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Journal of Undergraduate Research at Minnesota State University, Mankato

Volume 8 Article 1

2008

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The Effect of Online Training on Teams

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Abstract

Many organizations recognize the importance of utilizing teams to accomplish work (Chuboda et al., 2005; Devine et al., 1999; Ilgen, 1999; Martins et al., 2004). As technology has advanced, many of these organizations have recently become more reliant on virtual project work, which allows work teams to communicate across geographical distances (Driskell et al., 2003). Considering the growing prevalence of virtual teams in organizations, more needs to be known about how to facilitate virtual team effectiveness. In addition, the increased use of teams in organizations has identified and created the need for team training (Ilgen, 1999). Creating a training environment where the appropriate knowledge and skills transfer to a team should be taken into consideration for team performance (Marks et al., 2001). However, the literature provides inconclusive evidence on the effectiveness of the virtual team's training environment. The goal of the current study is to add to existing knowledge regarding training and virtual teams. It is expected, based on previous research, that virtual teams who receive online training will yield the best performance results, while virtual teams who receive in-person training will yield the worst performance results. Sixty-four undergraduate students from Minnesota State University, Mankato participated in the study. Participants were placed in two-person teams and were trained either on-line using web-based conferencing software or were trained in-person. Team members collaborated either virtually or face-to-face. Results of the research will be discussed along with implications and future directions.

The Effect of Online Training on Teams

The use of teams has become a prevalent practice within organizations (Chuboda et al., 2005; Devine et al., 1999; Ilgen, 1999; Martins et al., 2004). Historically, most work teams have met face-to-face, but with constant innovations in communication technology and a growing global product market, businesses have recently become more reliant on virtual project work (Arnison & Miller, 2002; Bell & Kozlowski, 2002; Harvey et al., 2005).

Considering the prevalence of virtual and face-to-face teams in organizations, more needs to be known about how to facilitate team effectiveness, especially for virtual teams. Research has recently begun to examine such issues; however, little is known about how to facilitate team effectiveness for teams whose members are not working together in the same geographic location. Researchers have identified the need for more empirical evidence to guide the training of virtual teams (Chou & Liu, 2005; Hertel et al., 2005; Ilgen, 1999; Salas et al., 2007). The purpose of the current research is to investigate the effectiveness of various types of training and to examine which type of training best contributes to performance effectiveness for both virtual and face-to-face teams.

Understanding Training and Team Effectiveness

Many factors contribute to the overall effectiveness of teams (Devine et al., 1999, Marks et al., 2001). At the organizational level, one such factor, training teams with the necessary knowledge, skills, and abilities needed to complete the goal or task, or *task training*, has been shown to improve team performance (Salas & Fowlkes, 1997).

Related to task training, another factor contributing to training effectiveness is the level at which the training is conducted: as a group versus individually. Salas et al. (2007) observed that using a group training technique resulted in better team performance. Thus, team training, especially at the group level, is an important activity for organizations to consider when trying to develop, implement, and facilitate successful team performance.

There are both benefits and disadvantages to organizations that rely on conventional teams rather than individuals to complete work tasks. Teams often are used to accomplish work that individuals cannot complete alone. In addition, teams provide an increased integration of viewpoints, opinions, and ideas (DeChurch & Haas, 2004). These benefits are the main reasons why the use of teams is prevalent in organizations today (Devine et al., 1999). However, the use of conventional teams in global organizations has become a question of practicality. It is expensive and time consuming for geographically dispersed teams to meet face-to-face. As a result, organizations have turned to virtual teams and distributed work (Hertel et al., 2005).

Virtual Teams

Virtual teams have been defined as, "groups of geographically and/or organizationally dispersed coworkers that are assembled using a combination of telecommunications and informational technologies to accomplish a variety of tasks" (Townsend et al., 1998, p.17). Other existing definitions of virtual teams tend to compare the qualities of virtual teams against those of conventional, or face-to-face, teams (Martins et al., 2004). The specific task environment characteristics that differentiate face-to-face and virtual teams include geographic location, time, and virtuality (Bell & Kozlowski, 2002; Driskell et al., 2003). Geographic location refers to the physical or

spatial boundaries that may limit or prevent team members from meeting with one another. Time refers to the ability for "real-time" interaction to occur between team members and includes the difficulty in working with team members located in various time zones. Finally, virtuality refers to the amount of media richness within a technologically mediated communication device. Each of these characteristics makes up the key differences that distinguish virtual teams from face-to-face teams (Bell & Kozlowski, 2002). Similar to previous studies, the present research will classify a virtual team (VT) as two or more individuals who are distributed, or are in separate geographic locations, and who use technology-mediated communication to accomplish a goal or task (Arnison & Miller, 2002; Driskell et al., 2003; Hertel et al., 2005; Martins et al., 2004).

Most, if not all, members of virtual teams must rely on some form of technology-mediated communication as an alternative method to face-to-face communication. Technology-mediated communications (TMC) can be described as technologies that allow individuals to engage with one another without face-to-face interaction (Gibson & Cohen, 2004). Examples include teleconferencing, e-mail, instant messaging, or video conferencing. In addition, these technologies can be distinguished by the amount of media richness or, virtuality, they possess. The level of media richness is dependent on four factors: the ability for teammates to see one another, the ability to hear one another, the ability to synchronize their messages as to when messages are sent and received, and the ability of the technology to keep messages in the correct sequence (Driskell et al., 2003). By applying these criteria to the TMC available today, video conferencing achieves the highest media richness while e-mail retains the lowest.

Just as TMCs can help virtual teams by allowing members from different geographic locations to interact, it also can interfere with teamwork and team performance. It is important, when choosing a TMC device, for virtual teams to consider the device's level of media richness as it can directly affect the team's overall performance (Martins et al., 2004). Compared with traditional, face-to-face teams, virtual team members may have a harder time identifying a clear goal and developing a vital sense of purpose with the overall team task due to the limit of contextual cues (i.e. posture, gestures, eye contact) available from the TMC device (Blackburn et al., 2003; Chuboda, Wynn et al., 2005; Rico & Cohen, 2005). This limitation may result in misinterpretations of received messages which, in turn, could compromise the effectiveness of a virtual team to complete their project or task (Hertel et al., 2005; Martins et al., 2004). However, choosing a TMC device appropriate for the virtual team task to be complete should help mitigate these effects.

Researchers, practitioners, and team members should be aware that devices low in virtuality are not a problem in themselves, but rather the problem lies in applying these technology-mediated devices to the type of teamwork being performed (Hertel et al., 2005). In their study in 2005, Rico & Cohen explored the relationship between task type and communication type further. Specifically, they looked at task interdependence and effects of synchronous and asynchronous TMC on performance effectiveness. Asynchronous refers to those communication devices which have the absence of "real-time" interaction (i.e. e-mail), such that team members are communicating at different times. In other words there is a time-delay between information exchanges. Synchronous refers to communication devices which allow "real-time" interaction and instant

information exchange, such as that provided by instant messaging or other similar technology. Results showed that virtual teams completing highly interdependent tasks using synchronous communication technologies had the highest performance, while virtual teams with low interdependent tasks using asynchronous communication technologies resulted in the second highest performance (Rico & Cohen, 2005). From this, it can be inferred that matching TMCs with specific aspects of the team task does not only mitigate the aforementioned effects, but also increases the effectiveness of virtual teams.

Training for Virtual Teams

The prevalence of virtual teams in global organizations and the lack of research regarding what facilitates virtual team effectiveness, especially training virtual teams, has created a need for further exploration into these topics. To complete a goal successfully, a team, whether communicating virtually or face-to-face, must have the proper training. The same assumption must be applied when working with virtual teams to produce the best performance results possible.

There are many different ways to conduct virtual team training. Based on previous research the current study relied on group level training design and eliminated individual-level training as it does not allow flexibility in task training. Because group level training is best for face-to-face teams, it is expected that this method will also be best for virtual teams. Further, the present research considered the training environment. Because the communication environment of a virtual team affects team performance it is the purpose of the current research to examine a training method that matches the virtual team environment, on-line task training.

Many similar terms have been used to describe on-line learning: computer-assisted instruction (c.f., Tynjälä & Häkkinen, 2005), distance learning (c.f., Fry, 2001), and computer-supported collaborative learning. While all of the terms directly relate to on-line learning, there are slight differences between them, so it is important to distinguish on-line learning. On-line or e-learning learning has been defined as "the use of computer network technology, primarily over an intranet or through the internet, to deliver, information and instruction to [employees]" (Welsh et al., 2003, p. 246). In recent years, organizations have adopted this method to individually train employees (Wang et al., 2007).

Welsh and colleagues (2003) distinguished between asynchronous and synchronous learning for virtual teams just as Rico and Cohen (2005) distinguished asynchronous and synchronous communication for virtual teams. An individual who has access to an asynchronous e-learning program can access training essentially at any time, regardless of whether a trainer or other team members are learning at that same time. However, there is no constant real-time interaction between the trainer and trainee. A person with synchronous e-learning, on the other hand, has the drawback of only being able to access training at specified times, but benefits from the training's real-time question-answer sessions, which may occur at anytime in the training session (DeRouin et al., 2005). Though asynchronous e-learning is more common at the present time, some suggest that organizations will be using synchronous e-learning more in the future (DeRouin et al., 2005). This identifies a need to research on-line synchronous learning and its applications.

Benefits of on-line training include cost savings and convenience (Forrester Research, 2000), flexibility and self-pacing (Fry, 2001), and reductions in information overload (Welsh et al., 2003). Furthermore, those implementing an on-line training program must be concerned about up-front costs, the restricted amount of communication among trainees, and the extensive development needed to produce an online training program (Welsh, et al., 2003). However, the main disadvantage is that online training, especially programs which are asynchronous and designed for team training, can have problems with contextual cues. For example, using e-mail to communicate with team members and trainers prevents the message receiver from receiving tone of voice and gestures.

Previous research has supported online training as an effective device in individual learning; however, support for its use in team training still is inconclusive (Ilgen, 1999). For example, creating a training environment where the appropriate knowledge and skills transfer to a team should be taken into consideration for team performance (Marks et al., 2001). Generally, the existing literature provides inconclusive evidence on the effectiveness of the virtual team's learning environment. We know that e-llearning can be successful (c.f., Kulik & Kulik 1991; Tynjälä & Häkkinen, 2005), but currently do not know which specific training characteristics drive effective performance for virtual teams.

The Current Study

This research examines the effectiveness of a training program designed for virtual teams. The purpose is to compare two types of training programs (synchronous on-line and synchronous in-person) with two types of team situations (face-to-face and

virtual). It should be expected that teams whose training environment matches the task environment should have higher performance. Considering communication drawbacks of technology-mediated devices, virtual teams may be negatively affected. However, the purpose of this research is at a more basic level: It is not intended to examine specific contextual cues associated with specific devices. Rather, this study will test the following hypotheses:

Hypothesis 1: Virtual teams who receive virtual training will have higher performance than virtual teams who have in-person training.

Hypothesis 2: Face-to-face teams who receive in-person training will have higher performance than face-to-face teams who have virtual training.

Method

Participants

Participants were 64 undergraduate students recruited from psychology courses at Minnesota State University, Mankato. Participants were randomly assigned to one of four experimental conditions and received one extra-credit point toward their class.

Materials

A multiplayer computer-based video game, "Command and Conquer: Generals" was used in this study to measure team performance. The simulation required teams to work interdependently to complete the assigned task successfully within an allocated time. Each person within a two-person team used his or her own networked desktop

computer. Thus, teams were able to work together on the same task while being at separate workstations.

Design & Procedure

The current study used a two (team design: face-to-face or virtual) x two (type of training: in-person or e-learning) between-subjects design to examine differences in performance outcomes on the assigned task. Participants, upon arrival, were handed an informed consent sheet to read and sign. They were also made aware that the study was voluntary and they could stop the research at anytime without losing extra-credit.

Upon signing the informed consent, participants were randomly assigned to one of four experimental conditions. In conditions two (a face-to-face team with on-line training) and four (face-to-face team with in-person training) participants sat alongside one another with no barrier in between them and were sectioned off within the lab room. Participants in conditions one (virtual team with in-person training) and three (virtual team with in-person training) sat with a barrier between them and were also sectioned off within the lab room. This was to prevent virtual team members from face-to-face contact and optimize the "virtuality" of the environment. Participants in all conditions had computers directly in front of them.

Next, participants completed task training. In conditions three and four, an in-person trainer read from a scripted training manual. Participants listened to the instructions while carrying out designated training tasks necessary for completing their mission. Condition one and two participants received instructions to place a pair of noise-canceling headphones on their ears at which time a separate researcher read a training script via a web-conferencing application. Participants were able to hear and see the

trainer through the conferencing media (i.e., microphones, headphones, webcams, and virtual meeting software) while also following a power-point presentation showing various screen shots of the training steps. Also, those receiving virtual training were instructed on how to ask the instructor or researcher any questions on the "Command and Conquer: Generals" computer game. Specifically, participants had a chat or instant-message tool available on their computer to type any questions or responses to the trainer's requests. Participants were told they could ask questions at any time, just as they would in a face-to-face training program. It is important to note that although trainers for all conditions had a script to follow, they were also trained prior to the experiment on tone, emphasis, and speed at which to read the script.

Participants in all experimental conditions completed the same training program. This allowed every participant in every condition to receive the same practice. Following training, participants completed two separate performance missions. Both were identical in terms of targets, goals, performance requirements, and performance context. Participants has six minutes total to complete their task in each mission. The researcher observed to see how many buildings were destroyed and tallied it on the performance measure sheet. At the end of the mission, the researcher recorded the number of enemy tanks each team member destroyed separately and also recorded it on the performance measure sheet.

Measures

A manipulation check measure (see Appendix A) was used to determine whether participants in each condition learned the appropriate information about the task, and whether they thought the training was effective. Performance was measured as four

different variables, the number of buildings destroyed, the number of units lost, the number of units destroyed, and whether or not the command center was destroyed. The participants were required to destroy 10 buildings, including the command center, and 6 enemy tanks between themselves and their team member. These performance measures were similar to those used in previous studies using this task (i.e., Woller, 2007). (See Appendix B)

Results

Prior to testing hypotheses, a one-way ANOVA was conducted on the manipulation check. This test revealed significant differences as expected for items one, $F(1, 63) = 162.42$, $p < 0.01$ and two $F(1, 59) = 60.62$, $p < 0.01$ (see appendix A for manipulation check items). This means all participants knew how they communicated with their trainer and knew what type of training they had received. Participants also rated the tasks in the mission as not very difficult, $F(1, 63) = 14.90$, $p < 0.01$. These findings also were as expected. An unexpected finding in the manipulation check was that participants rated online training to be less effective than face-to-face training, $F(1, 63) = 36.01$, $p < 0.05$. Since pilot studies did not indicate this pattern, it was surprising that there was a difference in perceived training effectiveness.

In terms of hypothesis testing, the current study had two independent variables. The first was whether a team was collaborating face-to-face or virtually. The second was whether a team was trained online or in-person. The dependent variable was team performance, which was measured in four different ways. A one-way analysis of variance

was used to test each of the hypotheses. Tests of the first hypothesis indicated the effect of online training on virtual team performance was not significant for the number of units destroyed (M = 3.13, SD = 1.60), the number of units lost (M = 4.90, SD = 1.63), the number of buildings destroyed (M = 7.40, SD = 2.31), or whether the command center was destroyed (M = 1.63, SD = .50). Thus, receiving online training did not result in higher performance for virtual teams for any of the different performance measures. The results testing the second hypothesis also revealed no significant effect of in-person training on face-to-face teams for each of the measured performance factors (M = 3.13, SD = 2.10), (M = 4.50, SD = 1.60), (M = 7.40, SD = 1.80), (M = 1.63, SD = .50). In other words, receiving in-person training did not contribute to higher performance for face-to-face teams. Although both hypotheses were not significant, it is important to note that two of the performance means for virtual teams and all four of the performance means for face-to-face teams were in the expected direction.

Discussion

The purpose of this research was to provide very basic data regarding effectiveness of training design features for virtual teams. It was expected that online learners would benefit most from online training, and that face-to-face teams would benefit most from face-to-face training. This is consistent with the literature about environmental conditions for training programs. Contrary to expectations, the proposed hypotheses in the current study were not supported by the results. However, various studies concentrating on the performance differences between both types of teams

indicate that face-to-face teams should perform better than virtual teams. While not statistically significant, findings from this study do follow this pattern.

Limitations

Several factors may have contributed to insignificant results. First, the amount of power within the study was limited because of the small sample size. There were only eight teams per experimental condition, which is not enough to detect moderate effects. Previous power analyses from team research suggest 12-15 teams per condition is adequate (e.g., Marks et al., 2002). It would have been preferred to have at least 12 teams per condition for this research.

A second limitation was the perceived virtuality of the training environment. Even though participants were separated and limited to only virtual communication to increase virtuality, they were aware that both they and their teammate were in the same room. This situation may have undermined the effects of our virtual team set-up and is a problem with lab-based research. Also, it is a concern that the manipulation check results indicated participants found virtual training to be not as effective as face-to-face training. Future research should investigate ways to make online training environments more comparable to face-to-face programs.

Finally, future research should continue to study online training. There is much to be learned about this topic. One direction might be to study online training in relation to other types of teams, such as project teams or production teams. In addition, such research should be extended to real working teams, not only lab-based teams.

Conclusion

While the findings were not significant, this research does provide some recommendations for future research and practice to guide virtual team training. This study also begins to answer the call for discovering more about the interaction between communications technologies and task performance (e.g., Bell & Kozlowski, 2002; Rico & Cohen, 2005). Future research should be conducted in this area to explore the particular aspects of training design that most influence virtual team effectiveness.

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Appendix A

Manipulation Check

Directions: Please **circle** your answer clearly.

How did you receive instructions from the *trainer*?

a. Online/E-Learning Format
b. In-Person Format

How did you communicate with your *trainer*?

a. Speaking through headphones
b. Typing in a chat
c. Talking Face-to Face

How effective do you think your training was?

1	2	3	4	5
Not Effective	Slightly Ineffective		Slightly Effective	Extremely Effective

How well were you able to communicate with your trainer?

1	2	3	4	5
Very Difficult	Slightly Difficult		Slightly Easy	Very Easy

Overlord tanks are strong against crusader tanks. True or False

Commanche helicopters are strong against:

a. Crusader Tanks
b. Gattling Tanks
c. Overlord Tanks

To select a unit:

a. Right-Click the unit
b. Left-Click the unit
c. Hit the enter key.

The success in both of your missions was determined by:

a. If you just attacked and destroyed the command center.
b. How many enemy units you destroyed.
c. How many enemy units and buildings were destroyed, and if the enemy command center was destroyed.

In order to select more than one unit at a time you hold down the shift key and click on which units you want to select. True or False

Appendix B

Performance Measure

 # 01PM

Units Destroyed_____

Units Created_____
(If # is higher than 6, please enter 6)

Units Lost _____
(If # if higher than 6, please enter 6)

For Ariel to Fill Out
Surviving Units _____
Total Points____/22

 # 02PM

Units Destroyed_____

Units Created_____
(If # is higher than 6, please Enter 6)

Units Lost_____
(If # is higher than 6, please enter 6)

For Ariel to Fill Out
Surviving Units _____
Total Points____/22

Team PM

Buildings Destroyed (you must watch and tally each building) Not including bunkers. This is a "team" tally, so don't mark the same building for both participants, just one tally.	Make a tally here for each building destroyed.
Command Center (at very right of screen) Destroyed	(yes/no)