THE RELATIONSHIPS BETWEEN TRUST, PERFORMANCE, SATISFACTION, AND DEVELOPMENT PROGRESSIONS AMONG VIRTUAL TEAMS

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This study investigated the relationship between the level of trust, performance, satisfaction, and teamwork development progressions among 4 online virtual teams. The participants were 15 graduate students who were randomly assigned to 4 teams to complete 5 team projects in an online instructional design course across 15 weeks. Four different instruments, including the Measures of Trust scale, Project Scores, Teamwork Satisfaction scale, and Teamwork Activities and Behavior scale, were collected and analyzed. The bivariate correlation analysis was conducted to test the relationship between trust and performance as well as between trust and satisfaction among virtual teams. The results revealed that the level of trust has a strong positive relationship with team performance as well as teamwork satisfaction, and the teams reporting higher levels of trust in finals week also demonstrated more matured teamwork development stages.

INTRODUCTION

The emergence of distance education has led to fundamental changes in the ways educational systems function and in the way students learn (Waldvogel, 1999). Some of these changes include a greater focus on learner-centered approaches (Garrison, 1993), more formal interactions with peers, and an increased availability of rich knowledge resources. Moreover, technology-rich environments support learner engagement in meaningful contexts, thereby increasing learning ownership (Chung, Rodes, & Knapczyk, 1998).

Online collaborative learning is one strategy instructors could implement to promote student creativity and productivity during the teamwork process (Ku, Cheng, & Lohr, 2006; Lee, Rogers, & Postmes, 2002; Thompson & Ku, 2006, 2010). Gerlach (1994) stated, "Collaborative learning is based on the idea that learning is a naturally social act in which the participants

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talk among themselves" (p. 12). The conversations, multiple perspectives, and arguments that arise in groups may explain why collaborative groups can attain greater cognitive development than that which the same individuals would achieve when working alone (Harasim, 1997). Online collaborative teamwork could be a valuable means for scaffolding and could facilitate and enhance learners' metacognitive knowledge (An & Kim, 2007) when learners experience opportunities for sharing and constructing knowledge (Dewiyanti, Brand-Gruwel, & Jochems, 2005).

Social interactions in collaborative groups have been characterized as important activities for the development of higher mental processes (Driscoll, 1994). According to Daradoumis and Marquès (2000), learning in a team not only promotes affective and social benefits in distance education but also increases positive attitudes and social interactions among students. Collaborative learning environments provide the opportunities for team members to examine tasks from different perspectives, to collaborate and interact from processes of problem solving (Mühlenbrock & Hoppe, 1999), and to build relationships by gradually breaking personal boundaries (Dixon, 2007).

Trust has been identified as a critical factor for effective team process and performance (Costa, 2003; Geister, Konradt, & Hertel, 2006; Mayer & Davis, 1999) and teamwork satisfaction (Furumo, Pillis, & Green, 2009; Liu, Magjuka, & Lee, 2008). In order to help a team to break the ice and form productive working relationships, trust serves as the glue that maintains the cohesiveness of a team. Trust also allows team members to depend on each other and is the foundation for good teamwork. The aim of this research is to investigate the relationship between the level of trust, performance, satisfaction, and teamwork development progressions among four online virtual teams.

LITERATURE REVIEW

Team members build trust through sharing one's opinions, conclusions, and feelings, and expecting the other team members respond with acceptance, support, and reciprocation of disclosures. The level of trust within a group is constantly changing according to group members' willingness to be trusting and trustworthy. Lewicki and Bunker (1995) stated that the developmental views of trust are closely intertwined with the process of relationship development. Because there is often little time for relationship building in virtual teams, team members are presumed to trust others based on their past experiences or from other settings with which they are familiar (Jarvenpaa & Leidner, 1999; Meyerson, Weick, & Kramer, 1996). As soon as the team begins to interact, positive experiences regarding the behavior and assumed intentions of team members can improve trust. Likewise, miscommunication, different expectations regarding behavior, and presumed negative intentions can quickly destroy trust.

Only a few studies have compared virtual teams' trust as it changes over time. For instance, Jarvenpaa and Leidner (1999) assessed the level of trust in teams at two time periods: following the deadline for a second voluntary exercise (Time 1) and following the deadline for the completed final project (Time 2). Jarvenpaa and Leidner categorized their case study teams into four categories based on their levels of trust at Time 1 and Time 2. These categories were: (1) lower than the mean trust of the sample at Time 1 and Time 2 (LoLo), (2) lower than the mean trust at Time 1, but higher than the mean trust at Time 2 (LoHi), (3) higher than the mean trust at Time 1, but lower at Time 2 (HiLo), and (4) higher than the mean at Time 1 and Time 2 (HiHi). Jarvenpaa and Leidner concluded that members in the HiHi and HiLo teams appeared to have more confidence and optimism to work on team collaboration at the early teamwork stage than members in the LoLo and LoHi teams. In another study, Kanawattanachai and Yoo (2002) examined team's trust changing patterns at the early, middle, and late stages of a project. Their research suggests high-performing teams were better at developing and maintaining a higher level of trust and

groups display clusters of behaviors at various points of their lifespan.

Teamwork performance may take the form of a summative assessment which involves comparing a team's design with a model solution (Porter & Lilly, 1996; Sargent & Sue-Chan, 2001). Jones, Dirckinck-Holmfeld, and Lindström (2006) stressed the importance of collective trust by stating that "trust is a central element in the provision of both a safe environment for learners and the conditions for communication and collaboration" (p. 49). If individuals trust and like each other, thus promoting effective communication, they become more willing to respond helpfully to each other's wants, needs, and requests. Evidence from Jarvenpaa and Leidner's (1999) study of global virtual student teams suggests that low levels of collective trust are associated with lower team performance. Costa, Roe, and Taillieu (2001) presented trust as a four-dimension model and they suggested that trust is positively related to perceived task performance.

Teamwork satisfaction may be defined generally as a positive "affective response that members have to some element pertaining to a small group" (Witteman, 1991, p. 31). Costa et al. (2001) have cited measures of satisfaction as dimensions of effectiveness on learning performance predicted by trust. Their study suggested that trust is positively related to team satisfaction, task performance, and relationship commitment, and negatively related to stress. Morgan and Hunt (1994) argued that work relationships characterized by trust reduce conflicts, increase cooperation, and diminish tendencies to leave the team. Furthermore, Brown, Eastham, and Ku (2006) advocated that building relationships and establishing trust among team members is essential to team satisfaction. The importance of trust and its relationship with team satisfaction are generally accepted.

Teamwork Development Processes

Because collaborative teams are composed of members with different beliefs regarding appropriate behavior, attitudes, and perceptions for members, teamwork processes are not stable and unchanging interaction patterns; instead, teamwork processes are dynamic. Miller (2003) asserted that "Groups are systems, often changing in social and work processes throughout the time of their existence.… It is important to understanding how to build teams and guide teams toward high performance" (pp. 121-122).

Many researchers have focused on identifying theoretical models concerning group developmental processes (Drexler, Sibbet, & Forrester, 1988; Gersick, 1988, 1989; Tuckman, 1965). Most of these models can be categorized into three approaches: progressive, cyclical, and nonsequential models (Mennecke, Hoffer, & Wynn, 1992). A classic progressive model was provided by Tuckman (1965) who proposed that groups go through four stages: forming, storming, norming, and performing. Drexler et al. (1988) proposed a cyclical model—team performance model—that describes a team's progression through seven interdependent phases of group growth: orientation, trust building, goal clarification, decision making, implementation, high performance, and renewal. In addition, Gersick's (1988, 1989) punctuated equilibrium model (nonsequential model) suggests that regardless of group structure, tasks, or deadlines, groups work on their tasks in the same temporal pattern.

Although there is a large amount of literature referencing the concepts of Tuckman's models (see for example, Hurt & Trombley, 2007; Marks, Mathieu, & Zaccaro, 2001; McMorris, Gottlieb, & Sneden, 2005; Rickards & Moger, 2000; Weber & Karman, 1991), empirical research regarding the group development process using Tuckman's model in virtual teams is rare. Johnson, Suriya, Yoon, Berrett, and Fleur (2002) concluded that Tuckman's model described how the virtual teams develop and determine their group process better than the other models. In addition, Dennis, Garfield, and Reinicke (2003) also concurred that newly formed groups, whose members

have little prior experience working together, are best understood from the stages model of group development perspectives. Therefore, the present study chose the best known and established model of group development, Tuckman's four-stage developmental sequence in groups, as a conceptual framework.

In Tuckman's model, the forming stage refers to team members trying to determine their roles in the team and identifying the procedures required to complete the tasks. During the storming stage, roles and responsibilities are articulated and team members build their patterns of interaction and communication. The norming stage begins when cohesiveness and commitments have been established to achieve the team goals and successful team products, and the team sets norms for appropriate behaviors. Finally, the performing stage occurs when the team becomes proficient in cooperating together and all team members feel very motivated and creative.

Purpose

The purpose of this study was to investigate the relationship between the level of trust and subsequent team performance and satisfaction among four virtual teams who worked collaboratively in an online course. In addition, how team members' relationships and group dynamics were built over time were measured based on Tuckman's four stages of team sequential development processes (forming, storming, norming, and performing). Finally, how each team's level of trust associated with Tuckman's four stages of team sequential development processes were examined. The research questions that guided the investigation were as follows:

1. What is the relationship between team's level of trust and virtual team performance?
2. What is the relationship between team's level of trust and virtual team satisfaction?
3. How do levels of trust change over time in virtual teams based on Tuckman's four-stage teamwork development processes?

METHODS

Participants

The participants were 15 graduate students who enrolled in an instructional design online course at a western university in the United States. Among the 15 participants, 12 were female and three were males. In addition, 12 students were working toward their master's degree and three were working toward their doctoral degree.

Online Course Format

The instructional design course was a 15-week course designed to teach students how to create effective, efficient, and appealing self-paced instruction. Blackboard, the web-based course management system, was used to support online students' communications and interactions. In order to achieve the course objectives, each team was required to complete five team projects. For each of the team projects, the learners provided feedback to and received feedback of their individual contributions within the team project from their team members, revised their drafts based on team members' feedback, and then posted their revised final drafts. Following the posting of these drafts, the instructor reviewed the revised drafts of the project, assigned grades, and provided feedback to each team.

Instrumentation

Measures of Trust Scale. The individual team member's trust was measured using a scale adapted from Jarvenpaa and Leidner's instrument (1999) which includes nine items (see Table 1). All items were measured on a 6-point Likert-type scale, ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Jarv-

enpaa and Leidner used and modified two separate measures to ascertain the level of trust on the team. The first measure was used by Pearce, Sommer, Morris, and Frideger (1992) to measure trustworthiness, and the second measure was a modified version of Mayer, David, and Schoorman's (1995) instrument on trust. Both instruments were modified by Jarvenpaa and Leidner to reflect the team, rather than the original dyad, as the unit of analysis. Jarvenpaa and Leidner's (1999) instrument was selected because they had conducted one of the most detailed studies on virtual trust thus far and the instrument had high reliability (i.e., each of the variables had a Cronbach's alpha reliability over .80). Example items include "Members of my work group show a great deal of integrity," "I can rely on those with whom I work with in this group," and "Overall, the people in my group are very trustworthy." The Cronbach's alpha reliability coefficient for the Measures of Trust scale of the present study was .92.

Project Scores. Each team finished five team projects over the course of the semester. Their project grades and the instructor's feedback were used to evaluate the quality of the projects. The following is the relative weighting of the project grades for the instructional design course: Project 1: needs assessment, learner analysis, and contextual analysis (10 points); Project 2: task analysis, instructional objectives, questions, and feedback (15 points); Project 3: instructional sequencing, instructional strategies, and message design (10 points); Project 4: formative evaluation (5 points); and Project 5: final design document and self-paced lesson (15 points). To minimize the potential for bias in the assessment of performance, projects were graded by the instructor and an outside expert based on grading rubrics.

Teamwork Satisfaction Scale. Tseng, Wang, Ku, and Sun's (2009) 10-item Teamwork Satisfaction scale was utilized to measure students' satisfaction with their team members. All items are measured on a 5-point Likert-type scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). For this survey, learners' satisfaction involves two perspectives, satisfaction with online collaborative learning environment and satisfaction with the benefits from peer interactions. The Teamwork Satisfaction scale has been shown to demonstrate desirable factorial validity and internal consistency with the selected graduate student population (Tseng et al., 2009). Example items include "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 teammates." The Cronbach's alpha reliability coefficient for the Teamwork Satisfaction scale was .95.

Teamwork Activities and Behavior Scale. This 24-item scale has been modified from

TABLE 1
Measures of Trust Scale

	Survey Items
1.	I would be comfortable giving the other team members complete responsibility for the completion of this project.
2.	I would be comfortable giving the other team members a task or problem which was critical to the project, even if I could not monitor them.
3.	I really wish I had a good way to oversee the work of the other members.
4.	Members of my work group show a great deal of integrity.
5.	I can rely on those with whom I work in this group.
6.	There is a noticeable lack of confidence among my team members.
7.	We are usually considerate of one another's feelings in this work group.
8.	The people in my group are friendly.
9.	Overall, the people in my group are very trustworthy.

Source: Adapted from Jarvenpaa and Leidner (1999).
Note: Items 3 and 6 are reverse-coded.

Clark's (1998) generic reference model which is intended to assess at what stage the team operates. Six statements are associated with teamwork activities and behaviors anticipated at each of Tuckman's four developmental stages. All items are measured on a 5-point Likert scale (almost never, seldom, occasionally, frequently, almost always). Example items for each of the four stages are as follows: forming stage, "We are trying to define the goal and what tasks need to be accomplished"; storming stage, "Many of the team members have their own ideas about the process and personal agendas are rampant"; norming stage, "We take our team's goals and objectives literally"; and performing stage, "We enjoy working together; we have a fun and productive time." The Cronbach's alpha reliability coefficients for four of the developmental stages were .79 (forming), .81 (storming), .82 (norming), and .89 (performing), respectively. Scale items of teamwork activities and behavior anticipated at each developmental stage are shown in Table 2.

Procedures

During the first week, students were asked to post their picture and personal biography to Blackboard. The course instructor then informed students to read other students' pro-

TABLE 2
Teamwork Activities and Behavior Anticipated at Each Developmental Stage

Stages	*Teamwork Activities and Behavior*
Forming stage	1. Team members are afraid or do not like to ask others for help. 2. We are trying to define the goal and what tasks need to be accomplished. 3. We assign specific roles to team members (team leader, facilitator, time keeper, note taker, etc.). 4. There are many abstract discussions of the concepts and issues which make some members impatient with these discussions. 5. It seems as if little is being accomplished with the project's goals. 6. Although we are not fully sure of the project's goals and issues, we are excited and proud to be on the team.
Storming stage	1. We are quick to get on with the task on hand and do not spend too much time in the planning stage. 2. Many of the team members have their own ideas about the process and personal agendas are rampant. 3. The tasks are very different from what we imagined and seem very difficult to accomplish. 4. We argue a lot even though we agree on the real issues. 5. The goals we have established seem unrealistic. 6. We generate lots of ideas but we do not use many because we fail to listen to them and reject them without fully understanding them.
Norming stage	1. We have thorough procedures for agreeing on our objectives and planning the way we will perform our tasks. 2. We take our team's goals and objectives literally. 3. We often share personal problems with each other. 4. We have accepted each other as members of the team. 5. We try to achieve harmony by avoiding conflict. 6. We express criticism of others constructively.
Performing stage	1. Our team feels that we share responsibilities for the team's success or failure. 2. We enjoy working together; we have a fun and productive time. 3. We fully accept each other's strengths and weaknesses. 4. We are able to work through group problems. 5. There is a close attachment to the team. 6. We get a lot of work done.

Source: Adapted from Clark (1998).

files so they could learn more about their classmates. During the second week of the semester, the course instructor randomly assigned three or four students to each collaboration team and four teams were consequently formed. Team members reached a team agreement and brainstormed a topic for self-paced instruction. In order to obtain initial level of trust scores among team members, each team member completed the Measures of Trust scale at the end of Week 2.

According to Tuckman (1965), group development takes place within two realms: the interpersonal and the task activity. In addition, Marks et al. (2001) asserted that teamwork processes progress as members' interdependent acts that convert inputs and feedback to outcomes. Therefore, we decided that each team member should complete the Measures of Trust scale and Teamwork Activities and Behavior scale after each of five team projects was completed in Weeks 3, 6, 9, 12, and 15. Such an approach would help us to measure the level of trust, team performance, and teamwork development processes at five different time periods in 3-week intervals across 15 weeks among four teams. However, we only distributed the Teamwork Satisfaction scale to participants in Weeks 6 and 15 after they completed team projects 2 and 5 to avoid overwhelming them with a large number of survey items.

Data Analysis

To answer research question one—What is the relationship between team's level of trust and virtual team performance?—first, means of survey items were calculated from the Measures of Trust Scale and the quality of each team's performance was evaluated based on the scores of team projects at five different time periods. Then, the bivariate correlation analysis was conducted to test the relationship between trust and performance among virtual teams.

To answer research question two—What is the relationship between team's level of trust and virtual team satisfaction? —first, means of survey items were calculated from the Measures of Trust scale and the Teamwork Satisfaction scale was calculated to indicate each team's satisfaction at two different time periods. Then, the bivariate correlation analysis was conducted to test the relationship between trust and satisfaction among virtual teams.

To answer research question three—How do levels of trust change over time in virtual teams based on Tuckman's four-stage teamwork development processes?—first, the stages of teamwork development progression at every 3 weeks were identified using the Teamwork Activities and Behavior scale. The 24-item scale was used to assess and identify what stage the team operates. Six statements are associated with teamwork activities and behaviors anticipated at each of Tuckman's four developmental stages. The lowest score possible for a stage is 6 (*almost never*), while the highest score possible for a stage is 30 (*almost always*). According to Clark (1998), the highest of the four scores indicates which stage the team members perceive their team is operating at that time while the lowest of the four scores is an indicator of the stage this team is least likely to operate. In addition, if two of the scores are close to the same (within three points), the team is probably going through a transition phase. Second, means of survey items from the Measures of Trust scale collected every 3 weeks were calculated to indicate each team's level of trust. Last, each team's trust scores and its developmental stages were charted to provide a better visual understanding of the variations of the team's level of trust and development processes over time.

RESULTS

The Relationship Between Level of Trust and Team Performance

The levels of trust and team performance were assessed at five different time periods among four teams, and the statistical result

revealed that team's level of trust correlated significantly with team performance ($r = .75$, $p < .01$). In addition, with an R^2 value of .56 indicating that team's level of trust accounted for approximately 56% of the variability in virtual team's performance.

The Relationship Between Level of Trust and Teamwork Satisfaction

The levels of trust and teamwork satisfaction were assessed at two different time periods among four teams: following the completion of Project 2 (Week 6) and following the completion of final project (Week 15). The statistical result revealed that team's level of trust correlated significantly with team satisfaction ($r = .83$, $p < .01$). In addition, with an *R-squared* value of .69 indicating that team's level of trust accounted for approximately 69% of the variability in virtual team's satisfaction.

Level of Trust and Teamwork Development Progression Over Time

Initial Trust. All participants of the four virtual teams completed the Measures of Trust scale the week after the teams were formed in Week 2 to determine the initial level of trust. The results indicated that Team 1 reported the second highest initial trust ($M = 4.52$, $SD = .57$), Team 2 reported the third highest initial trust ($M = 4.11$, $SD = .49$), and Team 3 had the most positive attitude toward initial trust ($M = 4.92$, $SD = .59$) among four virtual teams at the end of Week 2. In contrast, Team 4 had a least favorable attitude toward initial trust ($M = 3.92$, $SD = .37$).

Team 1. The teamwork development for Team 1 started with the forming stage in Week 3 and then it passed the storming stage and jumped to the norming stage in Week 6. At Week 9, Team 1 progressed to the performing stage, and it stayed in the performing stage of teamwork development for 6 weeks.

Team 1 reported a high initial trust at the end of Week 2 ($M = 4.52$), increased to 4.89 at the end of Week 3, and reached 5.17 at the end of Week 6 and Week 9. In Week 12, the level of trust was 5.11 and reached the highest score of 5.22 in Week 15 after they submitted the final project. Team 1 remained in the performing stage from Week 9 until the end of the semester.

Team 2. Team 2's teamwork progression and levels of trust over time confirms Tuckman's sequential model. Team 2 started with the forming stage in Week 3 and progressed to the storming stage in Week 6 and stayed at the storming stage until the end of Week 9. The teamwork progression moved to the norming stage at the end of Week 12 and reached the performing stage during finals week. However, unlike Team 1, they spent much more time in the storming stage to resolve conflicts and define each team member's role in order to accomplish each project efficiently.

Team 2 reported a high initial trust at the end of Week 2 ($M = 4.11$) and decreased slightly to 4.09 at the end of Week 3, and dropped rapidly to 3.81 at the end of Week 6. The level of trust increased to 3.90 in Week 9 and to 4.26 in Week 12. The increments of levels of trust that started from Week 9 to the last week were closely coupled with the team's teamwork development progression. Further, the level of trust peaked at 4.66 with the completion of all team projects.

Team 3. Team 3 initiated their teamwork progression at the forming stage in Week 3. Team 3 progressed to the storming stage at the end of Week 6 as members tried to find their role within the team and tried to resolve conflicts. At the end of Week 9, Team 3 reached the norming stage, where it remained until the end of the semester. Therefore, it never approached a mature state of the performing stage.

Team 3 reported a high initial trust level at the end of Week 2 ($M = 4.92$), decreased slightly to 4.67 at the end of Week 3, and to 4.45 at the end of Week 6. At the end of Week 9, it increased slightly to 4.50. The level of trust dropped slightly to 4.26 in Week 12 and reached the lowest score of 3.56 after they submitted the final project in Week 15.

Team 4. The teamwork development for Team 4 started with the forming stage in Week 3 and passed through the storming stage to the norming stage in Week 6. However, Team 4 regressed to the storming stage at the end of Week 9. On close inspection of Team 4's artifacts during Week 9, it was noted that there were relationship conflicts among team members and team identity was challenged. At the end of Week 12, Team 4 progressed to the norming stage and stayed in the norming stage until Week 15.

Team 4 reported a moderately high initial trust level at the end of Week 2 (M = 3.92), increased slightly to 4.00 at the end of Week 3, and to 4.25 at the end of Week 6. At the end of Week 9, the level of trust dropped dramatically to 3.11 as the teamwork development regressed to the storming stage. The teamwork development reached the norming stage again at the end of Week 12, where it remained until the end of the semester. The levels of trust were also increased to 3.39 and to 3.92 during the latest two measured time points in Weeks 12 and 15.

The level of trust between the early semester (Week 2) and the late semester (Week 15) were assigned to four categories as suggested by Jarvenpaa and Leidner (1999) in the Introduction section. The overall mean trust of the four teams (M = 4.32) was used to distinguish between the virtual teams' high trust and low trust levels. Of the four teams, Team 1 fell into the HiHi category (M = 4.52 versus 5.22), Team 2 fell into the LoHi category (M = 4.11 versus 4.66), Team 3 fell into the HiLo category (M = 4.92 versus 3.56), and Team 4 fell into the LoLo category (M = 3.92 versus 3.92).

In terms of the four teams' development progression, Team 1 and Team 2 reached the performing stage as they completed the entire teamwork process. However, Team 3 and Team 4 stayed in the norming stage and failed to approach the performing stage. Comparing the levels of trust and teamwork development stages in the finals week among four teams, it was found the teams that reported higher levels of trust also demonstrated more matured teamwork development stages. The level of team trust, team performance, team satisfaction, and teamwork development among four teams are shown in Table 3.

DISCUSSION

The major results of the three research questions were the following: (1) the level of trust has a strong positive relationship with team performance; (2) the level of trust has a strong positive relationship with teamwork satisfaction; and (3) the teams that reported higher levels of trust also demonstrated more matured teamwork development stages in finals week.

The Relationship Between Level of Trust and Team Performance

This present research extended the group process literature to examine the dynamic effectiveness of trust. In addition, this research expanded Jarvenpaa and Leidner's (1999) and Kanawattanachai and Yoo's (2002) study by longitudinally examining virtual trust associated with the five teamwork projects.

The results revealed that the levels of trust significantly and positively correlated with the performance of the virtual teams (r = .75, p < .01). In other words, the virtual teams reporting higher levels of trust were accompanied by higher performance levels as 56% of the variation in virtual team performance can be explained by variation in team's level of trust (R^2 = .56). This finding mirrors the finding by Jarvenpaa and Leidner (1999) that low levels of collective trust are associated with lower team performance, and by Costa et al. (2001) that trust is positively related to perceived task performance. Teams with higher levels of trust has the same commitment on improving team processes and hence, to self-manage their own performance (Kirkman, Rosen, Tesluck, & Gibson, 2006; Polzner, Crisp, Jarvenpaa, & Kim, 2006).

TABLE 3
Level of Team Trust, Team Performance, Team Satisfaction, and Teamwork Development

	Week 2	*Week 3 Project 1*	*Week 6 Project 2*	*Week 9 Project 3*	*Week 12 Project 4*	*Week 15 Project 5*
Team 1						
Trust	4.52	4.89	5.17	5.17	5.11	5.22
Performance		10.00	14.00	10.00	5.00	14.50
Satisfaction			4.45			4.90
Stage		Forming	Norming	Performing	Performing	Performing
Team 2						
Trust	4.11	4.09	3.81	3.90	4.26	4.66
Performance		8.50	12.75	8.88	4.13	13.25
Satisfaction			3.10			3.60
Stage		Forming	Storming	Storming	Norming	Performing
Team 3						
Trust	4.92	4.67	4.45	4.50	4.26	3.56
Performance		9.25	14.38	9.00	4.13	12.00
Satisfaction			3.30			3.13
Stage		Forming	Storming	Norming	Norming	Norming
Team 4						
Trust	3.92	4.00	4.25	3.11	3.39	3.92
Performance		8.38	13.63	9.00	4.00	13.15
Satisfaction			3.25			3.35
Stage		Forming	Norming	Storming	Norming	Norming

Note: Measure of Trust items were measured on a 6-point Likert-type scale and Teamwork Satisfaction items were measured on a 5-point Likert-type scale. Maximum possible score of Project 1 was 10, Project 2 was 15, Project 3 was 10, Project 4 was 5, and Project 5 was 15.

The Relationship Between Level of Trust and Team Satisfaction

The findings on research question two showed that level of trust strongly correlate with teamwork satisfaction across the four virtual teams ($r = .83$, $p < .01$ and $R^2 = .69$). This suggests that virtual trust is an important factor for the level of teamwork satisfaction in a way that trust works as the glue that maintains the cohesiveness of a great and effective team. According to Zand (1972), teams with higher levels of trust, as compared to teams with lower levels of trust, exchange ideas more openly, search more extensively for alternative courses of action, and have greater motivation to implement conclusions. This finding concurs with previous studies like that of Costa et al. (2001), which advocated that trust is positively related to team satisfaction, and with Liu, Magjuka, and Lee's (2008) observation that trust contributes significantly to higher levels of teamwork satisfaction.

Level of Trust and Teamwork Development Progression Over Time

In this study, all four virtual teams demonstrated moderate to high levels of initial trust after they had interacted with their team members for only 2 weeks. The findings are consis-

tent with the results of Jarvenpaa and Leidner's (1999) study which showed trust can exist in a virtual team with no history. Spector and Jones (2004) also stated, "Understanding initial trust levels is important for the improvement of team functioning" (p. 318). A high level of initial trust among team members is important to extend the optimal effects on their relationships and task performance. This is logical because the virtual team lacks any physical interactions among team members and they have little to no history together.

Furthermore, Keller (2001) has found that trust levels tend to stay in their initial direction, either positive or negative. Thus, initial trust levels are highly important because once negative trust is established it may be difficult to overcome. Thus, the instructor could assist virtual teams to begin their work together with a synchronous conversation (i.e., chatroom, chat software, etc.) or encourage them to build their social relationship with the Web 2.0 applications (i.e., Facebook, Twitter, etc.) According to Kavanaugh (1999) and Lee Sing (2009), computer-supported social networks, such as Facebook, could break down status and power boundaries among users as well as provide users with opportunities to build relationships, while creating companionship and a sense of belonging. When congenial relationships grow, initial trust among teammates grows as well.

The present study found that the level of trust changed rapidly because of team members' behaviors and attitudes. For instance, the level of trust of Team 3 dropped considerably from Week 2 ($M = 4.92$) to finals week ($M = 3.56$). This finding may suggest that the teams with little to no history of collaboration experience benefit from higher initial trust, but that benefit can be short lived. To continue the solid trusting relationships that team members built initially, they should demonstrate accountability and have to discover approaches to creating "team spirit" in which deep, continual, and mutual relationships sustain cooperative behaviors (Erdem, Ozen, & Atsan, 2003). The instructor should also encourage a positive and supportive teamwork atmosphere to remain team members on the teams' mission, thus they can focus on the tasks (norming stage) as early as possible.

In terms of the four teams' development progression, Team 1 and Team 2 reached the performing stage as they completed the entire teamwork process. However, Team 3 and Team 4 failed to approach a mature state of the performing stage. Comparison of the levels of trust and teamwork development stages in Week 15 revealed the teams that reported higher levels of trust in finals week also demonstrated more matured teamwork behaviors and activities. For Team 1, Team 2, and Team 4, the levels of trust and development progressions were correspondent, which supported that the virtual team progressing in the higher stage of Tuckman's (1965) model will experience higher levels of trust.

Overall, Team 1 maintained the performing stage of teamwork development for 6 weeks and had the highest scores on teamwork satisfaction and performance in the finals week among the four teams. Team 2, on the other hand, reached the performing stage in the finals week and performed the second highest score on the final project. It could be argued that the length of time spent on the performing stage or the rate at which a typical team progresses in order to reach the performing stage (i.e., the rate of transition between forming to storming, storming to norming, norming to performing) will influence team functioning and the quality of the final output.

Furthermore, both Team 1 and Team 4 progressed from the forming stage to the norming stage between Weeks 3 and 6. This finding suggests that Tuckman's model of development progression is not always clear cut; virtual teams may progress to the next higher level of stage before resolving all of the issues from the previous stage. Next, comparing the development progressions of Team 1 and Team 4 from Week 6 to Week 9, Team 1 progressed from the norming stage to the performing stage but Team 4 regressed from the norming stage to the storming stage. The phe-

nomenon in Team 4 indicate that a team might move to a new stage, when in reality it still needed to resolve certain issues associated with previous stages as well as issues associated with the current stage (Byer & Weston, 2005).

Implications and Future Research

The present study has implications for both educational practice and for future research. This study suggests that virtual trust can maintain the cohesiveness of an effective team and can promote students' satisfaction on collaborative learning processes. In practice, the findings of this study suggest that Tuckman's model can serve as a guide for describing team's development progression and conceptualizing team experience over time.

The following three recommendations should help instructors improve students' collaboration experiences and assist students in maintaining virtual trust and stable teamwork progression by monitoring students' behaviors as they change over time.

1. Specify collaborative tasks and determine specific task-related activities with clear expectations to prevent teams from wasting time puzzling over directions.
2. Delegate task roles and make sure that the team roles are balanced. Roles ensure that the task behaviors of team members are appropriately interrelated so that the team's goals are achieved.
3. Elicit progress reports from leaders on teamwork behaviors and activities. Each member's contribution should be recorded in the progress report or in the self-assessment form periodically.

This study was limited by the small sample size because only four collaborative groups were investigated. Therefore, the findings of this study have limited generalizability but it was an authentic class with authentic group work. In regards to future research, researcher could investigate the dynamic nature of trust in both cognitive and affective elements over time and how these two elements of trust are associated with Tuckman's development progressions.

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