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Abstract

Recent advances in information technologies provide a unique opportunity for sharing knowledge free from constraints of time and place. This research explores the developmental patterns of CMC-based group who must collaborate to complete an assignment project. Seven groups in the cyber- university participate in the study. In general, the groups are found to be alike in the following categories of development patterns: dependency, flight, counter-dependency, pair, counter-pair, and work. The results suggest that CMC-based groups do not go through the same successive development stages as teams of the physical world.

Keyword*:* CMC-based group, group development process

1. Introduction

The Internet has been portrayed as a cost-efficient tool to support group work. Modern digital technology has enormous potential to improve group work by building a social network of common interests on the World Wide Web. Indeed, the computer -based technique provides a unique opportunity for sharing knowledge free from constraints of time and place. Today, many educators have begun to apply the Internet for their tasks. One specific area of this application is the CMC-based (Computer-Mediated-Communication) learning space. The participants in CMC-based groups develop forms of expression that enable them to communicate social information, codify group-specific meanings, negotiate group specific identities, and create norms that serve to organize interactions and to maintain desirable social climates.

In this article, we explore the CMC-based group development process. In the physical world, an effective and productive work group must successfully navigate through the earlier stages of tension and disagreement so as to emerge as a mature, high performing unit capable of achieving its goals and task (Erikson, 1950; Bennis, et al., 1956; Tuckman, 1965; Dunpy, 1974; Levinson, et al., 1978; Cissna, 1984; Wheelan, 1994). The accumulated evidence supports that groups move through successive phases has been provided by Wheelan (1994). According to her research, group development consists of four predictable stages (Wheelan, et al., 1993; 1996; 1998): the first, dependency and inclusion; the second,

counter-dependency and fight; the third, trust and structure; and the fourth, work. This is called the Integrative model of Group Development.
In the CMC-environment, computer-based communication loosens constrains of proximity and structure on communication (Feldman, 1987). Many studies have suggested that electronic communication can support effective relationships among parties (Abel, 1990; Wilkins, 1991; DeSanctis, 1984, 1998). Communication in this environment has several characteristics (DeSanctis, 1998). First, communication content and direction are temporary. Second, there may be pressure to make communication more formal or programmed in order to gain efficiencies and to bring routine to otherwise customized work. Third, some communication is likely to become more relationship-base. However, the relevant research in cyber-group developmental process is largely lacking. Thus, while we are certain that traditional groups go through relatively explicit and concrete developmental model to improve their capacity, we are unsure if the same happens in a virtual context. In this research, we attempt to study the process of group development in the CMC-environment to determine if this indeed exists.

2. Group Development Process

Group development has been an area of study since 1950 (Bales, 1950). Many previous studies point out that the group effectiveness is linked with group development (Erikson, 1950; Bennis, et al., 1956; Tuckman, 1965; Dunpy, 1974; Levinson, et al., 1978; Cissna, 1984; Wheelan, 1991, 1994; Hill, 1974; Wheelan & McKeage, 1993). Furthermore, in all types of groups, regardless of their task or the length of time they were studied, there are many more similarities in their development patterns reported in the literature than differences. The studies suggest that groups go through a period of dependency, counter-dependency, fight, trust and work. The following describes these stages (Wheelan, 1994).

2.1 Stage One: Dependency and Inclusion:

The first stage appears very harmonious on the surface. Perhaps because of the tension experienced during the first phase of the group, members wish to remain cooperative and pleasant with each other at least superficially. Sameness, cooperation, and agreement are strongly encouraged, and differences among members due to race, gender, or occupation tend to be denied or ignored.
Work occurs, of course, but at minimal levels. While the group knows its task, the members avoid working on it. Rather, members are more concerned with issues of psychological safety and inclusion, and they try all kind of strategies to gain the leader and other members' approval. Thus, interactions are not task oriented. However, as underlying the pressure of

group uniformity continues to build, the group cannot communicate effectively by denying the reality of differences among members.

2.2 Stage Two: Counterdependency and Fight

This stage is characterized by conflict between a member and a leader. Conflict has been described as essential to the development of cohesion (Coser, 1956; Northen, 1969), and it has also been described as a way to delineate areas of common values (Theodorson, 1962). This has the potential to create additional stability for the group through the establishment of shared values and norm.

Essentially, the group's task at this stage is to begin to struggle with how it will operate and what roles members will play. All this struggling is an attempt to define itself and to outline the structure of the group and the roles that various members will play. If group members are to be able to work together in a productive way and if members have divergent points of view, conflict is a necessary part of this process. The motivation behind the struggle is to reduce anxiety by clarifying the goals and structure of the group. Consequently, individual members seek to define their roles more clearly, and the group seeks to liberate itself from the perceived control of the authority figure.

However, conflicts can lead to the destruction of relationships between participants. Many groups get stuck in this stage and cannot progress. Longstanding wars, feuds, and the breakup of business partnerships are examples of the potential negative outcomes of conflict. Thus, while this stage is the only route to mature collaboration, most of us would rather bypass the conflict stage of group development. Yet for groups that avoid this stage, they remain dependent, insecure, and incapable of true collaboration, or unproductive work.

2.3 Stage Three: Trust and Structure

Assuming that the conflict stage is successfully navigated, members of the group will feel more secure with and trusting of each other and the leader. In a sense, the group will function to accomplish its task and the group is preparing for work. Now the attention to structures and roles during this stage significantly increases the group's capacity to work effectively and productively. Of course, relationships are becoming more defined, and role assignments can be made on the basis of competence and talent. Norms or rules of conduct can be decided upon. Communication is more open and task oriented. Feedback is possible and tends to be more related to the task at hand than to hidden agendas or emotionality. Information is shared rather than used as way to gain status or power.

2.4 Stage Four: Work

Once goals, structure, and norms are established, the group can work together more effectively than before. Furthermore, for work to occur, groups must also be able to use available resources include information, individual expertise, and materials, that are necessary to accomplish the task. However, if groups have not adequately resolved the issues of previous stages, such as trust and roles, they will be unable to utilize input necessary to their work. As a result, most of members may refuse to listen to certain information because the individual who offers it is somehow devalued by the group.

3. CMC-based Group

For the virtual teams, many studies have suggested that electronic communication can support effective relationships among parties and achieve mutual understanding (Abel, 1990; Wilkins, 1991; DeSanctis, 1998). CMC in a deindividuated setting may render group members more susceptible to the influence of norms, social identity salience. Postmes, Spears, and Lea (1998) proposed that team member appear to be more susceptible to group influence, social attraction, stereotyping in cyber space. Besides, Jarvenpaa and Leidner(1998) have studied the challenges of creating and maintaining trust in a global virtual team. Because there is insufficient time for the CMC-based groups to build their trust on the first hand information, schemas governing some previously experienced settings are imported quickly to virtual teams. Thus, for the CMC-based groups, trust is temporary and it is useful to enhance the group's members working as a team. These studies collectively suggest that CMC-based group development may differ from that physical world.
In conclusion, in the physical world, groups move through successive phases that can be described according to the integrated model of group development process. The link between group development process and working effectiveness is conspicuous. But relevant research in cyber-group developmental process is largely lacking. We therefore need to analyze the pattern of developmental process for effective group management in virtual teams.

4. Research Methodology

4.1 Procedure

In order to study how the verbal categories of conversation emerge, travel, and gain acceptance in a set of interacting groups, Wheelan (1991,1994; Wheelan, et al., 1993; 1996) uses a systematic observation method and adapts the content analysis technique for analyzing the group development process. The central idea of content analysis is that the many words of

the text are classified into much fewer content categories (Berelson , 1952; Weber, 1985). Each category may consist of one, several, or many words. Words, phrases, or other units of text classified in the same category are presumed to have similar meanings. Thus, the content analysis utilizes a set of procedures to make valid inferences from text so the high reproducibility reliability is a minimum standard for content analysis. From the research purpose, content analysis could reflect cultural patterns of groups or reveal the focus of individual, group, institutional, or societal attention (Weber, 1985; Strauss, et al., 1998). For example, culture indicators could be generated from a series of documents in several years. Thus, Wheelan, et al. (1993; 1996; 1998) rely on the recording of all group members' conversations over time for analysis of the group developmental process.
There are several basic steps about the process of applying a coding scheme in this study. First, the analysis unit is the theme, which is a unit of text "having no more than one each of the perceiver, the perceived, or the action"(Berelson , 1952). Sometimes a posting, or the complex sentences must be broken down into different categories. This form of coding is labor intensive, but leads to much more sophisticated comparisons. Second, this study uses the category of the integrated model of group development (Wheelan, 1994). These categories have been applied to the small group productivity and effectiveness (Wheelan, 1991; Wheelan, et al., 1993, 1996, 1998). The third step is to assess if the coding of a small sample of the text meet the accuracy and reliability requirement. 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. In our study, there are two researchers performing content analysis separately. Comparing with two researchers' coding results, the reproducibility reliability is 86.5%. Because the reliability is acceptable, we code all the sampled data for final analysis. The last step is to assess the reliability of human coders. The reproducibility reliability of the entire set of data is 95.23%.

According to the Wheelan (1994) observation system for analyze group development contains seven categories (Wheelan, 1994), which are derived from the theoretical and research literature on group development (Bion, 1961; Thelen, 1954). Behaviors that are frequently described as characteristic of the various phases of group development are chosen for inclusion in the system. The seven categories are briefly described as follows:

(1) Dependency statements are those that follow suggestions made by the leader and demonstrate a desire for direction from others.
(2) Flight statements are those that indicate avoidance of task and confrontation.
(3) Fight statements are those that convey participation in a struggle to overcome someone or something. It implies argumentativeness, criticism, challenge, or aggression.
(4) The counter-dependency statements are those that assert independence from and rejection

of leadership, authority, or member who attempts to lead.
(5) Pairing statements are those that include expressions of warmth, friendship, support, or intimacy with other.
(6) Counter-pairing statements are those that indicate an avoidance of intimacy and connection as well as a desire to keep the discussion distant and intellectual.
(7) The verbal statements of work represent purposeful, goal-directed activity and task-oriented efforts.

According to the Wheelan (1994), the dependency and flight categories always occur in the first stage of the integrated model of group development, the fight and the counter-dependency categories in the second, the pairing and the counter-pairing in the third, and the work category in the fourth stage. Table1 shows the sample of words in each category.

[Table 1] The sample of words in each category

Category	Sample
Dependency	Agree, Look for, Depend on, Leader
Flight	Hi, Congratulation, Good Luck,
Counter-Dependency	Self, Alone, Individual
Fight	Disagree, Ineffectiveness, Unreasonable
Pair	Support, Provide, Need, Help
Counter-Pair	Rule, Follow, Principle
Work	Meeting, Coordinator, Assignment, Task, Goal

4.2 Sampling and data

Our study adopts the theoretical sampling methodology, which is to gather data driven by the integrated model of group development (Wheelan, 1994). In qualitative form of research, sampling concerns the representativeness of concepts and how concepts vary dimensionally (Lasswell, et al., 1949; Berelson, 1952; Weber, 1985; Strauss, et al., 1998). In another word, the purpose of theoretical sampling is to maximize opportunities to compare persons, places, events or incidents to discover how a category varies in terms of construct (Lasswell, et al., 1949). Based on the integrated model of group development (Wheelan, 1994), the greatest potential data to be captured is the members' discussions that record the members' interaction, group meetings, and task coordination. Note that, this study's purpose is to explore the CMC-based group's development process. As a result, we collect the data from the students

in the cyber-university, where they are assigned to their respective groups for this learning. Data was collected from students' postings in the electronic bulletin board in the cyber-university of National Sun Yat-Sen University (http://cu.nsysu.edu.tw). These virtual teams were organized via a professor of information system. Students and teachers had on-line office hours. They can also post their recommendation on the board. Most of students use posting in the electronic bulletin board to share information with others because these students come from different areas. There were forty-five students in virtual learning groups over a period of 15 weeks, beginning on 1 October 2000 and ended on 13 January 2001. These members were divided into 9 teams. However, only 39 students, belonging to 7 teams, finished the entire program.

5. Result

A total of 1,516 postings were obtained across fifteen weeks of seven groups. There were 546 postings for team1, 167 for team2, 123 for team3, 10 for team4, 220 for team5, 267 for team6, and 83 for team9. There are 1355 themes are recorded and 250 for flight, 73 for dependency, 127 for fight, 9 for counter-dependency, 174 for pair, 14 for counter-pair, and 708 for work category. The seventh and eighth groups quit program, so that their postings were not analyzed. Figure 1 displays the proportions of each verbal category across semester.
To explore the CMC-based groups development, MANOVA is performed comparing the differences in verbal behavior patterns in groups. Table2 shows the result of MANOVA testing. No significant difference is noted in flight, counter-dependency, pair, counter-pair, and work verbal categories. A significant difference is noted in the verbal of fight ($F=631,883$, $p<0.05$). The high performance groups generate fight statements in an increasing rate, indicating that their attention to migrate into mature negotiation. The low performance groups' fight statements are discontinuous, indicating that they had not mastered an appropriate communication with each other.

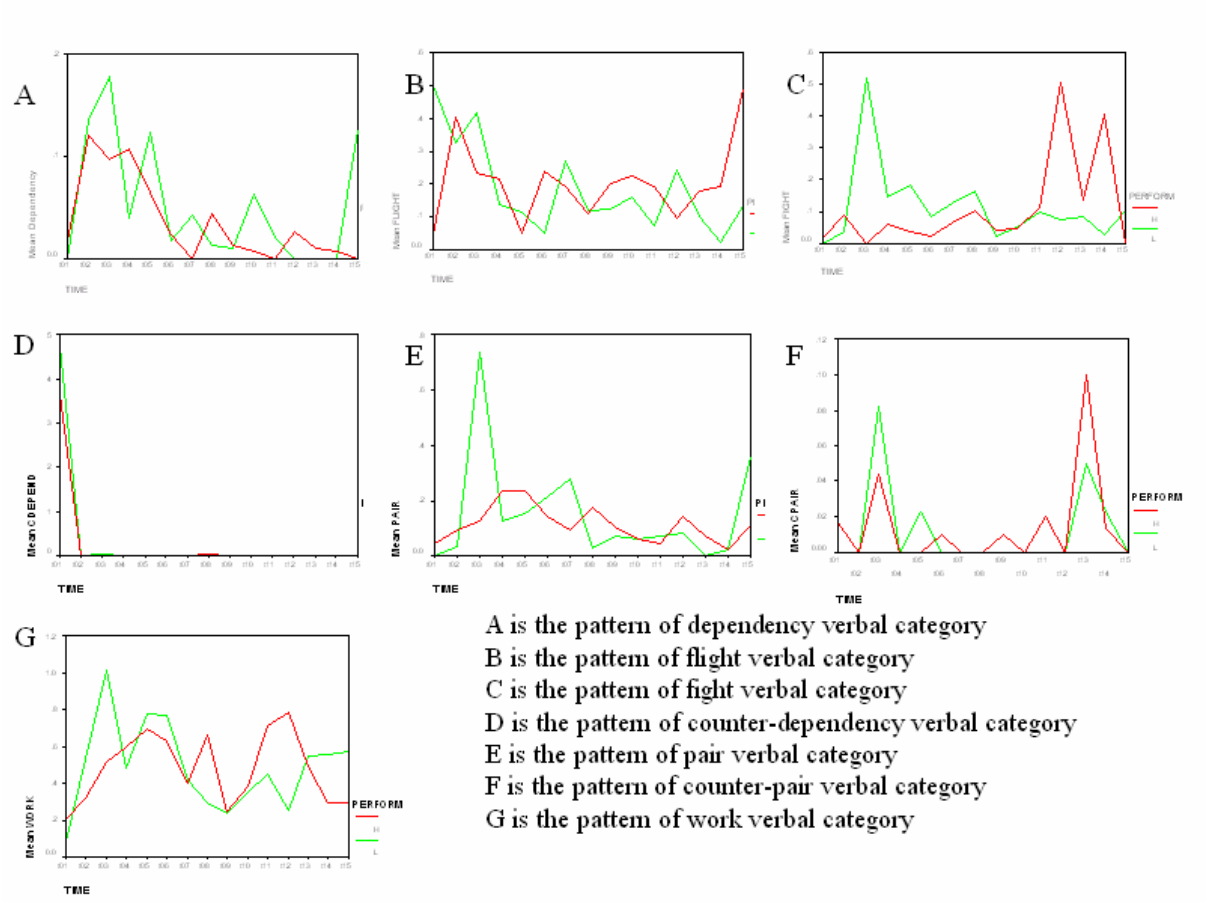
[Table 2] The result of MANOVA tests (*significant ,alpha=0.05)

Category	F	P-value
Dependency	0.629	0.737
Flight	0.614	0.742
Fight	631.883	*0.03
Counter-Dependency	0.263	0.892
Pair	1.472	0.553
Counter-Pair	0.486	0.789
Work	0.072	0.986

These same data are examined to determine if there are significant differences between the groups. Again, no significant differences are noted for the verbal categories of dependency, flight, counter-dependency, pair, counter-pair, and work. Every group generates the same proportion of these verbal categories within a given session. The only significant difference is noted in the proportion of fight statements ($F=631.883$; p-value=0.03). Comparing the three high performance groups reveals that team 4 is significant different with teams 1 and 6 in the proportion of fight statements ($F(team4,6)=5.275$, p-value=0.029, $F(team4,1)=6.761$, p-value=0.015). Among the low performance groups, there is significant difference between team2 and team9 ($F=7.971$, p-value=0.009). During each week, team2 generate the quantity of fight statements fewer than team 9.

The patterns of these verbal categories are depicted in a graph in figure 1. From the pattern of verbal dependency category, the CMC-based groups generate more dependency statements initially. The quantity of verbal flight category is high at both the beginning and the end. However, there are few verbal counter-dependency category postings. All groups generate pair statement during all weeks. From the pattern of verbal counter-pair category, team6 generated the more quantity than others. Finally, as shown figure 1, the quantity of verbal work category last throughout all fifteen weeks and it is the most generated category than others.

[Figure 1] developmental sequence of each verbal category



6. Discussion

Our findings suggest four preliminary conclusions. First, dependency occurs in the early stage as suggested by Wheelan (1994)'s model. Second, CMC-groups do not go through the same successive development stages as teams of the physical world. Third, CMC-based groups work more rapidly than physical groups. Fourth, fight is an important mechanism for the CMC-based group to be productive.

6.1 Dependency

Our first finding shows that CMC-based groups generate more dependency statements initially. This is consistent with Wheelan(1994)'s suggestion. Members tend to be overly polite in an attempt to ward off potential group rejection. Thus, they often choose conventional, societal established communication structures. Members prefer to conform to their leader in order to reduce anxiety and to secure their inclusion in such an ambiguous situation.

6.2 No stages

In our database, the CMC-based groups produce flight, paring, and work statements in all weeks. There are few counter-dependency and counter-pairing statements in CMC-based groups. Thus, our second finding suggests that the CMC-based group does not go through the same stages as the physical world. This means the integrated model of group development does not apply to the CMC-based groups'.

According to the SIDE (Social Identity/Deindividuation Theory) model (Reicher, 1982), the CMC environment gives people a strategic freedom to express themselves that they don't have in face-to-face conditions (Walther, 1995). Participants in CMC-base groups tend to perceive the self and others not as individuals with a range of idiosyncratic characteristics, but as representatives of social groups or wider social categories that are made salient during interaction (Spears, et al., 1992). This may allow members to pair and work without following the group developmental pattern of the teams in the physical world.

6.3 Work and Pairing Occurring Constantly

Our data shows that the work statements are generated rapidly by the CMC-based groups, and members support one another to attain the group's goal even when they lack a limited experience of working together. This differs from that the physical group members can only work effectively after the groups go through earlier stages. Also, these groups' members give positive-maintenance statements to cooperate with one another so as to finish the group's task.

Why can the CMC-based groups work more rapidly than physical groups? And why do the CMC-based groups keep generating work and pairing statements in all weeks? Meyerson, Weick, and Kramer (Meyerson, et al., 1996) suggest the swift trust may occur in temporary systems, which are a set of diversely skilled people working together on a complex task over a limited period of time. For the CMC-groups, trust is temporary and it is useful to enhance the group's members working as a team. Although the members of a temporary group may lack a shared history with respect to previous contact with each other, there is a sense in which the temporary group itself is not without history. Thus, members under time pressure make greater use of category-driven information processes, emphasizing speed and confirmation rather than evidence-driven information processing that is focused on accuracy (Meyerson, et al., 1996). Jarvenpaa, and Leidner(1998) have found that virtual teams may experience a form of swift trust but such trust appears to be very fragile and temporal.

6.4 Fight as an important mechanism

Finally, our research shows that there is a significant difference among the groups in the

percentage of fight statements. The high performance groups have fewer numbers of fight statements, but the verbal fight continue throughout all 15 weeks. The low performance groups generate many fight statement at the beginning, but the quantity decreases with time. Indeed, the high performance groups have made a mature transition to accept distinctness but the low performance groups lack it.

Conflict has been described as essential to the development of cohesion (Coser, 1956; Northen, 1969). It provides the opportunity to clarify psychological boundaries. All this struggling is to define group itself and to outline the structure of the roles. Some groups pass the fight, others get stuck in fight status and cannot progress. In our study, the high performance teams create a mature negotiation process to clarify the goals and group structure after they overcome the fight.

7. Conclusion

In this study we have to explored the developmental patterns of CMC-based groups. Our preliminary findings suggest that while there is no significant difference between physical and CMC-based groups in the dependency status, they do not go through the same successive stages. Thus, the integrated model of group development provided by Wheelan may not apply to the CMC-based groups. Furthermore, the CMC-based groups can pair and work rapidly from the beginning. But such focus and pair may not contribute positively to the final performance, unless fight is carried to resolve work assignment successfully. Fight, therefore, becomes an important mechanism for the CMC-based Group to become productive. We speculate that the swift trust could be a factor behind this phenomenon. The swift trust may energize the group to focus on work, but members must overcome the fight to create a mature negotiation process.

Much research is needed in the future to study CMC-based collaboration. For example, we may investigate the issue of cohesion in virtual groups. We may also research the formation of group identity and it might affect group performance. Another relevant topic is the issue of collective efficacy in CMC-based group work. These studies collectively may yield important insights into the working of CMC-based groups and help the management to take advantage the CMC-based technology.

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