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The effects of teamwork on individual learning and perceptions of team performance

A comparison of face-to-face and online project settings

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Abstract

Purpose – In light of contradictory research findings, the purpose of this paper is to examine the moderating effects of team setting (face-to-face or online) on the relationship that team member affect and interaction processes have on individual team source learning, and at the team level on the relationship between group cohesiveness and perceived team performance.

Design/methodology/approach – Students enrolled in graduate level organizational behavior classes at a large university in the southeastern United States responded to the survey. The final sample included 79 students in 21 on-campus teams and 97 students in 26 online teams. All classes surveyed required a detailed team project. Tests of the moderator hypotheses were conducted using hierarchical linear multiple regression.

Findings – Team setting moderated the relationship that member teamwork orientation and member social interaction had on individual team-source learning; the relationships were stronger in online teams.

Practical implications – The results have implications for teams in a variety of settings since the team composition and nature of the work conducted by student teams are similar to that in Western organizational contexts. To avoid possible conflicts that impede learning and performance in online teams, administrators should ensure that team members are chosen carefully and give members a strong reason for being on the team.

Originality/value – This paper extends the model examined by Williams *et al.* to include member social interaction and consider the context in which teamwork occurs and its effects on personal learning and team performance.

Keywords Team working, Individual development, Team performance, Online operations, United States of America

Paper type Research paper



Increasingly, Westerns organizations are implementing work teams (Devine *et al.*, 1999). A team is defined by its unity of purpose, identity as a social structure, and members' shared responsibility for outcomes (Powell *et al.*, 2004). Members of a team have clearly defined membership, represent an intact social system (Hackman, 1987), and have highly interdependent functioning and performance (Wageman, 1995). Teams are considered an

important ingredient for organizational success since they allow for rapid information exchange and increased responsiveness (Cohen and Bailey, 1997).

Paralleling Western organizations, the use of teams has also increased in management education (Baldwin *et al.*, 1997). Research reports establish that collaborative team interactions increase learning (Alavi *et al.*, 1997). Interactions involve interpersonal processes surrounding social support among members, sharing of work, and cooperation (Campion *et al.*, 1996). The skills gained through interaction on a team in the educational setting can be useful in the organizational context and for this reason organizations have recommended that instructional methods use student groups to develop cognitive, communication, and interpersonal skills (Colbeck *et al.*, 2000).

Increasingly, traditional institutions are implementing education programs online via the internet (Alavi and Leidner, 2001). One of the issues with these online education programs is that teams in online education are generally virtual teams. Powell *et al.* (2004, p. 7) define a virtual team as a group "... of geographically, organizationally, and/or time dispersed workers brought together by information and telecommunication technologies to accomplish one or more organizational tasks ... assembled on an as needed basis". While "virtualness" may be a potential characteristic of all teams (Griffeth *et al.*, 2003), what distinguishes virtual teams from face-to-face teams in this research is that they rely on technology-mediated communication while crossing several boundaries (Lipnack and Stamps, 1997). They often rely on asynchronous communication media (e.g. e-mail, file exchange) that limit real time interactions (Bell and Kozlowski, 2002). As long as the majority of interactions occur over electronic media, the team can be classified as virtual (Davidow and Malone, 1992; Kristof *et al.*, 1995). Thus, teams in online distance education can be classified as "virtual" for the purposes of the current research.

While there is a research looking at what factors contribute to the success of online courses (Arbaugh, 2005), there are conflicting perspectives on online teams. Some researchers argue that computer-mediated communication cannot provide the socio-emotional depth present in face-to-face communication (Cramton, 2001) and others arguing that computer-mediated communication does not differ in its ability to exchange information but requires more effort (Sole and Edmondson, 2002). Wartekin *et al.* (1997) and McDonough *et al.* (2001) found that teams using computer mediated communication systems did not typically outperform traditional face-to-face teams, and that members reported similar levels of communication effectiveness. In light of possible contradictions that exist when teams operate in different environments, this research examines the moderating effect of team setting (face-to-face or online) on the relationship between teamwork and outcomes. The current research responds to Martins *et al.* (2004) call for more research on the role of cohesiveness and other factors important in overcoming the difficulties inherent in virtual interaction.

A study by Williams *et al.* (2006) on computer-supported collaborative learning, examined the use of teams in online education to determine the extent to which the individual value placed on teamwork and perceptions of interpersonal ties affect student learning. Williams *et al.* (2006) reported that both teamwork orientation (representing individual values supporting teamwork and identified as the propensity for accomplishing work as part of a team as opposed to individually: Driskell and Salas, 1992) and group cohesiveness (identified as shared commitment, attraction to and pride in the team; Beal *et al.*, 2003) predicted student learning in online teams, with

group cohesiveness mediating the relationship between teamwork orientation and student learning. They also found that teamwork orientation and group cohesiveness appeared to be equally important predictors of team-source learning. Team-source learning is defined as the acquisition of skills from interacting with others in a team that contributes to an individual's effectiveness (Lankau, 1996; Williams *et al.*, 2009).

In particular, our research extends Williams *et al.*'s (2006) as we examine individual level values (i.e. teamwork orientation), interaction processes (team member social interaction), and group processes (group cohesiveness) in face-to-face and online teams. We consider the level of analysis at which our concepts operate in our research as we examine how different contexts (team setting) shape the way that individual values and interaction processes influence individual team-source learning (individual learning that occurs as a result of team interaction and interdependence). At the team level we use an aggregated measure of individual perceptions of group cohesiveness to examine how team setting shapes the way that group cohesiveness influences self-rated team performance.

While research that examines degrees of virtualness recognizes that many teams have some face-to-face contact to supplement virtual interactions (Martins *et al.*, 2004), we examine teams that use either solely online interactions or mainly face-to-face interactions supplemented by e-mail. Project teams are examined in the current research and represent a common approach to employing teams in Western educational and organizational settings (Druskat and Kayes, 2000). Project teams are time-limited, produce one-time outputs, and require the application of knowledge, judgment, and expertise, with members drawn from different areas (Cohen and Bailey, 1997) and who may have membership on multiple teams (Mathieu *et al.*, 2008).

Background

Research on face-to-face teams has a long history, having been studied for many years. Some early research on groups established that physical proximity enhances information processing and is associated with internal cooperation which, in turn, is related to team effectiveness – member satisfaction, cooperation, and team performance (Pinto *et al.*, 1993). This implies that face-to-face teams are more effective. However, relatively little research has actually compared face-to-face teams with online virtual teams. Mathieu *et al.* (2008, p. 446) in their review of the literature on teams concluded that while over 60 percent of workers may be involved in virtual teams it is ... “still an area that is not all that well understood”. In the online setting, research is needed to understand the social processes that impact interaction within virtual teams and how this might affect learning (Montoya-Weiss *et al.*, 2001). There is some research comparing face-to-face and online teams that focuses on differences in the levels of teamwork and information exchange with higher levels of satisfaction reported for face-to-face teams (Warkentin *et al.*, 1997).

There is also research that focuses solely on online teams. Montoya-Weiss *et al.* (2001) found that increased participation in virtual online teams (whether competitive or collaborative) has a positive effect on team performance (attaining team goals or meeting the standards set for the team: Beal *et al.*, 2003). Similarly, Arbaugh (2005) found that the perceived level of interaction was positively associated with learning in online courses. Given that the process of interacting differs by setting, the level of interaction experienced might also differ and thus, need to be enhanced in virtual teams wherever possible.

Knoll and Jarvenpaa (1998) suggest that there are three key areas that should be attended to in order to encourage behaviors that might enhance a virtual team's effectiveness. These include: virtual collaborative skills (exchanging ideas without criticism, creating work documents that summarize members' ideas, agreeing on activities, and meeting deadlines), virtual socialization skills (communicating immediately, soliciting feedback, expressing appreciation, and acknowledging role assignments), and virtual communication skills (using e-mail to communicate emotion, timely responses, and rephrasing unclear sentences so that all team members understand the message). While many aspects of virtual teams may mirror face-to-face teams, the dynamics that give rise to synergy may be limited with longer times being necessary to complete work in virtual teams and higher performance occurring in face-to-face interaction (Andres, 2002). Hagen (1999), however, suggests that people who are introverted in face-to-face contexts may thrive in the virtual team setting. They may more freely share ideas and information via e-mail or message boards. Virtual teams may provide a means for providing social support even if the levels of support are lower than might occur with face-to-face contact.

Current research suggests that performance may be higher in face-to-face teams (Andres, 2002) with the characteristics of virtuality posing challenges that hinder innovation (Gibson and Gibbs, 2006). A review of the literature on virtual teams by Powell *et al.* (2004) suggests that while virtual teams provide incredible flexibility and responsiveness they cannot be implemented blindly since there are inherent barriers to trust and relationship building, cohesiveness, and predictable communication. Thus, some authors have concluded that periodic face-to-face meetings are necessary to successful team development (Saunders, 2000). While research on group support systems (Nunamaker *et al.*, 1997) and electronic meeting system theory (Rains, 2005) show that these tools are important for increasing participation to support information sharing and can democratize teamwork, the group support system research indicates that participation in idea generation increases with anonymity and often requires a skilled facilitator. The reduction of physiological arousal in a group support system (GSS) meeting may reduce its effectiveness (Reinig *et al.*, 1995). Rains (2005, p. 100) reported that while anonymity is a cornerstone of GSS and electronic meeting systems, the anonymity provided may "...undermine source credibility and influence". We therefore expect that teams that are not colocated (face-to-face) take longer to establish interpersonal relationships and have more difficulty resolving interpersonal disputes (Gibson and Gibbs, 2006) – this dissipated social interaction may weaken personal learning and affect bonding within the team required for team performance.

Member teamwork orientation

Teamwork orientation is defined as the degree to which members have a positive attitude toward working in a team (Mathieu *et al.*, 2008). Teamwork orientation can also be thought of as the extent to which members are willing to engage in social interaction and cooperativeness, often expected in completing interdependent tasks (Lankau, 1996). Teamwork orientation reflects the level of team stability (interest in maintaining membership on a team: Mathieu *et al.*, 2008) and commitment to working with others, as well as commitment to team goals and interpersonal relations (Watson *et al.*, 1998). Team members' orientation toward teamwork allows researchers to determine the potential for cooperativeness and success in working with others

(Hough, 1992). Team members with an orientation toward teamwork may be more likely to support learning and this may be especially important for the success of virtual teams. Members who have a high teamwork orientation can create an environment that promotes individual team-source learning since they are willing to share information and work toward group goals.

Individuals who believe that being part of a team is important and essential to success are less likely to withhold effort or give less than full effort (Kidwell and Bennett, 1993) and are more likely to collaborate in project work. Mixed motives or competing demands are less likely to result in withholding of effort when the dominant motivation is to assure the welfare of team members (Brickson, 2000). In virtual team settings where increased effort is often needed a positive attitude toward teamwork may be an antecedent to learning. This disposition provides a social cue that encourages cooperation among team members and might build interpersonal relationships in co-located teams.

Watson *et al.* (1998) contrasted team oriented behaviors (i.e. the individual recognizing the importance and unique nature of their contribution and managing their interdependence) with self-oriented behaviors. Team oriented behavior results from an appreciation of interdependence and an attitude or propensity to act to improve group functioning (Bell, 2007). The degree to which members value playing a role on the team and act in ways to build team processes is reflected in teamwork orientation and where high levels of cooperation are present, individuals learn more - learning is considered to be comprised of systematic information processing (De Dreu, 2007). Personal learning was defined by Kram (1996, p. 140) as knowledge acquisition, skills, or competencies that contribute to individual development and also noted that it raises a deeper understanding of oneself "... as increasingly connected to others". Because such a deep understanding is facilitated by social cues evident in face-to-face interaction, where individuals value teamwork the relationship between individual teamwork orientation and personal learning should be stronger in face-to-face teams:

- H1.* Team setting will moderate the relationship between member teamwork orientation and individual team-source learning such that there will be a stronger positive relationship between member teamwork orientation and individual team-source learning for members of face-to-face teams (than members of online teams).

Team member social interaction

Team processes refer to how teams achieve outcomes (Weingart, 1997). Team member social interaction builds a positive team climate since it improves problem solving skills and interpersonal relations on the team (Campion *et al.*, 1993). That is, both action processes and interpersonal processes (Marks *et al.*, 2001) are affected by the level of member social interaction. Ultimately, the more interdependent team members are with each other the more they should be able to realize outcomes related to teamwork as they build team efficacy (Gully *et al.*, 2002). Interdependence is enhanced in face-to-face settings more so than virtual settings where more separation is present between individuals in the team (Shapiro *et al.*, 2002). This separation can manifest itself in lower team identification or "deindividuation" (less affective bonding) because interactions are depersonalized (Kramer, 1993).

Research supports a positive relationship between team member social interaction and team effort. Kirkman *et al.* (2004) acknowledged that the frequency of face-to-face meetings is a key process factor which affects features of task accomplishment that are fundamental to teamwork. Campion *et al.* (1993) demonstrated that member social interaction was related to effectiveness. Research has also reported that social support among team members, sharing of the workload, and high levels of cooperation and communication improve team effectiveness (Albanese and Van Fleet, 1985; Guzzo and Shea, 1992; Pearce and Ravlin, 1987). Pinto *et al.* (1993) noted that physical proximity allows for frequent interactions required to produce interpersonal attraction and conditions needed to promote high levels of task performance. Propinquity has been identified as a means for emphasizing social norms and in creating supportive relationships and an improved flow of communication (Keller, 1986).

In virtual teams, interaction may be less frequent and asynchronous with no physical contact. Interestingly, errors associated with hampered communication were often attributed to individual characteristics such as work ethic (Cramton and Orvis, 2003) while Gibson and Cohen (2003) reported that teams with limited face-to-face meetings are more vulnerable to process losses. Virtual communication may be no more task-oriented and no less intimate than face-to-face communication, yet perceptions of quality of interaction may differ (Mortenson and Hinds, 2001), negatively affecting individual team-source learning. Additionally, in the virtual realm behavior may be less inhibited (Siegel *et al.*, 1986) and thus negative actions are more likely to lead to conflict which can inhibit learning. This is critical in short-term teams such as project teams since in this short-term environment there may not be enough time to benefit from improved processes that can result from conflict resolution. Being present in a face-to-face setting increases the potential for conflict resolution (Bierly *et al.*, 2009). Thus, in face-to-face teams the effect of member social interaction on individual team-source learning should be stronger than in virtual teams:

- H2. Team setting will moderate the relationship between perceptions of member social interaction and individual team-source learning such that there will be a stronger positive relationship between member social interaction and individual team-source learning for members of face-to-face teams (than members of online teams).

Group cohesiveness: building team unity

Group cohesiveness is important for team development (Watson *et al.*, 1991) and refers to the extent to which members of a group are attracted to other members and its task, and are motivated to remain part of the group (Kozlowski and Bell, 2003). Stable team member composition is conducive to the establishment of strong interpersonal relationships. Research by Nandhakumar and Baskerville (2006) found that virtual teams are effective for short-term projects even with no face-to-face interaction but for longer term projects the teams could not build personal relationships without face-to-face interactions. Cohesiveness and performance have a long established relationship (Beal *et al.*, 2003; Gully *et al.*, 1995). Cohesiveness reflects an interpersonal process (Marks *et al.*, 2001) and while cohesiveness tends to be higher in face-to-face teams (Warkentin *et al.*, 1997) in virtual teams cohesiveness has been related to higher satisfaction (Chidabaram, 1996). Studies of the cohesiveness-performance relationship have reported stronger effects when studied at the team level (than individual level).

Since cohesiveness requires members to feel bonded and reflects shared perceptions of trust, cooperation and unity it reflects the atmosphere within the team.

In virtual teams there is a lack of social and contextual cues that normally aid face-to-face interactions. This is likely to influence the effect of social communication on group demands in virtual teams. Druskat and Kayes (2000) reported that team performance was determined by interpersonal understanding. Druskat (1996, p. 332) defined interpersonal understanding as "... an accurate understanding of the spoken and unspoken preferences, concerns, and strengths of other members". This is built through frequent and prolonged interactions. In addition to understanding, the provision of task-related feedback has been indentified as important for team performance in project teams (Druskat and Wolff, 1999). Positive effects result from the reinforcement of desired member actions which increases the ability to work well together. Thus, the relationship between group cohesiveness and perceived team performance should be stronger in face-to-face teams where the frequency and intensity of interaction results in greater interpersonal understanding.

Earlier research has examined group size, group reality, level of analysis, and interdependence (among others) as moderators of the cohesion-performance relationship (Beal *et al.*, 2003). We propose team setting as a moderator and expect that performance reports of team members should be higher in face-to-face teams with a greater understanding of member needs, task requirements, and performance objectives occurring as members give and receive feedback in real time with greater information cues and build intimacy (Valacich and Sarker, 2002). The development of shared mental models (SMMs) occurs as understanding of each other and task demands allow for the coordination of behaviors to align with other team members thinking and behaviors (Salas and Fiore, 2004). These SMMs allow for effective teamwork, interpreting cues and the development of unity required for teamwork. Supporting the development of understanding in real time physical settings, McDonough *et al.* (2001) found that information processing and project management were more effective in a real time setting with co-located teams. Given the observation by Gibson and Cohen (2003) that fewer face-to-face meetings in a team increases the risk for performance problems we propose the following hypothesis:

- H3.* Team setting will moderate the relationship between group cohesiveness and perceived team performance such that that there will be a stronger positive relationship between group cohesiveness and perceived team performance in face-to-face teams (than online teams).

Method

Sample

Students enrolled in graduate level organizational behavior classes at a large university in the southeastern United States responded to the survey. The total sample size was 176, and 63 percent were male. The average age was 30 years old and 95 percent were currently employed. The sample was 65 percent Caucasian, 12 percent Hispanic, 8 percent Asian, 7 percent African American, and 6 percent "other". Teams ranged in size from three to six members, with an average of 4.3 members. The final sample included 79 students in 21 on-campus teams and 97 students in 26 online teams. All classes surveyed required a team project that entailed using course information to evaluate and discuss organizationally-relevant issues. The university offers AACSB

accredited MBA programs. The classes surveyed were four on-campus and four online Organizational Behavior MBA classes, and the surveys were collected over four consecutive semesters. On-campus classes completed a paper and pencil survey while online classes completed a survey that was e-mailed to students and returned via an anonymous e-mail. Surveys were administered after students had been in teams for at least ten weeks, following the completion of team projects. The response rate was approximately 96 percent.

Team projects were extensive case analysis and verbal presentations of the analysis and recommended solution for real world type organizational problems that involved the management of subordinates. The project included critical thinking, rational analysis, and creativity. Teams were expected to conduct outside research, analyze costs and benefits of available approaches, and make recommendations for improvement. Groups were advised to relate course content and readings to connect theory with the project topic. In addition, in working together they were advised to control personal evaluations of each other and use intellect to try to understand what is being shared and why, attempt to build consensus on a conclusion which reflects the best thinking of the group as a whole and not just an individual's view, practice active listening skills and if more information is needed to understand what someone is saying, to ask for it, and share what is learned with others to help everyone to learn more. We believe that the experiential approach of the class provided a realistic lens for approaching the team project, allowing our results to have implications for the use of teams in organizations.

Online classes were delivered using E-education course software. The main student features of the web platform included:

- home page;
- e-mail;
- document sharing/file exchange;
- announcements;
- threaded discussion;
- exam;
- chat;
- dropbox;
- profiles;
- audio/video web streaming;
- help; and
- feedback.

More details on this type of education delivery system are discussed in Arbaugh and Duray (2002, p. 336).

Measures

All of the scales we used in the study employed their original response scales (i.e. each had the response scale used by the scale's developers). Without exception, we used the original scale without modifications in an attempt to maintain construct validity.

Member teamwork orientation. Teamwork orientation was measured using the scale developed by Scandura (1995). The items employed in the measure describe team members' affect toward participating in teams to attain work goals. A five-point scale ranging from "Strongly disagree" to "Strongly agree" was employed. A sample item from this scale is: "I feel positive about working in teams in this program". Previous research that has employed the Scandura (1995) measure has demonstrated adequate psychometric properties (Lankau, 1996; Williams *et al.*, 2006). The reliability coefficient was 0.91 for this study.

Group cohesiveness. Group cohesiveness was measured using a scale developed by Podsakoff *et al.* (1990). A seven-point scale ranging from "Strongly disagree" to "Strongly agree" was employed by respondents to indicate the level of trust and cooperation among group members. A sample item from the scale is: "The members of my team stand up for each other". The reliability coefficient (Cronbach's alpha) was 0.93.

Team member social interaction processes. A 12-item scale that was developed by Campion *et al.* (1993) was used to measure interaction and exchange among team members. It captures the four inputs that can influence effectiveness: belief in the ability of the team to be effective (team ability), social support, workload sharing, and levels of cooperation and communication. A five-point scale ranging from "Strongly disagree" to "Strongly agree" was used to measure responses. A sample item is: "Being in my team gave me the opportunity to work in a group and provide support to other team members". The reliability coefficient was 0.72.

Individual team-source learning. The eight-item measure developed by Lankau (1996) and detailed in Williams *et al.* (2006, 2009) was used to measure team-source learning. A five-point scale ranging from "Strongly disagree" to "Strongly agree" was employed. The items presented to respondents were preceded by the following statement "From interacting with other members on this team I learned". Sample items are: "How to improve my communication skills," "Different perspectives on problems," and "More information about the case/class". The reliability coefficient was 0.85 for this study.

Team performance. Respondents rated the performance of their team using the measure developed by Van de Ven and Ferry (1980). Professor grades on the team project were collected, these ratings however were all in the B to A range (83 percent to 95 percent) and thus did not provide enough variance for our analyses to detect a significant correlation. For this reason we employed self-rated performance as an alternative measure but tried to elicit more objective ratings than a simple "What was the level at which your team performed?" We asked respondents to reflect on past team experiences to encompass a more broad perspective on the teams' performance in relation to other comparable project teams (this included any other project team they had been exposed to in previous courses or in their experiences outside the classroom). A five-point scale ranging from "far below average" to "far above average" was utilized (e.g. "attainment of team goals"). The reliability coefficient was 0.90 for this study. Wagner and Goffin (1997, p. 96) suggest that comparative methods are important because "... comparative methods of performance appraisal may result in ratings with greater validity and accuracy ... absolute appraisal methods may tend to hamper social comparisons thus detracting from accuracy and validity".

Team setting and control variables. Team setting was coded as 1 = Face-to-face and 2 = Online. Corresponding to earlier research that discusses the importance of

background characteristics of respondents and team characteristics on the outcomes of teamwork (Arbaugh and Duray, 2002; Davis and Ralph, 2001) the following were included as covariates in our analysis of the data: age, number of members on the team (team members), previous experience on teams in the MBA program (team experience), and frequency of meetings such as weekly, biweekly, and monthly (meetings).

Analyses

Descriptive statistics. Means, standard deviations, and coefficient alpha internal consistency reliabilities (where appropriate) were computed for each measure. Additionally, intercorrelations between the measures were calculated.

Level of analysis. We examined the ICC(1) and r_{wg} statistics for the variables of interest to ensure that we were employing the appropriate level of analysis. In examining the level of analysis at which each variable resides we relied on the r_{wg} (James *et al.*, 1984) as an index of the degree of within team agreement and the ICC(1) as an index of the amount of between-team variance (Bliese, 2000). ICC(1) values below 0.10 to 0.20 do not represent sufficient between-team variance to support aggregating individual level data to represent team-level phenomena (Bliese, 2000). From a theoretical perspective we were interested in individual team-source learning to examine the individual learning that occurs as a result of interactions on a team. We also cast and presented teamwork orientation as an individual level variable to reflect the orientation of each team member toward working on the team. Team social interaction was also presented as an individual level variable reflecting each member's perception that members worked well together and individual contributions (e.g. Being in my team gave me the opportunity to work in a group and provide support to other team members). From a theoretical perspective group cohesiveness and perceived team performance reflect team characteristics and were therefore examined the ICC(1) and r_{wg} statistics for these variables to ensure that there was enough between-team variance and within group agreement to support aggregating the individual reports to represent team level phenomena. Support for aggregation is provided with ICC(1) values between 0.10 to 0.20 or higher and median r_{wg} values above 0.70 (Bliese, 2000).

Hierarchical regressions. Tests of the moderator hypotheses were conducted using hierarchical linear multiple regression (Cohen and Cohen, 1983). Separate regressions were conducted for each dependent and independent variable pair, but the equations in each set of regressions were identical. In the first equation, the control variables (age, number on the team, previous experience on teams and frequency of meetings) were entered. In the second equation, the independent variable was added. In the third equation, the moderator variable (i.e. team setting) was added. Finally, the fourth equation added the interaction term (the independent variable multiplied by team setting). The change in R^2 resulting from the addition of the interaction term was determined and tested for statistical significance. A statistically significant finding indicated that team setting moderated the relationship.

Results

The means, standard deviations, correlations, and coefficient alpha reliabilities (where appropriate) are reported in Table I. All multiple item measures had acceptable reliabilities (i.e. greater than 0.70).

Table I.
Means, standard
deviations, correlations,
and coefficient alpha
reliabilities

	Mean	Std dev.	1	2	3	4	5	6	7	8
<i>Individual level variables</i>										
1. Age	29.61	7.76	—							
2. Team members	4.32	0.72	0.01	—						
3. Team experience	1.66	1.77	0.08	—						
4. Meetings	2.60	1.41	0.04	0.03	—					
5. Member teamwork orientation	5.68	1.09	—0.01	—0.09	0.08*	—				
6. Member social interaction	4.23	0.72	—0.06	—0.03	—0.17**	—0.03				
7. Team setting	1.55	0.50	—0.04	0.11	—0.23**	—0.01	(0.91)			
8. Individual team — source learning	3.74	0.63	—0.17*	—0.09	0.53**	0.09	—0.17*	(0.93)		
					—0.18*	0.04	0.46**	—0.13	—	
							0.54**	0.54**	—0.13	(0.83)
<i>Group level variables</i>										
1. Age	29.59	4.20	—							
2. Team members	4.18	0.74	0.11	—						
3. Team experience	1.67	1.27	0.01	0.02	—					
4. Meetings	2.57	0.91	0.11	0.02	0.03	—				
5. Group cohesiveness	5.37	0.80	—0.04	—0.01	—0.54**	0.25*				
6. Team setting	1.55	0.50	—0.04	0.11	0.70**	0.10	(0.93)			
7. Team performance	3.63	0.43	—0.22**	—0.09	—0.42**	0.05	—0.56**	—		
							0.54**	—0.32**	(0.90)	

Notes: * $p \leq 0.05$ ** $p \leq 0.01$; Coefficient alpha reliabilities are in parentheses on the diagonal; $n = 176$

The ICC(1) statistic for the team-source learning, teamwork orientation and team social interaction variables were 0.006, 0.002, and 0.05 respectively. These statistics support examining these variables at the individual level of analysis. The ICC(1) values for group cohesiveness and perceived team performance were 0.23 and 0.10, respectively, with median r_{wg} statistics of 0.93 and 0.92. Since the median r_{wg} values were above 0.70, and the ICC(1) values were within or above the recommended range of 0.10 to 0.20, we concluded that there was strong support for aggregating the measures of group cohesiveness and perceived team performance to the team level.

The results indicate moderating effects for two of the three hypotheses, in particular, *H1* and *H2*. In these two sets of equations, the addition of the multiplicative term (e.g. teamwork orientation * individual team-source learning) in the fourth step explained a significant amount of variance in the dependent variable beyond the previous step (Table II). Team setting moderated the relationship between teamwork orientation and individual team-source learning and member social interaction and individual team-source learning (Table III).

To obtain an understanding of the relationships, each relationship was graphed using the procedure outlined in Cohen and Cohen (1983). The three significant relationships are depicted in Figures 1-3. We plotted the slopes for both team settings (online and face-to-face). High and low values of the independent variables were calculated at one standard deviation above and below the variable's mean. Contrary to what was expected, the form of the interaction hypothesized for *H1* and *H2* was in the opposite of that predicted. The relationship between teamwork orientation and individual team-source learning was stronger for members of online teams (*H1*). The relationship between member social interaction and individual team-source learning was stronger in online teams (*H2*). The *post hoc* interaction plot for *H3* revealed that the positive relationship between cohesiveness and team performance was stronger in face-to-face teams (*H3*).

Discussion

Summary of findings

Teams in the twenty-first century have the technological capability of working across time and distance. While research has demonstrated the benefits of teamwork in traditional environments, there are many unknowns in the virtual environment. In this study member reports on their orientation toward teamwork and perceptions of team member social interaction, group cohesiveness, and team performance were examined. Team setting moderated the relationship between teamwork orientation and individual team-source learning and the relationship between team member social interaction and individual team-source learning; the relationships were stronger in online teams. While we found no significant effect for team setting moderating the relationship between group cohesiveness and perceived team performance, the plot of the interaction effect revealed that relationship was stronger in face-to-face teams. This suggests a need for future research that employs a larger sample since our small sample size restricts the conclusions that can be drawn. *Post hoc* analyses also revealed that the means on teamwork orientation and member social interaction were higher for members of face-to-face teams than online teams, there were also significant differences for group cohesiveness, and perceived team performance with higher means for face-to-face than online teams.

Table II.
Regression results for
individual team source
learning (*H1* and *H2*)

Step and variable added	Unstandardized partial regression coefficients					Total R^2
	Step 1	Step 2	Step 3	Step 4	ΔR^2	
1. Age	-0.01*	-0.01*	-0.01*	-0.01*	0.076**	0.076**
Team members	-0.11	-0.07	-0.07	-0.07		
Team experience	-0.07*	-0.04	-0.03	-0.03		
Meetings	0.03	0.03	0.04	0.04		
2. Teamwork orientation	-	0.26**	0.26**	-0.02	0.192**	0.269**
3. Team setting	-	-	-0.04	-0.09*	0.001	0.272**
4. Teamwork orientation*team setting	-	-	-	0.17*	0.018*	0.290*
1. Age	-0.01*	-0.01*	-0.01*	-0.01*	0.076**	0.076**
Team members	-0.11	-0.08	-0.08	-0.04		
Team experience	-0.07*	-0.02	-0.01	-0.01		
Meetings	0.02	0.02	0.02	0.02		
2. Member social interaction	-	0.45**	0.45**	-0.08	0.335**	0.257**
3. Team setting	-	-	-0.08	-1.48**	0.003	0.336**
4. Member social interaction*team setting	-	-	-	0.33*	0.030	0.366**

Notes: * $p \leq 0.05$; ** $p \leq 0.01$

Step and variable added	Unstandardized partial regression coefficients				ΔR^2	Total R^2
	Step 1	Step 2	Step 3	Step 4		
1. Age	-0.02	-0.02	-0.02	0.02	0.235*	0.235*
Team members	-0.04	-0.04	-0.04	-0.04		
Team experience	-0.14**	-0.06	-0.08	-0.07		
Meetings	0.04	-0.01	-0.02	-0.02		
Group cohesiveness	-	0.23**	0.25**	0.64**	0.356**	0.121**
Team setting	-	-	0.09	1.38**	0.005	0.361**
Cohesiveness*team setting	-	-	-	-0.24	0.032	0.393
Notes: * $p \leq 0.05$ ** $p \leq 0.01$						

Table III.
Regression results for
team performance (*H3*)

Theoretical implications

Our findings support research which asserts that teams utilizing computer-mediated communication are superior to face-to-face groups in brainstorming and decision making tasks (Dennis and Valacich, 1993; Sabamurthy *et al.*, 1993). Team setting moderated the effects that teamwork orientation and member social interaction had on personal learning. Research suggests that virtual teams produce more high quality ideas (Martins *et al.*, 2004). Kirkman *et al.* (2004) note that virtual teams are often knowledge based, solving problems or developing new products so one key outcome is process improvement which is reflective of learning that occurs within the team. The results of this study suggest that the independent generation of ideas before completing an analytical task might in fact reduce the possibility of groupthink and encourage the consideration of creative ideas.

Figure 1.
Interaction of teamwork
orientation and team
setting (*H1*)

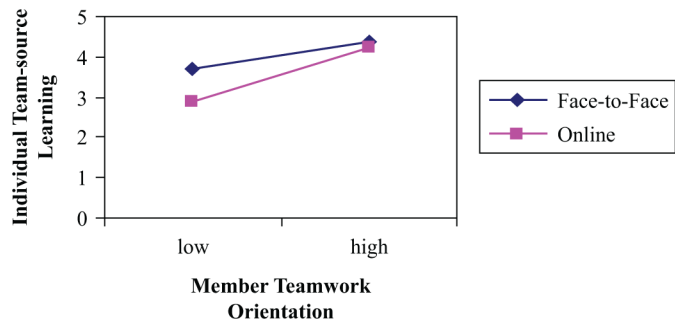


Figure 2.
Interaction of member
social interaction and team
setting (*H2*)

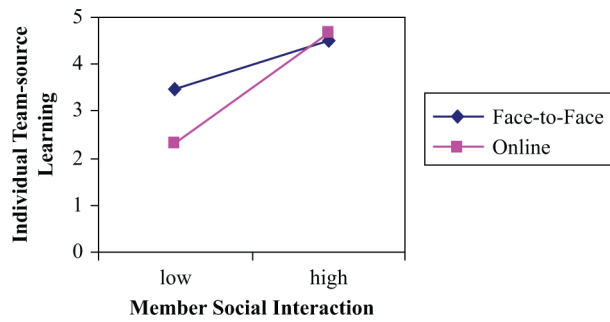
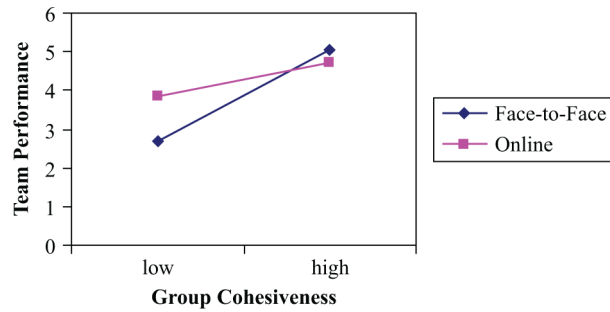


Figure 3.
Interaction of group
cohesiveness and team
setting (*H3*)



The non-significant finding for the moderating effect of team setting on the group cohesiveness to performance relationship suggests the need for further research that examines project teams. The form of the relationships revealed by plotting the interaction *post hoc* suggests that cohesion could potentially be a stronger predictor of self-rated team performance that occurs in a face-to-face than online team. This reinforces the importance of research on team context to determine how best to approach conflict management and problem solving (Straus and McGrath, 1994). The definition of cohesiveness used in the current study describes the desire to maintain membership in the team and a feeling of unity that was reflected in team members working together, cooperating and behaving in a reliable manner. This suggests that relationship conflict is low in cohesive teams (Jehn and Chatman, 2000). Face-to-face communication allows for quick feedback and facilitates conflict management, motivation, and the promotion of positive attitudes such as job satisfaction because there may be fewer delays, a stronger common frame of reference, and non-verbal cues that validate assumptions (Powell *et al.*, 2004). The information that is received in face-to-face communication is rich in the degree to which feedback is delivered quickly and misunderstandings can be resolved quickly. It might therefore facilitate high performance. Alternately, more research is needed to compare both the face-to-face and online settings because the ability to store information produced via online exchanges might prove to be an advantage for tracking member inputs and improving the final product (Mathieu *et al.*, 2008).

Practical implications

The perceived learning outcome that resulted from teamwork in the current study was more pronounced in the online context where collaborative behaviors and their outcomes might be more easily recorded. This allows members to reflect on the interaction process and attitudes demonstrated toward teamwork and therefore students might be able to link them to learning outcomes. We found that individual teamwork orientation and perceptions of member social interaction are vital to personal learning in teams. This suggests that the ability to save and access information on team interactions and information generated in online meetings that are recorded (Mathieu *et al.*, 2008) augments learning.

The results of the current study suggest that individual team-source learning occurs where there are high levels of member interaction and an orientation toward teamwork. Thus, the learning that occurs as a result of team interactions might be increased where team members value teamwork and work together to accomplish goals, especially where online interactions occur. While face-to-face interactions are heavily laden with contextual cues, new technologies are allowing for a closer approximation of two-way communication and continue to be encouraged for online exchanges (Cramton, 2002). However, different technologies may be more appropriate for specific tasks regardless of the team setting. Different tasks might include generating ideas, solving routine and complex problems, and negotiating over technical or interpersonal conflicts. While e-mail or chat rooms are appropriate for some of these tasks, such as information sharing, it is difficult to find a medium other than face-to-face meetings that is most appropriate for handling emotional or ambiguous issues that can hinder performance (Duarte and Snyder, 1999).

Study limitations

The sample in this study represents a limitation in that it is a student sample and the data are all self-report. The study was limited to student project teams, which also limits the conclusions that can be drawn. The design of the study was cross-sectional and causality cannot be inferred. Same source bias may offer a potential explanation for the results reported. In *post hoc* fashion, we employed the partial correlation technique (Podsakoff *et al.*, 2003) to examine the potential for bias in our results. The marker variable sex of the respondent was included in our analyses, since it has not been linked to individual learning or performance, and its inclusion did not change our results (Podsakoff *et al.*, 2003). Future research should employ more measures from a variety of sources to strengthen the conclusions that might be drawn. The Harman one-factor test revealed that there was no single general factor that best represented these data (Podsakoff *et al.*, 2003). The pattern of significant interaction terms reported suggests that results are unlikely to have resulted from single-informant bias (Kotabe *et al.*, 2003).

We tried to mitigate some of the study limitations noted above by using graduate students in multiple sections over multiple semesters. We assessed the perceptions of team members directly since the variables in the study were personal to each respondent (for example, what they learned, how they felt they performed in comparison to other teams and how well they interacted). Greenberg (1987, p. 158) attempted to dissuade researchers from dismissing the findings of student samples and drew on the work of Locke (1986), stating that he (Locke) "... argued that with respect to many of the processes operating within organizations the similarity between students and employees are greater than the differences between them and that any critical differences between these two groups (ones that may alter research findings) cannot be determined deductively". We believe that our results have implications for teams in educational settings and also for work teams in organizational settings since the team composition and nature of the work conducted by our student teams are similar to that in organizational contexts.

Directions for future research

Our results are useful for future research that compares face-to-face and virtual teams. Future research can expand the scope of the current study by capturing learning and performance evaluations based on instructor/supervisory reports of student/employee behavior. The implication is that leaders might have different perceptions of the outcomes of teamwork. Is it also important to consider the impact that leadership in teams can have on outcomes as well as how leadership affects the processes that occur in teams as they work toward outcomes. Because cohesiveness, orientation toward teamwork, and social interaction are important for the effective functioning of a team, leadership that promotes strong teamwork will influence the success of the team.

The lessons learned from studies on traditional face-to-face teams are being applied to the designs and processes implemented in virtual teams (Powell *et al.*, 2004). Further research is needed that examines the impact of team processes on team outcomes such as objective performance and turnover. Research that looks at the implications of delayed communication for members in different time zones (e.g. receiving an e-mail many hours after it has been sent) versus real-time communications also needs to be addressed in future studies. Because virtual teams are growing in popularity and a

majority of Western corporations use some form of virtual team structure, it is important to address the issue of how best to train members and managers of virtual teams. To foster high performance it is important to agree on common values and improve team skills. It therefore appears that leaders should think carefully about the kinds of behaviors that are most likely to enhance a virtual team's ability to share ideas (Cascio, 2000).

Conclusion

The study of teams in educational settings is important for many reasons. As noted earlier, businesses have advocated the use of teams in educational settings (Colbeck *et al.*, 2000). Thus, gaining a better understanding of how to improve the processes within teams as well as the "products" are paramount. Our findings that member social interaction and team orientation had stronger positive effects on individual team-source learning in virtual teams suggest that collaborative learning can occur in asynchronous environments as discussed by Jarvenpaa and Leidner (1999). The flexibility provided by the online environment might allow for more ongoing learning and more frequent exchanges than might occur if students rely mainly on class meetings to exchange ideas. Thus, it appears that the presence of team processes that support collaboration are effective for promoting learning in the virtual realm that might surpass levels attained with face-to-face contact.

Our *post hoc* finding that the cohesiveness-team performance relationship was stronger for face-to-face teams implies that while cohesive team members in an online setting believe they are able to outperform comparable teams, this belief may be more pronounced for members of cohesive face-to-face teams. The result for face-to-face teams suggests that in this setting team members might be more focused on tasks, and are able to use feedback received to maintain clarity and focus their exchanges to meet task objectives. To avoid possible conflicts that impede cohesiveness in online on face-to-face teams, instructors, managers, and administrators should ensure that team members are chosen carefully and give members a strong reason for being on the team. They should also frame the team's task appropriately, emphasizing clear, well-defined goals and the consequences of the team's actions on outcomes (Townsend *et al.*, 1998). One approach presented by Laverty and Beattie's (1984) "Management by Teamwork" emphasizes each team member's role and demands the total involvement and commitment of all. Socialization techniques might be useful for promoting team goals. This would encourage coordinating the manner in which teams are formed and the presentation of information to frame team goals.

With the growth of virtual teams' use in organizations for project coordination and for the delivery of educational objectives, team members in a variety of contexts may need to take on the responsibility for developing each other. This requires a positive attitude toward teamwork, a willingness to work together and the ability to cooperate. Since nonverbal communication may account for as much as 60 percent of the message that an individual conveys (Kezbom, 2000), it appears that face-to-face interaction should be promoted wherever possible to promote high performance. Gilson and Shalley (2004) reported that members of more creative teams spent more time socializing with each other both on the job and off. Cohesiveness and a positive orientation toward teamwork might also be important factors for promoting creativity. Even when face-to-face interaction is not possible, training that improves problem

solving and interpersonal relations within the team can improve the learning that occurs and can impact the resulting level of productivity (Campion *et al.*, 1993).

Research in this area may find it necessary to more closely evaluate the use of technology such as video conferencing to help virtual teams incorporate the types of feedback available when teams meet face-to-face. Training should include ensuring computer literacy and that team members use similar or compatible products and applications. There also needs to be a central repository for work in progress to avoid duplication of effort and provide open access to team members (Duarte and Snyder, 1999). These approaches can promote higher levels of productivity regardless of team context.

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