Improving Technical Communication Group Projects: An Experimental Study of Media Synchronicity Theory Training on Communication Outcomes

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**Abstract**

This article reports the results of an experiment that was conducted to determine the impact of media synchronicity theory (MST) training on media fit behavior, communication quantity, communication quality, and group effectiveness. MST training introduces students to a framework for assessing a media’s capabilities and matching those capabilities to a particular task. From three technical communication courses, 80 participants were randomly divided into two groups and compared using a between-subjects design. The MST training group reported significantly higher levels of media-fit behavior, communication quantity, and the communication-performance qualities of discussion quality, richness, and openness. The article discusses practical ways to implement MST training into technical communication group projects.

Keywords

teamwork, group projects, communication training, technical communication, media synchronicity theory

Students in team projects have access to more communication technology than ever before. In fact, Presnsky (2001) coined the term “digital native” to describe this new generation of students (born after 1980) who have spent their entire lives surrounded by digital technologies. While the rhetoric surrounding digital natives often characterizes them as technological prodigies, research suggests that “in reality many young people’s engagement with technology is often far more passive, solitary, sporadic and unspectacular” than we might expect (Selwyn, 2009, p. 372). Additional research suggests that students do not necessarily want to use technology—the same technology they use in their homes—in institutional contexts such as school (Lohnes & Kinzer, 2007). These findings about digital natives were recently supported in my earlier study of communication technology in technical communication classrooms (Lam, 2013). Participants in that study put little consideration into their communication media choices and relied almost solely on e-mail to communicate during an 8-week team project, which further suggests a lack of critical thought regarding media choice because even though they may have been exposed to, or even experts at using, a variety of media, they tended to default to a conventional form of communication media in team projects. *Media choice*, for the purposes of this article, is defined as an individual’s selection of particular communication media to complete particular tasks. In addition to students’ lack of critical thought in making media choices, research suggests that instructors who assign team projects often fail to explicitly train students to work effectively in teams, so students often lack training in navigating the complexities of media choices while working on team projects (Barker & Franzak, 1997; Wolfe & Alexander, 2005).

In summary, research suggests that students, even digital natives, seem to lack a framework for effectively using media in their classrooms. Furthermore, research also indicates that instructors often do not equip students to make critical media choices because they do not explicitly teach teamwork skills when assigning team projects. Therefore, a clear gap exists that this study seeks to fill by testing the effectiveness of a media-choice training program on technical communication teams. Effective media choice has been found to influence team functioning and have a significant impact on outcomes such as communication performance and task performance (Dennis, Fuller, & Valacich, 2008; Dennis & Kinney, 1998). More specifically, this study tests the impact of media synchronicity theory (MST) training on media-fit behavior, communication quantity, communication quality, and group effectiveness for 20 teams of technical communication students. MST argues that matching media capabilities to communication processes and appropriation factors will positively affect communication and task performance. The training, therefore, introduces students to a practical framework for assessing media capabilities and matching those capabilities to particular tasks. Using a randomized between-subjects design, an experimental group received MST training at the beginning and midway point of their team projects while a control group received placebo training. All participants then completed a survey to determine the effectiveness of the training.

Literature Review

In this literature review, first I present the theoretical framework for the study. Then, I review empirical research on MST, dividing the research between laboratory and field studies.

**Theoretical Framework**

The theoretical framework for this study is divided between two prominent media choice theories: media richness theory and MST.

***Media Richness Theory.*** Media choice theories describe and explain what impacts media have on outcomes such as communication performance, task performance, and communication satisfaction. Media richness theory (MRT), originated by Daft and Lengel (1984), provides a framework for ranking media based on their capabilities to support rich communication, characterized by the media’s: (a) availability of instant feedback, (b) capacity to transmit multiple cues (e.g., body language), (c) use of natural language, and (d) personal focus. According to MRT, face-to-face communication represents the richest possible medium, whereas e-mail is considered less rich because of its lack of immediate feedback and multiplicity of cues. MRT argues that richer mediums are more effective when communicating equivocal information whereas leaner mediums are more effective for unequivocal information. MRT, however, has received some criticism. Dennis and Kinney (1998) found that matching richness to task equivocality did not improve outcomes such as decision quality, decision time, consensus change, or communication satisfaction. Additionally, MRT was developed prior to computer-mediated communication (CMC), and CMC has been retrofitted into the theory’s framework, which some argue is not adequate to explain the complexities of CMC. In response, Dennis and Valacich (1999) developed MST, which reframes tasks, media capabilities, and contextual cues such as appropriation factors and communication processes. The theory has been recently refined and has received positive empirical support (Dennis, Fuller, & Valacich, 2008).

***Media Synchronicity Theory*.** MST posits that communication and task performance are enhanced when communication meets the condition of *media fit*, which occurs when the capabilities of media to support synchronicity match the communication process and appropriation factors. Communication is divided into two primary processes: *conveyance*, which is the transmission of new information, and *convergence*, which is the process of mutually agreeing (or disagreeing) on the meaning of information. Convergence processes require rapid information transmission and less cognitive processing whereas conveyance processes require more cognitive processing and less rapid information transmission. Therefore, convergence processes benefit from media that support high synchronicity whereas conveyance processes benefit from media that support lower synchronicity.

*Synchronicity* is defined as “a shared pattern of coordinated behavior as [teammates] work together” (Dennis et al., 2008, p. 575). Five fundamental media capabilities determine synchronicity: transmission velocity (how fast a message can reach the recipient), parallelism (the number of transmissions that can occur simultaneously), symbol sets (the ways in which a message can be encoded), rehearsability (the ability to edit a message before sending it), and reprocessability (the ability to retrieve a message again after it has been transmitted). Highly synchronous mediums have higher transmission velocity and more natural symbol sets, but have less parallelism, rehearsability, and reprocessability. Dennis et al. (2008) argue that finding the best fit between communication processes and media appropriation will enhance communication and task performance.

A final consideration of MST is appropriation factors, which include familiarity with a medium, training on a medium, past experiences, and social norms. These factors play a role in determining the appropriate or best fit for a communication event. For instance, if a team member is not familiar with a tool such as Google Docs, communication performance may suffer even if the medium fits the process.

**Laboratory Experiments on MST**

Much of the empirical work on MST occurs in laboratory settings and tests media differences. For example, Dennis, Valacich, Speier, and Morris (1998) found support for MST in that face-to-face groups (high synchronicity) performed better on convergence tasks whereas e-mail groups (low synchronicity) performed better on conveyance tasks. Murthy and Kerr (2003) tested face-to-face and text-based CMC for idea generation (conveyance) and problem solving (convergence). They found support for MST because those in the face-to-face group performed better on the convergence task whereas the groups using the text-based CMC performed equally as well as the face-to-face on the conveyance task. Finally, Lober, Grimm, and Schwabe (2006) compared audio to text-based chat and found support for MST, as participants who used audio chat performed better on a convergence task.

Some empirical work has compared only CMC mediums and did not examine face-to-face interactions. For instance, Schouten, Van den Hooff, and Feldberg (2010) found support for MST when comparing 3D virtual worlds and text-based chat, as 3D virtual worlds out performed chat in convergence processes. Similarly, Baker (2002) found support for MST in virtual teams because teams using video and audio (high synchronicity) performed significantly better on a convergence task than did audio-only (low synchronicity) teams. Hassell and Limayem (2010) found a significant relationship between media synchronicity and job satisfaction when they explored communication in a virtual world (high synchronicity) versus e-mail (low synchronicity) on a decision-making task.

Another strand of research compares media capabilities. Munzer and Holmer (2008) investigated parallelism, immediacy of feedback, and reprocessability within text-based CMC. For coherence and mental effort, media that supported synchronicity had a positive effect, providing support for MST. But for task performance, there were no significant differences between the experimental treatments, which deviates from MST. Finally, in a study of deceptive communication Carlson and George (2004) found that participants preferred synchronous media when asked to detect deceptions (a convergence process) and asynchronous media when asked to engage in low-risk deceptions (a conveyance process), findings that support MST.

Because laboratory experiments test MST on short decision-making tasks, a need remains for testing MST in field settings. Additionally, previous research has treated media fit as an experimental condition and not as measurable behavior. While research has provided evidence that media fit positively affects communication and task performance, research has yet to examine whether training is an effective antecedent to media fit.

**Field Studies** **on MST**

Several field studies provide support for MST. For instance, Niinimaki, Piri, and Lassenius (2009) interviewed members of a global software development team who reported using media having higher synchronicity when they needed to “ask for clarifications”—a convergence process (p. 158). In a follow-up study, Niinimaki, Piri, Lassenius, and Paasivaara (2010) similarly found that a single medium was often not sufficient for completing tasks and activities. DeLuca and Valacich (2006, 2005) interviewed participants who reported that low synchronicity media were better for conveyance processes, and that high synchronicity media were preferred for convergence processes. Finally, Fox, Leicht, and Messner (2010) suggested that MST has practical applications for planning physical media in the architecture, engineering, and operation industry.

But some field studies have not supported MST. Hung, Duyen, Kong, and Chua (2008) surveyed instant-messaging users who considered the medium more effective for conveyance than for convergence processes. And Muhren, Van den Eede, and Van de Walle (2009) interviewed senior managers of humanitarian aid organizations who reported that media with low synchronicity capabilities were not sufficient for conveyance processes.

Because research has revealed such mixed support for MST in field settings, and no field studies exist examined the direct impact of MST on communication outcomes and team functioning, I wanted to contribute to this research area by examining MST in a classroom experiment and measuring team outcomes.

**Training for Computer-Mediated Communication**

The training used in this study follows many of the principles of CMC training outlined in the computers and composition literature. For instance, Breuch (2002) described a framework for computer-based instruction in which she outlined the importance of not just performance but also of contextual and linguistic factors when teaching technology. Duffelmeyer (2003) supported this notion that computer-based instruction should not purely rely on technical training when she outlined the importance of encouraging 1st-year TAs to critically explore computer integration and “not robotically follow a series of steps” (p. 308). These perspectives on computer-based instruction are particularly useful in framing the MST training described here because the training focuses primarily on contextual factors (i.e., learning to match media to tasks) and less on performance (i.e., how to use a particular technology). Dennis, Wixom, and Vandenberg. (2001) further supported this notion of training when they argued that training should go beyond technical training to involve creating shared expectations for group members.

Communication training has also been connected to important team-level outcomes. Cornelius and Boos (2003) found that groups who received communication training experienced higher levels of coherence and mutual understanding than did groups who received no training. Savicki, Kelley, and Ammon (2002) tested a high communication-style training protocol for e-mail communication and found that groups receiving training reported significantly higher levels of self-disclosure and willingness to share opinions. Because MST training has never been empirically examined in any context, this study seeks to determine how effective MST training is in influencing students’ behavior and important team outcomes.

**Hypotheses**

The central proposition of MST states that matching media capabilities, communication processes, and appropriation factors leads to media fit. Since the MST training program explicitly teaches participants these concepts, groups who receive MST training should report higher levels of media-fit behavior. Therefore, I propose hypothesis 1 (H1):

**H1**. Participants who receive MST training will report higher levels of media-fit behavior than will participants who do not receive this training.

Second, Dennis et al. (2008) argued that “communication performance will be improved when individuals use a variety of media to perform a task, rather than just one medium” (p. 575). Because participants will be trained to this end, participants who receive MST training should communicate more, as hypothesis 2 (H2) proposes:

**H2.** Participants who receive MST training will communicate more than will participants who do not receive this training.

Third, MST posits that media fit leads to improved communication performance. In previous research, communication performance is measured at the task level. Because this study is a field study, I could not measure communication performance for each individual task. Instead, I used a fully validated communication-quality construct, which consists of five subcategories: discussion quality, appropriateness, richness, openness, and accuracy (Lowry, Roberts, Romano, Cheney, & Hightower, 2006). Hypothesis 3 (H3), therefore, is broken into five subhypotheses to measure communication quality:

**H3a.** Participants who receive MST training will report higher levels of group discussion quality than will participants who do not receive this training.

**H3b.** Participants who receive MST training will report higher levels of communication appropriateness than will participants who do not receive this training.

**H3c.** Participants who receive MST training will report higher levels of communication richness than will participants who do not receive this training.

**H3d.** Participants who receive MST training will report higher levels of openness than will participants who do not receive this training.

**H3e.** Participants who receive MST training will report higher levels of accuracy than will participants who do not receive this training.

Finally, MST argues that task performance is positively influenced by communication performance. Again, since this study examines teams in a field setting, I cannot not measure performance at the task level. Furthermore, the training should hypothetically influence behavior throughout the project and not merely on a single task. Hypothesis 4 (H4), then, predicts improved performance, which is measured using a fully validated group-effectiveness construct:

**H4.** Participants who receive MST training will report higher levels of group effectiveness than will participants who do not receive this training.

This theoretical research model is illustrated in Figure 1.

**INSERT FIGURE 1 ABOUT HERE**

**Method**

In the methods section, I describe the participants, MST training, measures, and procedure used in this study. My university’s Institutional Review Board approved this study.

**Participants**

I recruited 80 participants from a population of undergraduate students enrolled in three technical communication courses at a large state university in the southern United States. I did not personally know any of the participants. Participation in the study was voluntary, and students earned a small amount of extra credit in exchange for their participation. Of the 80 participants, 41 were female and 39 were male.

The three general technical communication classes from which I recruited the participants were selected because they required a team project with research and writing-intensive deliverables. Furthermore, these projects required both convergence and conveyance processes. The project for class 1 required teams to conduct a feasibility study, write a feasibility report, and formally present their findings; this project lasted eight weeks. In class 1, the instructor did not formally lecture or assign readings on teamwork. The instructor encouraged students to self-appoint leaders, but students did not have any other team roles. Finally, the instructor required a peer evaluation at the end of the project. The project for classes 2 and 3 lasted seven weeks and required teams to comprehensively evaluate, rewrite, and redesign a series of technical documents for the university library. The instructor for classes 2 and 3 did not formally lecture or hold discussions on teamwork; however, the instructor assigned reading for a chapter on teamwork from a technical communication textbook. Finally, the instructor did not assign team roles and did not require the students to self-assign team roles.

To achieve a random team assignment in each class, I numbered each participant (e.g., 1 through 24 for a class with 24 students). Using an online random-number generator, I generated a randomly ordered list of numbers based on the total number of participants in each class. Then I started with the first participant on the generated list and assigned that participant to the experimental or control group by randomly generating a 0 (control group) or a 1 (experimental group). To achieve equal representation, the next number on the list was automatically placed in the opposite group, and the process was repeated. In two of the three classes, there were 28 participants (seven teams of four). To account for the odd number of teams, I placed all of the first four randomly generated numbers into either the experimental group or the control group, and then proceeded with the alternating random assignment.

Once participants were divided into experimental and control groups, I randomly generated teams of four participants. This created 20 total teams—10 in the experimental group and 10 in the control group. Class 1 had seven teams (4 control, 3 experimental), class 2 had seven teams (4 experimental, 3 control), and class 3 had six teams (3 experimental, 3 control).

**MST Training and Measures**

Before the project began, I facilitated a 50-minute MST training session for the experimental group. I introduced participants to the principles of MST and how it practically applies to their projects. I presented much of this content via lecture, using presentation slides supplemented with classroom discussion. All participants received paper copies of the presentation slides, and they were instructed to take notes during the lecture. Instructors received all materials as well, but they did not instruct students on MST beyond the training. Students also considered four team communication scenarios and selected media based on what they learned about MST.

At the end of the training session, each team completed a handwritten media-choice plan in which all team members agreed on media for a variety of communication scenarios. They also added their own scenarios to the plan based on previous experience working in teams. Finally, participants were trained to complete a communication log, which was used to measure communication quantity. At the midway point of the project, I conducted a 30-minute follow-up session with the experimental group.

Participants in the control group received a placebo training session in which they were trained to log their communications, but they did not receive any MST training. At the midway point, they also received a placebo follow-up session in which I hosted a question-and-answer session regarding the communication-logging process. Again, no MST training was provided in the follow-up training for the control group.

**Procedure**

After receiving consent from participants, I created teams and scheduled the training sessions. I instructed teams in the experimental group to arrive for the first part of the period and teams in the control group to arrive for the second part. Participants were not told whether they were assigned to the experimental group or the control group. I presented the MST training to the experimental group and then allowed them to leave class. Then I presented the placebo training to the control group. To avoid bias, participants were asked not to discuss their training experiences. At both the MST and the placebo training sessions, I instructed participants to log all of their communication during the project. To complete the logs, students were told to communicate as they normally would (via e-mail, text message, Facebook posts, etc.) and then complete an online form for each communication. The form asked three questions: time of communication, media, and message type. Based on the scope of this study, I did not analyze these three variables. Instead, the only data from the communication logs used in this study were those on quantity of communication (measured by the number of forms completed per participant). Students were asked to log their communication as it occurred, but I gave them a weekly Sunday deadline so that I could monitor participation. If students did not communicate during a week, they notified me via e-mail and still remained eligible for extra credit. I checked the logs on Monday to ensure that all students were actively participating. If a participant missed the deadline, I sent out a reminder e-mail with a Monday evening deadline. Overall, all the participants except one completed their logs every week of the project.

At the midway point of the project, I asked the experimental group to arrive at the beginning of the class period and the control group to arrive halfway through the period. I provided follow-up MST training to the experimental group and placebo training to the control group. After teams completed their projects and submitted them to their instructor, I administered the final survey during class using my university’s online survey software. The survey was completed before students received grades to avoid bias. Participants were asked not to sit next to their teammates when completing the survey. Once submitted, participants were informed that they had successfully completed the research project.

**Measures**

In this subsection, I outline the four main measurement scales used in the study. For each scale, I present the internal reliability statistic and a sample item.

***Media-Fit Behavior*.** The media-fit behavior scale measures the extent to which the participant considers the fit between a medium’s capabilities of supporting synchronicity, communication processes, and appropriation factors when communicating in a group project. Although previous research has treated media fit as an experimental condition, no self-reporting measure has been developed that examines media fit behavior as an outcome variable. Therefore, I developed a 7-item media fit scale that is measured on a 7-point likert scale (1 meaning *strongly disagree* and 7 meaning *strongly agree*). I constructed each item based on the propositions in MST that lead to media fit. Initial tests of this scale indicated high internal reliability (∝ = .86). For example, this scale includes the following item: “Before communicating with my team, I carefully selected media based on the preferences or expectations of my teammates.”

***Communication Quantity***. The communication quantity scale (Lam, 2013) measures the number of unique communication events an individual sends during the span of a project. Communication quantity was collected based on the communication logs that participants kept throughout the project, with each entry representing a single communication event. For conversational mediums such as instant messaging, participants were instructed to enter the conversation as a single entry, so that entire conversation would constitute one unique event.

***Communication Quality*.** The **c**ommunication quality scale measures the participant’s overall perceptions of team communication quality and consists of five subscales including discussion quality, appropriateness, richness, openness, and accuracy (Lowry et al., 2006). Each of these is fully validated and measured on a 7-point likert scale.

The *discussion quality* subscale (Burgoon, et al., 2002) measures the level of “effectiveness and satisfaction experienced during group discussions and discussion development” (Lowry et al., 2006, p. 635). A sample item is “The outcome of the group discussions were satisfactory”. This measure has high internal reliability (∝ = .82)

The *communication appropriateness* subscale (Burgoon & Walther, 1990) measures how “suitable, applicable, and satisfying a group’s communication is to its members” (Lowry et al., 2006, p. 635). A sample item is “The group discussions were suited to the topic.” This measure has high internal reliability (∝ = .77).

The *communication richness* subscale (Burgoon, Bonito, et al., 2002) measures how “on-topic, detailed, and vivid messages are within a group” (Lowry et al., 2006, p. 635). A sample item is “In terms of our group’s communication, responses were filled with details.” The measure has high internal reliability (∝ = .77).

The *communication openness* subscale (O’Reilly & Roberts, 1977) measures the “willingness of a group member to be receptive to the communication of others” (Lowry et al., 2006, p. 635). A sample item is “When people communicated to each other in this group, there was a great deal of understanding.” The measure has high internal reliability (∝ = .80).

The *communication accuracy* subscale (O’Reilly & Roberts, 1977) measures “the degree to which information in a group is correctly communicated and properly understood” (Lowry et al., 2006, p. 635). A sample item is “The information I received was generally accurate.” The measure has high internal reliability (∝ = .78).

***Group Effectiveness***. The group effectiveness scale (Jung & Sosik, 2002) measures an individual’s perception of how effective a group or team is at completing its goals and tasks. A sample item is “My group accomplished its goals successfully.” The measure has high internal reliability (∝ = .73).

**Results**

I tested the hypotheses in this study by performing a one-tailed *t-*test for measure differences. I also calculated the effect size for each hypothesis. In this section, I present the test results for each hypothesis.

**H1. Participants who receive MST training will report higher levels of media-fit behavior than will participants who do not receive this training.**

A one-tailed *t*-test revealed a significant difference between the two groups (*t* = 2.32, *p* = .011). That is, participants who received training reported significantly higher levels of media-fit behavior (*M* = 5.53, *SD* = 1.07) than did participants who did not receive training (*M* = 4.95, *SD* = 1.08). There was a medium effect size for H1 (*d* = .52). Cohen (1992) provides general guidelines for interpreting effect size: small (*d* = .2), medium (*d* = .5), and large (*d* = .8). Therefore, H1 was supported with a medium effect.

This finding suggests that students who received training were more considerate of media capabilities, which increased their ability to appropriately match media to communication tasks. Additionally, it suggests that the training sessions were effective at influencing behavior over an extended period of time.

**H2. Participants who receive MST training will communicate more than will participants who do not receive this training.**

A one-tailed *t*-test revealed a significant difference between the two groups for communication quantity (*t* = 2.70, *p* = .004). That is, participants who received training communicated significantly more (*M* = 14.83, *SD* = 6.64) than did those who did not receive training (*M*  = 9.67, *SD* = 9.44). The effect size for communication quantity was medium to large (*d* = .61). Thus, H2 was supported with a medium to large effect.

This finding suggests that those who received training may have altered their communication behavior by choosing to use more than one medium for a single task, as Daft and Lengel (1984) suggested.

**H3a. Participants who receive MST training will report higher levels of group discussion quality than will participants who do not receive this training.**

A one-tailed *t*-test revealed a significant difference between the two groups for group discussion quality (*t* = 1.933, *p* = .02). That is, participants who received training reported significantly higher levels of group discussion quality (*M* = 5.91, *SD* = .62) than did participants who did not receive training (*M* = 5.58, *SD* = .85). The effect size for group discussion quality was medium (*d* = .45). H3a, then, was supported with a medium effect.

This finding is particularly important because it suggests that MST training not only alters behavior, it affects team outcomes. Specifically, the finding suggests that participants who effectively used media were also more satisfied with their team discussions. Because students were not trained in discussion management, this finding suggests that appropriate media use may have a significant influence on perceptions of the actual message itself.

**H3b. Participants who receive MST training will report higher levels of communication appropriateness than will participants who do not receive this training.**

A one-tailed *t*-test revealed no significant difference between the two groups for appropriateness (*t* = 1.43, *p* = .078). Although participants who received training reported higher levels of appropriateness (*M* = 6.37, *SD* = .43) than did participants who did not receive training (*M* = 6.19, *SD* = .64), this difference was not statistically significant. Thus, H3b was not supported. MST training, therefore, might not be a factor in appropriate communication.

**H3c. Participants who receive MST training will report higher levels of communication richness than will participants who do not receive this training.**

A one-tailed *t-*test revealed a significant difference between the two groups for richness (*t =* 1.88, *p* = .03). That is, participants who received training reported significantly higher levels of richness (*M* = 5.44, *SD* = .49) than did participants who received no training (*M* = 5.16, *SD* = .75). The effect size was medium (*d* = .44). Thus, H3c was supported with a medium effect. This finding suggests that training not only influenced behavior but also ultimately played a role in how on-topic and vivid a team’s communication was.

**H3d. Participants who receive MST training will report higher levels of openness than will participants who do not receive this training.**

A one-tailed t-test revealed a significant difference between the two groups for openness (*t* = 1.775, *p* = .04, *d* = .41). That is, participants who received training reported significantly higher levels of openness (*M* = 6.05, *SD* = .75) than did participants who did not receive training (*M* = 5.66, *SD* = 1.15). The effect for this difference was medium (*d* = .41). Thus, H3d was supported with a medium effect.

This finding suggests that MST training actually influenced individuals to be more open and receptive to their teammates communication. The finding is particularly interesting because openness is a relational aspect of team functioning; therefore, the finding supports the extension of MST into relational team outcomes.

**H3e. Participants who receive MST training will report higher levels of accuracy than will participants who do not receive this training.**

A one-tailed *t*-test revealed no significant difference between the two groups for accuracy (*t* = 1.23, *p* = .22). Although participants who received training reported higher levels of accuracy (*M* = 6.01, *SD* = .75) than did participants who did not receive training (*M* = 5.71, *SD* = 1.15), this difference was not statistically significant. MST training did not seem to significantly affect whether information was accurately conveyed, so H3e was not supported.

**H4. Participants who receive MST training will report higher levels of group effectiveness than will participants who do not receive this training.**

A one-tailed t-test revealed no significant difference between the two groups (*t* = .94, *p* = .17). Although participants who received training reported higher levels of group effectiveness (*M* = 6.23, *SD* = .65) than did participants who did not receive training (*M* = 6.06, *SD* = .98), this difference was not statistically significant. Thus, H4 was not supported. Table 1 summarizes the test results for these hypotheses.

INSERT TABLE 1 AROUND HERE

**Discussion**

In this section, I divide my discussion of the results between theoretical and pedagogical implications.

**Theoretical Implications**

Several findings in this study provide theoretical support for MST in a research context that has not been previously examined, MST training. These findings are important because they suggest that MST training changes communication behavior and that such training improves communication quality.

***MST Training Changed Communication Behavior*.** An important implication of this study is that MST training alters communication behavior both indirectly and directly. Indirectly, MST training positively affected communication quantity. That is, the training did not explicitly teach students to communicate more; increased communication was simply a natural outgrowth of that training. Perhaps those in the training group used more than one medium for a single task, resulting in increased communication. Regardless of the reason, increased communication between students in team contexts has benefits. For instance, my earlier research (Lam, 2013) suggests that a lack of communication from team members may be related to an inequitable distribution of work.

MST training also had a direct effect on media-fit behavior because the findings suggest that participants who received training implemented what they learned that the training throughout the project. These findings support the notion that media fit is a behavior that can be taught, and, more important, that this type of training is sufficient for changing behavior. This training encourages critical thinking and does not simply teach students how to use tools or technology, which are constantly changing. Instead, it provides students with a framework to critically evaluate the capabilities of all tools (past, present, and future). Therefore, the fact that media-fit behavior was significantly altered provides support for a sustainable approach to selecting and effectively using communication media.

Another major implication of this study is that it provides initial support and validation for a self-reporting instrument for measuring media-fit behavior. Previously, media fit has not been conceptualized as an outcome variable, and researchers had yet to examine antecedents to media fit. This study examines individuals’ behavior that leads to media fit and introduces a broader behavioral view in which media fit is not a given. Instead, it assumes that a project has some tasks in which individuals may effectively exhibit media fit behavior and others in which they may not. Therefore, developing a self-reporting instrument for measuring media-fit behavior is particularly important because it will allow researchers to measure this behavior holistically. The finding that training positively affected media-fit behavior provides initial evidence that this measure could be useful in future testing and validation.

***MST Training Improved Communication Quality*.** The results of the study also provide evidence that improved media-fit behavior affected desirable team communication outcomes such as discussion quality, richness, and openness. First, MST training appeared to lead to higher discussion quality, in that the participants who received training rated their discussions higher for effectiveness and satisfaction than did those who did not receive training. This finding provides support for the notion that the medium in which a message is delivered significantly affects how the message is actually perceived and thus affects overall communication satisfaction. Again, students in these courses were never instructed on how to hold effective group discussions. Therefore, the fact that MST training positively influenced discussion quality is noteworthy because the relationship between MST training and discussion quality has not been previously established. The implications of this finding also extend beyond discussion quality, as research suggests that high-quality discussions lead to shared knowledge and a better understanding of the collective group problem (Burgoon et al., 2002). Therefore, the connection between MST training and discussion quality may have broader impact for teams.

Another significant finding is that MST training positively affected communication richness, characterized by on-topic, detailed, and vivid messages. This finding suggests that participants in the training group may have more effectively selected media, which in turn facilitated more detailed and vivid responses. Again, the relationship between these two variables has not been previously established, so the finding provides extended support to MST. Research has outlined the importance of rich communication, finding that it increases group coordination and pooling of individual information (Burgoon et al., 2002). Further, studies suggest that pooling of information is an important factor in overall group performance (Ackerman & McDonald, 2000).

Finally, MST training increased openness, which is characterized by individuals’ receptiveness to others’ communication. Like discussion quality and richness, no previous relationship between MST and openness had been examined. In addition, openness is a particularly interesting outcome because it has implications on relational aspects of teamwork. For instance, research suggests that increased openness allows team members to better address conflicts with maturity (Haney, Banks, & Zimbardo, 1973). Furthermore, a team member who is open “evaluates threats more accurately and tolerates change more graciously” (Lowry et al., 2006, p. 635). Therefore, the fact that MST training facilitated more open discussions is important because openness is a quality that extends into the overall relational health of a team.

Also worth discussing are nonsignificant findings, which includes the finding that MST training had no significant impact on scores for accuracy (i.e., the degree to which information was correctly communicated), appropriateness, and effectiveness. Both the training and control groups reported relatively high levels of accuracy (*M* = 6.01 and *M* = 5.75, respectively). This finding might suggest that even if participants chose to communicate in a way that violated MST, information could still be accurate. A similar explanation may also hold true for appropriateness (i.e., how suitable and applicable communications were). Both groups reported high levels of appropriateness, which suggests that a violation of MST might not necessarily cause inappropriate communication.

A final nonsignificant finding worth discussing is that MST training did not affect scores for overall group effectiveness. There may be a few explanations for this finding. First, the overall mean scores were very high for both experimental (*M =* 6.23) and control (*M* = 6.06) groups. Perhaps responses were skewed positively because participants were generally satisfied because they had just submitted their projects. Additionally, both instructors provided their students with some (albeit limited) instruction on teamwork. One instructor required all students to read a chapter on teamwork from a technical communication textbook, and the other instructor encouraged students to assign team roles and implement peer evaluations. This instruction may have played a role in the generally high scores for group effectiveness.

**Pedagogical Implications**

MST provides a useful framework for instructors. Of course, MST training should not be the sole mechanism in which students are prepared for teamwork. Instead, instructors should consider integrating principles of MST into existing training paradigms such as Wolfe’s (2010) textbook and chapters from Hunzer’s (2012) book. Here are five practical ways that instructors can consider integrating MST into existing teamwork paradigms.

***1. Create a team media choice plan***. Wolfe (2010) articulated the importance of project planning when she pointed out that a “team that spends an hour at the very beginning of the project discussing goals, expectations, and team norms can save substantial time and stress later on in the project” (p. 28). She suggested creating a team charter that outlines goals, commitments, and potential problems. Because students will already be considering expectations during this exercise, it may be beneficial to have them complete a media-choice plan that can help them prepare for effective media use. The media-choice planning should be more about discussing than writing the plan

The plan that I use is a table with rows that outline common communication tasks such as simple conveyance messages (e.g., scheduling), complex convergence messages (e.g., suggestions for revision), or synchronous collaboration (e.g., group discussions or authoring). Students or instructors can alter these tasks in any way that is beneficial to the project. I also provide blank rows in the table for students to add their own tasks. Students can then discuss and agree upon a medium or media for each communication task. The plan is useful in the planning stage, but also can be referenced if communication begins to break down throughout a project.

***2. Incorporate a media-choice plan for the project manager*.** Assigning team roles is an important factor in the equitable distribution of work (Wolfe, 2010). In particular, Wolfe outlined the importance of the project manager position, but she argued that students often misconstrue a project manager to be a boss or dictator. In reality, the project manager’s primary role is “keeping the project on course” (p. 13), which often means that the project manager becomes the primary communicator and coordinator. As such, I require project managers to think through and complete a separate media-choice plan that focuses specifically on tasks and scenarios unique to their role. For instance, if a project manager needs to send a deadline reminder to team members (conveyance process), they should consider using a medium high in reprocessability (so all team members can refer back to the date). In that case, a group text or phone call is not as reprocessable as an e-mail or calendar reminder. If the deadline is urgent, the project manager must also consider transmission velocity, which might require an e-mail reminder and text message instead of communicating via just one medium. This media plan does not replace the need for an overall project schedule, but in the inevitable case of an impromptu coordination task, the plan for project managers could prevent miscommunication.

***3. Use the media-fit behavior scale and MST framework to help manage diverse teams*.** Wolfe (2010) discussed the impact of conflicting norms and provided students with tools such as discussion, presentation, and problem-solving style inventories that allow students to gain insights about themselves and teammates. A useful addition to these tools is the media-fit behavior scale, which allows individuals to assess their media-fit tendencies. Since many students are not thinking critically about media choice, completing this scale allows them to more deeply think through the implications of their media choices. Instructors or students can also identify those who score low on the scale and provide additional instruction on MST. Those who score high on the scale may be identified as potential candidates for project manager.

MST can also provide a relevant framework for further understanding gender differences, which has been previously studied in writing teams (Wolfe & Alexander, 2005; Wolfe & Powell, 2006). In regard to media, research shows that women often prefer online over face-to-face discussions, perhaps due to the interruptive nature of face-to-face discussions (Lind, 1999; Wolfe, 2000). Furthermore, according to Woodfield (2000), women tend to prefer holistic problem solving whereas men prefer action-oriented problem solving. Action-oriented problem solvers may prefer a synchronous medium (e.g., face-to-face) that allows for quick decision making whereas those who prefer holistic problem solving may prefer a medium that is slower in transmission velocity so that they can more thoughtfully process and communicate their ideas. If students are cognizant of their problem-solving preferences, perhaps they can leverage media choices to compromise and avoid potential conflict. For instance, team members might select synchronous chat for convergence processes as it provides advantages for both types of problems solvers. For holistic problem solvers, chat allows for rehearsability and reprocessability as individuals can scroll back and read through the chat conversation at any point during or after the conversation. For action-oriented problem solvers, online chat has been found to increase decision-making speeds (Bacabac, 2012).

***4. Apply MST to the writing process*.** Principles of MST could be useful in supporting phases of writing such as prewriting, drafting, and revising. Prewriting involves input from a variety of teammates that actually may be hindered in face-to-face meetings. Instead, media that supports rehearsability and reprocessability (e.g., real-time discussion board or chat) may allow students to thoughtfully provide input and feedback and make decisions more easily (Bacabac, 2012).

For the drafting process, Alexander (2012) proposed a layered writing model in which individuals author alone on overlapping parts of the project and then converge in face-to-face meetings to discuss what they have written. While this process may be effective, it may not be viable for all classes, particularly when instructors are not able to dedicate class time for face-to-face meetings. In these instances, convergence on global writing issues may need to occur online. To avoid what Wolfe (2010) described as a divided collaboration style in which team members divide the work and compile their respective parts, synchronous online environments for collaboration should be considered through the lens of MST. When considering a synchronous online medium, students should consider reprocessability because it can greatly differ depending on the tool. For example, Google Hangout is a group video-chat tool that allows for screen sharing and synchronous text-based chat. All within a single tool, students can view a document draft, discuss opinions, and write down key discussion points using the text-based chat. A team member can then go back through the text-based chat and construct meeting minutes based on the chat. If students were to choose a different video-chat option without text-based chat capabilities, they would not be able to reprocess vital information. The point of MST, however, is not to promote any particular technology. Again, technology changes rapidly and can easily disappear. Rather, by considering media capabilities through the lens of MST, students will be better equipped to select tools that will more effectively meet their task goals.

Finally, MST can support the revision process. Wolfe (2010) outlined a variety of technologies available for use in the revision process. Thinking through these technologies through the lens of MST provides further opportunities for students to effectively revise. Again, students should think carefully about their need for reprocessability before choosing any technology for a revision task. Google Docs, for example, allows for both synchronous and asynchronous revision, but it lacks the reprocessability that the Microsoft Word comment feature provides. Therefore, if everyone is present during the revision process, Google Docs may be effective; however, asynchronous revision would benefit from a technology such as Microsoft Word. Additionally, media high in rehearsability should be considered for providing potentially negative or face-threatening feedback. For example, e-mail allows senders to rehearse or edit their suggestions before sending them and receivers to “react to (these) suggestions in private and…tone down [their] initial reactions” (Wolfe, 2010, p. 69). In summary, using MST as a framework for choosing collaborative writing technology provides students with a helpful decision-making tool during the various writing phases.

***5. Encourage flexible media use to help alleviate conflict*.** When conflict arises in a team project, changing media habits or procedures may help to the diffuse conflict. Wolfe (2010) described a situation in which nonassertive individuals feel that their teammates are not listening to their ideas. Her solution, which is supported by MST, is to move the conversation to e-mail because “emailing your thoughts gives you a chance to state your ideas without the pressure and competition of a face-to-face meeting” (p. 113). Changing media habits based on MST might also be helpful when a team member misses meetings. In such cases, Wolfe suggested emailing the student and perhaps assigning the student with extra work. In addition to these measures, it may be helpful to alter media use to accommodate the team member as well. If the team member is willing to work but cannot make meetings due to external factors like a long commute, perhaps a hybrid face-to-face/video chat meeting, where some students are collocated and others are on video chat, might be beneficial and could alleviate conflict.

**Limitations and Directions for Future Research**

As with any experiment, generalizability is an issue when applying findings outside of the studied population. That is, because the population of this study consists primarily of students, the results might not extend to practitioners because their existing organizational frameworks for communication are likely more rigid. Therefore, the findings of this study must be viewed in the context in which they were discovered. But similar studies in workplace contexts could provide valuable insight.

The study has also a few limitations in regard to data collection. First, the measure for media-fit behavior is exploratory and has not been fully validated. Future research should fully validate the measure and explore additional applications of it. Second, using self-reporting surveys has inherent limitations to the scope of feedback that a participant can provide. Therefore, a future field study could also examine behavior with methods such as observation or interviews. And third, I did not collect any information regarding face-to-face interaction. A future study should examine how face-to-face communication and mediated communication interact. Finally, a future study might benefit from collecting additional outcome variables such as social loafing or free riding to determine how effective media use might affect those variables.

Group projects provide students with an opportunity to build important skills that 21st century employers seek. As technical communication instructors, then, we have the responsibility to prepare our students by equipping them to think critically about their media choices. This study provides empirical support for integrating MST into existing teamwork training protocols.

**References**

Ackerman, M. S., & McDonald, D. W. (2000). Collaborative support for informal information in collective memory systems. *Information Systems Frontiers*, *2*, 333-347.

Alexander, K.P. (2012). Collaborative composing: Practices and strategies for implementing team projects into writing classrooms. In K.M. Hunzer (Ed.), *Collaborative learning and writing: Essays on using small groups in teaching English and composition* (pp. 181-200). Jefferson, NC: McFarland.

Bacabac, F. (2012). Revisiting collaborative writing and electronic dialogues in business communication. In K.M. Hunzer (Ed.), *Collaborative learning and writing: Essays on using small groups in teaching English and composition* (pp. 166-180). Jefferson, NC: McFarland.

Baker, G. (2002). The effects of synchronous collaborative technologies on decision

making: A study of virtual teams. *Information Resources Management Journal (IRMJ)*, *15*(4), 79-93.

Barker, R. T. & Franzak, F. J. (1997). Team building in the classroom: Preparing students for their organizational future. *Journal of Technical Writing and Communication,* 27, 303-315.

Breuch, Lee-Ann Kastman. (2002). Thinking critically about technological literacy: Developing a framework to guide computer pedagogy in technical communication. *Technical Communication Quarterly*, 11, 267-288.

Burgoon, J. K., Bonito, J. A., Ramirez, A., Dunbar, N. E., Kam, K., & Fischer, J. (2002). Testing the interactivity principle: Effects of mediation, propinquity, and verbal and nonverbal modalities in interpersonal interaction. *Journal of communication*, *52*(3), 657-677.

Burgoon, J. K., & Walther, J. B. (1990). Nonverbal expectancies and the evaluative consequences of violations. *Human Communication Research*, *17*, 232-265.

Carlson, J. R., & George, J. F. (2004). Media appropriateness in the conduct and discovery of deceptive communication: The relative influence of richness and synchronicity. *Group Decision and Negotiation*, *13*, 191-210.

Cohen, J. (1992). A power primer. *Psychological bulletin*, *112*(1), 155.

Cornelius, C., & Boos, M. (2003). Enhancing mutual understanding in synchronous computer-mediated communication by training trade-offs in judgmental tasks. *Communication Research*, *30*, 147-177.

Daft, R. L., & Lengel, R. H. (1984). Information richness: A new approach to managerial behavior and organizational design. *Research in Organizational Behavior, 6*, 191-233.

DeLuca, D., & Valacich, J. S. (2005, January). Outcomes from conduct of virtual teams at two sites: Support for media synchronicity theory. In R. Sprague, Jr. (Ed.), *Proceedings of the 38th Annual Hawaii International Conference on* *System Sciences* (p. 50b). Los Alamites, CA: IEEE Computer Society.

DeLuca, D., & Valacich, J. S. (2006). Virtual teams in and out of synchronicity. *Information Technology & People*, *19*, 323-344.

Dennis, A. R., & Kinney, S. T. (1998). Testing media richness theory in the new media: The effects of cues, feedback, and task equivocality. *Information systems research*, *9*, 256-274.

Dennis, A. R., Fuller, R. M., & Valacich, J. S. (2008). Media, tasks, and communication processes: A theory of media synchronicity. *MIS Quarterly, 32*, 575-600.

Dennis, A. R., & Valacich, J. S. (1999). Rethinking media richness: Towards a theory of media synchronicity*. Proceedings of the 32nd Hawaii International Conference on System Sciences* (pp. 10-17). Los Alamites, CA: IEEE Computer Society Press.

Dennis, A. R., Valacich, J. S., Speier, C., & Morris, M. G. (1998, January). Beyond media richness: An empirical test of media synchronicity theory. *Proceedings of the 31 Hawaii International Conference on System Sciences* (pp. 48-57). ). Los Alamites, CA: IEEE Computer Society Press.

Dennis, A. R., Wixom, B. H., & Vandenberg, R. J. (2001). Understanding fit and appropriation effects in group support systems via meta-analysis. *MIS Quarterly*, *25*, 167-193.

Duffelmeyer, Barb Blakely. (2003). Learning to learn: New TA preparation in computer pedagogy. *Computers and Composition,* 20, 295-311.

Fox, S., Leicht, R. M., & Messner, J. I. (2010). Assessing the relevance of media synchronicity theory to the use of communication media in the AECO industry. *Journal of Architectural Engineering*, *16*(2), 54-62.

Haney, C., Banks, W., & Zimbardo, P. (1973). Interpersonal dynamics in a simulated prison. *International Journal of Criminology and Penology*, *1*, 69-97.

Hassell, M., & Limayem, M. (2010). Working in the new way: A preliminary study of media synchronicity and job satisfaction. *Proceedings of Americas Conference on Information Systems*, 1-10.

Hung, Y. T., Duyen, N., Kong, W. C., & Chua, A. L. (2008). Reexamining media capacity theories using workplace instant messaging. *IEEE Transactions on Professional Communication,* *51*, 352-368.

Hunzer, K. M. (Ed.). (2012). *Collaborative learning and writing: Essays on using small groups in teaching English and composition*. Jefferson, NC: McFarland.

Jung, D. I., & Sosik, J. J. (2002). Transformational leadership in work groups: The role of empowerment, cohesiveness, and collective-efficacy on perceived group performance. *Small Group Research*, *33*, 313-336.

Lam, C. (2013). The efficacy of text messaging to improve connectedness and team attitude in student technical communication projects. *Journal of Business and Technical Communication, 27*, 180-208.

Lind, M. R. (1999). The gender impact of temporary virtual work groups. *IEEE Transactions on Professional Communication, 42*, 276-285.

Lober, A., Grimm, S., & Schwabe, G. (2006). Audio vs. chat: Can media speed explain the differences in productivity? In *Proceedings of the 14th European Conference on Information Systems* (pp.2172-2183). Goteborg, S: Association for Information Sciences Electronic Library.

Lohnes, S., & Kinzer, C. (2007). Questioning assumptions about students' expectations for technology in college classrooms. *Innovate: Journal of Online Education*, *3*, 2.

Lowry, P. B., Roberts, T. L., Romano, N. C., Cheney, P. D., & Hightower, R. T. (2006). The impact of group size and social presence on small-group communication: Does computer-mediated communication make a difference?. *Small Group Research*, *37*, 631-661.

Muhren, W. J., Van Den Eede, G., & Van de Walle, B. (2009). Making sense of media synchronicity in humanitarian crises. *IEEE Transactions on Professional Communication*, *52*, 377-397.

Munzer, S., & Holmer, T. (2008). Bridging the gap between media synchronicity and task performance: Effects of media characteristics on process variables and task performance indicators in an information pooling task. *Communication Research, 36,* 76-103.

Murthy, U. S., & Kerr, D. S. (2003). Decision making performance of interacting groups: An experimental investigation of the effects of task type and communication mode. *Information and Management, 40*, 351-360.

Niinimaki, T., Piri, A., & Lassenius, C. (2009, July). Factors affecting audio and text-based communication media choice in global software development projects. In *Proceedings of the* *2009, Fourth IEEE International Conference on Global Software Engineering* (pp. 153-162). Washington, DC: IEEE Computer Society.

Niinimaki, T., Piri, A., Lassenius, C., & Paasivaara, M. (2010, August). Reflecting the choice and usage of communication tools in gsd projects with media synchronicity theory In *Proceedings of the* *2010, 5th IEEE International Conference on Global Software Engineering*  (pp. 3-12). Washington, DC: IEEE Computer Society.

O'Reilly, C. A., & Roberts, K. H. (1977). Task group structure, communication, and effectiveness in three organizations. *Journal of Applied Psychology*, *62*(6), 674.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*, 1-6.

Savicki, V., Kelley, M., & Ammon, B. (2002). Effects of training on computer-mediated communication in single or mixed gender small task groups. *Computers in Human Behavior*, *18*, 257-269.

Schouten, A. P., Van den Hooff, B., & Feldberg, F. (2010). Real decisions in virtual worlds: Team collaboration and decision making in 3D virtual worlds. In *Proceedings of the Thirty First International Conference on Information Systems* (pp. 1-19). Retrieved from Association for Information Systems Electronic Library.

Selwyn, N. (2009). The digital native–myth and reality. *New Information Perspectives, 61*, 364-379.

Wolfe, J. (2000). Gender, ethnicity, and classroom discourse: Communication patterns of Hispanic and white students in networked classrooms. *Written Communication, 17*, 491-519.

Wolfe, J. (2010). *Team writing: A guide to working in groups*. Boston, MA: Bedford.

Wolfe, J., & Alexander, K. P. (2005). The computer expert in a mixed-gendered collaborative writing group. *Journal of Business and Technical Communication*, *19*, 135-170.

Wolfe, J., & Powell, E. (2006). Gender and expressions of dissatisfaction: A study of complaining in mixed-gendered student work groups. *Women and Language,* 29, 13-21.

Woodfield. (2000). *Women, work, and computing.* Cambridge: UK: Cambridge University Press.

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Table 1. Summary of the Test Findings for the Hypotheses

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Hypothesis** | **Finding** | ***p* Value** | **Effect Size** | **Supported (Yes or No)** |
| H1 | Training group reports higher media fit. | .011\* | Medium  (*d* = .52) | Yes |
| H2 | Training group communicates more. | .004\* | Medium to Large  (*d* = .61) | Yes |
| H3a | Training group reports higher quality group discussions. | .02\* | Medium  (*d* = .45) | Yes |
| H3b | H3b Training group reports higher level of communication appropriateness. | .078 | N/A | No |
| H3c | Training group reports higher level of communication richness. | .03\* | Medium  (*d*  = .44) | Yes |
| H3d | Training group reports higher level of communication openness. | .04\* | Medium  (*d*  = .41) | Yes |
| H3e | Training group reports higher level of accuracy. | .22 | N/A | No |
| H4. | Training group reports higher group effectiveness | .17 | N/A | No |

\*Significant at <. 05 level

Figure 1. Research hypotheses and theoretical model.

H4

H4

H3

H2

H1

Communication quality

Communication quantity

Media-fit behavior

Group effectiveness

Media synchronicity theory training