

KEY FACTORS IN ONLINE COLLABORATION AND THEIR RELATIONSHIP TO TEAMWORK SATISFACTION

Hungwei Tseng

University of Northern Colorado

Heng-Yu Ku

University of Northern Colorado

Chien-Hsin Wang

National Taiwan College of Physical Education

Ling Sun

*Central Taiwan University of Science and
Technology*

Online instructors today search for ways to engage students in authentic activities in their courses to create real-world learning experiences. Collaborative grouping is 1 way that instructors promote students' creativity and productivity during the teamwork process. The present study is an attempt to enhance our understanding of students' teamwork experiences. The researchers in this study investigated the relationship between collaboration factors and teamwork satisfaction among 46 graduate students. Online survey protocol was used to collect data. Results revealed that the selected collaboration factors jointly accounted for 63% of the variance in online collaboration satisfaction. "Trust among teammates" and "organization practices" were effective factors for explaining online collaboration satisfaction. Recommendations for instructors to improve students' collaboration experiences are provided.

INTRODUCTION

The rapid development of technology during recent years has broken down the physical and temporal barriers of schooling by removing time and space constraints. The evolution and innovation of the social system have taken place by conveying knowledge and experience in the human society. We now live in a global

village sharing knowledge and exchanging information with people all around us, near and far. Lehtinen, Hakkarinen, Lipponen, Rahikainen, and Muukkonen (1999) stated that "One of the basic requirements for education in the future is to prepare learners for participation in a networked, information society in which knowledge will be the most critical resource for social and economic develop-

• **Hungwei Tseng**, Educational Technology Program, University of Northern Colorado, Greeley, Colorado 80639. Telephone: (626) 348-1114. E-mail: hwttseng63@hotmail.com

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ment” (p. 2). Working in an online environment, more and more instructors realize the importance of providing quality feedback, encouraging intrapersonal interactions, and engaging students in meaningful and effective learning activities that will prepare them for life in this networked world.

The rapid development of technology has also changed the ways students learn and has shifted students’ role towards self-directed exploration in the online learning environment. Current research suggests that an online collaborative learning environment can positively affect students’ performance on problem-solving group projects. Uribe, Klein, and Sullivan’s (2003) study suggested that computer-mediated collaborative groups had positive attitudes toward learning collaboratively and performed significantly better than participants who worked alone. In addition, a collaborative environment that encourages clear and strong definitions of the group itself has the potential to raise group productivity (Lee, Rogers, & Postmes, 2002; Thompson & Ku, 2006).

The collaborative learning environment is learner-centered in nature with the instructor giving a certain degree of the autonomy to student collaborative groups. Students are then encouraged to become active agents who will be discovering and constructing knowledge by working at their own pace within a problem-solving environment. In collaborative learning, the aim is not only to help students to produce successful products but also to ensure that each group member participate actively in the problem-based learning environment.

Collaborative Learning

Collaborative learning is defined as “an activity that is undertaken by equal partners who work jointly on the same problem rather than on different components of the problem” (Brandon & Hollingshead, 1999, p. 111). Collaboration involves the interdependence of individuals as they share ideas and reach a conclusion or produce a product. Collaboratively,

these individuals must come to a common understanding of the problem, identify what they as a group already know, and focus on what areas they need to research or investigate further. They must also come up with a plan of action and possibly conduct independent work that will ultimately affect the rest of the team.

Katzenbach and Smith (1993) defined a collaborative team as a “small number of people with complementary skills who are committed to a common purpose, performance goal, and approach for which they hold themselves mutually accountable” (p. 45). A learning group can be defined as a collection of individuals who may come from different academic backgrounds, have different learning preferences, and have independent ways of sharing ideas and communicating with others. However, the individuals do not become a group until they commit to achieve the same goal, create their own scenarios and workflows toward solving problems, and contribute their abilities and productivity for the group projects.

Online Collaborative Learning Environment

Collaborative grouping in a distance learning environment can promote potentiality, creativity, and productivity during the teamwork processes. Daradoumis and Marquès (2000) stated that

collaborative learning creates the potential for cognitive and metacognitive benefits ... collaborative learning promotes affective and social benefits in distance education. In particular, it increases the student interest and value that gives to the subject matter. It also increases positive attitudes and social interactions among students. (p. 76).

Previous studies (Bruffee, 1999; Johnson & Johnson, 2000; Panitz, 2001) found that online collaborative learning can benefit students’ learning efficiency and facilitate students’ critical thinking and communication skills. The participants in Wang, Poole, Harris, and

Wangemann's study (2001) reported that students in this learning environment had learned many things, including improved communication skills, problem-solving strategies, the value of teamwork, and the ability to present their ideas and recommendations in the teamwork processes.

Conceptual Frameworks

The major theme in Vygotsky's socio-cultural theory of learning is that human intelligence originates in the society's learning environment, and the individual's growth in cognition occurs first through interpersonal rather than intrapersonal situations. One important aspect of Vygotsky's theory is the "Zone of Proximal Development" (ZPD). This is a zone in which a learner cannot achieve an understanding of a new idea or concept unless he/she acquires help or feedback from a teacher or a peer. Vygotsky (1978) stated that the ZPD is the distance between the "actual developmental level as determined by independent problem solving" and the higher level of "potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). In Vygotsky's view, peer interaction is an important way to facilitate individual cognitive growth and knowledge acquisition. Vygotsky's idea assumes that because of engagement in collaborative activities, individuals can master something they could not do before the collaboration. In other words, collaboration is more a matter of participation in a social process to construct new knowledge and cognition growth than an individual endeavor (Lipponen, 2002).

Collaboration Factors

Waters and Napier's (2002) study provided an overview of one method for optimizing and organizing online collaboration. They collected both quantitative and qualitative data from pre- and post-teamwork surveys, electronic chatrooms and forum postings, and e-

mails from 24 graduate students' virtual team experiences. The researchers identified five optimal elements in successful online teams, including providing support, getting acquainted, establishing communication, building trust, and getting organized. They also indicated that these five elements can help students learn effectively and efficiently in virtual teams to complete the tasks successfully.

The first element in creating successful online teams is getting support from the facilitator. Oliverr, Omari, and Herrington (1998) recommended that online instructors should "scaffold" their support to assist students. According to Waters and Napier (2002), the support from instructors offers encouragement, guidance, information, and resources to team members, thus building a bridge across the members' differences and acting as a referee when participants cannot resolve conflicts. The second element for successful online teams is getting acquainted with teammates, which is important at the beginning in the online learning environment. According to Daradoumis and Xhafa (2005), "A learning group is considered to be viable if each member has reached a fairly deep degree of acquaintance with the other members' profiles" (p. 227). For instance, teammates could share personal and cultural information, such as information about personal beliefs, background, interests, family life, technical skills, and expectations of the team. Sharing personal and cultural information with each other enables team members to open communication channels (Waters & Napier, 2002).

The third element in creating successful online teams is establishing communication. Clear communication is fundamental for all aspects of online teams, and typically, teams that do not clearly communicate their goals may be fraught with disagreement about priorities and processes for accomplishing objectives (Yukl, 1994).

The fourth element for successful online teams is building trust among teammates. Teams that trust each other feel that they are working towards the same goal and make their

best efforts to promote successful teamwork in order to earn trust from one another. The trust among teammates can be built "through sharing one's thoughts, ideas, conclusions, and feelings and having the other group members respond with acceptance, support, and reciprocation of disclosures" (Johnson & Johnson, 2000, p. 32).

Finally, the fifth element in creating successful online teams is getting organized. Setting a team agreement at the beginning of the course can help teams resolve conflicts and encourage participants to agree to respect their collaborative construction (Brown, Eastham, & Ku, 2006). Selecting a capable team leader can help teams develop manageable directions and unique patterns of workflow which may save time and diminish different cultural perceptions among team members. Waters and Napier (2002) suggested that several factors could facilitate a team's efficiency with verbal communications: establishing protocols for responding to each other's correspondence in terms of frequency and timeliness; editing, naming, dating, and tracking document; and creating meeting schedules and agendas.

Rationale of the Study

Students do not become collaborators merely by being grouped into teams. Effective collaboration involves a set of important skills that need to be learned and cultivated, especially in the isolated environment of online learning (Waters & Napier, 2002). Varied constructs have been identified as impacting the collaborative team's performance and satisfaction. For example, Shaw and Barrett-Power (1998) explored the effect of diversity on group processes and performance. Kitchen and McDougall (1998) found that students enjoy working collaboratively in the group more as the process forces them to interact with team members in the construction of knowledge. In addition, Summers, Beretvas, Svinicki, and Gorin (2005) assessed the effects of collaborative group-learning methods based on three specific dependent variables: feelings of cam-

pus connectedness, academic classroom community, and effective group processing.

Johnson and Johnson (2000) defined an effective team as "A group that meets all the criteria for being an effective group and outperforms all reasonable expectation, given its membership" (p. 22). Group efficacy has been described as "a group's sense of its capacity to complete a task successfully or to reach its objectives" (Whiteoak, Chalip, & Hort, 2004, p. 158). In the present study, group efficacy was defined operationally as having all team members take personal responsibility for working together to accomplish the team's goals and help to increase the effectiveness of how the group collaborates. Even though the theoretical framework behind these collaboration factors seems sound in terms of logic and practical considerations, research has yet to empirically test these factors and ascertain the relative importance of each. As a result, a psychometrically sound measure of collaboration factors is not available to educators and researchers. The present study was an attempt to develop such a measure by the authors, namely a Collaboration Attitude Scale that can help better understand students' perceptions of the teamwork experience.

In addition, a perspective lacking in the literature concerns the relationship of the efficient teamwork processes to improving the students' performance and collaborative satisfaction with the virtual teams. The reviews of literature in the field of collaborative learning reveal that researchers are measuring the effectiveness of teamwork from two different perspectives: teamwork performance and teamwork satisfaction. The quality of problem-solving tasks and products are defined as the degree to which the outcome meets required criteria set by the instructor to indicate teamwork performance. For the present study, learners' satisfaction involved three perspectives: satisfaction with group processes, satisfaction with online collaborative learning environment, and satisfaction with peer interactions. In collaborative learning, the aim is not just to help students to produce successful

products but to ensure that each group member participates in the problem-based learning environment and contributes equally. In particular, the factors contributing to team satisfaction and performance with collaborative learning strategies in the online collaborative learning environment have not been clearly understood and studied.

Purpose of the Study

The purpose of this study was to investigate the degree of relationship between teamwork satisfaction and collaboration factors including support from the facilitator, acquaintance with teammates, clear communication, trust among teammates, and team's organization practices. Moreover, this study investigated team members' attitudes toward online collaborative learning experience. The research questions that guided the investigation were as follows:

1. What are the factors that underlie collaborative learning components as measured by the Collaborative Attitude Scale?
2. Is teamwork satisfaction related to the extracted online collaboration factors?
3. How much of the variance in teamwork satisfaction can be explained by the extracted online collaboration factors?

It was hypothesized that groups receiving more support from the facilitator, getting better acquainted with teammates, establishing clearer communication among teammates, building more trust and having better organization practices would have greater satisfaction with online collaboration experiences.

METHOD

Participants

The participants were graduate students enrolled in online courses that involved a collaborative setting at a Midwestern university in the United States. The participants were

recruited from the graduate programs of education and nursing. Forty-six participants completed the online surveys. Of the 46 respondents, 18 (39%) were male and 28 (61%) were female. There were 28 participants who had taken at least one online course prior to the current semester.

Materials

Online surveys were used to collect data in this study. The self-developed questionnaire used in this study was composed of two major parts: online collaboration attitude and teamwork satisfaction.

Collaboration Attitude Scale: The 20-item Collaboration Attitude Scale was developed based on Waters and Napier's (2002) five collaboration factors model, including "providing support," "getting acquainted," "establishing communication," "building trust," and "getting organized." An instructor with over three years teaching experience with online collaboration courses reviewed the scale and concluded that the Collaboration Attitude Scale items reflected the collaboration content domain and was appropriate in the online learning context. There are four items in each subscale of the Collaboration Attitude Scale, and all items are measured on a 5-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Sample questions included "My team members share cultural information to know each other better," "Communicating with team members regularly helps me to understand the team project," and "I trust each team member can complete his/her work on time."

Teamwork Satisfaction Scale: The 10-item Teamwork Satisfaction Scale was developed to measure students' working experiences with their team members (see Table 1). All items are measured on a 5-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Sample questions included "I really like working in collaborative groups with my teammates," "I like solving problems with my team members in group projects," and "I have benefited from interacting with my team-

TABLE 1
Teamwork Satisfaction Scale

<i>Survey Items</i>
1. I really like working in collaborative group with my teammates.
2. I like solving problems with my teammates in group projects.
3. Interacting with the other members can increase my motivation to learn.
4. I have benefited from interacting with my teammates.
5. I have benefited from my teammates' feedback.
6. I enjoy the experience of collaborative learning with my teammates.
7. Online teamwork promotes creativity.
8. Working with my team has better project quality than working in individual.
9. My team members are sharing knowledge during the teamwork processes.
10. I gain online collaboration skills from the teamwork processes.

mates." Exploratory factor analysis by principal component extraction indicated that only one factor had an Eigenvalue greater than 1.0, with a total of 72.61% variance explained. The internal consistency of the Teamwork Satisfaction Scale was excellent, having Cronbach's alpha of .96.

Sampling Design and Procedures

To obtain a representative sample from the target population, a convenience sampling procedure was utilized to select the research participants for the current study. First, a list of instructors who implement collaborative problem-based learning in online courses in five colleges across campus was acquired from the administrator of the Blackboard Technical Support Center. An e-mail that included the purpose of this study was sent to the instructors of 116 online courses in order to solicit agreement for using their students as participants in this study. Then, students were asked to use a Web link to access the online survey. Participants were asked to fill out the online survey system with two scales included.

Data Analysis

The data analysis in this study involved exploratory factor analysis, multivariate correlational analysis, and multiple regression anal-

ysis. First, an exploratory factor analysis was employed to construct validity that seeks to uncover the underlying structure of a relatively large set of variables. The criteria used for determining number of factors were based on examination of Eigenvalue ≥ 1.0 , Cattell's scree plot, and salient loadings of $\geq .4$. Second, a multivariate correlational analysis was performed to test the degree of the relationship between the variables being studied. Third, a multiple regression analysis was conducted to investigate the extent to which facilitators' support, acquaintance with teammates, clear communication, trust among teammates, and general collaboration skills explain the satisfaction of online collaboration. Specifically, the *F* test was employed to test whether this set of five regressors collectively explained a significant proportion of the variance in the satisfaction of online collaboration; the *R*-square was used to determine how much variance in the satisfaction of online collaboration was explained by the five regressors in the model. In addition, post-hoc procedures, involving five individual *t* tests, were utilized to examine whether facilitators' support, acquaintance with teammates, clear communication, trust among teammates, and general collaboration skills were effective regressors in explaining the satisfaction of online collaboration.

RESULTS

Research question one was formulated to examine factors underling collaborative learning components as measured by the Collaborative Attitude Scale. Exploratory factor analysis by principal component extraction and promax rotation indicated that five factors were extracted with a total of 80.61% variance explained. Items with loadings equal to or greater than .40 without double loadings were included in the same factor. Based on the loaded items, the predominant factor was termed "Trust" (items 14 and 15) and operationally defined as "sharing one's thoughts, ideas, conclusions, and feelings in the team and having the other team members respond with acceptance, support and reciprocation of disclosures." The second factor was termed "Acquaintance" (items 5, 6, and 13) and operationally defined as "team members share personal and cultural information, such as personal beliefs, background, interests, family life, technical skills, and expectations of the team." The third factor was termed "Organization" (item 19) and operationally defined as "the team should establish protocols for responding to each other's correspondence in terms of frequency and timeliness; editing, naming, dating, and tracking document; and creating meeting schedules and agendas." The fourth factor was termed "Communication" (items 4, 10, and 11) and operationally defined as "the open communication channel among team members so no one is hesitant to express or share his/her thought to the team." The fifth factor was termed "Facilitator" (items 1, 2, and 3) and operationally defined as "the supports from facilitator that offer encouragement, guidance, information, and resources to team members building the bridge upon the members' differences and acting as a referee when they cannot resolve conflicts." Items 7, 8, 9, 12, 16, 17, 18, and 20 were deleted because they were double-loaded on the extracted factors or were not well interpreted by the factor solution (see Table 2 for factor loadings).

The internal consistency of each Collaboration Attitude Scale factor was estimated by Cronbach's reliability alpha (Cronbach, 1951). The results revealed that the internal consistency was acceptable for four of the Collaboration Attitude Scale factors, having Cronbach's alphas of .74 (Facilitator), .74 (Communication), .75 (Acquaintance), and .78 (Trust), respectively. The Organization factor contained only one item, and thus was not appropriate for the estimation of Cronbach's alphas. No deletion of any scale item would result in an improvement of Cronbach's alpha. The finalized Collaboration Attitude Scale contained five factors with a total of 13 items, including three items on the Facilitator factor, three items on the Acquaintance factor, three items on the Communication factor, two items on the Trust factor, and one item on the Organization factor.

Research question two was formulated to investigate whether teamwork satisfaction is related to the extracted collaboration factors. The results revealed that all collaboration factors were positively correlated with teamwork satisfaction and four of the five collaboration factors were significantly correlated with teamwork satisfaction, except for the supports from facilitators. The highest correlation was found between teamwork satisfaction and clear communication ($r = .64$), followed by trust among teammates ($r = .63$), organization practices ($r = .63$), acquaintance with teammates ($r = .53$), and facilitators' supports ($r = .10$). Table 3 illustrates the bivariate correlations between teamwork satisfaction and the collaboration factors.

Research question three was formulated to explore the explanation of teamwork satisfaction through the online collaboration factors. The standard multiple regression analysis was performed to investigate the extent to which facilitators' supports, acquaintance with teammates, clear communication, trust among teammates, and organization practices contributed to the explanation of online collaboration satisfaction. The results revealed that this set of five variables contributed significantly to

TABLE 2
Standardized Factor Loading of the Collaboration Attitude Survey

Items	F1	F2	F3	F4	F5
14. My team members reply to all responses in a timely manner.	.890				
15. I trust each team member can complete his/her work on time.	.819				
5. My team members share cultural information to know each other better.		.890			
6. My team members share personal information to know each other better.		.827			
13. My team members learn how other members wish to be treated and then act accordingly.		.773			
19. My team has an efficient way to track the edition of documents.			.796		
4. My team is receiving feedback from each other.				.885	
10. My team members communicate in a courteous tone.				.837	
11. Communicating with team members regularly helps me to understand the team project.				.676	
3. The support from the instructor helps my team to reduce anxiety among team members.					.894
1. My team is receiving guidance in the group project from the instructor.					.830
2. The instructor acts as a referee when our members cannot seem to resolve differences.					.773
Eigenvalues	11.37	2.55	2.11	1.33	1.16
Variance explained	47.39%	10.62%	8.77%	5.54%	4.82%

Note: F1: Trust. F2: Acquaintance. F3: Organization. F4: Communication. F5: Facilitator.

TABLE 3
Intercorrelations of the Collaboration Factors With Teamwork Satisfaction

Scale	1	2	3	4	5	6
1. Facilitators' supports	--					
2. Acquaintance with teammates	.07	--				
3. Clear communication	.14	.62**	--			
4. Trust among teammates	.06	.55**	.69**	--		
5. Organization practices	.08	.24	.50**	.36*	--	
6. Teamwork satisfaction	.10	.53**	.64**	.63**	.63**	--

Note: * $p < .05$. ** $p < .01$.

the explanation of online collaboration satisfaction and accounted for 63% of the variance in online collaboration satisfaction, $R^2 = .63$, $F(5, 40) = 13.35$, $p < .05$. Post-hoc coefficient examination further indicated that trust among teammates, $t(40) = 2.15$, $p < .05$, and organiza-

tion practices, $t(40) = 3.80$, $p < .05$, were effective explanatory variables of online collaboration satisfaction [Table 4 displays the unstandardized regression coefficients (B), the standard error of B ($SE B$), and the standardized regression coefficients (β)]. Positive

TABLE 4
Summary of Regression Analysis for Variables Explaining Online Teamwork Satisfaction

<i>Variable</i>	<i>B</i>	<i>SE B</i>	<i>β</i>
Facilitators' supports	-.03	.12	-.02
Acquaintance with teammates	.12	.21	.09
Clear communication	.24	.14	.21
Trust among teammates	.25	.12	.30*
Organization practices	.42	.11	.43*

Note: * $p < .05$.

β value indicated that an individual would feel more satisfied with the collaborative experience if he or she possessed a higher level of organization practices. β value of .43 further inferred that one standard deviation change on organization practices would associate with .43 unit standard deviation change on teamwork satisfaction. Likewise, an individual would feel more satisfied with the collaborative experience if he or she had more trust built among teammates. It was also inferred that one standard deviation change on trust among teammates would associate with .30 unit standard deviation change on teamwork satisfaction.

DISCUSSION AND RECOMMENDATIONS

It was hypothesized that groups receiving more support from the facilitator, getting more acquainted with teammates, building more trust, having clearer communication among teammates, and involving better organization practices would have greater satisfaction with online collaboration experiences. In this study, the strongest relationship was found between clear communication and teamwork satisfaction ($r = .64$), which suggested that group members who communicated clearly will have better understanding of teamwork tasks and have stronger team commitment. Consistent with previous studies, a team's communication tends to be more frequent, open, complete, and

accurate when its members are working collaboratively (Deutsch, 1973; Johnson & Johnson, 1989). If individuals like each other and communicate frequently, they become more willing to respond helpfully to each other's wants, needs, and requests. Even though conflicts occur, team members tend to recognize each other's personality and how individuals wish to be treated in collaborative situations. Thus, conflicts tend to be defined as mutual problems to be solved in ways that benefit everyone involved (Johnson & Johnson, 2000).

Surprisingly, the results of this study did not provide strong support for the relationship between facilitator's support and teamwork satisfaction ($r = .10$). This finding was different from Hara and Kling's (2000) study that a lack of support from the instructor resulted in anxiety and frustration among students and affected team effectiveness. A plausible explanation would be that the group members seemed to resolve problems or different learning styles on their own rather than relying on the facilitator's intervention. In the collaborative learning environment, students are the center of learning. Students are the active agents and have the ownership of teamwork projects that they are purposefully discovering and constructing knowledge within a problem-solving environment. As student-centered activities are facilitated by emerging online learning technology, the instructor's role is primarily to observe, monitor, coexplore, facilitate, and provide information (Harasim et al.,

1995; Teles et al., 2001). Thus, the online instructors should find ways to create an atmosphere wherein students will trust their team members and will respect the abilities of other members. The instructors should also act as a referee in resolving relationship conflicts and as a help provider in negotiating with the free rider in the teams. Another consideration towards an interpretation of the finding is that facilitator's support does not influence teamwork satisfaction directly; rather, it has a mediating effect. By receiving encouraging comments and timely feedback from the facilitator, students can feel that they are in a safe online learning environment. Thus, they will have higher level of motivation to engage social interactions with their team members and to participate in the teamwork process.

This study also set out to achieve a more comprehensive understanding of students' satisfaction with online collaborative learning by measuring facilitators' support, acquaintance with teammates, clear communication, trust among teammates, and organization practices during the collaborative learning processes. We were able to account for 63% of the variance in online collaboration satisfaction by using the five collaboration factors. The results also suggested that "organization practices" and "trust among teammates" were the two most effective variables explaining the teamwork satisfaction of online collaboration. This finding resonated with those studies on learning in group settings where trust is important to successful group learning to occur (Allen, Bergin, & Pickar, 2004; Costa, 2003).

The results have practical implications for instructors who are planning to employ online collaborative learning components. In an attempt to enhance the satisfaction level of online collaboration, online course instructors can focus on developing strategies to promote the significant collaboration factors. To help students get organized with their collaboration, instructors may provide clearly-addressed project descriptions and grading rubrics. Being able to envision the teamwork project's outcome will help students to identify their roles,

determine individual tasks, and divide responsibilities. These efforts facilitate not only the formation of collaboration style and a communication channel within the group but also members' agreement on conflict-resolving and working norms. As far as trust among teammates is concerned, building up a dynamic interactive environment and atmosphere is particularly important. Instructors can apply pre-project activities, such as weekly thematic discussion, that will lead students to share their personal backgrounds which in turn will build understanding and trust among themselves.

With regard to the limitations of the study, the researchers were concerned about the following two issues. First, this study was conducted with graduate students during one semester at a single institution. Caution should be taken in generalizing from this study to students enrolled in different courses or studying at different institutions. Second, 46 subjects were not enough for standard regressions. Based on a medium effect size ($R^2 = .13$) and five independent variables, Green's (1991) rule of thumb for determining regression sample sizes N indicated that the necessary sample size for this study was 89. Further research could be conducted with a larger group and by considering other factors, such as learning motivation, conflict management, and the leadership of group leaders. Further research is also needed to determine the different components of learning motivation, such as intrinsic motivation, extrinsic motivation, and academic self-concept that might influence the teamwork project's success in the online collaborative learning environment.

REFERENCES

- Allen, K., Bergin, R., & Pickar, K. (2004). *Exploring trust, group satisfaction, and performance in geographically dispersed and co-located universities technology commercialization teams*. Retrieved December 10, 2006, from http://nciia.org/conf_04/proceedings_04/htmldocs/papers/allen.pdf

- Brandon, D., & Hollingshead, A. B. (1999). Collaborative learning and computer-supported groups. *Communication Education, 48*(2), 109-126.
- Brown, L., Eastham, N., & Ku, H. -Y. (2006). A performance evaluation of the collaborative efforts in an on-line group research project. *Performance Improvement Quarterly, 19*(3), 121-140.
- Brufee, K. (1999). *Collaborative learning: Higher education, interdependence, and the authority of knowledge* (2nd ed.). Baltimore: John Hopkins University Press.
- Costa, A. C. (2003). Work team trust and effectiveness. *Personnel Review, 32*(5), 605-622.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297-334.
- Daradoumis, T., & Marquès, J. M. (2000). A methodological approach to networked collaborative learning: Design and pedagogy Issues. In M. Asensio, J. Foster, V. Hodgson & D. McConnell (Eds.), *Networked learning 2000. Proceedings of the 2000 International Conference on Innovative Approaches to Lifelong Learning and Higher Education through the Internet* (pp. 72-77). Lancaster, England: University of Sheffield, Division of Education.
- Daradoumis, T., & Xhafa, F. (2005). Problems and opportunities of learning together in virtual learning environment. In T. Robert (Ed.), *Computer-supported collaborative learning in higher education*. Hershey, PA: Idea Group.
- Deutsch, M. (1973). *The resolution of conflict*. New Haven, CT: Yale University Press.
- Green, S. B. (1991). How many subjects does it take to do a regression analysis? *Multivariate Behavioral Research, 26*, 499-510.
- Hara, N., & Kling, R. (2000). Students' distress with a web-based distance education course: An ethnographic study of participants' experiences. *Information, Communication and Society, 3*(4), 557-579.
- Harasim, L., Hiltz, S. R., Teles, L. & Turoff, M. (1995). *Learning networks: A field guide to teaching and learning online*. Cambridge, MA: The MIT Press.
- Johnson, D. W., & Johnson, R. T. (2000). *Joining together: Group theory and group skills* (7th ed.). Edina, MN: Interaction.
- Johnson, S., & Johnson, D. W. (1989). *Cooperation and competition: Theory and research*. Edina, MN: Interaction.
- Katzenbach, J. R., & Smith, D. K. (1993). *The wisdom of teams: Creating the high-performance organization*. Boston: Harvard Business School Press.
- Kitchen, D., & McDougall, D. (1998). Collaborative learning on the Internet. *Journal of Educational Technology Systems, 27*(3), 245-258.
- Lee, M., Rogers, P., & Postmes, T. (2002). SIDEVIEW: Evaluation of a system to develop team players and improve productivity in Internet collaborative learning groups. *British Journal of Educational Technology, 33*(1), 53-63.
- Lehtinen, E., Hakkarinen, K., Lipponen, L., Rahikainen, M., & Muukkonen, H. (1999). Computer supported collaborative learning: A review of research and development. In J. H. G. I. Giebers (Ed.) *Reports on education, 10. Department of Educational Science*. University of Mijmegen, The Netherlands.
- Lipponen, L. (2002). Exploring foundations for computer-supported collaborative learning. In G. Stahl (Ed.), *Computer support for collaborative learning: Foundations for a CSCL community* (pp. 72-81). Hillsdale, NJ: Erlbaum.
- Oliverr, R., Omari, A., & Herrington, J. (1998). Exploring student interactions in collaborative World Wide Web computer-based learning environments. *Journal of Educational Multimedia and Hypermedia, 7*(2/3), 263-287.
- Panitz, T. (2001). *The case for student-centered instruction via collaborative learning paradigms*. Retrieved December 25, 2006, from <http://home.capecod.net/~tpanitz/tedsarticles/coopbenefits.htm>
- Shaw, J. B., & Barrett-Power, E. (1998). The effects of diversity on small work group processes and performance. *Human Relations, 51*(10), 1037-1325.
- Summers, J. J., Beretvas, S. N., Svinicki, M. D., & Gorin, J. S. (2005). Evaluating collaborative learning and community. *The Journal of Experimental Education, 73*(3), 165-188.
- Teles, L., Ashton, S., Roberts, T., & Tzoneva, I. (2001). The role of the instructor in e-learning Collaborative environments. *TechKnowLogia, 3*(3), 46-50.
- Uribe, D., Klein, J. D., & Sullivan, H. (2003). The effect of computer-mediated collaborative learning on solving ill-defined problems. *Educational Technology Research and Development, 51*(1), 5-19.

- Vygotsky, L. (1978). *Mind in society: The development of higher psychological process*. Cambridge, MA: Harvard University Press.
- Wang, M., Poole, M., Harris, B., & Wangemann, P. (2001). Promoting online collaborative learning experiences for teenagers. *Education Media International*, 38(4), 203-215.
- Waters, L. H., & Napier, W. (2002). Building and supporting student team collaboration in the virtual classroom. *The Quarterly Review of Distance Education*, 3(3), 345-352.
- Whiteoak, J. W., Chalip, L., & Hort, L. K. (2004). Assessing group efficacy: Comparing three methods of measurement. *Small Group Research*, 35, 158-173.
- Thompson, L., & Ku, H-Y. (2006). A case study of online collaborative learning. *Quarterly Review of Distance Education*, 7(4), 361-375.
- Yukl, G. (1994). *Leadership in organizations*. Englewood Cliffs, NJ: Prentice-Hall.

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