Investigating the Development of Work-oriented Groups in an e-Learning Environment

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ABSTRACT

In this study, we have investigated developmental patterns of virtual groups in the e-learning environment. Our findings suggest that for virtual groups formed for the purpose of e-learning, dependency and inclusion characterize the initial stage of group development, as such characteristics reinforce cooperative relationships and help to build a stronger social bond among group members. This is followed by the second stage, swift work, which enables participants to labor as a team and facilitates continual collaboration among members. However, the third stage, conflict, is inevitable, as conflicts provide important diagnostic evidence for each member to assess and adjust his or her values and preference. Finally, by overcoming conflicts, partners build strong bonding, which fosters intimate communication and provides many opportunities for frequent interactions that demonstrate concern and desire to satisfy the needs and wishes of one another. Our finding suggests that initial active dependency interactions in the first period provide a sense of coherence. Accordingly, the instructor of a virtual learning system should encourage learners to express their concern for one another in order quickly to build strong norms. In addition, as work intensifies, the instructor could aim to support both the effective interaction channels of groups as well as their task-focused activities. Finally, to improve members' involvement and information sharing, the instructor could provide feedback to groups regarding their level of interactivity and encourage members to remind each other about the quality and quantity of individual contribution.

Keywords

Collaborative learning, Virtual group, Group development, E-learning

Introduction

Computer-mediated communication (CMC) technology such as the Internet has relaxed the limitations of proximity and structure on communication (Newhagen & Rafaeli, 1996; Hsu et al., 2008). It provides a unique opportunity for the learning and sharing of knowledge free from the constraints of time and place. One specific area of this application is Internet-based learning, often called e-learning, as many educators have begun to integrate the Internet into their work. The effectiveness of e-learning has been demonstrated by Dawson (2008), Hsu et al. (2008) and Rosson et al. (2009), who show that when the group is committed to a strong norm of cooperation, learners are able to share resources to improve their learning productivity in the group-based learning system. Other studies have also shown that collaboration in the CMC context can significantly improve learning interest and attitude (Vaughan, 2002) as well as facilitate better learning performance (Vaughan, 2002), increase cognitive capability, promote greater learning efficiency (Dawson, 2008; Ounnas et al.,2009), and enhance learning satisfaction (Rosson et al., 2009).

It is against such a background that the present research attempts to study how virtual groups develop and become actively engaged in collaboration in an e-learning environment. A virtual group is a collection of geographically distributed, functionally and/or culturally diverse entities that are linked by electronic forms of communication, the purpose of which is to make arrangements for alternative actions and to evaluate outcomes to determine future actions. In terms of e-learning, members coordinate with one another to set policies, make plans, execute these plans, and monitor their own activities to achieve the goal of completing the on-line course (Duphorne & Gunawardena, 2005). Research on physical groups suggests that such groups face many successive challenging phases (Wheelan & Mckeage, 1993; Wheelan et al., 1998). According to Wheelan et al. (1998), there are four stages of development for physical groups: dependency and inclusion, counter-dependency and fight, trust and structure, and work. Since there

has been little empirical research on the development of virtual groups, it is sensible to assume that the virtual group would go through similar stages of development (Duphorne & Gunawardena, 2005; Rosson et al., 2009).

However, this assumption is open to challenge because virtual groups differ from the groups in the physical world in many ways. One important distinction is that relationships within the virtual context are tenuous, rendering virtual group membership much less distinct than physical-world membership groups (Järvenpää et al., 2004). For example, randomly allocating students to e-learning groups may lead to "orphan student" problems (Ounnas et al., 2009) and strong relationships among group members play a critical role in support and information exchange (Dawson, 2008). It has even been suggested that the development of the virtual group is likely to be ineffective because participants may withdraw from discussion easily (Ounnas et al., 2009). Therefore, the study of how virtual groups develop to become productive in learning is important to the designers of e-learning systems and educators who wish to employ them in their work.

Group development

Group development refers to the stages through which a group must successfully navigate in order both to structure relationships and roles within the group and to emerge as a mature, highly interactive unit capable of achieving its goals (Wheelan et al., 1998). For example, the study by Bales (1950) found that when faced with a decision, groups exhibited an increasing degree of maturity and performance over time that could be classified as linear. In his observation of task-oriented groups, Tuckman (1965) also identified four developmental phases: forming, storming, norming and performing, while Gersick and Hackman (1990) investigated student group development and proposed the punctuated equilibrium group model. Recently, Hsu et al. (2008) investigated the relationship between the norms of cooperation and resource sharing in e-learning group formation, while the study by Dawson (2008) suggested the need for virtual learning groups to succeed through social interactions to provide opportunities for knowledge construction and to generate a sense of group learning. In addition, Ounnans et al. (2009) considered the issue of group formation to propose a group-learning based system, while Rosson et al. (2009) investigated the role of the learning community for young women.

In brief, studies have shown that group effectiveness is linked to group development (Gersick & Hackman, 1990; Wheelan & McKeage, 1993). Summarizing previous studies (Tuckman, 1965; Gersick & Hackman, 1990), Wheelan (1994) suggested dividing group development into four stages: dependency and inclusion, counter-dependency and conflict, trust and structure, and work. Note that in this paper, we have chosen to use the term conflict to replace Wheelan's term fight.

Stage one: Dependency and inclusion

The first stage appears, on the surface, to be very harmonious (Wheelan & McKeage, 1993). Initially, these individuals often have only tentative relationships; however, what is lacking in terms of depth is compensated for in terms of breadth. Increased interactions among members assist group members to exchange both tangible and intangible resources, enabling the group as a whole to benefit. Members therefore look for guidelines that may alleviate their concerns and anxiety. There is also considerable imbalance with regard to relationship involvement, and members' optimistic assumptions about partners are not likely to be questioned. The main issues are related to psychological safety and inclusion, and members utilize a variety of strategies to gain the approval of the leader and other members. Consequently, while work occurs in this stage, members' mutual interactions are characterized not by task performance, but by dependency and inclusion, both of which facilitate the making of their social capital.

Stage two: Counter-dependency and conflict

This stage is characterized by conflicts among members, as well as between the leader and members. Conflict is somewhat of a two-edged sword. On the one hand, as the depth of interaction and interdependence increases, it is evitable for people with different backgrounds gradually to discover each other's imperfections. On the other hand, if issues are avoided or if either partner withdraws from problem-solving interactions, the opportunity to use episodes of conflict to evaluate further a partner's abilities is likely to become entrenched in these dysfunctional patterns of conflict resolution (Peng et al., 2008). Thus, a partner's response during episodes of conflict may provide important

diagnostic evidence concerning the extent to which he or she is able to work to make the relationship successful. Ambivalence and an increase in the incidence of conflict often result from this enhanced awareness of the need for further compromise and adjustment. The motivation behind the struggle is to reduce anxiety by clarifying the goals and structure of the group. The extent to which conflicts can be successfully resolved is deemed to be essential to the development of cohesion and delineation of common values (Gersick & Hackman, 1990). This is demonstrated by good citizenship behaviors, such as helping others beyond one's call of duty, and by more systematic organizational endeavors, such as task-relevant knowledge and tacit understandings to break boundaries.

Stage three: Trust and structure

Assuming that the conflict stage is successfully navigated, members of the group will feel secure with, and trusting of, one another and the leader. Not only do they feel no need to question their partner's motives and commitment, but their attention to structures and roles during this stage significantly increases the group's capacity to work effectively and productively (Newhagen & Rafaeli, 1996; Duphorne & Gunawardena, 2005). These embedded relationships involve the sharing of private, situated information and tacit knowledge, and relying on social, informal contracts between exchange partners (Meyerson et al., 1996). Participants are able now to exchange their comments openly. In addition, there is a shared sense of the expectations and standards of appropriate behavior, so that norms and rules of conduct can be decided upon.

Stage four: Work

For groups that successfully migrate through the previous stages, the next stage means that goals, structure, and norms are already established, and that the group can work more effectively. By this time, group members can receive and provide feedback about their effectiveness and productivity, and are able to take more responsibility than in the previous stages for jointly creating alternative directions and activities. Strong bonding exists because members now share similar beliefs, values and informality. This bonding, in turn, enables them to communicate regularly and interact socially to form more social capital (Wheelan et al., 1998; Duphorne & Gunawardena, 2005).

Methodology

Assessing group processes

In previous studies of physical groups, researchers have typically relied on videotapes or audiotapes, which are less intrusive than visible observers (Wheelan, 1994; Wheelan and McKeage (1993). In the CMC environment, CMC-technology can automatically record members' mutual interactions in a natural context. This method requires the collection of data from group interactions through CMC-technology and application of the content analysis approach to analyze the data generated. However, its limitations include difficulties in obtaining members' subjective perceptions as well as the historical and environmental contexts governing group development (Strauss & Corbin, 1998). It also may not record members' interactions that take place outside the CMC environment. Despite these disadvantages, collecting data from the discussions of virtual group members through the system log is the most viable method, since members of virtual groups, are separated in space and may interact asynchronously.

Participants

Observation of the class participating in the study took place over a sixteen-week period. Of the total of one hundred and fifty-eight participants, thirty-five were female. The majority of participants came from different areas. Their occupations were diverse, including teachers, programmers, managers, journalists, project leaders, doctors and company workers. They were assigned to twenty-five groups, the average group size consisting of 6 – 8 people, and were required to meet in the first week of the semester. One third of the participants had previous experience of courses offered by the same cyber-university. In the virtual classes, the students and the teacher kept on-line cyber-office hours every week. Students were evaluated on the basis of the quantity and quality of their contributions to discussions and final project reports. Each team had its own electronic BBS for collaborating with one another. In

addition, like the study by Järvenpää et al. (2004), each team held two FtF (Face-to-Face) meetings with the instructor, one in the middle and one at the end of the semester.

Tasks

Based on the task classification schema provided by McGrath and Hollingshead's (1994), students in this study were asked to accomplish four types of tasks arranged sequentially: (1) Week 1 to Week4, generate ideas; (2) Week 5 to Week 8, choose a preferred solution and set up the coordination mechanism; (3) Week 9 to Week 14, negotiate; and (4) Week 15 to Week 16, execute. The tasks are described below:

Week1~Week4:
Task Type: All teams were asked to determine the subject that they wished to pursue for the semester.

Week5~Week8:
Task Type: Each team was obliged to submit a project proposal, including details of each sub-task such as goal, tasks, procedure, assessment, and schedule.

Week9~Week14:
Task Type: Members were expected to search for and exchange information, clarify any task ambiguity, and monitor each other's performance.

Week15~Week16:
Task Type: Execute. Teams were required to complete their respective projects and submit a written report showing their data analysis and collection methods, their findings and conclusions, which provided the important measures of the project's quality.

Content analysis

Content analysis has the capacity to: (1) reflect patterns of group interactions; (2) reveal the focus of individual, group, institutional, or societal attention; and (3) disclose the relationship between intent and content (Krippendorff, 1980; Strauss & Corbin, 1998). For virtual teams, the members' speech is a valuable resource in terms of describing members' traits and states (Newhagen & Rafaeli, 1996) and is useful in content analysis to reveal individuals' trust-related beliefs (Neuendorf, 2002).

The categories in our study are based on those developed by Wheelan (1994). Dependency sentences are those showing the inclination to conform to the dominant mood of the group, to follow suggestions made by the leader, and generally, to demonstrate a desire for direction from others. Tension-relief sentences are used to indicate avoidance of task and confrontation. Counter-dependency sentences assert independence and rejection of leadership and authority, or demonstrate the member's attempt to lead. Conflict sentences utter criticism, argumentativeness, or aggression that conveys one's struggle to overcome someone or something. Pairing sentences allow one to express warmth, friendship, support, or intimacy with others, while counter-pairing sentences are employed to indicate avoidance of intimacy and connection, and a desire to keep the discussion distant and intellectual. Finally, work sentences are those that represent purposeful, goal-directed activity and task-oriented effort. Note that tension-relief and conflict were referred to as flight and fight respectively in Wheelan's work (1994).

Procedure

As in the approach adopted by Wheelan et al. (1998), the analysis unit in our study is the sentence. Because it is easier to agree on how to categorize one simple sentence than it is to agree on a whole conversation, in our content analysis, sentences are used as the analysis units to produce higher reliability among coders (Neuendorf, 2002; Krippendorff, 1980). A sentence may refer to one of seven coding categories. The discussion is coded by substantive comments, while redundant sentences are not coded.

In this study, two coders were employed and trained to ensure their skill and reliability in placing each unit into the appropriate Group Development category. The training data were collected from another course at the same cyber-university. A total of 12,567 postings were obtained for twenty-five groups across sixteen weeks. Several rounds of training practice were necessary, and the training was considered complete only when the reproducibility reliability of the results from the two coders exceeded 90% (Neuendorf, 2002; Krippendorff, 1980). Reproducibility reliability refers to the extent to which content classification produces the same results when the same text is coded by more than one coder.

To test the reliability of this study, we evaluated stability and reproducibility. In this study, each coder was asked to code a set of data at two different times. The degree of stability established by the two respective coders exceeded 90 per cent, satisfying the stability criteria (Krippendroff, 1980). Comparison of these two researchers' coding results revealed that the reproducibility between the two coders was 94.37 percent, indicating an acceptable level of reliability (Neuendorf, 2002).

Furthermore, both face validity and semantic validity were employed in this study. To assess face validity in our study, the researchers were asked to step back in order to examine each concept objectively. Validity was considered to have been reached when all the researchers agreed on the data tapped into the desired concepts. For the classification to have semantic validity, coding units such as words classified together should possess similar connotations (Neuendorf, 2002). In this study, the two coders had two years' experience participating in studying virtual teams and were familiar with the communication content. Semantic validity was achieved when the two coders examined the list of words placed in the same category and agreed that these words had similar meanings or connotations (Krippendorff, 1980).

Results

A total of 12,567 verbal sentences were obtained across sixteen weeks from twenty-five groups. Of these, 1,477 units (13.32% of the total) could not be classified into one of the seven categories of the integrated group development process because they were either duplicated or fragmentary. Therefore, the number of units used in the various analyses totaled 11,091.
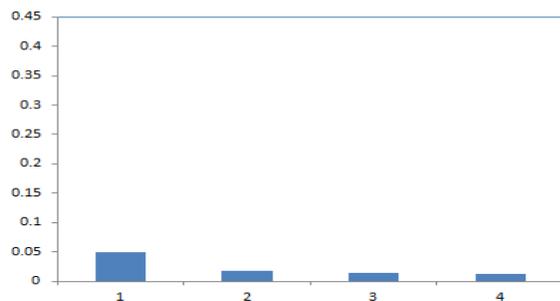

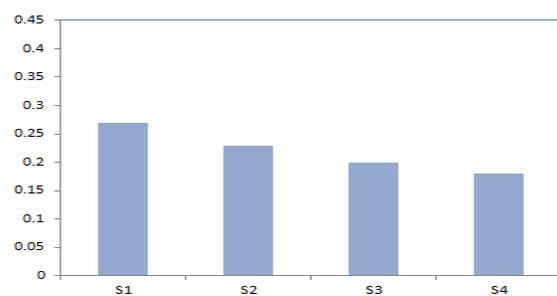*Figure 1A*. Frequency of dependency verbal sentences

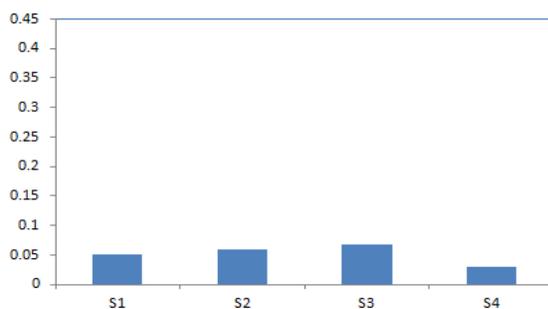*Figure 1B*. Frequency of tension-relief verbal sentences

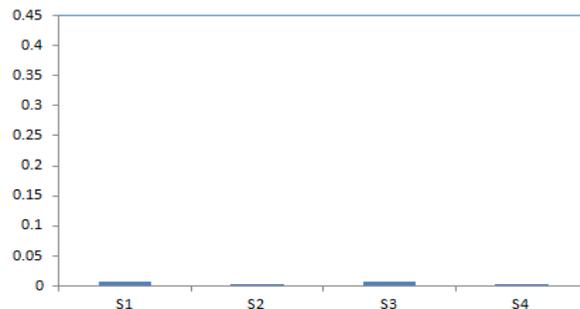*Figure 1C*. Frequency of conflict verbal sentences

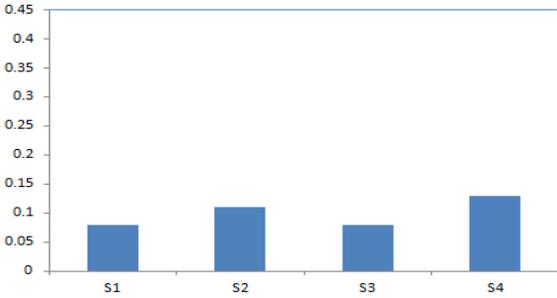*Figure 1D*. Frequency of counter-dependency verbal sentences

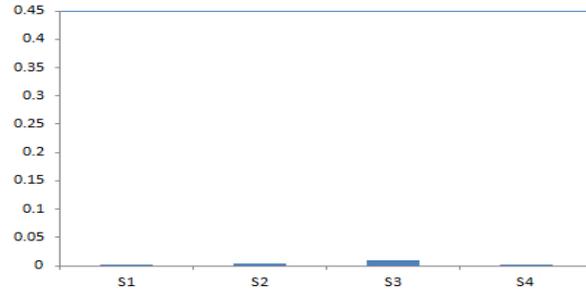*Figure 1E.* Frequency of pairing verbal sentences

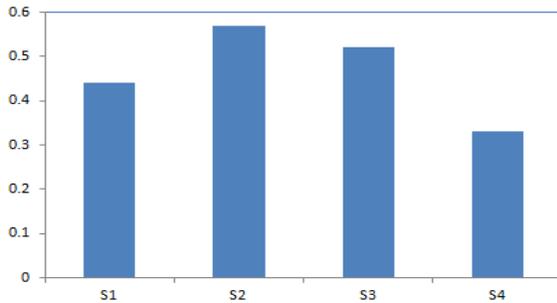*Figure 1F.* Frequency of counter-pairing verbal sentences

Figure 1G. Frequency of work verbal sentences

To identify the characteristics of the four stages, ANOVA was performed to compare differences in verbal group developmental patterns. Significant differences were noted in dependency, tension-relief, and conflict and work (P-values were less than 0.001). The frequency of dependency was high in the first stage, as was tension-relief (Figures 1A and 1B). Conflict sentences peaked in the third stage, with work being high during the second and third stages (Figure 1C). The level of pairing increased during the final stage (Figure 1E). Note that Figures 1D and 1F show that very low numbers of counter-dependency and counter-pairing verbal sentences were generated in all stages, indicating a possible difference between virtual and physical groups.

Dependency and inclusion

Consistent with the study by Wheelan (1994), all of the virtual groups generated a large number of dependency and tension-relief sentences in the first stage (see Figures 1A and 1B). A typical example was, "No problem, we will follow the leader's commands …" (in groups H2, L5, L17) or, "Our team members are experts …… I believe we could accomplish our mission successfully…. This is great…. and I will follow it..." (in group H4). Dependency and tension-relief sentences may provide people with an alternative way to connect with others who commit to their interests or relational goals. Learners tended to be overly polite and tentative in an attempt to ward off potential group rejection, conforming to the leader to reduce anxiety levels. Thus, dependency and tension-relief communication reinforced the cooperative relationships, helping to build stronger social relations among the team members.

Swift work

In our data, the second stage was characterized by a surge of pairing and work-type sentences, although pairing sentences would surge again in the fourth stage. While this sudden surge in trust and work departs from the theory of integrated group development by Wheelan (1994), who predicts that members' work will increase gradually over time, it is consistent with the finding of Wheelan and McKeage's (1993) empirical study. Such a swift surge in work and trust may occur in both the physical and virtual teams (Meyerson et al., 1996; Järvenpää et al. 2004). With regard to groups formed for temporary purposes and under pressure to work, members emphasize speed and

confirmation information initially (Meyerson et al., 1996). As such, a person's work-type sentences may serve to provide assurance to the group, therefore, permitting the upholding of the individual's reputation.

Furthermore, this role-based interaction allows participants to cooperate with one another without spending time building relationships. In CMC environments, the lack of social cues and individual features may enhance, rather than diminish, the salience of stereotypical group features so that people may perceive others not as individuals with a range of idiosyncratic characteristics, but as representatives of social groups (Spears & Lea, 1992; Postmes et al., 1998). Accordingly, in CMC environments, members of temporary groups may strengthen the cognitive process of social categorization to form stereotypical impressions of other members (Spears et al., 2002). The categories affect expectations of good will or ill will, and encourage swift work and swift trust. For example, labels such as "leader" or "active participant" are quickly confirmed by their sentences. In group H7, Jack volunteered to become the leader. In order to create a brave leader's image, he posted large amounts of work-related information such as, "I've got several interesting reports in XX magazine… Hope they are helpful for our project….." In another group, H5, the leader actively encouraged Mary to engage in their teamwork, even though she had no cyber-university experience. To be a "good" member, Mary always posted her class notes, homework, technical reports, and interesting URL on their group board and said, "If you need more information, please let me know….." Thus, Järvenpää et al. (2004) assert that members of virtual groups rely heavily on category information at the beginning of group development and act accordingly.

It should be noted that the work sentences may not be helpful in completing the group project in the early stage, as illustrated by the statement made by the leader of H7. However, this should not be considered negative. Swift work-type sentences allow participants to work as a team and promote continual collaboration. They are relied on by members to establish their position in the group. Even though members are not aware of the covert purpose of a discussion in the initial stages of group development, they generally respond to others' demands in order to be viewed as influential. In other words, work-type sentences at this stage are frequently made by individuals to indicate to other members their willingness to collaborate, leading to the possible establishment of a cooperative and responsible group.

Conflict

While swift work creates an active and effective virtual group image that allows members to collaborate quickly, it runs the risk of the group losing touch with reality. When words are said but results are not delivered, members are unable to accomplish their mission and become frustrated, which inevitably leads to conflicts. Thus, our study shows that in the third stage of virtual group development, the number of conflict sentences peaks (see Figure 1C).

According to Wheelan (1994), conflict-type sentences pave the way for the resolution of conflicting needs and preference differences, allowing the partners to further consolidate their state of trust. That is, when conflicts emerge and are resolved successfully, members' relationships may be permanently stabilized (Meyerson et al., 1996; Järvenpää et al., 2004). H5 is an example of successful conflict resolution, where members expressed doubts, such as, "It is not a good idea… we could try another method…."or "You need to revise…." Yet, at the same time, they provide warmth and support to encourage their partners, as revealed in expressions such as, "You did a good job…," "We could overcome it together…," or "I can provide you with some relevant information about…." After several weeks, H5 team members collaborated to work out the project schedule together and expressed a sense of satisfaction in on-line discussions. By that time, they had already agreed to a common goal and shared a structured communication process. One of them stated, "I enjoyed very much working with you. This is an impressive negotiation process…," and another said, "I think it is a great experience that we could build our ideas upon this project…." In H5 group, learners were more likely to become involved in vicarious learning through comparison of their own attainments with those of their partners. Ultimately, H5 members dealt successfully with conflicts.

However, conflicts may also lead to dysfunctional groups, partly because members fail to act as expected, and partly because they prompt individuals to question their initial judgment concerning the categories obtained earlier. L3 is an example of failure. From the second stage to the third, L3 members disagreed with their final report draft and became embroiled in serious conflict. The leader commented, "You should be more responsible! …Look at what you have handed in!" One member did not accept the leader's criticism, saying, "It is unfair...….I have done everything I could …." Other members also failed to act as expected, and negative emotions prevailed. Ultimately, the L3 group failed

in their final project. Members felt frustrated and regarded their group as unreliable, which led to a breakdown in collaboration.

To sum up, conflict-type sentences provide important diagnostic evidence to each member involved in virtual group development to assess and adjust his or her values, needs, and preferences in order to make the successful transition into the next stage. If virtual groups avoided confrontation or withdrew from problem solving, they would lose opportunities to evaluate problems from within the group.

Trust

The percentage of pairing sentences peaked in the fourth stage (Figure 1E). To repair the wounds caused by conflicts, partners had to demonstrate concern and desire to satisfy others' personal needs, preferences, and wishes. Consequently, the team's social capital was strengthened, and members became engaged in a shared practice. The leader of H7, for example, invited all members to resolve problems together when conflicts arose. They used expressions such as, "This idea is great and we need to talk about it together…."or "We would like to know everyone's comments…." In essence, partners truly felt they were accepted for who they were, and developed mutual understanding. In such a situation, participants' expectations accorded with their general feeling of solidarity involvement. Moreover, for successful group development, a sense of trust and group identity could grow on the basis of the assessment of the feelings and attitudes of the partners toward one another. For example, in group H2, members in the third stage had conflicts, illustrated in expressions such as, "Our project is not qualified…." However, in the same stage, they also used phrases such as, "I feel proud of our group, and I know you work very hard…." or "We could overcome it together…." These exchanges led H2 members to believe that they could accomplish the group goal in spite of their conflicts.

By this time, with respect to high interactivity groups, their social capital is clearly developed. Let us consider H2, for example: as a group, strong trust, shared knowledge, and mutual obligation develop in H2, and learners voluntarily collaborate in data collection, data analysis, or assist other members. However, in dysfunctional groups (L09 and L11), members either put up strong resistance to the suggestions of others or withdraw from the problem-solving activity.

In short, virtual groups produce dependency, tension-relief, work, conflict, and pairing sentences in all stages, although the number of counter-dependency and counter-pairing sentences are few. In our study, dependency and tension-relief sentences characterize the first stage, swift work the second, conflict the third, with the pairing verbal category characterizing the final stage.

Discussion

In this section, we will compare the results of our study with those of Wheelan and McKeage's (1993) study. Figures 2 through 4 compare the patterns of the verbal category in the two studies. The first similarity between these two is found in the dependency-type sentences (see Figures 2A and 2B). It appears that in order to build group relations and a sense of involvement, both FtF and virtual groups display a large number of dependency sentence to reinforce collaborative relations among the team members. Second, there is a similar pattern of pairing-type sentences in FtF and virtual groups (see Figures 3A and 3B). In the pairing conversations, members act as supporters, attempting to get their work back on track and sharing different opinions. They serve to smooth out the anxiety and embarrassment aroused by conflict sentences. Third, both virtual and FtF groups generate a considerable number of work sentences during the early stages of group development (Figures 4A and 4B). In order to secure their position in the early stage of group development, members rely on category information as the basis of mutual interaction, and seek to listen, observe, practice, and ask for feedback from work-type sentences. These pave the way for later conflicts and their resolution.

It is worth pursuing further analysis of the work statements in our study from the perspective of interactivity, which refers to the extent to which "in a given series of communication exchanges, any third or later transmission is related to the degree to which previous transmissions" (Rafaeli, 1988, p. 111). In our study, while there was a total 5,823 work-type statements, there were only 1,477 statements replying to previous postings. In other words, only around

25.36 per cent of work conversations could be shared and discussed with each other. Although it is not clear if it also appears in Wheelan and McKeage's study (1993), we suspect that one reason for our study's low interactivity is the existence of free-riders, i.e., virtual group members who do not respond to others and do not participate in group work. According to Spears et al. (2002), in CMC environments, depersonalization may cause people to be less accountable to others due to the lack of identity, leading to negligence of important information or withdrawal from discussion. This effect of depersonalization can be seen in Figures 5A, which shows a decreasing pattern of tension-relief statements in our study, and Figure 5B, which shows that the number of tension-relief statements remains high over time in Wheelan and McKeage's (1993) study. Thus, it is possible for CMC to become a space where members deal with feelings of anxiety and embarrassment by remaining silent and, subsequently, may not feel the need to employ tension-relief sentences to evade confrontation. For example, when members of groups T09 and T25 had problems with their work, they seemed to ignore their mistakes. Our data show that they never addressed the first failure and, worse yet, their level of communication dwindled substantially afterward. As others failed to act as expected, many members remained silent to avoid negative emotion. Eventually, members seldom verbalized their commitment, excitement, and optimism. Consequently, silence can become a double-edge sword in the CMC-world: while it helps to hide negative feelings, silence also allows negative feelings to build up.
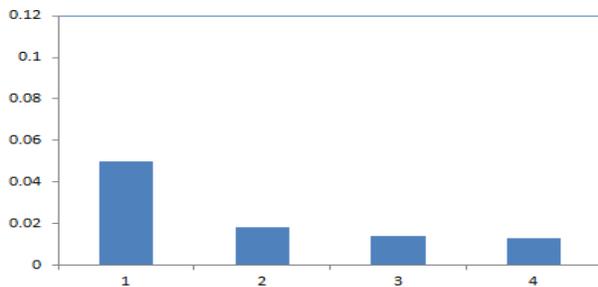

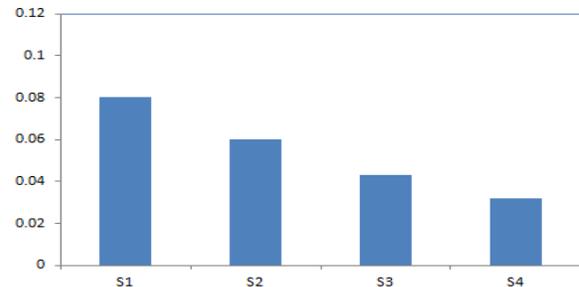*Figure 2A*. The pattern of dependency-type sentences in our study

Figure 2B. The pattern of depdendency-type sentences in Wheelan and McKeage's study (1993)
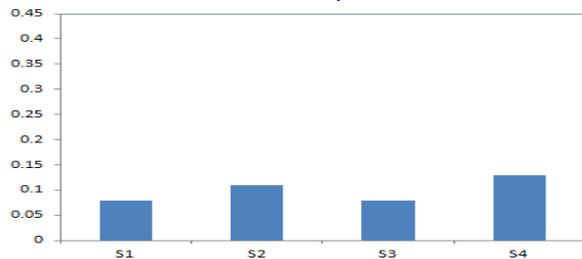

Figure 3A. The pattern of pairing-type sentences in our study
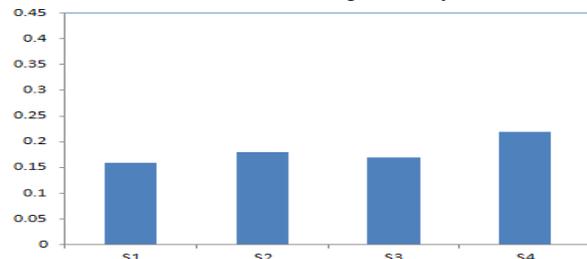

Figure 3B. The pattern of pairing-type sentences in Wheelan and McKeage's study (1993)
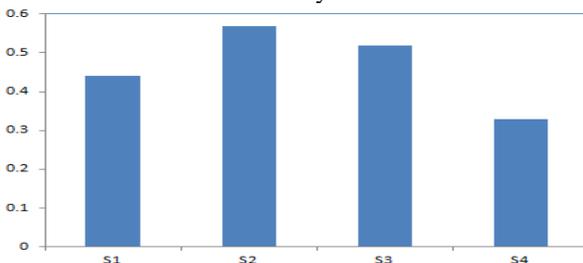

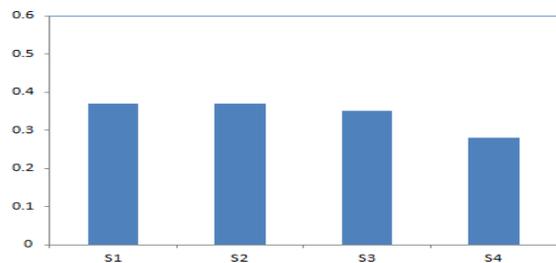*Figure 4A*. The pattern of work-type sentences in our study

Figure 4B. The pattern of work-type sentences in Wheelan and McKeage's study (1993)

In addition, the pattern of conflict sentences for the virtual groups differs from that of the FtF groups (Figures 6B and 6A), with the percentage of conflict sentences for the former group being higher than for the latter. In the virtual world, lack of authority and loose membership may provoke a greater exchange of extreme arguments (Spears & Lea, 1992). In other words, members of the virtual groups may use conflict-type sentences more frequently than FtF groups. According to Gunawardena's study (1995), the removal of social cues, particularly indicators of status,

power and leadership) eradicates those social inhibitions or normative constraints that could act as a brake on the generation or articulation of extreme arguments. Thus, participants in virtual groups might use conflict statements more frequently than FtF groups because virtual group members are not as concerned with maintaining satisfactory personal relationships as in those involved in FtF communication.
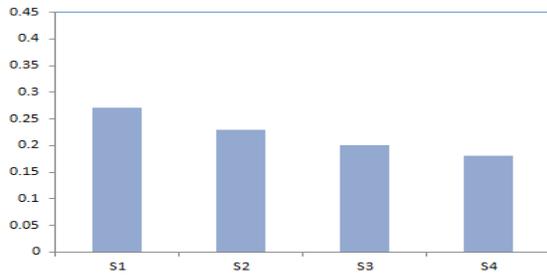

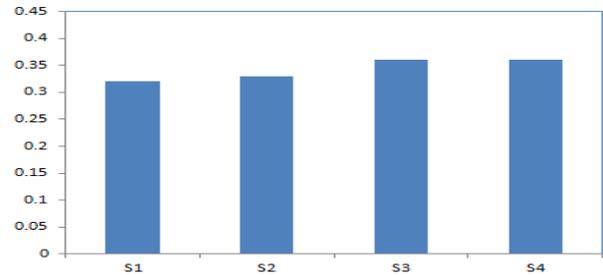*Figure 5A.* The pattern of tension-relief-type sentences in our study

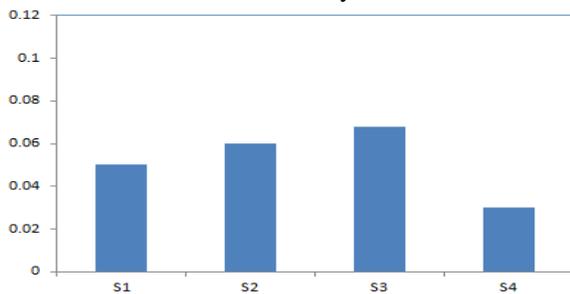*Figure 5B.* The pattern of tension-relief-type sentences in Wheelan and McKeage's study (1993)

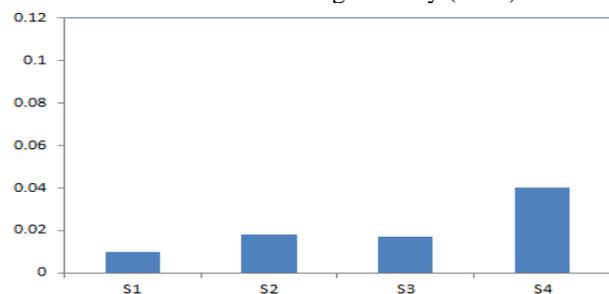*Figure 6A.* The pattern of conflict-type sentences in our study

Figure 6B. The pattern of conflict-type sentences in Wheelan and McKeage's study (1993)
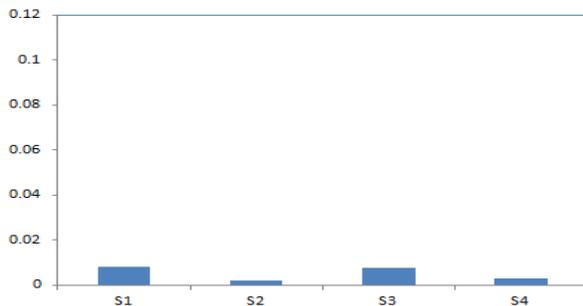

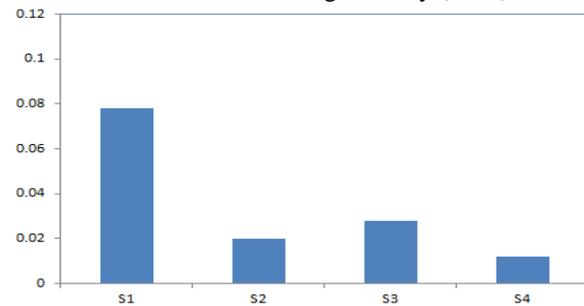*Figure 7A.* The pattern of counter-dependency-type sentences in our study

Figure 7B. The pattern of counter-dependency-type sentences in Wheelan and McKeage's study (1993)

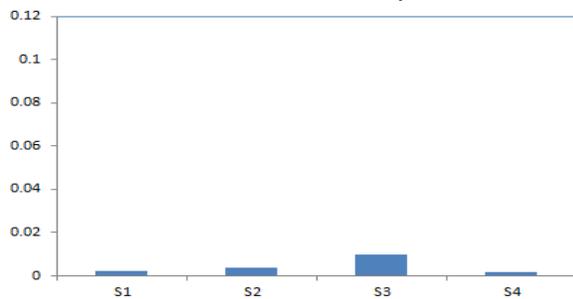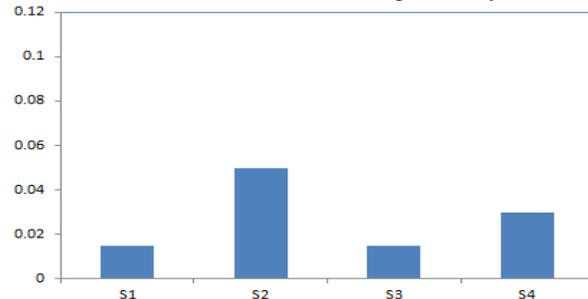*Figure 8A.* The pattern of counter-pairing-type sentences in our study

Figure 8B. The pattern of counter-pairing-type sentences in Wheelan and McKeage's study (1993)

Finally, while Wheelan and McKeage's study shows that FtF groups produce a large number of counter-dependency and counter-pairing sentences, groups in our study rarely employ these two types (see Figures 7A, 8A, 7B, and 8B).

This could be due to the difference between FtF communication and CMC. According to Wheelan (1994), when group members feel hurt by authority, they become hostile or aggressive, resorting to counter-dependency sentences to retaliate. However, in CMC communication virtual groups, members can easily withdraw from the virtual space and cut themselves off from other members. Similarly, there is probably little need for members of virtual groups to rely on counter-pairing sentences to indicate the avoidance of intimacy and connection.

Conclusion

In this study, we have investigated development patterns of virtual groups in the e-learning environment and have compared the differences between virtual and FtF groups. Our findings suggest that virtual groups produce tension-relief, work, conflict, and pairing sentences in all stages; however, their counter-dependency and counter-pairing sentences are few. In addition, we have found dependency and tension-relief sentences to characterize the first stage; swift work, the second; conflict, the third; and trust, the final stage. Dependency and tension-relief communication reinforce cooperative relationships and then help to build stronger social relationships among the team members. Swift work-type sentences allow participants to collaborate as a team and facilitate continual cooperation among members. Gradually, conflicts provide important diagnostic evidence for each member to assess and adjust his or her values, needs, and preferences in order to make a successful transition into the next stage. Finally, overcoming conflicts, partners use pairing sentences to demonstrate concern for and desire to satisfy others' personal needs, preferences, and wishes.

Moreover, comparing our study with that of Wheelan and McKeage (1993) reveals that virtual and FtF groups have similar patterns in terms of dependency, pairing, and work-type sentences, but differ with respect to the tension-relief and conflict statements, due probably to depersonalization. It is likely that there is little need for members to rely on counter-dependency and counter-pairing sentences to indicate the avoidance of connection and intimacy, because they are able easily to withdraw from the virtual space and cut themselves off from other members.

This study provides a basis for theorization about virtual group development. With findings that are consistent with those of Dawson (2008), who suggested the need for virtual learning groups to succeed through social interactions to provide opportunities for knowledge construction, our study is useful in developing guidelines for managing virtual-groups in education settings. First, initial active dependency and tension-relief interactions in the first period provide a sense of coherence. Accordingly, instructors on virtual learning systems should encourage learners to express their concern for one another in order quickly to establish strong norms (Hsu et al., 2008). To reduce the problem of low interactivity caused by free rider effect, it is also necessary for the instructor to make clear, as early as possible, that group interactions will be monitored constantly and used for assessing group performance (Roberts & McInnerney, 2007; Peng et al., 2008). Allowing comprehensive tracking of both the individual's and the group's on-line activity is truly an advantage of the CMC environment. The instructor can employ a marking scheme that provides different marks to group members based upon their individual contributions to group interactivity and build into the assessment process an element of peer and/or self-assessment (Roberts & McInnerney, 2007). This may reduce social loafing by enabling equitable allocation of outcomes to individual input.

Next, as work intensifies, instructors could aim to support both the effective interaction channels of groups as well as their task-focused activities. For example, the virtual learning system might provide clear learning-group goals and milestones so that members can easily organize their work to meet project requirements. This would reduce the likelihood of learners' commitment to work becoming nothing more than empty promises. The instructor could also provide feedback to groups regarding their level of interactivity and encourage members of respective groups to remind each other about the quality and quantity of individual contribution (Roberts & McInnerney, 2007; Peng et al., 2008).

Third, instructors of virtual groups should carefully consider issues related to conflict resolution to ensure the viability of these groups. For example, instructors and learners should be discouraged from making assertions about the personalities and motives of others or about others' incapacities to deal effectively with problems. Finally, to improve members' involvement and information sharing, the instructor should carefully consider issues for virtual teamwork conflict resolution such as dependability, conflicts, and trust in order to ensure the viability of e-learning groups. Such comments typically cause the group to experience doubt and cynicism about its problem-solving and decision-making effectiveness.

An important limitation of our study is that while our analysis has relied solely on discussions conducted on the Internet, these discussions do not include all of the communications within each team because the members maintained contact both through the Internet and through FtF meetings. These groups were work-oriented virtual groups but their communications did not happen in a pure CMC-environment. In addition, as the analysis is based on data collected from a single class in one specific school in a CMC-environment (C course in the cyber-university), the results may not be generalizable to other virtual contexts. Although we observed naturally occurring groups, these groups were comprised of students whose rewards were grade-based. The group size in our study was around 6-7 persons. In this situation, one person or small group could conceivably have completed the project although the workload would have been immense. Thus, because this study was conducted within a single cyber-class, generalization of the results to other virtual groups may be limited. Finally, there were several differences between Wheelan's (1993) sample and ours. Group members in Wheelan's study were training workshop participants, and the group life was one week. In contrast, our samples consisted of learners at cyber-university, who were members of groups with a life of sixteen weeks. However, there were also points of similarity between Wheelan's sample and ours; for example, both samples were learning groups. Despite the above-mentioned limitations, the results of this study may suggest interesting implications for the study of virtual group development.

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