideas were criticized during discussions via emails or bulletin boards. Delayed-time and distance constraints were identified as major sources of challenges to online collaboration. The problem of unfamiliarity with classmates found in asynchronous group discussion boards was also reported by Curtis & Lawson (2001). It found the asynchrony of the medium and students' unfamiliarity with the communication tools were constraining factors for group collaboration. Because small group members felt comfortable in using emails, they exchanged emails more (n=198) than they posted messages on the discussion board (n=24). Curtis and Lawson (2001) also noted that the

asynchronous online interactions lacked 'challenge and explain' cycles of interaction. They suggested using good real-time tools to support interaction.

3.3.4 Studies Focused on Communication Media

Asynchronous and synchronous communication tools support different aspects of collaborative learning and provide different benefits (Mabrito, 2006). In order to support social interactions to foster a more collaborative environment, online courses should be designed to provide various types of both asynchronous and synchronous communication tools (Curtis, 2004; Mausak & Ou, 2007; Schweizer, et al., 2003; Vonderwell, 2003).

Tool examination: Student communications using synchronous or asynchronous tools can be compared in an online writing course. Mabrito (2006) analyzed synchronous and asynchronous communication transcripts of 4 groups of 16 undergraduate students. There were apparent differences in communication patterns and types between the tools. The synchronous tool was used more for producing new topics and ideas (69%) than follow-up comments (31%), while asynchronous tools were devoted to creating new ideas (47%) and expanding topics (53%). Synchronous sessions were used for team building such as organizing group processes, while asynchronous discussions were focused on the writing task itself. The study concluded that instructors need to consider structuring collaborative time in both synchronous and asynchronous environments.

An experimental study (Schweizer et al., 2003) concluded that only text-based communication has limitations in depriving a socially rich communication. It analyzed 4246 log files collected from 94 students, 24 small groups formed with 4 members. The

percentage of correct answers for each type of task and the coherence of the conversations were statistically compared to identify any differences among groups interacting in three pure e-learning settings (synchronous chats, asynchronous forums, and videoconferencing group compared with blended learning [mixed mode of e-learning with face-to-face phases]). It found that learners in the blended setting led a much more coherent discourse than learners in the pure e-learning conditions or in a face-to-face setting.

Recognizing the limitations of asynchronous communication in supporting social interactions, two studies (Curtis, 2004; Maushak & Ou, 2007), examined the potential of synchronous communication tools. Curtis (2004) used synchronous chat rooms to supplement threaded discussions. The study analyzed 86 chat messages collected from 11 students working in 4 small groups. The study demonstrated the potential of chat rooms. The students enjoyed authentic social interaction, negotiated their own understandings of the course material, and even had fun in these processes.

These outcomes are similar to the characteristics found in face-to-face groups. Maushak and Ou (2007) examined how using Instant Messages (IM) facilitated collaboration during a group activity. Analysis of IM transcripts revealed that most of the properties of face-to-face collaborative interaction could be identified in terms of mutually constructing knowledge (44%) and facilitating group processes (15% of all IM). However, challenging each other's reasoning was rarely evident, because students did not know each other well. The study concluded that IM could be an efficient and productive tool for online project-based collaboration with careful design and implementation.

Using only asynchronous communication tools for small group activities in online courses does not seem to be sufficient to provide students with a safe and comfortable setting for collaboration. Vonderell's (2003) qualitative case study explored students' perspectives and experiences by analyzing asynchronous discussion transcripts and emails exchanged among students and between students and an instructor during small group activities in groups of 3 – 5 members in a class of 22 undergraduate students. Some students experienced frustrations due to the non-cooperation of some of the team members. The study reports members' uncomfortable feelings about interacting with the students whom they did not know beforehand.

3.3.5 Studies Focused on Facilitation

Three studies (Rose, 2004; Painter et al., 2003; Vonderwell, 2003) focused on the instructor's role and concluded that instructors' active facilitation resulted in more collaboration.

The studies identified instructors' intensive and active monitoring and involvement in small groups as an important factor for higher levels of interconnected messages (Rose, 2004) and for higher students' participation rates (Vonderwell, 2003; Painter et al., 2003). Painter et al. (2003) reported that the least interventionist strategy for instructor involvement in group work resulted in the least productive discussion in terms of both interaction and academic development. The authors conducted a content analysis with 480 messages collected from three groups consisted of five graduate members. In each group there were different tutors' levels of input responding to students' postings.

Vonderwell (2003) also reported the importance of the instructor's role in boosting collaboration and interaction. The qualitative case study with a sample of 22 undergraduate students concluded that instructors need to carefully structure and design activities to assist those students who did not participate actively and those who were frustrated in the small group setting of online courses. The author cautions online instructors by saying that "merely providing discussions or collaborative activities does not mean that students will actively participate" (p. 88).

3.4 Discussion and Connection to My Research

In my literature review, I found that the research studies that were included and reviewed contributed to resolving some issues in small group collaborations in online courses.

Some key findings of the studies confirmed the existing literature: (1) social communication is a critical element for effective collaborations; (2) although students can struggle with problems and troubles caused by communication tools, synchronous communication tools can be used to compensate for the limitation of asynchronous communication tools; (3) small group activities in online courses provide the benefits of both a self-directed and a student-centred collaborative environment for learning; (4) instructors should actively monitor and facilitate group collaboration; and (5) participation (communication quantity) is the fundamental element for successful collaboration, and is used as a typical measure to evaluate collaborations in small groups.

I also found some limitations in the research studies that were reviewed. Evaluating the collaborative learning process, in particular, needs improvement in terms of the research methods employed and the theoretical concepts underpinning text communication

analysis. I focus on three limitations related to my research. Most of all, I notice that managerial/procedural communication was not the focus of any of the studies in evaluating collaboration. Managerial communication functions to arrange and organize group processes, which should be key components of communication in small groups (Mabrito, 2006). As I discussed and presented in the Small Group Collaborative Learning model in Chapter 2, managerial communication should be one of the three categories for analyzing collaboration processes in small groups.

Second, participation was emphasized and used as an indication of successful collaboration. However, communication quantity does not ensure the quality of collaboration as many researchers have argued in the literature. Because few researchers recognized the aspects of groups' communication structure and relationships as indicators of successful collaboration, their studies often ignored factors such as democratic contribution to the group task through more equalized participation or open communication networks. Only one study, Thompson and Ku (2006), employed other indices along with participation: interdependence, synthesis of information, and independence. I found three of these elements, all except independence from the instructor, are highly correlated and thus do not add any further information to the participation indicator. Therefore, I proposed and used three quantitative indices for evaluating small group collaboration: *quantity, equality, and sharedness*.

Third, group collaboration was not evaluated according to individual groups. Studies compiled all the communication messages and analyzed the overall quality of collaboration in small groups without comparing or assessing the collaboration levels of

each group. Only the Thompson and Ku (2006) study evaluated collaboration levels in each group. Because they evaluated collaboration levels in each group by using four indicators, they could compare groups with higher and lower levels of collaboration to identify any problems with the indicators. In line with this research, I will evaluate collaborations of individual groups by employing quantitative indices, as well as examining the factors influencing the collaboration processes qualitatively. This will illustrate a more comprehensive understanding of small group collaboration processes to reveal practical approaches for evaluating collaboration through communication analyses.

CHAPTER FOUR

METHODS

The main goal of this research was to assess small group collaboration during a project-based assignment activity in an online course in higher education. A content analysis method in combination with a social network analysis was used for categorizing communication to assess groups' communication structure and members' participation behaviour. A qualitative method was also used for an in-depth assessment of small group collaboration process in six groups.

This chapter describes the research context and methodological approaches employed for this research. This chapter consists of three sections. Section 1 describes the research context and the data included in this research. Section 2 presents the research design and methodological approaches undertaken to answer specific research questions. Detailed procedures for content analysis, qualitative analysis, and social network analysis are explained. Section 3 introduces the following chapters to connect this chapter.

4.1 Research Context and Data

4.1.1 The Course, Students, and Activities

Data were collected from a graduate online course in an educational technology program. The course was delivered for 13 weeks from January 2008 through the WebCT Vista course management system. A total of 24 graduate students (12 females and 12 males) were enrolled. Most of the students were full-time or part-time teachers or working

professionals in the area of educational technology. All the students had taken one course at least before taking this course in the program. The course was taught by two instructors in two sections. I was neither an instructor nor a teaching assistant involved with the course. It had already been completed when I had access to the data from the course. This research was approved by the UBC Behavioural Research Ethic Board.

The course was designed to include two major learning activities: *whole group discussions and a small group activity*. For the whole group discussion activity, a discussion topic of a week was posted on the course bulletin board to require students to post thoughts and opinions based on suggested readings and to respond classmates' messages. There were four units of discussions to include Unit 1 (self-introduction, Bio activity) and Units 2, 3, and 4 (topic discussions). Instructors participated in the whole group discussions to answer students' questions, to clarify some of the confusions/misunderstandings, and to facilitate students' discussions.

For the small group activity, students were asked to form their own groups to write a group paper as an assignment of the course. Two topic options were given for groups to choose from. As described on the course website, topic option #1 was to analyze 'a real example of institutional planning for e-learning and the use of learning technology.' It required the group to read and analyze a series of documents that were produced as part of the planning process. In addition, they needed to do some background research on the institution to fully understand the context. Topic option #2 was to create 'an imaginary case to recommend a vision for the use of e-learning.' During the group collaboration for

the project, instructors rarely posted messages in groups' forum spaces unless groups asked for help.

As shown in Figure 4.1, the vertical lines present timelines for the learning activities. The horizontal lines are due dates for posting messages for the discussions or for submitting assignments. Whole group discussion Unit 1 was scheduled for the first week. Units 2, 3, and 4 were conducted as topic discussions. Small group activity was performed from week 5 to week 9. The broken line indicates the periods before and after the small group activity. There were three assignments for which submission days were firmly scheduled. Two were individual assignments (30% each) and one was a group assignment (35%). The final 5% was allocated for participation in the discussion forums.

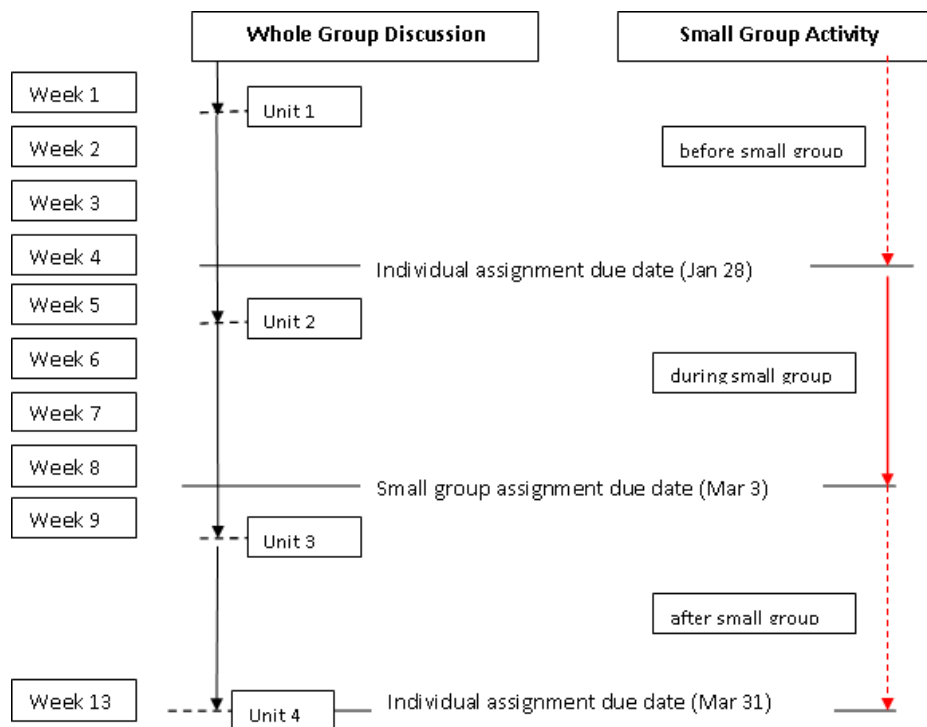


Figure 4.1 Course timeline for the activities

4.1.2 The Data

A total of 2029 messages were included in this research; 1297 messages were retrieved from the whole group activity and the remaining 732 messages from the small group forum spaces (Table 4.1).

Table 4.1 Description of data

Whole group activity	No. of messages	Small groups	No. of messages
Unit 1 (Bio)	260	Group A (n=4)	34
Unit 2	446	Group B (n=4)	201
Unit 3	280	Group C (n= 3)	65
Unit 4	61	Group D (n= 4)	244
Main	81	Group E (n= 5)	138
Café	169	Group F (n= 4)	50
Total	1297	Total	732

4.2 Research Design and Analysis Approaches

The main goal of this research was to investigate students' collaborative learning processes during a project-based small group activity. In order to uncover the complexity of the collaboration processes, I employed multiple methodological approaches: a content analysis, a social network analysis, and a qualitative analysis (Figure 4.2).

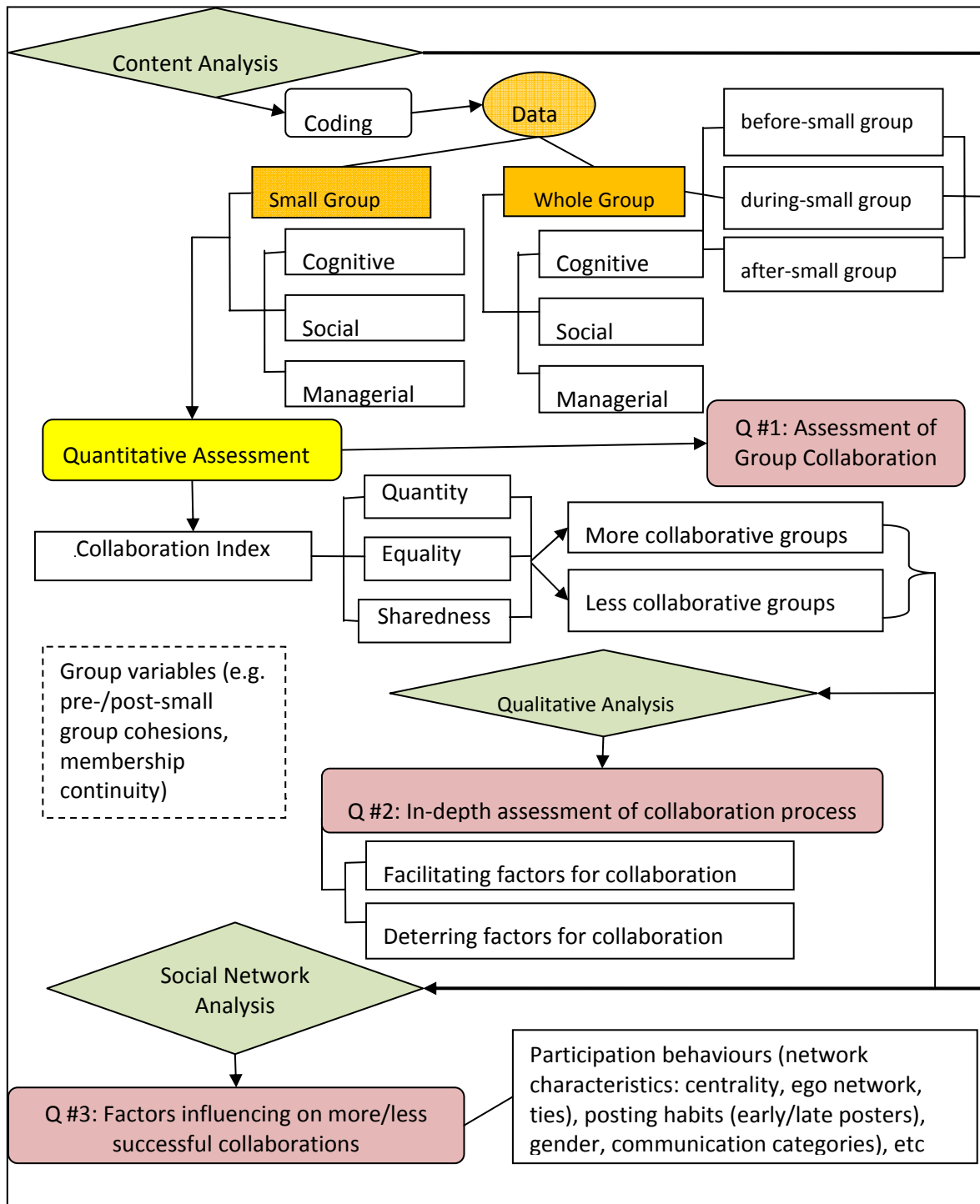


Figure 4.2 Methodological approaches for data analysis

The two sets of data (small group data and whole group data) were coded into three communication categories: cognitive, social, and managerial. Whole group data were subdivided into three sets according to the small group activity timeline (before-small group, during-small group, and after-small group). The small group data were analyzed to identify less or more collaborative small groups with the three collaboration indices. With the results of quantitative assessment of the group collaboration, a qualitative analysis of text communications was performed to identify specific problems that influenced collaboration. Finally, I examined the association of communication behaviours between whole group (before-small group) and small group collaboration. Key concepts and issues related to each methodological approach are explained further in the following sections.

4.2.1 Content Analysis

Content analysis method commonly refers to quantitative techniques analyzing text communication (Schwandt, 2001). Berelson (1952) defines a quantitative content analysis (QCA) as “a research technique for the systematic, objective, and quantitative description of the manifest content of communication” (as cited in Rourke & Anderson, 2004, p. 5). Kanuka and Anderson (1998) explain QCA as “a research methodology that uses a set of procedures to make valid inferences from text” (p. 59).

For the last two decades, many researchers have conducted content analysis for describing learning processes, evaluating quality of learning, and/or identifying factors affecting the quality of learning process (e.g., Arnold & Ducate, 2006; Aviv, 2001; Curtis & Lawson, 2001; Hara, et al., 2000; Heckman & Annabi, 2005; Rourke, Anderson,

Garrison, & Archer, 2004; Treleaven & Cecez-Kecmanovic, 2001). Henri (1991) urges instructors to use a content analysis method “as a pragmatic instructional tool to yield practical results which can be used immediately to coach and facilitate learning” (p. 134). She claims that a content analysis provides information on the participants and thus the informed educator is better able to offer immediate support to both the individual and the collaborative learning process (ibid). However, the procedure of conducting a content analysis has been recognized as “difficult, frustrating, and time-consuming” (Rourke, Anderson Garrison, & Archer, 2001, p. 2). Thus, Penney and Murphy, (2009) argue that content analysis may be “a technique more suited for *researchers* [italics added] than for *instructors* [italics added]” (p. 805).

Rourke and colleagues (2001) describe four essential steps of conducting a QCA:

1. Compiling the data of transcripts into text files
2. Creating a protocol for identifying and categorizing the target variable(s)
3. Coding (coder training and coding reliability check)
4. Analyzing the coded data to describe the target variable(s) or to identify relationships between variables.

For this dissertation research I followed the common steps of QCA as suggested above.

The below sections describe how I performed each step and discuss the issues associated with the procedures.

Step 1: Data Processing

The data used in this dissertation are completely intact and the authors are anonymous to the researcher (me). The course was selected from a list of the courses that had been completed by the time I started procedures to collect data, after acquiring the approval certificate. A program assistant of the online program provided a list of old courses. I reviewed the course outlines presented on the website of the program to select courses which employed a project-based small group activity. The assistant and I contacted the instructors. One of them agreed to help the research by downloading and transferring the data to the program assistant, who then replaced all the students' information (names, student ID numbers, email addresses, phone numbers) with an anonymous code to protect student privacy. I use the anonymous codes throughout this dissertation.

Step 2: Developing Coding Framework

Researchers have described the coding procedure of a QCA as a challenging and time consuming task (Garrison, Cleveland-Innes, Koole, & Kaplan, 2006; Rourke, Anderson, Garrison, & Archer, 2001). In relation to the coding procedure, establishing reliability is a critical methodological requirement to achieve reliable findings (Fahy, 2007; Murphy & Ciszewska-Carr, 2005). In order to ensure the reliability of the coding, a clear and objective coding scheme is key (Garrison et al., 2000). The objective coding scheme should be based on a 'parsimonious' theoretical model that can be translated into distinct categories and clear indicators (Garrison, et al., 2006, p. 2). Rourke and Anderson (2004) recommend employing previously developed and tested frameworks to achieve reliable and valid coding, as well as to contribute to the existing procedure.

For this dissertation research, I developed a coding scheme based on the Small Group Collaborative Learning Model (SGCLM) presented in Chapter 2 of this dissertation (p. 29). As presented in Table 4.2, there were three categories (cognitive, social, and managerial) used to code student communication. Since this research focuses on the students' collaboration process, instructors' and other staff's communication were not included in coding and analysis. The definitions and the indicator examples of cognitive and social categories are adopted from the works by Garrison et al. (2000) and Garrison, Anderson, & Archer (2001). For the managerial category, the definition and indicator examples are adapted from Henri (1992), Hara, et al. (2000), and Newman, Webb and Cochrane (1995).

Step 3: Coding and Reliability

A content analysis involves the unitizing and categorizing of the communication messages (Penny & Murphy, 2009). This research aims to assess collaboration in small groups in terms of the quantity of members' communication. As noted in the review of existing content analysis studies by Rourke, Anderson, Garrison, and Archer (2001), "routinely, unit of analysis for studies in which participation was described quantitatively are number of words, messages, or both" (p. 10). A message unit is not appropriate for this research because one message usually contains communication that can be coded into more than one category. A message unit is also inappropriate in terms of amount of communication since messages vary from very short with a couple of words, to very long with hundreds of words. Thus, I decided to employ *number of words* as an analysis unit.

Table 4.2 Coding framework

Category	Definition	Indicator/example
Cognitive	Statements directly related to on-task content of group assignment	<ul style="list-style-type: none"> - sharing knowledge; - comparing information or facts; - suggesting opinions on the assigned topics; - brainstorming, questioning, refining, elaborating; - suggested ideas with real life examples; - evaluating by agreeing or disagreeing with each other; - integrating and synthesizing the conflicted opinions;
Social	Statements to build up friendship and group membership	<ul style="list-style-type: none"> - salutation: greetings, calling names, conventional thanks; - openness: self-introduction, sharing personal feeling/emotional states; - humour, jokes; - encouragement/compliments (e.g. “Good work!” “Great team!”); - off-task information: statements not directly related to the course content or tasks, general information
Managerial	Statements to coordinate the group procedure and make strategies to complete the task	<ul style="list-style-type: none"> - scheduling (e.g. “I will post my work by 11am tomorrow”); - dividing jobs; - arranging meetings; - clarifying ambiguities and procedures about assignments (e.g. deadlines, word limits, technological problems); - discussing strategies (e.g. “Let’s post work individually and combine the work”.)

For coding purposes, I used ‘a thematic unit’. A thematic unit (also known as a meaningful unit) refers to a coding unit that conveys a single thought or idea (Budd & Donohue, 1967). A thematic coding unit allows coders to capture the meaning of a statement in a context beyond the confines of syntactic/grammatical units (i.e., a phrase, a sentence, a paragraph, or a message) (Murphy & Ciszewska-Carr, 2005; Palonen & Hakkarainen, 2000). Some researchers prefer to choose a syntactic unit because it allows clear segmentation to secure reliability of coding (Murphy & Ciszewska-Carr, 2005).

Although there is a concern about the subjectivity of segmenting units when employing a thematic unit, I decided to choose a thematic unit to categorize communication. My coding scheme also consists of only three coding categories, which is presumably less complicated for rating the content than some schemes with many sub-categories. I also coded senders and receivers of a unit to examine communication relationships among group members.

In order to check the inter-coder reliability of the coding, I recruited one coder, who is an experienced researcher with a doctoral degree, but with no prior coding experience, for a content analysis. I had two sessions of coder training. In the first session I explained the purpose of the studies and the coding scheme. I demonstrated how I coded, using examples. We then performed a trial coding separately with several messages. These were not used for later reliability rate calculation. Once I had the trial coding result, I ran the second coder training session, where we compared and discussed the discrepancies. Most frequent disagreement occurred between managerial and cognitive categories.

After establishing a clearer understanding with more detailed examples for each category, we coded 162 messages/10,169 words (about 20%) of small group data independently. The overall agreement rate was 87% (Table 4.2). This is a considerably high agreement rate as compared with 75% which is reported as an adequate agreement rate by Hara, Bonk, and Angeli (1998). I also calculated Cohen's kappa which is recognized as a more conservative measure of reliability (Kanuka, Rourke, & Laflamme, 2007). Cohen's K is preferred as a more robust reliability than a simple agreement rate because it takes into account for the proportion of agreement by chance (Cohen, 1960). The reliability of

Cohen’s k was 0.79, which is in the range of “substantial (0.61-0.80) strength of agreement” based on the suggested benchmarks for interpreting kappa (Landis & Koch, 1977, p. 165). The high reliability resulted in my decision to code the rest of the data myself.

Table 4.3 Reliability agreement rate in each coding category between two coders

		coder B			
coder A	category	cognitive	social	managerial	total
	cognitive	33.2%	0.8%	4.6%	38.6%
	social	0.6%	16.6%	1.9%	19.2%
	managerial	2.5%	3.0%	36.7%	42.2%
	total	36.3%	20.5%	43.2%	100.0%

Step 4: Analysis

The next step was to analyze the coded data to answer the research questions. All the coded data were entered to build up a database using MySQL 5.1. For social network analysis, Ucinet 6.0 was used, along with SPSS 8.0 for statistical analyses.

For the research questions #1 and #3, social network analysis (SNA) was employed. The major objectives of SNA are to characterize the group’s structure and the influence of each member on that group, and to describe students’ communication relationships and patterns of interaction (Haythornthwaite, 2000; Wasserman & Faust, 2005). For this dissertation research, the SNA concepts of prestige (in-degree centrality) and influence (out-degree centrality) were used as an indicator of members’ participation and

communication behaviour (Wasserman & Faust, 2005). Thus, the receivers and senders of each analysis unit were recorded and analyzed to identify the structures of groups' communication networks.

For the research question #1, a group's collaboration was assessed by employing three indices of collaboration: groups' communication *quantity*, members' participation *equality*, and groups' communication *sharedness*. A group's communication *quantity* was to identify how actively a group communicates. Because each group consisted of a different number of members, the index averaged the number of words per group member. This index was based on the assumption that a more collaborative group would exchange a higher volume of text communication. As a simple example, a group where members exchanged 100 words in average per a member can be identified as more collaborative group than another group where members exchanged only 10 words per person. Thus, the formula is:

$$\bar{X}_i = \frac{\sum_{j=1}^{N_i} X_{ij}}{N_i} ,$$

where \bar{X}_i refers to the mean number of words for group i , X_{ij} is the number of words sent by member j of group i , and N_i is the number of group members for group i .

The *equality* index was utilized to reveal the communication structure of a group in terms of whether members' participation was balanced or skewed. As discussed in Chapter 2 (p. 28), a roughly equal participation is required to establish well-connected group

communication structure. When the group communication is directed or dominated by one or two members and others rarely participate in the group communication, the group may face some problems in collaboration. Thus, equality index is calculated by the squared coefficient of variation (CV_i^2) to identify participation variability among members:

$$CV_i^2 = \left(\frac{\sqrt{\frac{\sum_{j=1}^{N_i} (x_{ij} - \bar{x}_i)^2}{(N_i - 1)}}}{\bar{x}_i} \right)^2,$$

where x_{ij} is the number of words sent by member j of group i , \bar{x}_i refers to the mean number of words for group i , and N_i is the number of group members for group i .

The *sharedness* index, S_i , was intended to reveal the communication connection between members in a group in terms of how they share messages with all group members without isolating a certain member(s). This index was based on the assumption that a group member tends to identify herself/himself as a group community member when more messages include her/his name as a team. Although the group forum allows all the members read all the messages as discussed in Chapter 2, a member would feel less responsibility or obligation for responding to the messages in which his/her name is not included. On the other hand, each member may more actively engage if the messages that are sent to all the group members. Assuming that more shared communication directed to

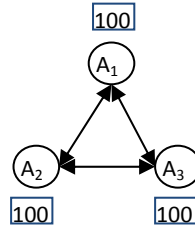
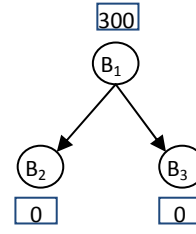
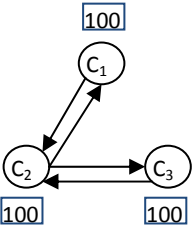
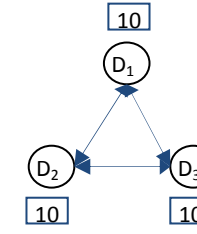
all the members (one-to-group) rather than to one person (one-to-one) would foster a stronger and more inclusive atmosphere in a group community, the sharedness index was the percentage of the number of words shared with all members out of the total number of words exchanged:

$$S_i = 100 * \frac{\sum_{j=1}^{N_i} X_{ij}^{(a)}}{\sum_{j=1}^{N_i} X_{ij}}$$

where X_{ij} is the number of words sent by member j of group i and $X_{ij}^{(a)}$ the number of words sent to all the other members by member j of group i .

The merit of the three indices is that they are independent from each other in terms of assessing different aspects of the groups' collaboration processes. Table 4.3 shows how the three indices reveal the groups' communication structure and what potential problems exist in the groups.

Table 4.4 Example of the three indices revealing different aspects of communication structure in small groups

Example	Group A (no problem indicated)	Group B (problem identified in equality)	Group C (problem identified in sharedness)	Group D (problem identified in quantity)
communication structure				
Quantity (words/member)	100	100	100	10
Equality (variability)	perfect (0.0)	none (3.0)	perfect (0.0)	perfect (0.0)
Sharedness (shard words %)	all (100%)	all (100%)	none (0%)	all (100%)

In the example of collaboration in four groups in the above table (Table 4.4), Group A does not indicate any problems on the three indices in terms of roughly enough communication (100 words per member) when compared with other groups, revealing equal participation, and sharing of all the communication among members. The communication network structure reveals solid connections without broken links. Group B reveals problem in democratic contribution. All the communication is dominated by B₁ while the other two never contribute to the group communication. A potential problem in Group C is identified by the sharedness index. All the members in Group C participate equally, but C₁ and C₃ never share communication when sending messages to C₂. Thus, C₂ is centralized in the group's communication network structure. Group D reveals the

same network structure as Group A. However, the group communicates very little, which may signify a lack of engagement in the community.

The research question #3, “Which participation behaviours in whole group discussions are associated with less or more collaborative groups?,” is intended to explore any variables/indicators in the whole group discussion community that might be associated with more collaborative small groups, and which could be useful for instructors as they form groups. Less or more collaborative groups were identified based on the results of the quantitative and the qualitative assessments.

By conducting Analysis of Variance (ANOVA) tests, group differences between more and less successful groups are statistically examined on the variables of social network characteristics (e.g. prestige (in-degree centrality), influence (out-degree centrality), ego size (the number of students with whom the ego student communicated directly, i.e., number of direct ties), pre-existing friendship (connections in whole group setting before entering a small group), post-activity membership (connection in whole group setting after the small group activity), participation behaviours in whole group setting (e.g. posting habit/late or early posters), participations in different forums in whole group setting (e.g. bio, Unit 2, Main) and gender. I also analyze the association of individuals' small group participation with whole group activities and her/his group members' participation by conducting stepwise regressions.

4.2.2 Qualitative Script Analysis

The third step of the data analysis was conducting a qualitative analysis on the communication transcripts. This is to provide a holistic picture of group dynamics by employing thick and intense descriptions of events occurring in a group situation (Krahwohl, 1998; Merriam, 1988; Yin, 2003). As Schrire (2006) suggests, I recognize the importance of merging a qualitative method with a quantitative method to move beyond quantitative analysis.

With this qualitative, in-depth analysis approach, I intended to diagnose any problem factors that caused less successful collaboration as assessed by the quantitative method.

Through the qualitative analysis, I focused on research question #2:

“What factors hinder or facilitate small group collaboration?”

I read each group’s text communication in small group forums repeatedly and summarized the collaboration procedures according to the timeline in terms of:

- (1) when and how a group initiates the group activity (ice-breaking stage),
- (2) what approaches a group takes for dividing the task (brainstorming),
- (3) how a group exchanges information and develops ideas (developing ideas),
- (4) how a group synthesizes to complete the task (compiling and editing), and
- (5) how members feel after completion of the collaboration (adjourning with satisfaction).

In summary, I focused on the social aspects influencing group membership that foster and maintain a positive atmosphere throughout the collaboration processes. I highlighted negative and positive attitudes and uses of language to explore their effects on the group collaboration. Uses of communication tools and technological problems were also examined.

I also read biographies posted in Unit 1 to understand students' characteristics and backgrounds for the small group communication behaviours. I looked at some of the factors that might be related to troubles in small groups such as the geographical area, in which they live, course experiences, job experiences, etc. I compared this qualitative result with the quantitative assessment results and discussed problems and facilitating factors for more/less successful collaborations.

4.3 Introduction to the Next Chapters

This chapter described the research design and methodological approaches employed for the research to explore three research questions:

1. How can group collaboration be assessed quantitatively?
2. What are the specific problems of the small groups captured by the quantitative indices for more/less collaboration?
3. Which participation behaviours in whole group discussions before entering small groups are associated with small group collaboration?

In the following three chapters (Chapter 5, 6, and 7), I will present results of the data analyses to answer the questions examined in the respective chapters.

CHAPTER FIVE

RESULTS- I:

QUANTITATIVE ASSESSMENTS OF

GROUP COLLABORATIONS

This chapter reports the findings of the data analysis to answer research question #1: “How can group collaboration be assessed quantitatively?” It consists of four sections. The first section reports the coding results of the data included in this research. The second section reports the results of the assessment of collaboration by three quantitative indices (i.e., quantity, equality, and sharedness). Based on the assessment, the groups are ranked from the most collaborative group (ranking 1) to the least collaborative group (ranking 6) in a rubric table. In the next section, the group rankings are discussed by comparing small group membership revealed in the whole group, before and after the small group activity. This is to see how communication networks in a whole group community may influence and be influenced by small group collaboration process in terms of pre-existing friendship and post-small group membership, respectively. The last section provides a brief summary of this chapter and an introductory note for the next chapter.

5.1 Description of Coding Results

A total of 2,029 messages (173,771 words) posted by students were coded for this research. 732 messages (59,166 words, 34% of the total data) were from the six small group forums and 1,297 messages (114,605 words, 66%) from the whole group

discussions (Table 5.1). The data were categorized into three communication categories (cognitive, social, and managerial). Overall, 58% of the data belong to the cognitive, 22% to the social, and 19% to the managerial category. Whole group discussions consist of 68% (cognitive communication), 26% (social communication), and 6% (managerial communication). On the other hand, the largest portion of small group communication is managerial communication (44%), followed by cognitive (38%) and social (18%) communication.

Table 5.1 Total data included in this research

	Whole group discussions				Small group activity			
	COG	SOC	MNG	ALL	COG	SOC	MNG	ALL
Total words	77967	29929	6709	114605	22582	10508	26076	59166
Average/person	3249	1247	280	4776	941	438	1087	2466
Standard deviation	1998	850	357	3205	865	337	959	2161
Variability Coefficient	0.62	0.68	1.28	0.63	0.92	0.77	0.88	0.81
Category portion	68%	26%	6%	100%	38%	18%	44%	100%

Note. COG: cognitive communication, SOC: social communication, MNG: managerial communication

Looking at the trends of the postings (Figure 5.1), whole group discussions peaked during the first week when all the students posted their biography. The whole group communications were low from week 4 to week 8 when the students focused on the small group activity. Small group interaction peaked at week 8 when the assignment was due.

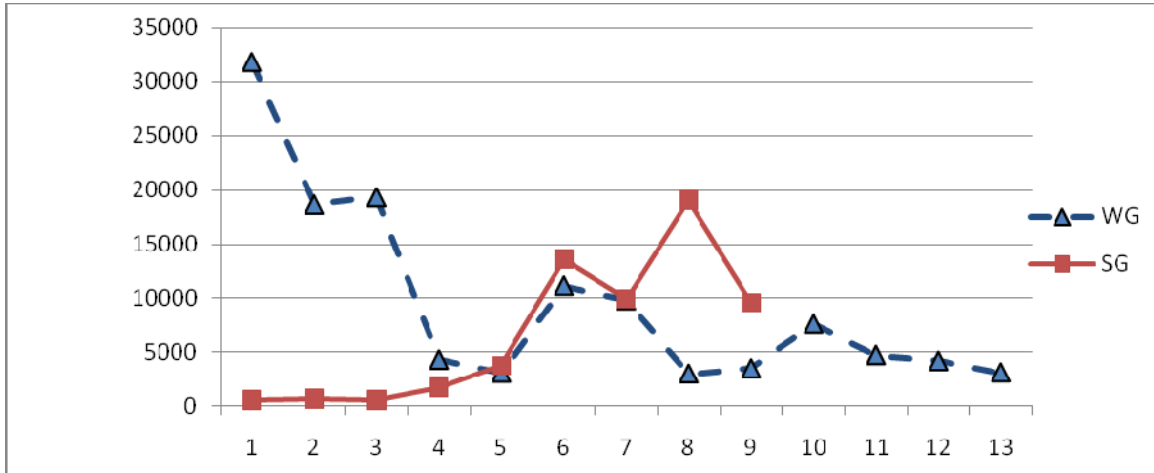


Figure 5.1 Communication trend during the activities

Groups were formed with 3-5 members (Table 5.2). Group C was formed with three members, Group E with five, and the other four groups with four members. The average number of females was two out of four members. Group D and E included more female members but Group C and F more male members.

Groups exhibit a wide range of variability in the extent of communication. Group A exchanged only 2,018 words, which is ten times fewer words than Group D. Three groups (B, D and E) show high interaction levels, while the other three groups (A, C, and F) show much lower interaction levels. ANOVA test for group difference in overall communication volume among six groups is statistically significant at $p < .05$ ($F=6.09$). The group differences in the social and the managerial communication categories also reveal statistical significances at $p < .05$ ($F=5.65$, $F=13.99$, respectively). However, there is no significant difference among groups in the cognitive communication category ($F=2.63$, $p=.059$).

Table 5.2 Description of small group data

Group	Members (male, female)	Total words	Cognitive	Social	Managerial
A	4 (2, 2)	2018	435	493	1090
B	4 (2, 2)	13581	5982	2569	5030
C	3 (2, 1)	5142	1395	841	2906
D	4 (1, 3)	20350	6304	2970	11076
E	5 (2, 3)	14205	6175	3153	4877
F	4 (3, 1)	3870	2291	482	1097
Total	24 (12,12)	59166	22582	10508	26076
F(5,18)	-	6.09	2.63	5.65	13.99
p-value	-	(.002)*	(.059)	(.003)*	(.000)*

* $p < .05$

5.2 Assessment of Collaborations with Three Indices

This section reports the results of group collaboration assessment by the three indices, *quantity*, *equality*, and *sharedness*. The *quantity* index is calculated by the average number of words sent by each member within a group. The *equality* index is calculated by using the coefficient of variability of the amount of messages sent by each member. This reveals how much group members contribute equally to their group activity. The *sharedness* index is calculated as the portion of open-communication messages sent to every other member out of the total amount of messages exchanged within the group. This reveals whether the interactions tend to be one-to-one or one-to-group within a group.

5.2.1 Assessment of Collaboration: Quantity Index

The quantity index shows that three groups (D, B, and E) had much more communication in all three communication categories than groups A and F. Group D exchanged the most words per member (5088), which is more than double the average words of all groups (2428). It should be noted, however, that 54% of Group D's communication was managerial communication. This is a much higher portion when compared with those of Group B's (38%) and Group E's (34%) managerial communication. Group C also exchanged lots of messages to manage group processes (57%), which is a much higher portion than that of its cognitive communication (27%).

Table 5.3 Communication *quantity* index (averaged number of words)

Communication category	Group A (n=4)	Group B (n=4)	Group C (n=3)	Group D (n=4)	Group E (n=5)	Group F (n=4)	Group Average
Cognitive	109 22%	1,496 43%	465 27%	1,576 31%	1,235 43%	573 59%	909 37%
Managerial	273 54%	1,311 38%	969 57%	2,769 54%	975 34%	274 28%	1,095 45%
Social	123 24%	646 19%	280 16%	743 15%	631 22%	121 12%	424 17%

5.2.2 Assessment of Collaboration: Equality Index

The *equality* index was to reveal the variability of members' participation in terms of how much each individual's contribution deviated from the group average. It was calculated by the squared coefficient of variance. Table 5.4 presents each group's equality in the

three communication categories. A greater number indicates a larger variability in members' participation. For example, the equality of Group A in cognitive communication is 1.64, which is the highest variability among the six groups. Results for Group A also reveal poor equality in managerial communication, with the highest coefficient of variability.

Groups B and C reveal fairly equal participation in all the three categories of communication, with lower variability than the other groups. Group D reveals some interesting results. This group shows the lowest variability in managerial interaction (0.05), which might imply there is no leader or that every member tried to manage the group. On the other hand, this group shows much higher variability in cognitive communication (0.44). In the social category, Group E reveals the highest variability (0.41).

Table 5.4 Participation *equality* index (squared coefficient of variability)

	Group A	Group B	Group C	Group D	Group E	Group F	All Groups
Cognitive	1.61	0.28	0.24	0.44	0.66	0.63	0.84
Managerial	0.65	0.25	0.19	0.05	0.38	0.44	0.78
Social	0.13	0.13	0.08	0.10	0.41	0.18	0.59

The overall cognitive equality of all students across the groups is 0.84. All the coefficient values for the groups in the cognitive category, except for Group A, are lower than the overall variability. This means that a member's participation tends to depend on the group to which s/he belongs.

Table 5.5 below shows individuals' contributions according to three communication categories. Unequal participation in Group A is obvious. The student A2f is responsible for about 70% of all of the groups' communication, while A4m contributes very little. This led to high variability when compared with the other groups. Students E4m and E1f in Group E contributed a significantly high number of words to the social communication, causing the high coefficient of variability.

Table 5.5 Individuals' participation *quantity* (word counts)

group member ID*	Group A				Group B				Group C		
	A1m*	A2f	A3f	A4m	B1m	B2m	B3f	B4f	C1f	C2m	C3m
cognitive	117	301	14	3	994	814	1618	2556	552	206	637
managerial	116	187	97	93	360	543	788	878	275	360	206
social	450	475	83	82	501	1006	1607	1916	1425	876	605

Group D				Group E					Group F			
D1f	D2f	D3m	D4f	E1f	E2f	E3f	E4m	E5m	F1m	F2m	F3m	F4f
843	1804	2958	699	2190	730	179	2423	653	1168	112	648	363
591	950	938	491	836	246	383	1242	446	182	70	89	141
2869	3279	3038	1890	1548	673	638	1679	339	508	101	167	321

Note: * member ID: e.g., A1m is a male member of Group A.

5.2.3 Assessment of Collaboration: Sharedness Index

Group D is identified as having the lowest level of sharedness (23%) in both the cognitive and the social categories (Table 5.6). This means that communication in Group D tended to occur between individuals instead of through sharing with all members. Overall, groups tend to share managerial communication (52%) more often than cognitive (41%) or social (33%) communication. This implies the importance of managerial statements in small group collaboration processes.

Table 5.6 *Sharedness* index (percentage of shared words with all members)

	Group A	Group B	Group C	Group D	Group E	Group F	All Groups
Cognitive	29%	36%	57%	23%	45%	83%	41%
Managerial	48%	61%	63%	43%	48%	80%	52%
Social	51%	37%	47%	17%	34%	55%	33%

5.2.4 Group Collaboration Rankings as Assessed by the Three Indices

For the purpose of quickly identifying potential problems in groups during group collaboration, a rubric table of collaboration assessment with 9 domains as assessed by 3 collaboration indices (quantity, equality, sharedness) in 3 communication categories (cognitive, social, managerial) is presented below (Table 5.7). The rubric table shows groups' collaboration ranking in each domain from the most collaborative group (ranking 1) to the least collaborative group (ranking 6).

The rubric table of collaboration assessment reveals that two groups (B and C) are not ranked as the least collaborative group in any of the nine domains. Meanwhile, the other four groups are ranked as the least collaborative group in one or more domains in the rubric table. Groups B and C can be identified comparatively as more collaborative groups than the rest of the groups. These two groups do not seem to have any serious problems and could not be red-flagged for instructors' careful attention. When examining the other groups, Group A is most frequently ranked as the least collaborative group. This group displays problems with members' active participation, as well as democratic contribution. Group D is ranked by the sharedness index as the least collaborative group

in all three communication categories. This indicates that members' communication tends to be one-to-one rather than one-to-group. By the equality index, Group E reveals the least collaboration in their social communications. By the quantity index, Group F is the least collaborative group in social and managerial communication and is also low on the equality index in all the communication categories.

Table 5.7 Rubric table identifying the least collaborative group by the collaboration indices

Index	Category	Group A	Group B	Group C	Group D	Group E	Group F
Quantity	cognitive	6	2	5	1	3	4
	managerial	6	2	3	1	3	6
	social	6	2	4	1	2	6
Equality	cognitive	6	2	1	3	5	4
	managerial	6	3	2	1	4	5
	social	3	3	1	2	6	5
Sharedness	cognitive	5	4	2	6	3	1
	managerial	4	3	2	6	4	1
	social	2	4	3	6	5	1

5.3 Small Group Membership Development

Small group membership development is examined by comparing communication relationships revealed in the whole group discussions before and after the small group activity, in terms of: (1) pre-existing friendship influencing small group collaboration and (2) post-group membership continued after the small group activity. A stronger pre-existing friendship presumably associates with more collaboration in a small group. In

post-group membership, it is assumed that members who experienced more collaboration would tend to continue communication after the small group activity.

In order to examine how small group membership reflects on the whole group communication network, interaction quantity among small group members is traced before, during, and after the small group activity (Table 5.8). The group membership is determined as the portion of communication among group members out of total communication among all students: Membership of Group X (%) = (Amount of communication between Group X's members in the whole group discussions / total amount of communication of Group X's members in the whole group discussions) * 100, for each group X.

Before starting their small group activity, the interaction levels among members (pre-existing friendship) in four groups were similar, ranging from 15% (Group B) to 12% (Group D). Group A had a lower level of interaction (6%) among members than the four groups and Group C members had no interaction among themselves (0%) before starting their group activity.

Table 5.8 Portion of interaction in whole group discussions between small group members

	Group A	Group B	Group C	Group D	Group E	Group F	Average
Before	6%	15%	0%	12%	13%	14%	11%
During	4%	15%	3%	0%	6%	0%	7%
After	0%	23%	5%	0%	11%	0%	11%

During the group activity, only Group B of the four groups, which started with more than 10% interaction levels, kept their level of interaction during whole group discussions. Group D and Group E never replied to messages posted by small group members on the whole group discussion board. Group C, which had never communicated before small group activities started, showed some interactions.

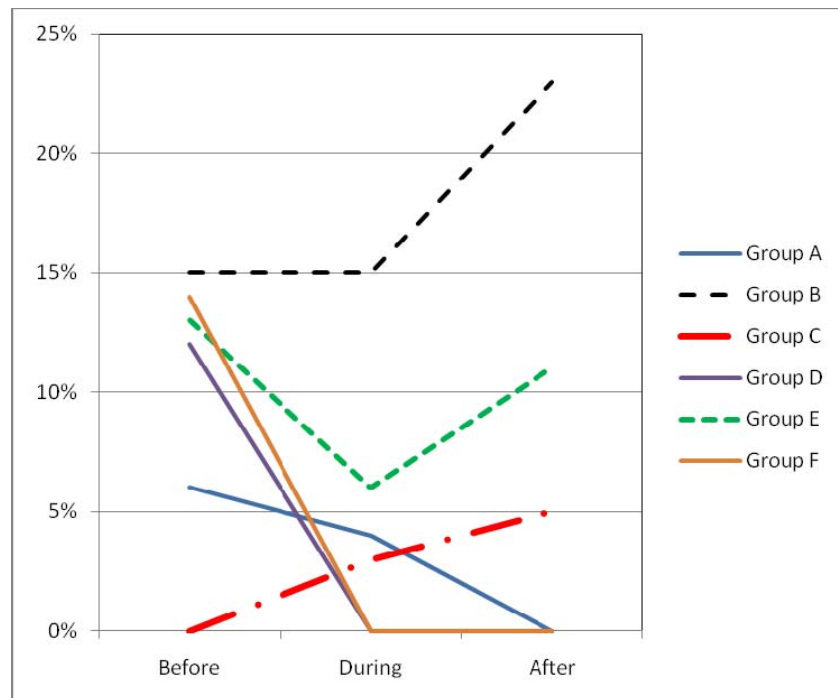


Figure 5.2 Membership development trend in whole group discussions

As shown figure 5.2, an interesting finding is that only three groups continued interactions on the whole group network after submitting the group assignment. Following the small group activity, Group B showed increased communication at a much higher level than the other groups. Group E maintained a similar level of communication to what they had exhibited before entering the small group activity. Group C started the small group activity without any previous interactions, but reached a 5% communication

level after the activity. Group A, D, and F did not communicate at all in the whole group discussions after the small group activity.

These results are consistent with the overall collaboration assessed by three indices in terms of identifying the two more collaborative groups (Groups B and C), which do not have any least domains in the rubric table.

5.4 Summary of Findings and Introduction to the Next Chapter

The findings reported in this chapter are summarized below:

1. Content of communication in small groups is different from that of whole group discussions. Small group members exchanged a lot of managerial communication (44%), while the managerial communication portion for whole group discussions was only 6%.
2. When the collaboration of the six groups was assessed by the three indices in three communication categories (i.e., nine domains), four groups were ranked as the least collaborative group in one or more domains.
3. Post-group membership reflected in the whole group setting seems to associate positively with the collaboration experience. The groups, which indicated no problems in any domains of collaboration assessment, continued communication after the small group activity. On the other hand, the groups that indicated potential problems in the rubric table of collaboration assessment showed reduced or no communication connections in the whole group discussion after the small group activity. Pre-existing friendship, however, does not seem to be related to small group collaboration. One group with no pre-existing friendship was

identified as being more collaborative than other groups with some pre-existing friendship.

In the next chapter, I report the findings of a qualitative analysis of communication data. The qualitative analysis focuses on identifying specific problems that associated with less or more collaboration as assessed by the quantitative indices in this chapter. I discuss the problem factors in relationship to the findings of this chapter.

CHAPTER SIX

RESULTS - II:

QUALITATIVE ASSESSMENTS OF GROUP COLLABORATIONS

This chapter presents the findings of a qualitative analysis of the small group communication to answer research question # 2: “What factors hinder or facilitate small group collaboration?” The qualitative analysis is intended to examine the results of the quantitative assessment of collaboration that were reported in the previous chapter. In order to examine whether the quantitative indices appropriately reflect problems and facilitating factors during collaboration processes, I scrutinize the communication scripts of each group.

This chapter consists of three sections. In the first section, specific problems are identified in the four groups that were assessed as the least collaborative groups (A, D, E and F) in one or more domains of collaboration. In the second section, facilitating factors that might be associated with the two more collaborative groups (B and C) are identified. The third section provides a summary of findings and discusses the implications of the key findings by comparing the findings with those of the previous chapter. The fourth section presents an introductory note to the next chapter.

The students are identified by anonymous codes made up of three characters (e.g., A1m, B3f). The first uppercase letter (from A to F) represents the group to which a student belongs. The next character is a number assigned randomly to members of a group from 1 to 5 depending on the number of group members, to individuate the members. The last

lowercase letter (f or m) represents gender. For example, *A1m* is a male member of Group A.

6.1 Problems Identified in Less Collaborative Groups

6.1.1 Group A: The Least Collaborative Group

Group A was ranked as the least collaborative in five out of nine domains: all three communication categories measured by the *quantity* index and the two communication categories (cognitive and managerial) measured by the equality index (see Table 5.7, p. 83). Major problems identified by the in-depth review of their communications are: (a) a late start for the group activity, and (b) a lack of social communication which might be caused by little interaction and unequal participation.

This group was formed with four members (*A1m*, *A2f*, *A3f*, and *A4m*). Three of the members, all but *A2f*, exchanged their hopes of working together in a group by posting biographical messages. The three students had known each other through previous courses, but the text communication does not show how *A2f* joined in the group because she did not communicate with the three during the biography posting period. No member of this group posted messages in the Main forum or Cafe forum before starting their small group activity.

Late start, no time for ice-breaking at the initial period: Group A started communication on February 14, which is much later compared to other groups (e.g., Groups B and E started communication on January 9 and January 15, respectively). Because of the late

start, Group A was hurried to complete the group assignment within 17 days. The shorter time seems to be an influencing factor that hindered the process of socializing and planning the task. The group did not have time for any icebreaking period at the beginning of the activity.

The group seemed to wish simply to split up the task to individuals for later compilation to complete the assignment. A2f led the group throughout the project. She set up a Google Doc and invited the other members to comment on her notes posted on the Google Doc. The other three members agreed to her suggestion to respond to her questions. A1m suggested the structure of the group paper in order to divide the assignment task. He listed five sections of their group's final paper and suggested each member take a section and share the conclusion section. A2f expanded A1m's structure of the group paper and each member picked one or two sections voluntarily that they wanted to take the responsibility for writing up.

Little social communication, no conflicting ideas: Very little social communication was exchanged among group members in the group forum space. Once taking on their own sections of the paper, individual members started working separately without communicating with each other. After working for about two to three days, they put drafts of individual sections on a Google Doc. There were no obvious conflicts/arguments or brainstorming/developing ideas among members. The editorial process was quick, as had been the process of picking the topic option and their dividing up tasks. After compiling individuals' writing in the Google Doc, only A2f asked some questions and added comments on A1m's writing and the rest of the members generally

expressed satisfaction on each other's writing. They took turns to proofread others' sections to complete the group work.

No synchronous communication: It appears that, Group A never considered using synchronous communication tools. All members simply agreed to put their individual section piece into a Google Doc. Because this group quickly moved to the Google Doc plan, their collaboration process was not clearly revealed in this analysis of forum postings. However, it was evident that the group did not socialize or collaborate much, rather the group just wanted to complete the group assignment. The group quickly split the job into various tasks and stitched them together to finish the group project without any major issues between members. This may look an efficient way of "cooperative group work" but is not an ideal/successful example of "collaborative group work." This group could not go beyond an individual level of learning because the members did not go through any brainstorming or any deep level of discussions that might challenge each other's existing knowledge, which was the objective of the collaborative activity as stated in the course design.

6.1.2 Group F: The Least Active Group

Group F was ranked as the least collaborative group in the categories of managerial and social communication when measured by the quantity index (see Table 5.7, p. 83). The group also revealed a very low level of equality in all three communication categories.

This group was formed with four members (F1m, F2m, F3m, and F4f). The group did not communicate at all during the Biography activity, or in the Main and the Cafe forums.

Three of them, except F4f, did not seem to be familiar with the course and did not know each other well. F1m was not an enrolled student in the program, but was taking the course as an elective course from another program. F3m came back to the program after two years' leave. While most of the students let the class know how many courses they had been through, F2m did not reveal whether he was in the program.

Indecisiveness, lack of leadership: The biggest problem of the group was members' indecisiveness or lack of leadership. For example, the group spent too much time on selecting a topic because each member did not clearly express his/her preference for the option. F4f wrote that she thought option 1 seemed more straight forward and option 2 was more creative and might be fun. All group members were reluctant to take a leading role, so they came face-to-face with the dilemma of how to start by choosing a topic. They passed responsibility on to each other. This group spent the initial 10 days (out of the total 25 days) of the assignment to post 16 messages (32% of total messages) just on deciding a topic option.

After the group divided up the tasks, members rarely communicated with each other. F1m set up a Google Doc on which to put a collective paper. F4f thought that the group should discuss and clarify each individual's ideas before she began writing her sections of the group paper. One week before the due date for submission of the paper, F1m posted a detailed schedule to move the process forward and encouraged members to discuss and clarify their ideas. However, the group members were very quiet on the Google Doc as well as in the group forum space. The final paper had to be stitched up by F1m. This group obviously failed at collaborative group work. The assignment mark was

very low and the members never communicated with each other after the group work was completed.

6.1.3 Group D: The Angry and Troubled Group

Group D was ranked as the least collaborative group in all three communication categories measured by the sharedness index (Table 5.7, p. 83). This is an interesting result because the group revealed the best level of collaboration in terms of the *quantity* and the *equality* of communication.

Group D was formed with four members (D1f, D2f, D3m, and D4f). D2f and D3m had known each other through previous courses and wanted to work together in the group. They interacted by responding to posts in the Biography and Cafe forums. The other two group members did not communicate at all.

Technology and internet problems: Group D struggled with many technology problems and an Internet access problem. For example, some members could not open attached documents because of file extension issues. Sometimes they were confused with too many track changes in the documents and worked with an older version while they took turns editing the paper. The group spent a lot of time on clarifying these technology-related issues and scheduling to match individual progress. D1f lived in a remote area of Canada where she had several power outages due to the extreme cold weather and had to make internet connections with the use of a dial-up service. She tended to be late for responding to other's requests. This made group members annoyed. One member (D3m)

was particularly upset about the group's progress. Emotional conflict between D1f and D3m became serious and reached a level of personal attacks on each other at the end.

Politeness issues/negative attitudes to members: Negative attitudes expressed among members were obviously harmful for smooth collaboration. Group D did not make appropriate self-introductions even though the members seemed unfamiliar to each other. They were in a hurry to jump into deciding when and what to do. The tone of messages was very stiff and formal. The first message by D3m in response to D2f sounded very concerned about time from the beginning. His frustration grew extreme, as he wanted to just complete the work. He wrote, "The good news, it's almost due."

The uneasy feelings and emotional conflicts brought out a lot of problems at the last minute of the group work. The combined paper was uncontrolled, with too many overlaps and inconsistent content caused from a lack of discussion. The group had to rapidly increase communication to tighten up the lengthy version of the draft paper. As the deadline for the assignment submission approached, members became anxious. About 50 % of the total group communication was exchanged during the last three days before the submission due date.

6.1.4 Group E: Some Problems but Okay Level of Collaboration

Group E was ranked as the lowest in equal participation on the social communication category. Equality in the cognitive and sharedness in the social category were also low. Text communication revealed that communication in these categories was predominantly

contributed by just two members (E1f and E4m). This resulted in the group showing the lowest equality level in the social communication category (Table 5.7, p. 83).

This group consisted of five members (E1f, E2f, E3f, E4m, and E5m). All of them connected to one or more members by responding to biography postings. They also communicated in the Cafe forum.

Group size and time-zone difference: Group E made a good start by way of informal conversation as they encouraged and comforted each other. The only problem was related to uses of communication tools. There were five members and they picked Option #2, an option that required a great deal of discussion and brainstorming. They spent three days discussing appropriate tools and arranging an available time for all members to join in a real time chat, which could never be agreed on because the members were geographically dispersed and had different work and family commitments.

E4m believed the group needed to meet synchronously. He suggested communicating either via chat, Messenger, or Skype. However, scheduling the meeting time and deciding upon a specific chat tool were not easily agreed upon by the five members. E1f lived the other side of Canada (Vancouver) and didn't feel comfortable in using Skype. E5m and E4m both lived in Ontario, so E1f's time did not work for them. Thus, even though E4m persistently emphasized "the benefit of talking versus posting" in terms of more, and deeper, discussion in a shorter time, a synchronous meeting did not happen in this group.

Resolving opinion gaps with communication tools: This group realized that it could overcome the trouble caused by different personal preferences in communication channels. The group decided to communicate frequently in the group forum and used Wiki to edit the compiled paper. It went smoothly, and the group task was completed ahead of due time without a lot of confusion at the last minute before submission. At the end of the group work, the members thanked each other and expressed satisfaction with the group work process and the paper quality.

6.2 Facilitating Factors Identified in More Collaborative Groups

6.2.1 Group B: The Most Active and Cheerful Group

Group B was assessed as having no problematic areas in any communication categories by the collaboration indices used in this study. Group B had excellent collaboration throughout the activity.

Group B was formed with four members (B1m, B2m, B3f, and B4f). Before entering the group, the students were strongly connected to each other through the Biography activity as well as in the Main and Cafe forums. They indicated in responses to biography postings that they were eager to work together.

Social statements, team spirit: Members fostered a welcoming and friendly mood from the beginning, and maintained a cheerful atmosphere, encouraging each other throughout the group process. Taking a close look at their messages, there were a lot of positive expressions, compliments, and casual chats such as:

“I’m excited to be working with the 2 of you for this project.”

“I too am looking forward to working with you. I really like being able to choose groups.”

“I can’t resist not joining such good quality and keen people as you!”

“Great ideas all around. ... Happy studies all around.”

The members frequently shared their individual lives and stories. This type of social communication helped to smooth out tensions when they had to resolve contradicting points of view. This group was good at improving team spirit by using nicknames and making jokes. For example, this group liked to start a message with “Hey Team” or “Hi [member’s nickname]” while other groups usually wrote “Hi All” or “Hi [member’s name].”

Making an early start and quick decisions: B4f opened the group communication much earlier than other groups did. He posted a message to suggest a topic option. The other members promptly responded to him and the decision was quickly made to proceed to the next step without wasting too much time.

Splitting jobs, but overall understanding throughout the readings: This group, like other groups, considered splitting jobs and combining the individual works later. B2m suggested dividing the questions for each member to be a subject-matter expert on one area. However, he believed that all members should read all the materials to discuss the combined version of writing.

The other members agreed on the idea of covering all the readings. They still engaged in discussions while individuals were working on their own questions. Therefore, the group avoided any huge discrepancies or gaps between individual pieces of writing to answer the questions in the combined version of the paper at the end.

Use of instructor as a resource: Group B effectively used the instructor as a resource to clarify confusions that were not able to be resolved within the group. B3f asked members' opinions about involving the instructor in their group discussion. The instructor replied promptly to the group's question. The group was pleased at having their confusion cleared.

Avoiding any last minute confusion with an incisive mind: The group knew when and how to stop editing the paper. Two days before submission of the final paper, B2m raised an issue and asked the team whether to add the issue to the paper. The group was wise enough not to create any last minute confusion.

Everybody in Group B was very satisfied and happy with their experience after successfully submitting the group assignment. Members debriefed after their collaboration with satisfaction, and expressed a desire to work together again. B1m even wanted to visit B4f to talk about something in person. They exchanged phone numbers and personal schedules to meet sometime. When they checked the group grade, everybody was very happy. It was a happy learning experience for this group.

6.2.2 Group C: Effective Uses of Synchronous Communication Tool

Group C was also a very collaborative group. This group was especially good at using synchronous communication tools efficiently along with the asynchronous forum provided on the course website. From the beginning of the group activity, the members planned synchronous chats and exchanged Skype addresses. As a next step, they decided to work on the topic in Option # 2 and moved on to brainstorm about the topic. As they frequently chatted synchronously throughout the group process, they worked to narrow the gap of individual opinions.

Group C was formed with three members (C1f, C2m, and C3m). This course was the seventh for C2m and the ninth (final) for the others. Interestingly, they never communicated in any of the forum spaces before entering the small group activity.

Keeping connected throughout the group process: There were three members in the group. The members sometimes simply continued synchronous meetings between two members when the third could not make it because of a technology problem or time differences. One member lived in Ontario and the other two in western Canada. Instead of organizing an available time for all members, the attendees posted a summary of the chat for the third member who missed the meeting. This process saved the time and effort of trying to organize a synchronous meeting that was found in some other groups.

The group used the group forum space to schedule synchronous meetings either via Messenger (MSN) or Vista chat linked to the course website. The members knew the importance of developing an overall understanding of the topic before entering into

individual tasks. In that way, they could manage some confusion that arose with overlaps, inconsistent concepts, and irrelevant arguments.

Members kept in communication and wanted to consult other's opinion whenever they faced some difficulties with individual sections. Because the members continued communication through both synchronous and asynchronous methods, combining the individuals' parts did not require too much effort.

However, they still had to deal with all of the incongruence through discussions for editing and revising the combined version. Unlike other groups that mostly used editing tools such as Google docs or Wiki, this group continued to chat and post revised drafts to the group forum space. They continued synchronous and asynchronous meetings to the last minute before paper submission.

6.3 Summary of Findings

This chapter was intended to identify factors that facilitate or hinder group collaboration by performing a qualitative analysis on the communication scripts. The facilitating factors found in more collaborative groups (B and C) are as follows:

- Using a lot of social statements to foster team spirit,
- Making an earlier start to have enough time to build up friendships,
- Having an overall understanding of the group task to go beyond a “split-and-conquer” approach,
- Using the instructor as a resource person,
- Expressing opinions explicitly for quick and clear decisions, and

- Using appropriate communication and collaboration tools (e.g., MSN, Wiki).

The hindering factors found in less collaborative groups (A, D, E, and F) are as follows:

- Having little time for ice-breaking during the initial period,
- Not attempting diverse uses of different communication tools,
- Using unclear expressions with an indecisive manner,
- Struggling with technology and Internet problems,
- Displaying bossy, negative attitudes, impatience, and little understanding toward members, and
- Living in different time zones.

6.4 Introduction to the Next Chapter

Based on the findings in both this chapter and the previous chapter, three groups (A, D, F) are identified as less collaborative groups, two groups (B, C) are more collaborative groups, and one group (E) is at an intermediary level of collaboration. In the next chapter, I examine factors that are associated with these less or more collaborative groups by comparing communication behaviours that appeared in whole group discussion settings before and after the small group activity.

CHAPTER SEVEN
RESULTS - III:
RELATIONSHIP BETWEEN SMALL GROUP AND WHOLE GROUP
PARTICIPATION

This chapter presents the findings for research question #3:

“Which participation behaviours in whole group discussions before entering small groups are associated with small group collaboration?” This question is based on the assumption that students’ participation behaviours in whole group settings before entering small group activity might be related to less or more collaboration once in the smaller groups. The question is intended to identify any variables in whole group discussions that can be used for forming more collaborative small groups. Whole group discussion data from week 1 to week 4 and all the small group data are used to examine this question.

This chapter consists of three sections. The first section examines factors that differentiate between more collaborative groups and less collaborative groups. According to the assessment results reported in Chapters 5 and 6, I divided small groups into two types, namely, less or more collaborative groups. Students’ posting behaviours (e.g. participation quantity, time, bio, or unit discussions), gender, and social network connections were also examined. I performed analysis of variance (ANOVA) and correlation tests to identify the factors that are associated with more and less collaborative groups. The second section examines individuals’ small group communication quantity in terms of how much participation quantity is determined by their participation behaviours in whole group discussion before entering a small group

and their group members' behaviour during the group collaboration. Finally, I examine the participation behaviour of the peripheral students on the whole group discussion network in relationship to their small group participation.

7.1 Factors Differentiating Less or More Collaborative Groups

Group differences between more and less collaborative groups were tested with the students' participation behaviours in whole group discussions before entering the small group activity. Categorizing more and less collaborative groups was based on the quantitative assessment results of group collaboration reported in Chapter 5, where four problem groups (A, D, E, F) and two no-problem groups (B, C) were identified. I made an adjustment of the grouping by dropping Group E from the problem groups because of the results of the qualitative evaluation as reported in Chapter 6. Group E's problem domain was its unequal participation in the social communication category. Looking at the group's communication process in the script, however, I found that the group had some problems at the initial period of group work and then overcame the challenges with two members' active social contribution. This group completed the project with satisfaction at the end. Group E can be assessed as having an intermediary level of collaboration, which means it cannot be put into either the less or more collaborative group. Therefore, I categorize three groups (A, D, F) as less collaborative groups that experienced serious problems, while two groups (B, C) are characterized as more collaborative groups that showed active, democratic, and open communication, and developed strong membership throughout the collaboration.

Table 7.1 below presents the group difference tests between the more collaborative groups and the less collaborative groups on the variables of participation behaviours in whole group discussions (before small group) and student gender.

Table 7.1 Analysis of Variance (ANOVA) between more and less collaborative groups

Variables	F(1,17)	p-value
Gender	0.08	0.78
Number of students communicated directly (ego network size)	1.24	0.28
Amount of words sent out during whole group discussions (WG)	5.65	0.03*
Amount of cognitive words sent out during WG	5.67	0.03*
Amount of social words sent out during WG	4.37	0.05*
Amount of managerial words sent out during WG	1.44	0.25
Amount of word received during WG	2.85	0.11
Amount of words sent out for self introduction	3.25	0.09
Posting day of self introduction	4.89	0.04*
Amount of words sent out for Unit 2 discussion	5.68	0.03*
Amount of cognitive words sent out for Unit 2 discussion	5.67	0.03*
Amount of social words sent out for Unit 2 discussion	0.81	0.38
Posting day of 1 st message for Unit 2 discussion	3.23	0.09
Number of reply to others' posting for Unit 2 discussion	3.15	0.09
Amount of words sent out for Main forum	1.28	0.27
Amount of social words sent out for Main forum	1.02	0.33
Amount of managerial words sent out for Main forum	1.16	0.30
Amount of words sent out for Cafe forum	1.81	0.20
Amount of social words sent out for Cafe forum	4.30	0.05*
Amount of managerial words sent out for Cafe forum	0.69	0.42

* $p < .05$

Some participation behaviours during whole group discussions before entering small group activity reveal significant differences between less and more collaborative groups.

Students in more collaborative groups posted (sent out) significantly more words than

their counterparts in whole group discussions ($F=5.65$, $p=0.03$). They, in particular, participated actively in the Unit 2 topic discussion ($F=5.68$, $p=0.03$), while no significant differences existed in the Main forum ($F=1.28$, $p=0.27$) and Cafe forum ($F=1.81$, $p=0.20$). As well, no significant difference is evident in the amount of received words ($F=2.85$, $p=0.11$). Students in more small groups tended to post self-introductions earlier in the process ($F=4.89$, $p=0.04$), but the first posting day for the Unit 2 discussion was not significantly different ($F=3.23$, $p=0.09$). Student gender and ego network size (i.e., direct connections on communication network) are not significant factors contributing to successful group collaboration.

7.2 Determination of Explanation Portion of Individual's Small Group Participation

In order to identify the factors associated with small group participation, correlation analyses were conducted (Table 7.2). Results show that individuals' small group participation is significantly correlated with her/his own group members' participation ($r=0.64$) and with his/her WG participation ($r=0.53$). The correlations of small group participation are significant within each forum, i.e. Bio ($r=0.57$), Main ($r=0.62$), and Cafe ($r=0.48$). However, the Unit 2 discussion is positively but not significantly correlated with small group participation ($r=0.37$). The individuals' network factors (ego net size, ego net ties: See the Notes below the table) show positive correlations with small group participation ($r=0.34$, $r=0.40$ respectively). Posting times in the Bio and Unit 2 discussions reveal negative correlations ($r=-0.3$, $r=0.07$, respectively), which means that earlier posters for the forums tended to participate more in small group activity although the correlations are not statistically significant.

Table 7.2 Correlations between small group and WG participation variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. SGP	1.00	.	.	.	.	.	.	.	.	.	.	.
2. WG	.53**	1.00	.	.	.	.	.	.	.	.	.	.
3. ENS	.34	.55**	1.00	.	.	.	.	.	.	.	.	.
4. ENT	.40*	.62**	.97**	1.00	.	.	.	.	.	.	.	.
5. Bio	.57**	.90**	.59**	.67**	1.00	.	.	.	.	.	.	.
6. BPD	-.30	-.31	-.72**	-.63**	-.33	1.00	.	.	.	.	.	.
7. Unit 2	.37	.95**	.46*	.54**	.77**	-.25	1.00	.	.	.	.	.
8. U2FPD	-.07	-.33	-.68**	-.60**	-.28	.86**	-.29	1.00	.	.	.	.
9. U2R	.25	.83**	.57**	.58**	.65**	-.30	.80**	-.45*	1.00	.	.	.
10. Main	.62**	.60**	.24	.25	.57**	-.30	.43*	-.29	.37	1.00	.	.
11. Café	.48*	.69**	.42*	.43*	.52**	-.18	.54**	-.33	.75**	.56**	1.00	.
12. OMP	.64**	.12	.14	.22	.24	-.19	.00	.05	.00	.18	.15	1.00

* $p < .05$, ** $p < .01$

1. SGP: Small Group Participation
2. WG: Whole Group participation during weeks 1-4 before entering small groups
3. ENS (Ego Net Size): Size of direct connections
4. ENT (Ego Net Ties): Number of connections
5. Bio: amount of words sent in Bio forum for self introduction
6. BPD: Bio Posting Day
7. Unit 2: amount of words sent in Unit 2 discussion forum
8. U2FPD: Unit 2 First Posting Day
9. U2R: amount of words as Unit 2 Reply
10. Main: amount of words posted in Main forum
11. Cafe: amount of words posted in Cafe forum
12. OMP (Other Members' Participation in small groups): average amount of words contributed by other members to small group collaboration

In order to investigate the proportion of individuals' small group participation that can be explained by their own WG participation and other members' participations in small groups, stepwise regressions were run. Small group participation (SGP) was identified as the dependant variable and the other variables listed in Table 7.2 above were used as independent variables. The results show 66.9% of small group participations can be explained by other members' participation (OMP) and the managerial communication in WG (WG-MNG) (Table 7.3). Because the correlation between SGP and OMP is the

highest, the variable OMP was entered at the first step which explains about 40.5% of SG participation (see Table 7.4).

Table 7.3 Amount of explanation for small group participation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Change Statistics			Sig. F Change
						F Change	df1	df2	
OMP & WG-MNG	.818	.669	.637	203.2042	.264	16.743	1	21	.001
OMP & Main	.816	.666	.634	209.0574	.261	16.378	1	21	.001
OMP & Bio	.772	.596	.557	329.3328	.191	9.920	1	21	.005
OMP & WG	.783	.613	.576	301.0436	.208	11.280	1	21	.003

*Note: OMP (Other Members' Participation in small groups): average amount of words contributed by other members to small group collaboration;
 WG-MNG (Whole Group Managerial): amount of words for managerial communication;
 Main: amount of words posted in Main forum;
 Bio: amount of words sent in Bio forum for self introduction;
 WG: Whole Group participation during weeks 1-4 before entering small groups*

When the regression analysis was repeated with the managerial communication excluded, results showed that 66.6% of individuals' small group participations can be explained by other members' participation and Main forum participation. By repeating another regression after eliminating the Main forum, 59.6% of small group participation could be explained by other members' participation and Bio forum participation. Next was to exclude the Bio forum variable. This revealed that whole group participation with other members' participation explains 61.3% of individual's small group participation. Therefore, it is concluded that two-thirds of individuals' small group participation can be determined by other members participation in small groups and own participation in WG setting.

Table 7.4 Amount of explanation for small group participation by a single variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Change Statistics			Sig. F Change
						F Change	df1	df2	
OMP	.636	.405	.378	575.9581	.405	14.970	1	22	.001
WG-MNG	.599	.359	.330	635.6613	.359	12.320	1	22	.002
Main	.616	.379	.351	609.4877	.379	13.446	1	22	.001
Bio	.575	.330	.300	672.0981	.330	10.841	1	22	.003
WG	.528	.278	.246	735.3702	.278	8.490	1	22	.008

Note: OMP (Other Members' Participation in small groups): average amount of words contributed by other members to small group collaboration;

WG-MNG (Whole Group Managerial before entering small groups): amount of words for managerial communication;

Main: amount of words posted in Main forum;

Bio: amount of words sent in Bio forum for self introduction;

WG: Whole Group participation during weeks 1-4 before entering small groups

7.3 Participations of Peripheral Students in Whole Group and Small Group

In order to examine peripheral participants' behaviours in different activity settings (WG and small groups), I identified the bottom 30% who were inactive in the Whole Group discussions. Z-scores show relative participation (Table 7.5). Five out of the eight students showed some improvement in participation during small group activities. For all but one student (D4f), however, these improvements in small groups were very minimal, showing similar levels as with the Whole Group (Table 7.5). Three students (A2f, F2m, A1m) showed even lower participation in small groups. This result implies that peripheral students at the initial period of a course in whole group communication setting also tend to be inactive in small group settings.

Table 7.5 Inactive students in WG and their participation in small Groups (z-scores)

overall			Cognitive			social		
st ID	wg	sg	st ID	wg	sg	st ID	wg	sg
E2f	-0.51	-0.41	A2f	-0.57	-0.74	F2m	-0.52	-1.09
A2f	-0.60	-0.75	F2m	-0.62	-0.96	C2m	-0.53	-0.23
F2m	-0.66	-1.09	F3m	-0.66	-0.34	A2f	-0.55	-0.74
A1m	-0.83	-0.89	A1m	-0.76	-0.95	A1m	-0.77	-0.95
F4f	-0.84	-0.82	D2f	-0.90	1.00	D4f	-0.87	0.16
F3m	-0.90	-0.78	F4f	-1.14	-0.67	C3m	-1.09	-0.69
C3m	-1.24	-0.51	C3m	-1.31	-0.35	E1f	-1.10	1.18
D4f	-1.31	0.31	D4f	-1.64	-0.28	F3m	-1.12	-1.03

Note: st ID: student identification; wg: Whole Group; sg: small group

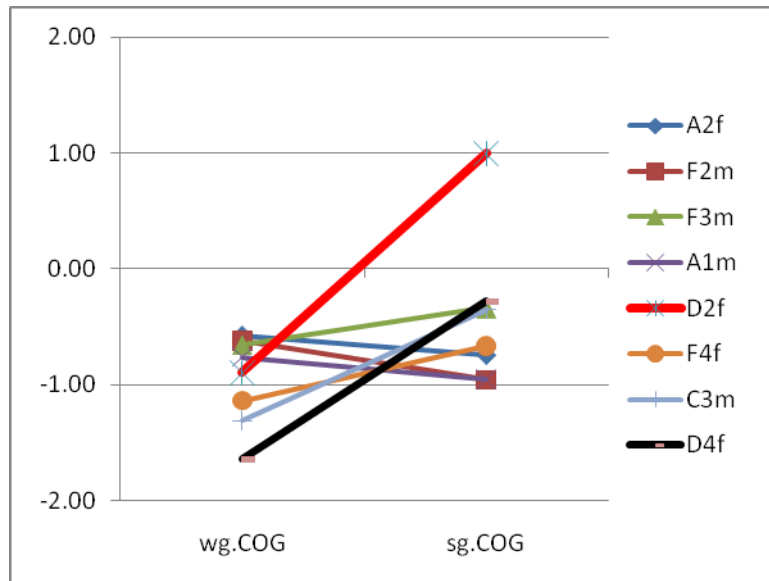


Figure 7.1 Inactive students' cognitive participation

When cognitive participation was compared, D2f was the only who showed above average cognitive participation in small group participation (Figure 7.1). The rest of the students showed below average rates of small group cognitive contribution, although

some revealed small improvements. Cognitively inactive students in the whole group tend to be inactive in the small group as well.

When my analysis focused on social communication, 6 out of 8 students who were identified on the list of cognitively inactive participants were also included in the socially inactive group (.Figure 7.2). Five of the six, except for D4f, revealed similar levels of participation in small groups as in whole group. Two students (E1f, C2m) who were added to the list of socially peripheral students in whole group discussions revealed much improved social participation in the small group setting.

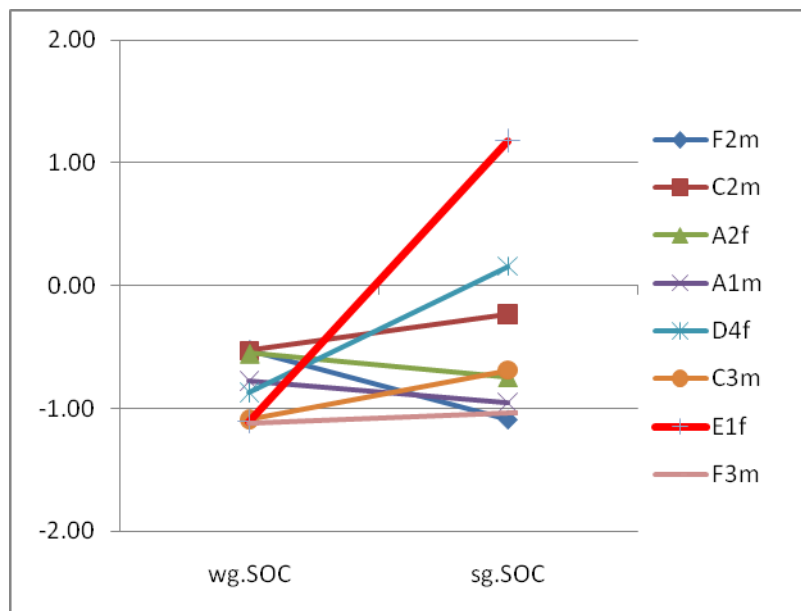


Figure 7.2 Inactive students' social participation

7.4 Summary of Key Findings

1. There was a significant difference in the amount of words sent out during whole group discussions before small group activity between the less collaborative groups and the more collaborative groups. This means that students in more collaborative small groups revealed more active participation in whole group discussions before entering the small groups.
2. About 70% of an individual's participation in a small group was explained by two factors: his/her participation in quantity in whole group discussions before entering small group activity (about 30%), and other members' participation in quantity during the small group activity (about 40%).
3. Inactive participants who sent out little communication in whole group discussions before entering small groups tended to remain similarly inactive during their small group activity.

CHAPTER EIGHT

CONCLUSIONS AND DISCUSSION

This chapter presents the overall conclusions and discussions of this dissertation research based on the key findings from quantitative and qualitative assessments of collaboration in project-based small groups in an online course. Summaries of key findings and discussions for each question are presented in Chapters 6, 7, and 8. In this chapter, I revisit the three research questions to provide an overview of this research. Next, I discuss how the findings can be applied to research and practice. Lastly, I make some suggestions for further research by recognizing potential limitations of the research.

8.1 Conclusions

The research was motivated by personal experience to better understand small group collaboration processes in online courses. As a researcher, learner, and teacher myself, I have experienced that collaborative learning in small groups in an online course is not easy. As many researchers have reported, I experienced frustration and anxiety during small group collaboration when I took some online courses. Approaching the situation from an instructor's perspective while working as a teaching assistant, I thought of the issue of the time commitment to reading hundreds of messages every day. Realistically speaking, an instructor may not know every detail that occurs in small groups. Project-based small group collaboration in higher education, in particular, places responsibility on the learner to make the effort to solve group problems with members in the learning community (Wenger, 1998). However, simply putting the learners into groups and letting

them work together is not likely to accomplish the perceived benefits of collaborative learning (Hill, Song, & West, 2009). Instructors should be able to know what the critical problems hindering collaboration are, and when to jump in to provide appropriate support. In this regard, I wondered if there were any methods or indices for an instructor to assess the collaboration process quickly and thereby provide timely support to the small groups that might face serious problems that would jeopardize collaboration processes. Thus, I explored an assessment method by using quantitative indices, demonstrated the assessment method to identify the potential problems in six small groups, and suggested some ideas as to how the assessment method and the indices can be useful for instructors and researchers in the future.

8.1.1 Research Question 1

Research question 1 was “How can group collaboration be assessed quantitatively?” The results of the research demonstrate that group collaboration can be assessed quantitatively using the three indices I developed: quantity, equality, and sharedness. The quantity index is the average number of words exchanged in a group. It signifies how actively a group communicates. The equality index is the squared coefficient of variation. It reveals participation variability among group members. The sharedness index is the percentage of communication sent to all the group members. It reveals communication connections between group members. Each index can be used across three communication domains—cognitive, social, and managerial.

Confidence in these indices is indicated by a) the consistency between the results using the quantitative indices and the qualitative analysis in terms of identifying more and less

collaborative groups and b) interactive behaviour in the whole group discussions traced before, during and after the small group activity.

8.1.2 Research Question 2

Research question 2 was “What factors hinder or facilitate small group collaboration?”

The facilitating factors found in more collaborative groups (B and C) are as follows:

- Using a lot of social statements to foster team spirit,
- Making an earlier start to have enough time to build up friendship,
- Having an overall understanding of the group task to go beyond a “split-and-conquer” approach,
- Using the instructor as a resource person,
- Expressing opinions explicitly for quick and clear decisions, and
- Using appropriate communication and collaboration tools (e.g., MSN, Wiki).

The hindering factors found in less collaborative groups (A, D, and F) are as follows:

- Having little time for ice-breaking during the initial period,
- Not attempting diverse uses of different communication tools,
- Using unclear expressions with an indecisive manner,
- Struggling with technology and Internet problems,
- Displaying bossy, negative attitudes, impatience, and little understanding toward members, and
- Living in different time zones.

8.1.3 Research Question 3

Research question 3 was “Which participation behaviours in whole group discussions before entering small groups are associated with small group collaboration?” Some participation behaviours in the whole group were found to differentiate significantly between more and less collaboration in small groups. These were: a) social network influence measured by the amount of sent-out words during the initial period of whole group discussions, b) bio posting day of self introduction, and c) posting social words in Cafe forum. Other variables tested that were not found to differentiate significantly were: a) ego network size measured by number of students communicated directly, b) social network prestige measured by the amount of received words, and c) gender.

8.2 Implications of the Research Findings

8.2.1 Three Quantitative Indices

The three indices can be helpful for researchers, instructors and course designers who aim at assessing and facilitating project-based small group collaborations in terms of more communication, more equalized contributions, and more open communication. These collaboration indices when used as a rubric can be useful for instructors to capture potential problems and to provide support for the groups. When a group indicates problems according to the indices in certain communication categories, instructors need to pay careful attention to diagnose the specific problems and to provide appropriate interventions for the group. Furthermore, it will be helpful for instructors if a course

management system provides a function that shows the collaboration indices of small groups.

The quantity index was the most evident indicator of group collaboration. Groups A and F completed the project with the least quantity of communication. The reasons were different in each group. Group A did not undertake a true collaborative process; its processes were more cooperative in nature. As the definition of 'collaboration' was differentiated from 'cooperation' in Chapter 2 of this dissertation, members simply divide the group task into individual parts and compile them as a final product. It may appear on the surface to be an efficient group, as it finished the group assignment very quickly without any conflicts or problems in the process. However, the group can be hardly assessed as one that achieved the benefits of collaborative learning in terms of better and more learning by challenging each others' existing knowledge system to reach a higher level of thinking and to construct new knowledge. Group F's problem was members' low level of communication and indecisive attitudes to decision making. An instructor would be able to identify specific problems and provide appropriate facilitation to the groups which show very little communication during collaboration processes.

Lack of sharedness indicated problems in communication between members. Group D was assessed as the least collaborative group by the sharedness index. This group exchanged a lot of one-to-one communications there were personal conflicts between two members that had been caused by internet access problems, technological skills, and time-zone differences. These problems made members anxious and impatient as the group approached the due date of the assignment. In order to prevent these problems,

instructors may need to provide an orientation to students about collaboration skills at the beginning of the course in terms of, for example, stress management skills, handling technology problems by asking members' understanding, or requesting the instructor's intervention when problems cannot be resolved within the group.

Inequality in social communication was not necessarily an indicator of problems in collaboration. Group E showed the least equality in their social communication. Two members contributed much more social communication than the other three members, which was assessed to result in the low levels of equality. Reviewing the communication script, I found the two members actually led the group to overcome some problems and helped other members relax whenever the group faced an anxious situation. Therefore, inequality in social communication may not be as important as inequality in cognitive or managerial communication.

8.2.2 Facilitating or Hindering Factors for Group Collaboration

Early starts allowed enough time for collaboration. Group B initiated communication earlier than other groups, while the members were busy doing an individual assignment. The members introduced themselves to the group and shared their concerns with the individual assignment. Warm and positive feelings were fostered in this initial period, and these continued throughout the group process. Group B could control time pressure and had time to discuss fully the topic, going beyond a quick split-and-stitch type of group work. Therefore, it seems to be critical for students to keep on 'time' and for a course instructor to encourage them to make an early start.

The importance of social communication has been confirmed in this research, and aligns with literature in this area of research. Having an ice-breaking period at the beginning of the group activity was particularly helpful for building a strong bond between members. Group members introducing themselves to each other by sharing their personal lifestyles resulted in better understanding among group members and helped them to establish warm feelings toward each other. Using positive words for appreciating others' work had the effect of cheering up the members. Making jokes and using nicknames are all facilitative communication acts for maintaining and strengthening team spirit. Students entering collaborative group work should recognize that negative words expressing anxiousness, blaming, negligence, or bossy attitudes, are like putting oil on fire, which exacerbates troubles and brings conflicts to such an extreme level that resolutions become impossible. Students in online courses should also be able to know that indecisive and ambiguous uses of language also have negative effects on the collaboration process. Individual members should express their opinions clearly instead of positioning themselves in a grey area. An expression such as 'Anything is good' is tantamount to saying 'I don't care,' and this may delay the group's decision.

Either synchronous or asynchronous communication tools worked well. Synchronous and asynchronous communication tools have different benefits. Real-time audio, video, and/or text chats can be used effectively for brainstorming or decision making processes without time delays. An online course management system (e.g. WebCT) usually includes synchronous chat functions. There are also some popular instant messaging tools (e.g. MSN, Skype) that are often used. These synchronous communication tools, however, require some effort in scheduling times for meetings. In particular, if members live in

different time zones and/or work full- or part-time, scheduling real-time chat sessions can become more complicated. Thus, some students prefer asynchronous text communication with its conveniences of time and place flexibility. As demonstrated in the more collaborative groups B and C, the communication tool itself does not have a critical influence on the success of a collaboration process. A group can work effectively by using both/either synchronous and/or asynchronous tools. Group C had frequent synchronous chats, while Group B frequently posted asynchronous messages. Successful uses of different types of communication tools depend on members' preference in terms of how comfortable they feel with the tools and their willingness to communicate in real time. Additionally, real-time meetings are less likely to happen when a group is larger and when members live in different time zones.

Overall understanding before splitting jobs and on-going discussions while working on individual tasks is an important factor for a more collaborative group. One of the most distinctive behaviours between more and less collaborative groups was the way of dividing the tasks and continuing the communication. Both Group B and C recognized the importance of the whole picture. Instead of focusing on individual tasks to complete the task separately, these groups took a collaborative approach to achieve an overall understanding of the project. All the members covered other members' questions and read all the reading materials. They kept connected during individual working periods. Students should recognize that collaboration is more than mere cooperation. For real collaboration, they should make a group effort toward sharing information, brainstorming, developing a deeper level of discussion, overcoming conflicting ideas to achieve

comprehensive understanding of the group task, and synthesizing various aspects of individual perspectives and speculations to reach a higher level of thinking.

Getting help from an instructor or an expert in the area helped for a more collaborative group. Students should know how to get help from their course instructor. Group B was the only group that used the course instructor as a resource when members could not resolve the problems within the group. Group E asked some questions to a boss of one group member. Using available resources can be an effective way for overcoming obstacles that cannot be solved within a group. This finding challenges the claim of Hathorn and Ingram (2002) who asserted *independence* from an instructor as one of four critical elements of collaboration: *participation, interdependence, synthesis of information, and independence*. I argue that using instructors for collaboration is not a sign of lower levels of collaboration. Groups should be encouraged to work interdependently among members as well as independently from the instructor. However, they should be encouraged to actively use experts in the area when they have difficulties resolving an issue or are uncertain.

8.2.3 Group Differences between More and Less Collaborative Groups

Students in more collaborative groups revealed also active participation in whole group discussions before entering small group activity. An individual's participation in a small group was associated with his/her own participation in whole group discussions (about 30%) and other members' participation within the small group (about 40%). These findings imply that students' participation behaviours during the initial period of whole group discussions can be used for group forming method to allocate students into groups.

Students who were inactive during initial discussions in whole group setting or posted their Bio message very late showed a pattern similar during small group activity. These findings can be useful for instructors when forming small groups. Instructors need to consider that the peripheral participations at the initial whole group discussions are mixed with more active participants when allocating members into groups. These students may also require more careful attention from the instructor during the small group collaboration processes.

8.3 Limitations and Suggestions for the Future Research

For this dissertation research, I developed the Small Group Collaborative Learning Model as an analytical model for project-based small group collaboration based on the Community of Inquiry model (Garrison, Anderson, & Archer, 2000) and the input-process-output framework of the online interaction learning model (Benbunan-Fich, Hiltz, & Harasim, 2005). At the initial period of this research, I tried to find existing models that fitted my research focus and methodological approaches. However, the existing models were not well-suited for this research as they did not specifically focus on assessing project-based small group collaboration in an online course. I needed a concrete and comprehensive model that illustrates the dynamics of an online course in terms of the relationship between variables in the process of small group and whole group collaborative learning processes. Because small groups are nested within a whole group setting, small group collaborations keep influencing and being influenced by the whole group process. In this regard, I decided to expand the CoI model by adapting the input-process-outcome framework. I used my analytical model not only for this dissertation,

but also for conducting a systematic review of the empirical studies as presented in Chapter 3. The analytical model was comprehensive enough to categorize all the included studies according to their research focus and findings. I believe that the model will be useful for researchers in designing empirical studies examining or exploring relationships between variables that are associated with small group collaborative learning processes.

As methodological approaches for the transcript analysis of this research, I employed both content analysis and social network analysis to categorize communication and analyze the communication patterns and structure. The benefits of transcript analysis by these two methodological approaches have been reported extensively in research literature and many researchers have employed these methods for the last two decades. Along with the benefits of transcript analysis, however, difficulties and concerns have also been frequently noted.

Conducting a content analysis, in particular, almost always accompanies issues such as the efficacy and reliability of the coding. Rourke, Anderson Garrison, and Archer (2001) describe the coding process as “difficult, frustrating, and time-consuming” (p. 2). Murphy and Ciszewska-Carr (2005) assert that reliable coding is a critical requirement to achieve trustful findings when conducting a content analysis. The difficulties become greater when large amounts of data are being coded and analyzed (*ibid*). The data examined in this dissertation research were all communications from an online course, i.e., 2,029 messages (173,771 words). Sampling some of the data by dropping or selecting some students was not a viable option for combining a social network analysis to look into the whole group communication network structure, so coding the data took quite a long time.

At the pilot stage of this research, I planned a more detailed coding framework with sub-categories for the three communication categories (cognitive, social, and managerial).

However, it was not doable in terms of the efficacy and reliability of coding.

Carr, Loopuyt and Cox (2002) state that one way to increase coding reliability is to have a simpler coding scheme with not too many categories. They caution, however, that simpler categories may result in a loss of insight into the subtleties of the complex learning processes. Although I acknowledged the weakness of having a simpler coding scheme, I made it a priority to establish reliable coding, because my interest in the research was examining communication connections rather than uncovering the subtleties of the communication. By limiting the coding scheme to three communication categories, I tried to establish clear and objective coding throughout the procedure. In future research, some other aspects of group collaboration may be uncovered by using a more detailed coding scheme if time and resources are available to ensure reliable coding with more subcategories (e.g., negative or positive expressions for social category, four phases of cognitive development for cognitive category, etc.)

The data used in this research were asynchronous text communications collected from an educational technology course for a Masters' degree delivered completely online. The students were either teachers or professionals in the field of educational technology.

Therefore, the interpretation of the findings may be limited to purely online courses in higher education. This is to say that students' communication behaviours and communication relationships may be different in face-to-face classrooms or mixed mode (hybrid) courses. There could be different aspects found if synchronous text

communications or audio/video chats were analyzed. More research is needed that analyzes diverse sets of data through different communication channels and in different academic levels and other disciplines.

This research is limited to assessing collaborative learning processes. It does not include outcome evaluations such as group marks, quality of the group product (group paper), and student satisfaction. Although it is reasonable to expect that more collaboration could result in better outcomes, a more collaborative group might not always receive a higher mark or report higher levels of student satisfaction. Examinations of the relationships between the learning process and outcomes and between inputs and outcomes can be research topics for further studies.

Different weights can be assumed among the three indices. Quantity is the fundamental element for collaboration. Thus, the quantity index should be given more weight than the other two indices. In terms of communication categories, the cognitive category could be given more weight than social or managerial communications. In order to measure the degree of collaboration, a weighing formula needs to be developed based on analysis of a much larger data set.

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