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Impact of Online Teamwork Self-Efficacy on Attitudes toward Teamwork

Abstract

The lack of professional skills in project teams is one of the most important factors contributing to the high failure rate of Information Technology (IT) projects. Therefore, preparing students for increasingly complex IT projects has been an important learning objective in information sciences and technology programs. This paper investigates the relationships between face-to-face students' self-efficacy of managing project tasks through online processes and their attitudes toward teamwork. The relationships among students' engagement in learning experiences related to teamwork, self-efficacy of technology-mediated teamwork, and attitudes toward teamwork are investigated using confirmatory factor analysis on a data set with 344 participants. The analysis shows that self-efficacy of technology-mediated teamwork mediates the effect of learning engagement on attitudes toward teamwork. Therefore, the paper postulates that mastering technology-mediated teamwork skills helps face-to-face students develop positive attitudes toward teamwork, which can be transferred to the workplace.

Keywords: Self-efficacy, Attitudes, Team Learning, Online Teamwork, Technology-mediated Teamwork

Introduction

IT projects are complex undertakings that are known to have high failure rates due to many reasons. In the literature, this high failure rate of information technology (IT) projects has been mainly attributed to the lack of professional skills in IT project teams rather than the deficiencies in the technical skills of the project teams (Keil et al., 1998; Whittaker, 1999). IT projects involve high levels of uncertainty due to complex interfaces between technology and people. Technology and user requirements can change during the course of the project. IT project teams usually involve members with diverse background from various departments of the organization and are usually geographically distributed. IT projects typically have a high degree of virtual components. Therefore, team members of an IT project should have the flexibility to adapt dynamic project requirements and technology. In addition to the technical knowledge, career resiliency in the 21st century demands excellence in teamwork, effective communication, adaptability to change, positive and flexible attitudes, continuous learning, self-confidence (Collard et al., 1996). To improve the readiness of their students for the ever-increasing complex IT challenges of the 21st century, information sciences and technology programs have integrated teamwork knowledge, skills, and abilities (KSAs) into their curricula through new course offerings, embedding them into existing courses, or extra circular activities such as workshops and seminars. Furthermore, the use of virtual teams in IT projects has become so pervasive that not only distance learning classes but also face-to-face classes incorporated virtual team projects to introduce IT students virtual teamwork skills (Chen, et al. 2008; Kulturel-Konak, Maurer, & Lohin, 2010; Falls et al., 2014; Brewer et al., 2015).

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In this paper, we study the effect of students' self-efficacy of applying teamwork KSAs using online mediums on their attitudes toward teamwork. We define self-efficacy of teamwork KSAs using online mediums as students' beliefs in their abilities to perform teamwork KSAs such as resolving team conflict, solving problems collaboratively, communicating effectively, establishing team goals, scheduling and coordinating project tasks using online communication and collaborative technologies. We will refer to this definition as *self-efficacy of technology-mediated teamwork* for not to create confusion with virtual teamwork self-efficacy. The target population of the study is information sciences and technology students who attend traditional face-to-face classes. The motivation of this research focus stems from the fact that even in face-to-face team projects, project tasks increasingly take place in online settings. In particular, commuter and non-traditional students have limited time on campus for face-to-face team meetings. Such student groups usually rely on online technologies to perform many components of face-to-face team projects. Therefore, it is important that students are well versed in managing team projects using online mediums for effective teamwork in face-to-face classes as well. Based on this premise, the main research question of the paper is to investigate whether face-to-face students exhibit more positive attitudes toward teamwork if they have self-efficacy of technology-mediated teamwork. In the literature, technology-mediated teamwork KSAs expected from information technology teams are mainly discussed in the context of virtual and distributed teams (Nunamaker, Reinig, & Briggs, 2009; Kulturel-Konak, Maurer, & Lohin, 2010; Schulze & Krumm, 2017). On the other hand, we emphasize the importance of technology-mediated teamwork KSAs for face-to-face student teams. This point is a unique contribution of the paper.

Attitudes toward teamwork can be defined as to the extent that a person is agreeable to work in a team. It is important that students develop a positive attitude toward teamwork because people's attitudes influence their future behavior (Ajzen & Fishbein, 1977). If students develop negative attitudes toward teamwork during their education, they may carry these negative experiences to the workplace. For example, Riebe et al. (2010) note that negative teamwork experiences can discourage new graduates to participate in real-life workplace teams. Cannon-Bowers, Salas, & Milham (2003) state that having positive attitudes toward teamwork is among the factors that determine the success of transferring teamwork skills learned in a training into practice. Furthermore, effective teamwork requires that team members perceive teamwork as an attractive work arrangement. Chapman and Van Auken (2001) investigate the factors affecting students' attitudes toward teamwork and report that students' understanding of the benefits of teamwork is one of the important factors for developing positive attitudes toward teamwork. This observation is the first hypothesis of the research model used in the paper.

Hypothesis One- *Students' perceived value of teamwork has a positive effect on their attitudes toward teamwork.*

The engagement of students in learning activities related to teamwork may help them avoid the pitfalls of teamwork, reduce the negative aspects of teamwork, and develop an appreciation of teamwork. As results of a meta-analysis, McEwan et al. (2017) report that teamwork training interventions have a positive effect on teamwork and team performance. Naveh et al. (2015) report that active learning in a team environment improves individual's work performance in medical fields through teamwork related KSAs such as feedback seeking and discussions. Konak et al. (2015) also report a positive correlation between engineering students' teamwork training and their attitudes toward teamwork. Therefore, engagement of students in teamwork related learning

activities may help them develop positive attitudes toward teamwork. This observation is the second hypothesis of the research model.

Hypothesis Two- *Students' engagement in learning teamwork KSAs has a positive impact on their attitudes toward teamwork.*

The main research question in this paper is to study the relationship between self-efficacy of technology-mediated teamwork and students' attitudes toward teamwork. This relationship has not previously been investigated in the literature for face-to-face teams as self-efficacy of technology-mediated teamwork has been mainly defined and studied in the context of distributed teams (Hertel, Konradt, & Voss, 2006; Hardin, Fuller, & Valacich, 2006; Fuller, Hardin, & Davison, 2006; Krumm et al., 2016). As IT projects are increasingly conducted in virtual environments, students' ability and knowledge of using online technologies to conduct team tasks are becoming increasingly important. Research also points out that collective efficacy of team members is closely associated with team resilience (Rodríguez-Sánchez & Vera Perea, 2015), which is important for the success of an IT project that includes a high degree of uncertainty and risks. Team members should know how to cope with failures, be flexible in changing directions, and maintain a positive attitude. Gray (2012) reports that building self-efficacy of teamwork KSAs through informal and formal learning can enhance team member resilience. Gray (2012) also notes that self-efficacy influences the individual performance of team members by improving individuals' satisfaction with the team environment, in particular in the case of low performing teams. Eby and Dobbins (1997) note that higher self-efficacy of teamwork skills is related to an individual's effective orientation toward working with others in a team setting. The findings by Falls et al. (2014) support that learning essential teamwork skills may make a positive change in students' perceptions of teamwork. Based on these earlier research, we postulate the following hypotheses.

Hypothesis Three- *Students' engagement in learning teamwork KSAs enhances their self-efficacy of technology-mediated teamwork KSAs.*

Hypothesis Four- *Self-efficacy of technology-mediated teamwork KSAs improves students' attitudes toward teamwork.*

Combining Hypothesis Three and Hypothesis Four, the main claim in this paper is that students' learning engagements related to teamwork KSAs will increase their self-efficacy of technology-mediated teamwork KSAs and in turn improve their attitudes toward teamwork. In other words, self-efficacy of technology-mediated teamwork facilitates the relationships between students' engagement in learning teamwork KSAs and their attitudes toward teamwork.

Background

An extensive number of papers in the literature discuss expected teamwork KSAs from students in face-to-face and virtual teams. Stevens and Campion (1994) define five major areas of teamwork KSAs: (*i*) Conflict Resolution; (*ii*) Collaborative Problem Solving; (*iii*) Communications, (*iv*) Goal Setting, and (*v*) Performance Management and Planning/Task Coordination. Within each area, several specific KSAs are defined. Schulze and Krumm (2017) organize virtual team KSAs into six major categories: (*i*) Knowledge about functionalities of a medium, (*ii*) Communications, (*iii*) Developing and maintaining interpersonal trust, (*iv*) Intercultural awareness, (*v*) Self-management, and (*vi*) Conflict management. Schulze and

Krumm's (2017) categorization emphasizes KSAs to cope with the challenges of virtual teams. In this section, we only highlight teamwork KSAs that are particularly important to be effective in face-to-face team projects with a high degree of online components. Further, we provide the conceptual definitions of the variables used in the research model of the paper.

Among planning/task coordination KSAs, self-management skills become particularly important in online settings because guidance and control by other team members are reduced in online team tasks. Hertel et al. (2006) argue that individuals need to develop an aptitude for planning and organizing their activities independently without motivation and support from others in virtual teams. Kankanhalli et al. (2006) also suggest that having the aptitude of independence is important for team members if the majority of project tasks are completed in virtual environments. It should be noted that self-efficacy is a precursor of developing an aptitude for independence in virtual teams (Hertel et al., 2005). Hertel, Konradt, and Orlikowski (2004) note that the quality of goal setting processes is an important factor determining the effectiveness of virtual teams. Although face-to-face teams have opportunities to coordinate team tasks in team meetings, IT students frequently rely on web-based tools (e.g., GitLab, Lucidchart, and Slack.com) to manage team projects (Boyd et al., 2017).

As face-to-face team processes are increasingly replaced with virtual ones, team goal setting and performance management increasingly rely on self-regulation, which is individuals' ability to set standards for their own performances, seek and evaluate feedback, and take remedial measures to correct discrepancies in their performance (Driskell et al., 2003). In team projects with a high degree of online components, students need to learn how to give and receive feedback actively on team performance. This feedback allows team members to refocus on project tasks in the case of distractions. In addition, Kankanhalli et al. (2006) note that persistence, which includes aspects of self-motivation, the endurance of goal striving and continuing activities after interruptions, is a critical attribute of team members in virtual teams because they are subject to external distractions more frequently compared to face-to-face teams. Persistence and independence are important attributes of resilience in online teamwork.

Effectively using electronic communication media is a fundamental skill for teamwork. Synchronous (text, video, voice) and asynchronous (email, discussion forums, document management systems) electronic media are frequently used to facilitate communication and coordination among team members in not only virtual but also face-to-face teams. Students should be clear and disciplined about electronic communication to avoid pitfalls such as lack of non-verbal cues, slow development of relationships, delay in information exchanges, lack of social presence (Warkentin et al., 1997). Students should also know various types of online collaboration technologies so that they select the most appropriate one for the project tasks (Havard et al., 2008) and have the competency of using them. Furthermore, students should have self-efficacy for experimenting with online collaboration technologies that tend to change rapidly.

Conflict resolution is one of the challenging KSAs for students to master. Rather than seeking win-win solutions, students tend to avoid conflict in virtual teams (Kankanhalli et al., 2006). Delay in asynchronous communication can cause problems in the development of a mutual team understanding and knowledge (Cramton, 2001). Electronic communications can also exacerbate misunderstandings due to cultural differences among team members (Dubé & Paré, 2001). Therefore, resolving conflict through online communication is more challenging compared to face-to-face communication.

Problems related to the asynchronous electronic communication may result in subpar team problem-solving processes. A slow development of mutual team knowledge through online communication affects teams' ability to formulate the problem precisely and clearly as well as reach consensus. For example, Jacob and Sam (2008) report that discussion forums fail to generate productive arguments in problem-solving without interventions from the instructor. Even high-quality video conferencing technologies may not lead to productive problem-solving sessions compared to face-to-face meetings in the case of complex projects with a high level of task interdependency such as software development (Andres, 2002). Therefore, soliciting input from and giving constructive feedback to team members through electronic communication in an unbiased and clear manner is a critical teamwork skill that students should learn to be an effective problem solver in online environments.

Attitude is an internal state that influences a student's decision on whether to participate in group work or not (Gardner &, 1998). Attitudes toward teamwork can be broadly defined as how apt a student is to work in a team with others (Ulloa & Adams, 2004). If a student has a positive attitude toward teamwork, then the student is expected to participate in a team more willingly. Students' negative attitudes toward teamwork is a frequently discussed topic in the literature. Particularly, many articles aim to discover the underlying reasons for negative attitudes toward teamwork so that appropriate interventions can be applied. Among the factors affecting students' attitude toward teamwork include rewards (Bacon et al., 1999; Pfaff & Huddleston, 2003), team size, workload, cooperation versus competitiveness, peer evaluations (Pfaff & Huddleston, 2003), level of participation (Bacon et al., 1999; Pfaff & Huddleston, 2003) myths about teamwork (Pauli et al., 2008), online settings (Vance et al., 2015), and the level of instructor's involvement (Chapman & Van Auken, 2001). Pfaff and Huddleston (2003) note that expected grade, perceived workload, class time, and absence of free rider play important roles in shaping students attitudes toward teamwork. Beigi and Shirmohammadi (2012) also report a moderate relationship between team evaluation concerns and attitudes toward teamwork in a study involving students from Iran. Konak et al. (2015) report that engineering students' attitudes toward teamwork are negatively correlated with their GPA, which also suggests that students are concerned with their grades being affected by underperforming team members. Ulloa and Adams (2004) report positive relationships between the characteristics of effective teams and students' attitudes toward teamwork. These characteristics included conflict resolution, communication, goal setting, purpose, psychological safety, role clarity, and accountability. Chapman and Van Auken (2001) state that positive attitudes could be nurtured by instructors who are actively involved in teamwork by providing students with timely feedback on their team progress, introducing team management techniques, and monitoring team performance by peer evaluations. Bacon et al. (1999) also identify instructor guidance on team processes as an important factor affecting students' teamwork experiences. According to Rawlings (2014), students' attitudes and perceptions toward online teamwork began in college after their first online team experience. Therefore, it is suggested that for effective online teamwork, instructors should include methods to ensure both team and individual accountability, promote team cohesiveness, and foster frequent communication among team members. Huitt et al. (2015) observe that including team-based learning in anatomy laboratories improve students' overall attitudes toward teamwork.

Bandura's self-efficacy theory (Bandura, 1982, 1991) states that self-confidence determines how successful one will be. Parallel to this definition, collective-efficacy refers to the shared beliefs of the team members in their team's capabilities to achieve the expected outcomes

of the team's tasks (Gibson et al., 2000). In order to assess team forming and responsibility through the self-efficacy theory, the Personal Efficacy Beliefs Scale (PEBS) can be used. The PEBS assesses each team member's comfort and motivation to achieve the team's expected tasks (McClough & Rogelberg, 2003; Riggs et al., 1994). Huh et al. (2014) report three approaches to measuring collective efficacy. One approach is to collect self-evaluations regarding a particular set of group tasks, which enables an effective method for both individual and teamwork self-efficacy. Another approach is to evaluate individual perceptions of the whole group's capabilities. The third approach involves reaching a consensus through a comprehensive discussion among group members communicating about the overall team efficacy. The Collective Efficacy Beliefs Scale uses a seven-point Likert scale (Huh et al., 2014) through various questions and statements regarding the group's ability to work together (Riggs et al., 1994). Overall, the recent research supports that collective-efficacy has a positive impact on team performance (Gibson et al., 2000; Huh et al., 2014; Katz-Navon & Erez, 2005; Tasa et al., 2007).

In this paper, the focus is on self-efficacy of technology-mediated teamwork KSAs which can be defined as a team member's confidence in performing the tasks related to team processes (McClough & Rogelberg, 2003). In this respect, teamwork self-efficacy is independent of the efficacy related to the tasks that the team undertakes. To study the role of self-efficacy in team processes, Tasa et al. (2007) use a research model in which self-efficacy of teamwork KSAs mediates collective-efficacy, which in turn determines the team performance. A longitudinal study based on this multi-level model supports that self-efficacy of teamwork KSA plays a significant role in the formation of collective-efficacy, and both self-efficacy and collective-efficacy are instrumental for effective team performance. Gully et al. (2002) also report that team-efficacy and potency are positively related to team performance. Lent et al. (2006) surveyed two groups of engineering college students during a team project and asked them to evaluate the overall group's confidence in performing tasks. The results of their survey indicated that self-efficacy and team cohesion were strong predictors of collective-efficacy. Eby and Dobbins (1997) provide an eight-item scale to measure teamwork self-efficacy and report that teamwork self-efficacy leads higher collectivism orientation in individuals. In the literature, self-efficacy of technology-mediated teamwork KSAs has mainly been discussed in the context of virtual teams (Hertel et al., 2005). Staples et al. (1998) report that self-efficacy of remote work skills is correlated with overall productivity and satisfaction of team members in virtual teams. In Staples et al.'s (1998) study, participants with high self-efficacy tend to have training in remote work and good information. Fuller, Hardin, and Davison (2006) define virtual team efficacy as a virtual team's belief in its ability to work together successfully in a noncollocated, technology-mediated environment. The authors measure virtual team efficacy in two dimensions: Computer Collective Efficacy and Group Potency. The empirical findings of Fuller, Hardin, and Davison (2006) support that virtual team efficacy is predictive of team outcomes in distributed teams. Wang and Haggerty (2011) define virtual self-efficacy as one's belief in his/her competence to work in virtual settings and measure virtual self-efficacy in two dimensions: computer self-efficacy and remote work self-efficacy. Their findings show that an individual's remote work self-efficacy is correlated with his/her virtual competence and affects work outcomes positively in virtual settings.

Although developing positive attitudes toward teamwork is an important objective of teamwork work training programs, the relationship between teamwork self-efficacy and attitudes toward teamwork has not been studied in the literature. Chen, Donahue, and Klimoski (2004) study the effect of teamwork training on teamwork KSA, teamwork self-efficacy, and attitudes

toward teamwork. They report a low but positive correlation between teamwork self-efficacy and attitudes toward teamwork. However, they do not directly investigate the relationship between these two variables. Interestingly, Chen, Donahue, and Klimoski (2004) report that while teamwork training was able to improve students' teamwork knowledge and skills in their study, they observed little improvement in attitudes toward teamwork after the training.

While the benefits of teamwork have been widely discussed in the literature, only a limited number of papers investigate how students perceive the value of teamwork. First of all, teamwork allows students to experience complex and large-scale projects which cannot be completed individually. Students may consider the value of teamwork in four main dimensions (Walker, 2001): (*i*) learning how real-life teams' function, (*ii*) learning how to run teams effectively, (*iii*) developing and practicing interpersonal skills, and (*iv*) creating collaborative learning opportunities. Chapman and Van Auken (2001) study the effect of students' perceived benefits of teamwork on their attitudes toward teamwork. In their study, Chapman and Van Auken (2001) measure the perceived benefits of teamwork using several items indicating how teamwork prepare students for real-life projects. Bailey et al. (2015) investigate the factors promoting the benefits of teamwork to students and report instructor contribution as a significant factor. Shankar and Seow (2010) note that students' perceived usefulness of teamwork depends on their personality. Students with lone-wolf tendencies generally perceive fewer benefits from teamwork. Nonetheless, the literature agrees that the perceived value of teamwork is an important factor influencing students' future engagement with teamwork.

Method

Participants

Participants in this study were undergraduate students from Information Sciences and Technology programs at several campuses of a public university in the northeast United States. Although the participants were geographically distributed, they were all enrolled in face-to-face programs that follow the same curriculum. In addition, the program courses require a significant amount of teamwork at all academic levels. After data cleaning, n=344 responses were used in this study. The distributions of the responses across various demographic metrics are as follows: Female (n= 86), Male (n= 257), First Year (n=80), Second Year (n=65), Third Year (n=85), and Fourth Year (n=114).

Procedures

Participants were recruited via email. An anonymous URL link to the online survey was emailed to the target population. The participation in the survey was voluntary, and no incentives were provided for participation. We collected limited background information about participants per the IRB requirements. The survey intended to measure students' overall attitudes toward teamwork during their education, without being specific to a course or a single project.

Measures

The measures of the study included four latent variables: overall attitudes toward teamwork (Attitude), self-efficacy of technology-mediated teamwork (TMT Self-Efficacy), Perceived Value

of Teamwork (Perceived Value), and Learning Engagement related to Teamwork KSAs (Learning Engagement). In the following discussion, these latent variables are referred to as Attitude, TMT Self-Efficacy, Perceived Value, and Learning Engagement for the presentation brevity. The survey items associated with each latent variable are given in Appendix. The average scores of the items related to each latent variable were used to measure the variable.

The TMT Self-Efficacy latent variable intends to measure how confident a student is in his/her capabilities to accomplish team forming, team management, and team coordination tasks via online communications and technologies. We developed items for TMT Self-Efficacy based on the learning outcomes areas defined in (Alexander, 2006; London, 2013; Lurey & Raisinghani, 2001). The items related to this latent variable were operationalized with a four-point Likert scale as (1)-Very Unconfident, (2)- Unconfident, (3)-Confident, and (4)-Very Confident.

The Learning Engagement latent variable measures how frequently students engage in learning activities related to teamwork KSAs. The survey items related to this latent variable were operationalized using four-level rating scales as (1)-None, (1)-Once, (3)-A few times (2-3), and (4)-Several times or more (>4). As given in Appendix, the items to measure Learning Engagement are action-oriented such as reading a book about teamwork or attending a speaker event. Students who performed such activities frequently are expected to have a higher level of teamwork KSAs.

As previously discussed, Attitude toward teamwork is defined as how agreeable a student is to work in a team. Based on this conceptual definition, the Attitude latent variable measures students' preference of working in team settings using three items operationalized by four-point Likert scales as (1)-Strongly Disagree, (2)-Disagree, (3)-Agree, and (4)-Strongly Agree.

Perceived Value is defined as the degree to which a student believes that teamwork usually enhances the outcomes of a project and helps them grow professionally. The Perceived Value latent variable was also measured by five items operationalized by four-point Likert scales as (1)-Strongly Disagree, (2)-Disagree, (3)-Agree, and (4)-Strongly Agree. We adapted teamwork attitude questions from (Beigi & Shirmohammadi, 2012; Pauli et al., 2008; Payne & Monk-Turner, 2006; Pfaff & Huddleston, 2003).

Validation of the Measurement Model

Before testing the path models to study the formulated hypotheses, we used a confirmatory factor analysis to evaluate internal consistency, convergence validity, and discriminant validity of the latent variables of the measurement model. The measurement model had CMIN/DF=1.87 (<2.5), CFI=0.954 (>0.90), TLI=0.95 (>0.95), and RMSEA=0.05 (<0.05), supporting a good model fit to the data for the measurement model. Table 1 summarizes Cronbach's Alpha (α), Composite Reliability (*CR*), and Average Variance Extracted (*AVE*) of the latent variables. In the measurement model, all standardized factor loadings of the survey items exceeded 0.50 and were significant ($p < 0.001$). The individual factor loadings and p values are not provided in the paper for the brevity of the presentation. In addition, all CR and α values were greater than 0.70, indicating an acceptable level of internal reliability of the latent variables. The Cronbach's Alpha value of the Attitude latent variable is slightly higher than the commonly accepted threshold of 0.70 (Nunnally, 1978) while it has a high CR value. The main reason for the discrepancy is that the Cronbach's Alpha measure assumes that standardized regression coefficients (factor loadings) are identical for all items. In the case of the Attitude latent variable, the factor loading of one of the three items was lower than the other two items as given in Appendix. Therefore, the

Cronbach's Alpha value of this variable was lower. In such cases, CR provides a better a measure of internal reliability (Peterson & Kim, 2013). The AVE values of the latent variables were very close to or larger than 0.50, indicating their convergent validity. However, the AVE value of Learning Engagement was lower than 0.50. Because of the fact that the AVE of Engagement was close to 0.50, the low correlations between Learning Engagement and other variables and a strong CR value, the convergent validity of Learning Engagement was considered as acceptable.

Table 1. Summary of the metrics for the internal reliability and convergent validity of the measurement model

Latent Variable	**α**	**AVE**	**CR**
Attitude	0.73	0.52	0.95
Learning Engagement	0.83	0.46	0.84
TMT Self-Efficacy	0.88	0.60	0.88
Value	0.91	0.60	0.88

We used heterotrait-monotrait ratio (HTMT) of the correlations to provide evidence of discriminant validity for the latent variables. The HTMT ratio is the average of the heterotrait-heteromethod correlations (i.e., the correlations of indicators across constructs measuring different phenomena), relative to the average of the monotrait-heteromethod correlations (i.e., the correlations of indicators within the same construct). Henseler et al. (2015) suggest that discriminant validity is supported between the two latent variables if the HTMT ratio between them is less than 0.85. Based on this criterion, discriminant validity was established for all latent variables of the measurement model as shown in Table 2.

Table 2. The heterotrait-monotrait ratio of correlations (HTMT) to assess discriminant validity (baseline value: HTMT < 0.85)

	Learning Engagement	TMT Self-Efficacy	Value
Attitude	0.33	0.22	0.83
Engagement		0.13	0.31
TMT Self-Efficacy			0.14

Validation of the Path Models

After establishing the psychometric validity of the latent variables based on the measurement model, we evaluated the validity of the structural pattern models underlying the research hypotheses. The first hypothesized structured equation model (SEM) states that Learning Engagement and Perceived Value has a direct causal effect on Teamwork Attitude (i.e., Hypothesis One and Hypothesis Two). This model is referred to as the Direct SEM. The second hypothesized SEM states that the effect of Learning Engagement on Attitude is mediated through TMT Self-Efficacy. As stated before, our main hypotheses are that the more students are engaged in learning activities related to teamwork skills, the higher self-efficacy of technology-mediated teamwork

they will have (Hypothesis Three), and self-efficacy of technology-mediated teamwork leads to positive attitudes toward teamwork (Hypothesis Four). This model is referred to as the Mediated SEM. As seen in Table 3, the goodness of fit for both direct SEM and mediated SEM was found to be acceptable.

Table 3. Goodness-of-fit statistics of the research models

	CMIN/DF	CFI	TLI	RMSEA
Measurement Model	1.87	0.95	0.95	0.050
Direct SEM	1.68	0.97	0.96	0.045
Mediated SEM	1.87	0.95	0.94	0.051
Baseline Values	< 2.5	> 0.9	> 0 .95	< 0.05

Discussions

Figure 1 illustrates the standardized regression coefficients and *p* values of the direct SEM and mediated SEM, respectively. Hypothesis One was strongly supported by both models, i.e., students' perceived value of teamwork had a significant positive effect on their attitudes toward teamwork. Even after including TMT Self-Efficacy in the direct SEM, the strength of the path from Perceived Value to Attitude remained virtually unchanged in the mediated SEM. This result indicates that students should appreciate the value of teamwork in order to develop positive attitudes toward the teamwork. Although this result is expected at some level, it has several practical implications. Firstly, teamwork should be used for tasks that are worthy of a team effort. Managing a team is itself a time-consuming process. Students need to schedule meeting times, meet as a team, collaborate on ideas, share the work, and coordinate tasks. Teamwork can unnecessarily complicate the tasks that are simple enough that can be performed by individuals. As students are regularly involved in teamwork in multiple classes, they may feel overwhelmed by the demand of managing teamwork and develop a negative attitude toward teamwork (James et al., 2002). Therefore, instructors should be aware of the negative effects of overusing teamwork. As indicated by Bailey et al. (2015), active involvement of instructors in team processes can also help students better understand the value of teamwork.

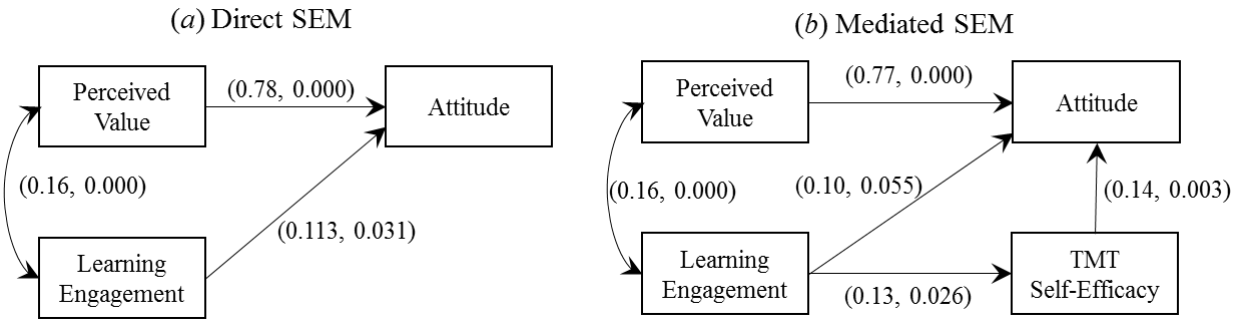

Figure 1. The standardized regression coefficients and *p* values of (*a*) direct SEM and (*b*) mediated SEM (standardized regression coefficient, *p*-value)

It is seen that Hypothesis Two was supported by the direct SEM ($p < 0.05$) but not by the mediated SEM ($p>0.05$). Both Hypothesis Three and Hypothesis Four were supported by the mediated SEM. The indirect path (Engagement →TMT Self-Efficacy→Attitude) had significant positive relationships. In addition, the direct path (Learning Engagement →Attitude) became insignificant when TMT Self-Efficacy was added to the model. These findings supported that the main research hypothesis of the paper, i.e., the TMT Self-Efficacy mediates the relationships between Learning Engagement and Attitude. This particular research finding has implications for the design of the programs to increase students' teamwork KSAs through formal and informal learning. First of all, formal learning in teamwork KSAs should emphasize building self-efficacy. The findings suggest that the impact of learning activities to develop and improve teamwork KSAs is realized more effectively if the activities lead students to build their self-efficacy. According to Bandura (2000), training employees in how to manage failure through informative processes is important for building self-efficacy. Bandura (2000) argues that if people are faced with only easy challenges, they tend to expect quick results and are easily discouraged by failures. In teamwork training programs, participants should experience overcoming challenges through perseverant effort in order to build resilient self-efficacy. The recommendations by Bandura (2000) certainly are applicable to educate students in teamwork KSAs as well. In addition, our findings support the role of informal learning in developing students' self-efficacy of technology-mediated teamwork KSAs. Our results suggest that students who engage in informal learning activities are often likely to have higher self-efficacy of technology-mediated teamwork KSAs.

The results showed that there was a positive relationship between students' self-efficacy of technology-mediated teamwork KSAs and their attitudes toward teamwork. This result suggests that technology-mediated teamwork KSAs should be incorporated into existing face-to-face curriculum to instill positive attitudes toward teamwork in students. IT students are likely to work in virtual teams when they join the workforce. Incorporating virtual teamwork in existing face-to-face classes can prepare students for the demands of jobs in our global economy (Falls et al., 2014; Brewer et al., 2015). Based on our findings, we suggest that face-to-face students can observe the benefits of developing self-efficacy of technology-mediated teamwork KSAs not only in their future careers but also in their current team projects. Foremost, our results show that there is a relationship between self-efficacy of technology-mediated teamwork and attitudes toward teamwork. Having positive attitudes toward teamwork can improve team processes and outcomes, increasing students overall learning experience in team projects. When students have positive experiences in team projects, they tend to transfer their learning into practice more effectively. Furthermore, positive team experiences can lead to more collaborative learning opportunities for students. Instructors can help students to nurture positive attitudes toward teamwork through appropriate teamwork training and practice (Hamer & O'Keefe, 2013; Rawlings, 2014). In particular, the involvement of instructors in early steps of establishing team leadership and roles as well as reducing free riders is important for developing positive attitudes toward teamwork (Rudawska, 2017). Our results also suggest that teamwork training for face-to-face students should also incorporate virtual team KSAs. In particular, knowledge about functionalities of web collaboration technologies, such as when to use a specific collaboration technology and their pros/cons (Schulze & Krumm, 2017), is quite important for face-to-face students as well.

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Conclusion & Limitations

It is evident from the mediated SEM that self-efficacy of technology-mediated teamwork KSAs is a factor in developing positive attitudes toward teamwork. While the importance of teamwork KSAs such as goal setting, team forming, performance evaluation, team coordination, communications, conflict resolution, and problem-solving have been widely discussed in the literature, the research in this paper draws attention to the self-efficacy of performing these KSAs in online settings for face-to-face students. As the project management processes increasingly take place in online environments for even traditional face-to-face teams, the strong relationship observed between TMT Self-Efficacy and Attitude reaffirms the need for increasing students' online teamwork KSAs.

In this research, we focused on the self-efficacy of technology-mediated teamwork KSAs. This is one of the limitations of the research. To expand the findings of the paper, a broader set of teamwork KSAs can be considered as further research. Studying other teamwork KSAs will also substantiate the main finding of the paper. In addition, the target population includes only information sciences and technology students. The validity of the research model should be tested in other fields in order to generalize the findings.

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Appendix

Attitudes

- I would rather work on team projects than on my own
- I like to participate in teamwork
- I am usually motivated to participate in teamwork

Value

- Teamwork improves the quality of the final project outcomes
- Teamwork keeps me more engaged and interested in project tasks
- Teamwork helps me learn new concepts from others
- Teamwork makes it possible to complete class projects in a timely manner
- Teamwork helps me to improve my communication skills

Technology-Mediated Teamwork Self-Efficacy

- Communicating effectively with other team members using the available online technologies
- Communicating effectively online with your team members without observing their social cues and body language
- Resolving conflict through online communication
- Developing team goals using the online technologies
- Encouraging team participation using the offered online communication technologies
- Providing, seeking, and accepting feedback well through communicating with the online technologies
- Participating in an online team discussion, such as discussion boards and online forums

Learning Engagement

- Read a book about teamwork
- Read an online article about teamwork
- Attended a speaker event about teamwork
- Performed a web search to learn about effective teamwork
- Watched a documentary or training video about teamwork