Engaging the Digitally Engaged Student: Comparing Technology-Mediated Communication Use and Effects on Student Learning

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Chapter 9

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ABSTRACT

The role of communication technologies in the learning process is both a dynamic and complex issue. Yet, we know surprisingly little about how the use of specific communication technologies may influence classroom performance, key learning outcomes, and other measures of course satisfaction. The research reported here attempts to add to our knowledge about the role of communication in the technology-enhanced classroom (TEC) education and in technology-enhanced online (TEO) education through a direct comparison of two courses. Our findings indicate additional support for “The No Significant Difference Phenomenon.” Furthermore, we found that prior experiences lead students to gravitate towards their preferred learning environments, and that basic website elements are required in any learning environment to enhance student outcomes. Finally, we found that when used appropriately, the benefits of communication technology use in education outweigh many of the drawbacks.

INTRODUCTION

There are few educational settings in much of today’s world without some form of advanced technology being used. From the introduction of the personal computer in some classrooms in the early and mid-1980s, to today’s students carrying around laptop and tablet computers wirelessly accessing the ever-expanding virtual universe of the Internet, students and teachers are faced with many decisions regarding the use of technology in and out of the classroom. Although technology is ubiquitous in face to face (FtF) as well as
online education, when the role of communication technology is discussed in relation to education, most of us initially think of distance education or distance learning. The United States Distance Learning Association (n.d.) defines distance learning on their website as “the acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance” (www.usdla.org). In such a definition, mediated information and various technologies are clearly highlighted. Over 4.6 million students were enrolled in at least one online course in 2008, up 17% from the previous year (Allen & Seaman, 2010). With the USDLA (http://www.dltoday.net) reporting that the majority of post-secondary students in the U.S. will participate in online virtual learning at some level by 2011, our understanding of this learning environment, and the technologies that make it possible, is especially important.

The use of computer-based technologies is not only relevant to distance learning, but also has become an important part of traditional education (see Sherblom, 2010). In some instances the same technologies that may be used to deliver instruction in a distance education course today, can be used to enhance the traditional classroom environment. For example, in large classes where face-to-face (FtF) exchanges are limited, technology may provide a means for sharing information and facilitating communication between instructors, students, and others. Computer-mediated communication (CMC) use in the classroom has become a prevalent fixture in education today, according to Thompson (2008). Bejerano’s (2008) research also parallels this changing environment, noting that collegiate classrooms are viewing the Internet as the new medium for instruction.

Many of the technologies used in distance learning and enhanced traditional classrooms are primarily communication technologies. Examples include chat rooms (Kirkpatrick, 2005), virtual worlds (Nesson & Nesson, 2008), discussion boards (Levine, 2007), and videoconferencing (Umphrey, Wickersham & Sherblom, 2008). This communication technology use is consistent with a clear desire for quality interactions in any learning environment. For example, the research indicates the most successful online courses allow for increased access to the instructors and feature more democratic discussions (Swan, 2001). And, among the 10 concepts Janicki and Liegle (2001) associate with effective web-based instruction are a variety of presentation styles, clear feedback, consistent layout, clear navigation, and available online help.

Despite this recognition of the importance of interaction and communication technologies to facilitate such exchanges, we know surprisingly little about how the use of specific communication technologies may influence classroom performance, key learning outcomes, and other measures of course satisfaction. Furthermore, while “The No Significant Difference Phenomenon” would suggest similarities between traditional and distance learning environments (Russell, 1999), the exact role of communication technology in classroom and dispersed settings that both make use of such tools remains unclear. The research reported here attempts to add to our knowledge about the role of communication in the technology-enhanced classroom (TEC) environment and in the technology-enhanced online (TEO) environment. We begin with a review of relevant literature leading up to our three research questions. From there we describe our research, which compares the two learning environments directly. Next we present findings, and then conclude with a discussion, limitations, and directions for continued work in this area.

**BACKGROUND**

Before we address the literature specific to our research, we are first compelled to clarify terms. One of the real challenges in this literature is the diverse vocabulary used to describe various
learning environments. As we alluded to in our introduction, *traditional* typically, but not always, refers to classrooms largely unsupported by computer-based technology. Of course, today, a number of traditional classrooms might use technology to supplement and enhance learning. These arrangements can be labeled web- (or technology- or computer-) supported or web- (or technology- or computer-) enhanced. *Distance education* has historically included very traditional channels (e.g., audiocassettes, mailing printed papers) (see Lease & Brown, 2009). Today, the term *distance education* has become limited in its scope as more and more students enroll in online courses while enrolled in *traditional* courses at the same time and at the same institution. Distance education models may use a number of online and other computer-based technologies, much in the same way the TEO classes do. These contexts can and have been termed web-based, online, and e-learning. The term *hybrid* has more recently been used to describe courses with features of both traditional classrooms and technology-enhanced learning or even distance education (see Berger & Topol, 2001).

To hopefully clarify rather than add to the terms used, we see key differences between the location of students relative to the instructor and to one another (co-located in class versus dispersed across time/space) and the level of computer-based technology used to support the learning experience. Table 1 attempts to display these simple, but crucial differences, because the specifics regarding media attributes of a study are key to understanding the context and results of the research. Though our goal is to not to create or even elaborate on such a taxonomy, it does help illustrate our focus on what we see as two increasingly common learning environments: TEC (technology-enhanced classrooms where students are co-located with one another and the instructor on regular basis, but with use of computer-based technology in the class) and TEO (technology-enhanced online education where students are rarely, if ever, co-located with one another or the instructor for class purposes, but are connected with use of computer-based technology as a primary tool in the course). We wish to emphasize that computer-based technology is present in both of these learning environments (though not necessarily the same exact tools), but they differ primarily in terms of location of students/instructors. Although most previous literature has tended not to directly compare these two learning environments in this manner, we see them in need of this type of assessment given changes in education. Thus, the point of comparison is not about whether one has computer-based technologies, it is about the use of technologies as they support interaction (and other educational processes) and facilitate learning goals in both classroom and distance learning environments.

### General Comparisons of Learning Environments

In general, the bulk of the previous literature has offered conclusions supporting the idea that learn-

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**Table 1. Learning contexts based on location and use of computer-based technology**

<table>
<thead>
<tr>
<th>Location of Learners Relative to Instructor and One Another</th>
<th>Computer-Based Technology Use</th>
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<tbody>
<tr>
<td>Co-located in Time/Space (Classroom)</td>
<td>Traditional Classroom</td>
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<tr>
<td>Dispersed Across Time/Space (Distance Learning)</td>
<td>Traditional Distance Learning</td>
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<td></td>
<td>Technology-Enhanced Classroom (TEC)</td>
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<td></td>
<td>Technology-Enhanced Online (TEO) Learning</td>
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ers in a TEO scenario perform as effectively as students in TEC, furthering Russell’s (1999) “The No Significant Difference Phenomenon” claim. Today there is a growing body of research on the comparison of traditional and Web-based learning indicating similar results (see White, 1999). In fact, research of this nature has become such a frequent focus of scholars examining educational environments that a website (http://www.nosignificantdifferne.org/) has been created to document this research as it becomes available. As an example, Thirunaryanan and Perez-Prado (2001-2002) found that, in a comparison of pre- and post-test data on course material, there was no significant difference in the overall achievement from the students in the traditional versus the online version of the course. Furthermore, Carswell, Thomas, Petre, Price and Richards (2000) found no significant differences in learning outcomes of students enrolled in an entirely web-based computer science course as compared to their traditional course counterparts. Also, Long and Javidi (2001) found similar results in a comparison of two communication courses taught in traditional and online formats.

A comprehensive examination of comparisons of the two learning environments can be found in a report by Benoit, Benoit, Milyo, and Hansen (2006). The report concludes that, as both students and instructors become more experienced and adept with distance learning venues and related technology, learning and satisfaction with distance learning could increase. Similarly, even though Zhao, Lei, Kai & Tan’s (2005) review found support for “The No Significant Difference Phenomenon,” there were significant differences in the research studies themselves. In particular, they note that in studies prior to 1998, there were no reported differences, however, in studies published after 1998, distance learning environments were more effective than FtF education. In particular, the studies by Benoit et al. (2006) and Zhao et al. (2005) may indicate that a transition is occurring in the learning environment, where both the Net Generation students and instructors are becoming more adept in maximizing the benefits of distance learning.

Other examples of differences can still be found in several studies. For example, Maki, Maki, Patterson, and Whittaker (2000) found that students in a web-based course learned more, performed better, but liked the course less than traditional ones. When the study was replicated, similar results were found (Maki & Maki, 2002). Faux and Black-Hughes (2000) found differences as well, but in the other direction. Students in their traditional course showed the most improvement between pre- and post-tests as opposed to two other courses, one an Internet-based version and the other utilizing a combination of traditional and Internet-based learning. Timmerman and Kruepke (2005) found in their meta-analysis of computer-assisted instruction (CAI) studies that a higher level of performance existed in the CAI environments. They also note that there is a great deal of ambiguity when it comes to defining ‘traditional instruction’ as learning technologies have become pervasive in education. They suggest that this should be recognized when evaluating studies between CAI and traditional learning environments. Whether differences exist or not, it is very difficult to compare learning environments in general without knowing more about them. We suggest one critical difference relates to the nature of the interaction in the learning context. This in turn suggests the role of communication technologies may influence various outcomes.

Importance of Interaction

Even with online courses, many students may assume a level of interaction that resembles the experience of FtF classes. It is this interaction that can often be the difference between a successful and a failed course. Moore (1993) suggested that for a successful online course there are three essential types of interaction: (a) learner-content interaction, (b) learner-learner interaction, and
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(c) learner-instructor interaction. Such claims have been echoed and supported regularly in the literature. For example, Palloff and Pratt (1999) stated that key to the overall process of learning in the online environment are the interactions among the students, the interactions between students and faculty, and the opportunities for collaboration that occur as a result of these interactions. Additionally, they posit that a well-delivered course will provide multiple ways for interaction to occur, as this will deepen the learning experience and create a positive learning environment. Similarly, Swan (2001) found that among the general factors that significantly improved student’s satisfaction and perceived learning in an online environment were interaction with instructors and active discussion among course participants.

More recent research also supports the need for interaction with and involvement of the instructors. An & Frick (2006) noted that a majority of students preferred FtF discussion to CMC; however, they also felt that they would learn better from instructors who were more involved and enthusiastic about CMC. Additionally, speed and convenience were viewed as more important to students regardless of the format of instruction. Focusing more on the instructor, Umphrey, Wickersham, and Sherblom (2008) found that instructor immediacy and receptivity, classroom communication connectedness/mutuality, satisfaction, quality, and interaction involvement were all viewed more negatively in the CMC environment than those in the FtF context. Both of these studies point to the need for increased instructor involvement in order to have successful CMC-based courses, whether in person or in an online context. This increased involvement is borne out in a study by Worley and Tesdell (2009) who found that instructors spend more time, nearly 20% more, per student when teaching an online course.

However, interaction differences may exist across learning environments. For example, in a study of instructors who teach in online environments, Smith and Ferguson (2003) found that online courses result in greater student-instructor equality, more explicitness in written instructions, larger workloads for the instructor, and deeper thinking in discussions. Conversely, LaRose and Whitten (2000) contend that many web-based courses fail to address the lack of interaction between students and the instructor, often seen as the leading concern of online learners. Furthermore, the interaction matters because it is related to key learning outcomes. When looking at the amount of interaction between students and instructors, Richard and Ting (1999) found that students who learned via written correspondence with their instructors were more concerned with instructor feedback, while students in the online learning environment felt that all interactions with the instructor were important. In a more recent study of online/web-based courses, Gregory (2003) found that students were generally satisfied with the quality of the instruction and education they received—and that assessment was based in large part on having meaningful real-time interaction between students and the instructor. Finally, Huang (2002) found that learner-instructor interaction was positively correlated with learner to content interaction. Hence, the literature overall appears to show that the more student-faculty interaction present in the online environment, the greater the level of student-content interaction.

The Digitally Engaged Student

One of the most significant changes related to the contemporary education scene is the transformation of students from the passive learner of the past to today’s digitally engaged student. According to a recent report from the Pew Internet & American Life Project (Zickuhr, 2010), millennials, or those 18 - 33 years of age, are the most likely individuals, compared to other generations, to access the Internet wirelessly, use laptops or cell phones, belong to social-networking sites, send instant messages, read blogs, and participate in virtual worlds. This tech-savvy generation appears to
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Students crave access to information, using technology in nearly every aspect of life – and the education environment is no different (see Lenhart, Raine & Lewis, 2001; Livingstone, Bober & Helstrup, 2005). Levin and Arafeh (2002) noted that this has led to warnings of a ‘digital disconnect’ between students and their instructors.

Today’s Net Generation students are not passive in their education, but rather as Dede (2005) noted they are active learners that integrate information from a multitude of sources. More recent statistics show this trend toward greater technology involvement in student learning is not slowing down. Smith and Caruso (2010) found in a large-scale survey that 84% of college students own a laptop, with another 46% owning a desktop computer. Even greater numbers of students, 63%, own an internet-capable mobile device such as a phone or tablet. They also note that beyond the mere presence of technology, 66% of the students used a course management system in at least one of their courses, with 35% of them accessing the system daily. TEC and TEO education environments are a closer match to their non-education lives, which may explain the growing interest in understanding these environments, the students, and the technologies.

Communication Technology

Increasingly, in the context of both the TEC and TEO environments, interaction is facilitated in sizable part by various communication technologies (see Thompson, 2008). Such tools can assist with learner-content, learner-learner, and learner-instructor interactions. Web-based courses that employ multiple technologies, such as video, chat, and discussion boards, can provide students with options for how they learn and interact with others. In addition, these courses are more likely to support student involvement compared to those that rely primarily on text-based interactions.

In general, a number of scholars highlight the value of communication technologies for learning. Freitas, Myers, and Avtgis (1998) point out a number of positive aspects of online learning and the use of computer-mediated interaction, such as: (a) opportunity to participate in online discussion, (b) interaction with the course material, and (c) access to the Internet. In general, faculty typically have a positive attitude towards the use of technology in teaching (Nnazor, 1998). Less common is research on the specifics of which technologies are valuable, for what purposes, and what outcomes; however, there is some evidence of this in the existing literature.

Online discussion tools have been examined more than most technologies. Hiltz and Wellman (1997) found that the use of online discussion led to increased satisfaction, and were also associated with achievement levels that were comparable to traditional FtF classes. Previous research has shown that students perceive online discussions as more equitable and democratic compared to traditional classroom discussions (Harasim, 1990). These discussions give the students time to reflect upon contributions from other students while developing their own. Similarly, the success of online courses can be linked to the value that instructors place on these discussions (Hawisher & Pemberton, 1997). Looking at links between discussion and performance, Jiang and Ting (2000) found a positive link between perceived learning in the online environment and the percentage of course grades based on discussions, and between perceived learning and the specificity of instructors’ discussion instructions. Althaus (1997) reported that individuals who were active in both computer-mediated discussions (CMD) and FtF interactions were in a superior learning environment, tended to make higher grades than non-CMD users, and reported learning more than those only using FtF interaction. More recently, Levine (2007) notes that discussion boards provide something unique that is beyond what is possible in a FtF interaction. Levine believes that this tool supports “higher order constructivist learning and the development of a learning community” (p. 68).
Other communication tools are described in the literature as well. Russo and Benson (2005) found that satisfaction with learning was more highly correlated with perceptions of others (i.e., students) than perceptions of the instructor. Additionally, they found that opportunities for students to connect with one another and the instructor, through chat, discussion boards, and interactive sessions were significantly related to the positive evaluations of the course. Wernet, Olliges, and Delicath (2000) found that students reported mixed reactions to the use of course web-tools in more of a traditional class. They perceived the use of online lecture notes as having an impact on their course performance; however, tools such as the discussion board and online grade book had no perceived impact. Other perceived successes included the use of online quizzes and tests. Stith (2000) reported that there appears to be a relationship between students’ grades and the number of bulletin board articles read on the web, while visits to the course website alone had no correlation.

**Conclusion to Literature Review**

Collectively, we suggest that this literature suffers from several challenges. First, it is often difficult to know exactly what is being compared because of the various terms used to describe the learning contexts; furthermore, the comparability of various learning conditions can become a real challenge as well when such comparisons are attempted. Second, there is evidence of “The No Significant Difference Phenomenon” with some key outcomes, but other data suggest key differences in learning contexts—and in both cases the explanation for such similarities is often unclear. We suggest that variations and similarities in interaction, especially as facilitated by communication technology, may help in better understanding such findings. This leads to a third challenge in that studies specifically examining various communication technologies and how they might relate to various outcomes of interest remain rather limited.

**TWO TECHNOLOGICALLY ENHANCED LEARNING CONTEXTS: STUDY CONTEXT AND RESEARCH QUESTIONS**

The current study attempts to tackle the challenges outlined above through a comparison of two courses taught in consecutive semesters utilizing nearly identical course technologies, instructors, and content—but with students in either a technology-enhanced classroom (TEC) education environment or a technology-enhanced online (TEO) education environment. The different locations create potentially different needs and opportunities for how students interact with content (in-person vs. streaming video), interact with one another (mix of offline and online vs. almost completely online), and interact with the instructors (again, mix of offline and online vs. almost completely online). Thus, we are able to examine the role of different communication technologies and their influence on learning outcomes across two distinct but comparable contexts where computer-based technology is widely used in education. While McFarland and Hamilton (2005) had similar goals in their study, the current study examines two much more distinct environments, one in which there was regular FtF interaction in a more traditional manner and another where FtF interaction was nearly non-existent. The conditions in McFarland and Hamilton’s study were also significantly different in that neither of the courses were conducted in a lecture format, which contrasts from the lecture format utilized in this study.

For this study, students in the initial semester participated in a classroom lecture and discussion environment, which was enhanced through the use of web-based technology (TEC). The instructor, teaching assistant, and students interacted, both during class time as well as through online synchronous and asynchronous discussions, chat and online office hours. Students also interacted somewhat extensively in online case study teams.
as a key assignment in the course. Class sessions were filmed showing both the instructor and the attending students. Special effort was made to capture the interactions between the instructor and students rather than simply record the presentation of the instructor. Upon completion of the semester, the video was integrated with PowerPoint slides utilized during lectures to create a series of video lectures. Each recorded lecture reflected the same content and length as the original. The following semester, the same instructor and teaching assistant taught the same course keeping everything associated with the class as similar to the first semester as possible—including assignments such as the online case studies, quizzes and exams. One major difference was the content delivery method; rather than have the students come to a lecture class three times a week for an hour, they would have access to a streaming-video version of the lectures recorded the previous semester. Students in this technology-enhanced online (TEO) education version of the course were able to view the same material and the prior classroom interactions between the instructor and students from the TEC section. A study by Boster, Meyer, Roberto, Inge and Strom (2006) provides support for the use of video-streaming as a delivery method as they note both a higher mean examination performance in both elementary and secondary courses and on average an increase in student learning outcomes. Both courses in the current study utilized web-based courseware to provide a place for additional material, activities and interaction between instructor, teaching assistant and students.

Based upon the existing literature and our goal to address some of the challenges related to the two distinct learning environments, the current research project explores the following primary research questions:

- **RQ₁**: How do the two learning environments compare on (a) the importance of various technologies, (b) satisfaction with key course elements, (c) perceived learning outcomes, and (d) objective measures of classroom performance?
- **RQ₂**: How well does the importance of various communication technologies predict (a) satisfaction with key course elements, (b) perceived learning outcomes, and (c) objective measures of classroom performance? Are there differences between the learning environments in making such predictions?

Finally, to help address the use of technology in the course, we sought to answer the following:

- **RQ₃**: How does the use of technology relate to the student opinions regarding the course?

**RESEARCH METHODS**

**Participants and Procedures**

Research participants were students in two sections of an upper division Organizational Communication course at a large public university in the United States. Students enrolled in the two classes were given extra credit in exchange for participation. In addition to completing survey questionnaires, they were told orally, FtF and online through written reminders, that log information from the course website would be used in this research—but they were also assured that none of that information would be examined until after final grades were turned in for the course. In the TEC course, 47 students completed both the pre-and post-course survey, for a response rate of 94%. In the TEO education version of the class, 71 students completed both surveys for a response rate of 81% (plus 11 more who only completed the post-course survey, bringing the partial response rate to 93%). The sample, from both the TEO and TOC sections, was comprised of 73% females.
and 27% males. Eighty percent of the students owned a computer, which was typically located at their home. Respondents reported taking an average of one previous online course, six courses where course management tools had been used, two where discussion boards were utilized, and 13 courses where e-mail use between students and the instructor/teaching assistant was routine.

Respondents from the two learning groups were similar on a number of the pre-course survey measures. However, there were also several significant differences on some of the 40-items from the pre-course survey. Regarding email use, TEO students reported more expertise, experience, reflection before responding, reading, and frequency of checking their email than did students in the TEC—although TEO students had generally taken fewer previous courses that utilized email. TEO students also tended to use the Internet more and have more positive attitudes about technology use than did TEC students. Finally, motives for taking the course varied significantly: TEO students took their class to avoid work/scheduling conflicts and to gain skill for the future more so than did TEC students; conversely, TEC students were significantly more motivated about engaging in class discussions than were TEO students. Given these differences, we control for key differences in the two learning groups in the statistical tests that follow.

Measures

Data for this research were collected at both the beginning and end of each of the two comparable classes. Except as noted, questionnaires were based on previous published assessments by Berge and Myers (2000) and Long and Javidi (2001), with some modifications. The pre-course survey began with 20 items assessing each student’s experience with various communication technologies as well as attitudes about working on computers. We created a 5-item scale (α = .69) out of those email use items indicating differences between the learning groups and used it as a control variable in several analyses. A single item on the questionnaire also assessed level of acquaintance with others taking the class. Eleven items examined goals and motivations for taking the course (e.g., increasing knowledge, avoiding work/schedule conflicts, acquire skills for use in the future, engage in class discussion with others), which were also seen as potential controls given the importance of this individual learner characteristic.

The post-course survey contained 25 items assessing the importance of various classroom tools as they related to success in the class. Principal component analysis with varimax rotation reduced these to seven key factors accounting for 16 items and 67% of the total variance: chat and discussion board (5 items, α = .87), instructor/TA phone/office (4 items, α = .89), website basics (2 items, α = .65), instructor/TA email (2 items, α = .93), and several important one-item measures related to printed readings, in-class conversations, and online quizzes. Additionally, we also examined 11 items asking about specific learning outcomes that were directly tied to the 11 goals/motivations asked about on the pre-course survey (each of which remained its own outcome when data reduction efforts failed to produce clear factor structures).

The post-course questionnaire also measured course difficulty (5 items, α = .74), participation in the class (3 items, α = .71), instructor communication competence (5 items reduced to 4 to improve reliability, α = .68), and teaching assistant communication competence (5 items, α = .84). Additionally, we added a measure of identification with other online case study student team members (4 items, α = .82) based on Cheney’s (1982) Organizational Identification Questionnaire. Finally, we included an open-ended question used to answer the final research question. In addition to the survey data, objective performance was based on total points in the course (out of 1000 maximum).
Analysis

To answer RQ\textsubscript{1a-d}, we used ANOVA and ANCOVA to compare the two learning groups and to control for key differences in the two groups (prior email use, motivation to avoid scheduling conflicts, and motivation to engage others in classroom discussion). RQ\textsubscript{2a-d} uses hierarchical regressions, where we entered motivation to engage others in classroom discussion as a key control variable first, followed by the set of technology importance predictors on step 2, followed by the learning group type on a final step; \( R^2 \) and \( R^2_{\text{change}} \), along with individual beta weights are used to answer the research questions. Given the somewhat exploratory nature of the research, the nonrandom sample, and the relatively small sample size, we use a significance criterion of \( p \leq .05 \), but provide some key results that approached, but did not achieve significance as one way to evaluate the research.

For the final research question, one author and a trained undergraduate research assistant familiar with the course both coded all the open-ended comments from the questionnaires (44 from the TEC section and 80 from the TEO class). Each entire comment made by a respondent was rated as either positive, negative, mixed positive/negative, or all neutral. Additionally, each comment was coded for the type of technology mentioned, which fell into 12 categories: none/general, announcements, chat, forums/discussion boards, website/WebCT generally, logs/archives, email, quizzes, streaming video/lectures, online notes, other, and multiple above categories. After training together on the first 10 items, the coders then individually coded all remaining comments. Although overall initial agreement was only 68\%, we note that disagreements were readily resolved through discussion and the large number of categories (12×4) contributed to the disagreement rate.

RESULTS

Research Question 1

RQ\textsubscript{1a} asks how the two learning environments compare on the importance of various technologies for success in the course. ANOVA reveals statistically significant differences between TEC (\( M = 3.28 \)) and TEO (\( M = 3.83 \)) students in importance of chat/discussion boards, \( F(1, 126) = 4.70, p = .03 \), and importance of in-class conversations with others (\( M = 4.42 \) and 3.28, respectively), \( F(1, 126) = 6.78, p = .01 \). Other results approached significance, such as the importance of website basics (\( M = 6.42 \) and 6.57, respectively), \( F(1, 126) = 3.01, p = .09 \), and importance of email (\( M = 5.63 \) and 6.14, respectively), \( F(1, 126) = 3.48, p = .06 \).

When controlling for prior email use and the key motivations related to scheduling conflicts and engaging in classroom discussion, learning type continues to account for statistically significant difference in the importance of chats/discussion boards, \( F(1, 111) = 9.33, p = .003, \eta^2_p = .08 \), and email, \( F(1, 111) = 2.76, p = .10, \eta^2_p = .03 \); but not for website basics (\( p = .40 \)) nor in-class conversations (\( p = .13 \)).

RQ\textsubscript{1b} asks how the two learning environments compare on satisfaction with key course elements. ANOVA reveals only one statistically significant difference between TEC (\( M = 4.47 \)) and TEO (\( M = 3.99 \)) students related to course participation, \( F(1, 125) = 7.59, p = .01 \). When key control variables are entered, the effect for learning group type disappears here (\( p = .18 \)). RQ\textsubscript{1c} compares the two learning environments as they relate to perceived learning outcomes. ANOVA reveals statistically significant differences between TEC (\( M = 4.93 \)) and TEO (\( M = 5.78 \)) students related to avoiding work and class scheduling conflicts, \( F(1, 126) = 10.72, p = .001 \), and for contributing to the field of organizational communication (\( M = 3.53 \) and 4.21, respectively), \( F(1, 126) = 5.45, p = .02 \). These differences persist even after considering key control variables for both avoiding work and
scheduling conflicts, \( F(1, 111) = 5.68, p = .02, \eta^2_p = .05 \), and for contributing to the field, \( F(1, 111) = 9.45, p = .003, \eta^2_p = .08 \). Finally, in answer to RQ\(_1p\), there are no statistically significant differences between the two learning groups in terms of objective measures of classroom performance, \( F(1, 127) = .645, p = .42 \).

**Research Question 2**

RQ\(_2\) asks how the importance of various technologies predicts other variables and whether there are differences between the learning environments in making such predictions. Based on correlations, we selected only the most relevant technology importance variables (chat/discussion board, website basics, email, and traditional phone/office) and the single most important control variable (motive to engage in classroom discussion) for inclusion in these analyses. Doing so was necessary to limit the number of variables included relative to sample size (Tabachnick & Fidell, 2001). After entering the control initially followed by the four technology importance variables, we entered learning group type on a final step.

Several learning outcomes are predicted by these variables. The control variable predicts the learning outcome related to networking with experts in the communication field, \( R = .25, R^2_{\text{adj}} = .05, F(1, 109) = 7.07, p = .009 \). Adding in the technology importance predictors results in a statistically significant improvement to the model, \( R = .44, R^2_{\text{change}} = .13, F(4, 105) = 4.27, p = .003 \). In this equation, the only statistically significant individual predictor is importance of chat/discussion boards for success, \( \beta = .34, p = .002 \). Adding in learning group type to the regression equation did not result in a statistically significant change in \( R^2 \). As for the outcome of avoiding work and class scheduling conflicts, neither the control nor the technology importance variables were predictive; however, learning group type resulted in a near statistically significant change in \( R^2, R = .33, R^2_{\text{change}} = .03, F(1, 104) = 4.27, p = .06 \). In addition to the predictive power of learning group type, importance of website basics was also a statistically significant predictor in this model, \( \beta = 2.03, p = .002 \). Regarding the outcome of contributing to the field of organizational communication research, the control variable was not predictive; however, the group learning type, \( R = .34, R^2_{\text{change}} = .03, F(1, 104) = 4.02, p = .05 \), adds a statistically significant explanation. Also, the technology importance variables approached significance, \( R = .29, R^2_{\text{change}} = .08, F(4, 105) = 2.28, p = .07 \). In the final model with all predictors, only group learning type is a statistically significant individual predictor, \( \beta = .21, p = .05 \).

Next, the control variable predicts the learning outcome related to engaging in classroom discussion with others in the course, \( R = .29, R^2_{\text{adj}} = .07, F(1, 109) = 9.63, p = .002 \). Adding in the technology importance predictors results in a statistically significant improvement to the model, \( R = .43, R^2_{\text{change}} = .10, F(4, 105) = 3.24, p = .02 \). In that model, not only is the control variable still statistically significant, but so is importance of traditional phone/office, \( \beta = .28, p = .01 \). The importance of website basics also approached significance, \( \beta = .18, p = .06 \). Learning group types does not add statistically significant explanation to the other variables in the model. Finally with respect to learning outcomes, the control variable predicts having acquired skills in occupation/job, \( R = .25, R^2_{\text{adj}} = .06, F(1, 108) = 7.32, p = .008 \). Adding in the technology importance predictors results in a statistically significant improvement to the model, \( R = .49, R^2_{\text{change}} = .16, F(4, 104) = 5.38, p = .001 \). In that model, not only is the control variable still statistically significant, but so is importance of chat/discussion board, \( \beta = .29, p = .007 \), and importance of website basics, \( \beta = .25, p = .006 \). Learning group types does not add statistically significant explanation to the other variables in the model.

Regarding other variables, the control variable does not predict course instructor communication competence. Adding in the technology importance
predictors results in a statistically significant improvement to the model, \( R = .39, \ R^2 \text{change} = .11, \ F(4, 105) = 4.50, \ p = .002 \). The only significant individual predictor is website basics, \( \beta = .26, \ p = .007 \), and again, learning group type does not add statistically significant explanation to the model. A nearly identical picture emerges for course TA communication competence. The control variable does not predict course TA communication competence, but adding in the technology importance predictors results in a statistically significant improvement to the model, \( R = .33, \ R^2 \text{change} = .06, \ F(4, 105) = 3.02, \ p = .02 \). The only statistically significant individual predictor is website basics, \( \beta = .28, \ p = .004 \), and again, learning group type does not add statistically significant explanation to the model. Finally, the control variable predicts identification with online case study team, \( R = .20, \ R^2 \text{adjusted} = .03, \ F(1, 109) = 4.33, \ p = .04 \). Adding in the technology importance predictors results in a statistically significant improvement to the model, \( R = .38, \ R^2 \text{change} = .11, \ F(4, 105) = 3.31, \ p = .01 \). The only individual predictor to approach significance is website basics, \( \beta = .17, \ p = .08 \), and again, learning group type does not add statistically significant explanation to the model.

Research Question 3

RQ3 was answered with responses to an open-ended survey question: “How did the use of technology and online features of the class impact your opinion/views of the course?” Tables 2 and 3 display representative comments from the two learning environments. In both environments, positive comments are most prevalent, followed by mixed positive/negative, negative, and then neutral. The most common “technologies” referenced in the remarks of students in both learning environments are “general” and those mentioning “multiple technologies.” However, we note that the TEC learning environment comments are spread across only four tools, whereas students in the TEO learning environment discuss 10 different technology categories. Beyond the general and multiple technologies discussed, there are a number of comments about the nature of the streaming video/lectures in the online-dispersed learning environment (but no mention of lectures during the traditional environment).

DISCUSSION

This research examines the use and importance of communication technology in two different learning contexts where it is used: TEC and TEO learning environments. Furthermore, it examines how those tools relate to learning and other key outcomes. Based on the findings reported here, we are able to draw several general conclusions.

First, we note that the students who selected these different learning environments were different from one another—especially in terms of prior technology use as well as in general motivation/goals for taking the course. Such differences are consistent with literature suggesting that individual motivations and experience may vary by student (Vonderwell, 2003). It is important to note that in the department where the two courses researched here were taught, students had options for taking other sections of the course where technology would not have been as prominent.

Second, there is substantial evidence of the “The No Significant Difference Phenomenon.” None of the course element satisfaction variables, nor the total points in the class, were different across learning contexts. Only a few of the 11 learning outcomes were statistically different, and even most of the technology variables were no longer different after control variables were included to adjust for initial differences in students. Even as we consider the comments from students about the role of technology in their class, the nature of their comments are very similar across learning contexts. Therefore, these findings provide additional support for “The No Significant Difference Phenomenon” between the technology-enhanced
classroom and technology-enhanced online education courses (which we believe have only rarely been compared). At the same time, these results seem to question conventional wisdom about what must surely be differences in two seemingly very distinct ways of teaching.

Third, while there are few statistically significant differences in these learning contexts overall, there are some differences related to the importance of communication technology. In fact, there are more differences related to technology importance than for the various outcome variables; and, in most cases, learning context fails to add additional explanation above and beyond that accounted for by communication technology variables when predicting those outcomes. More specifically, the TEO students viewed the chat/discussion board, website basics, and email as more important than did TEC students. Conversely, the TEC students felt that the in-class conversations were clearly

Table 2. Positive comments about the role of communication technology as related to class

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Representative Comments</th>
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<tbody>
<tr>
<td>Technology-Enhanced Classroom Education</td>
<td>“It definitely enhanced the course by organizing all of the thoughts and the events of the class. It was like insurance for students because you could always stay connected to what was going on and the progress you were making in the class.” “In respect to the group projects, quizzes, and some participation point activities, I loved the online features. I also liked how grades and comments were done online! In regards to all these things, it made everything convenient...it’s easy to do group things online and not have to worry about having to all meet at a certain time.” “It made me realize how useful technology and online features could be in helping to teach a class. The use of technology better prepared us for class – through online lecture notes, assignments, and case study requirements. I was very pleased with the use of technology in this course and I believe it really made the course appealing – I would like to see more of this used in future classes.”</td>
</tr>
<tr>
<td>Technology-Enhanced Online Education</td>
<td>“This course helped me to see just how important technology is and can be in organizations. Taking an online course helped me to feel confident that I can meet the technology demands that I will face in the future. The technology brought a lot to the course; it changed things up a bit and made the class more exciting.” “I really enjoyed this course. Everything was well structured and easy to follow. Having the online notes to follow along with videos was very helpful. Since this course was so organized it made it all the technology involved simple with little problems. Questions were responded to immediately (even though asynchronous). The use of technology and online features influenced my opinion greatly. It made the course awesome and ever more interesting.” “This was my first online course and I really enjoyed it. It allowed me to schedule lectures into my day at a time that was appropriate for my individual needs. Though some might find it difficult to keep up with this course work, online forums, and chats made retaining the information a lot easier for me.”</td>
</tr>
</tbody>
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Table 3. Negative comments about the role of communication technology as related to class

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Representative Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology-Enhanced Classroom Education</td>
<td>“I hated doing online case studies as a group. Their inability to get their act together on time deeply hindered our group grade and my overall grade...Doing group work (not online) is easier to set deadlines and to get people to start the ball rolling... Online, people were harder to influence.” “To be honest, it was more of a burden than a learning tool, something that I had to get done.” “I didn’t feel there was worthwhile communication in our online case studies...there was so little communication and motivation to participate...I felt my group members were not discussing the case with the rest of us, but rather writing opinions and not responding to the rest.”</td>
</tr>
<tr>
<td>Technology-Enhanced Online Education</td>
<td>“I found it difficult to stay motivated for the course material. Going to an actual classroom and experiencing the interaction with a professor is much more valuable in terms of motivation than I thought it would be. In terms of the actual online tools used...there wasn’t nearly the sense of community that gets built in a face to face class setting.” “The ability to set your own schedule with the technology was helpful, but it increases opportunities for procrastination.” “It was not as easy or convenient as I was hoping. The class took up a lot of time and more work than just sitting in the actual classroom for 3 hours a week. The lectures were hard to pay full attention to and a lot of other work was also involved... it took up more work and time then most other classes.”</td>
</tr>
</tbody>
</table>
Engaging the Digitally Engaged Student

more important than did their TEO counterparts. Additionally, even though students in both learning environments were generally positive about the various technologies we examined in terms of their role in the course, there were comments about a much larger range of technologies from the TEO students. It may be that a student in that setting seeks out technological alternatives for FtF interaction that would normally occur during the classroom setting. This seems consistent with some previous research, including that of Walther and Parks (2002). In short, students adapt to their surroundings by maximizing their communication through available means and channels—and may use a wider range of tools when in-class conversations are not a viable option.

As one final overall conclusion, some communication technology importance variables are predictive of more outcomes than are others. Consistent with existing literature, the use of chat and discussion board technologies were predictive of outcomes such as acquiring skills for work and networking with experts. In these classes we had guest experts speak to the students—and especially in the TEO class students would use discussion boards to post question in advance and the chat tool was used for the actual interaction with the guest. Additionally, students in the TEO class who felt that taking such a course provided them with special technology-related skills may have also been the ones who were actively using and valuing primary interaction tools like discussion boards and chat. However, the most predictive of the technology importance variables were the website basics (which included web page announcements and basic assignment descriptions). The importance of these website basic features positively predicted learning outcomes of engaging in class discussion and acquisition of skill for work. Additionally, the website basics were associated with communication competence of instructor, communication competence of TA, and even identification with student case study team. We suspect that providing useful announcements on the website and providing clear and detailed assignment descriptions helps students in both learning environments by reducing uncertainty. Indeed, the mean technology importance scores for both learning contexts on this factor are well above 6 on a 7-point scale.

Implications

The results reported here have several implications for students and instructors in courses utilizing technology. First, the findings suggest different students—based primarily on prior experience with tools such as email and distinct motivations/goals—gravitate toward either the TEC or TEO settings. Students should therefore think about their prior experiences and their goals when self-selecting into a TEC classroom versus TEO courses. For instructors and academic departments, it may be wise when possible to provide both types of learning environments so students can choose what is most appropriate for them. We had that luxury with this particular course, so students in the TEO course were generally ones who chose to be there rather than in a classroom setting—had that not been the situation, our findings may have differed somewhat.

The findings in support of “The No Significant Difference Phenomenon” can be used to support opposing arguments. For some, our results would further confirm claims that there is no real advantage of dispersing students in a distance education course. Even if technology is used in both learning contexts, tools such as streaming video servers are more expensive and the workload is often greater for faculty in distance education contexts. Such views may lead some to suggest that the TEO context has little to offer, but could be used as a last resort in situations where more TEC settings are not possible. Another view on this, and one we subscribe to, is that the results show there is no significant decline in learning. Thus, providing different learning options such as the TEO context may better meet certain students’
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needs and help them to learn effectively. There may be no difference in learning outcomes, but if students are able to take courses consistent with their own learning abilities and goals, then the overall learning may improve (though we do not have data to directly test that specific claim).

The importance of website basics suggests that even if one does little else with technology, there are some key minimums that will enhance a number of outcomes regardless of learning context. Instructors need to be sure to keep announcements current and helpful. Furthermore, detailed assignment descriptions should be included on the website. Students will find these most useful when they actually check and read them. To a somewhat lesser extent, there are clear positives associated with using tools such as discussion boards and chat. We think the idea of the virtual online guest, which is similar to what Russo and Chadwick (2001; Chadwick & Russo, 2002) call virtual visiting professors, is a wonderful use of these tools to facilitate student interaction with others outside the classroom (in addition to the interaction with one another and with the instructor that is seen as so important to learning).

Finally, the positive views that students in both environments had about technology suggests that when it is used appropriately, its benefits can outweigh any drawbacks. We are as aware as anyone that sometimes technology is used poorly in the classroom. But, in most ways, students perceive a number of positives related to the communication technologies examined here. The nature of our findings may serve to provide guidelines for teachers especially as they decide the extent to which they wish to include technology in their courses. The negative comments and mixed comments also remind us that problems remain and not all students respond in equal ways about the role of technology in education.

FUTURE RESEARCH DIRECTIONS

Future research in this area should begin by addressing some of the key limitations of the research reported here. Although we think the sort of comparison we were able to make with identical content and teachers as well as very similar technologies across two learning environments is valuable, it too has problems. For example, we, as instructors, were more experienced by the time we did the TEO version of the course and the students were clearly not identical—all of which suggests efforts have to be made to find reasonable comparisons to make when examining differences (and similarities) across learning contexts. Another limitation was that we lost some of the log data on usage of various website tools—meaning that we relied heavily on self-reports of usage. Greater use of behavioral and other log data could add additional information.

Now that we have some ideas about the extent to which communication technologies may matter in these learning contexts, and even which ones are key, we need to know more about what was actually communicated using these technologies. What was communicated in the website announcements and assignment descriptions that apparently made them so important? Which uses of the chat and discussion board tools, and what comments on them actually made a difference for students? Future research should begin to focus even more on the actual messages communicated to/from students, instructors, and others.

Finally, future research must continue to be very careful about exactly what is being compared. As we have noted, this is often not clear in the literature when one person’s use of the term “traditional” classroom includes new communication technologies but another’s use of that same terms does not. We think one of the most appropriate points of comparison is to examine differences based on the general location of students and instructors relevant to one another (co-located versus dispersed), recognizing that technology
may be used extensively in both settings. Certainly, other work should examine hybrid classes and other variations—while also being sensitive to terminology used and what exactly is being compared or examined.

CONCLUSION

We have little doubt that new communication technologies will continue to be part of most educational settings. We have even less doubt that, when used appropriately, they can serve a vital role in facilitating the sorts of interaction that are so crucial to learning in both traditional classroom and more online settings. As a result, scholarship that continues to examine the role of communication technology in learning must move forward. As it does, researchers would be wise to continue to consider a sizable variety of communication technologies—ranging from very basic one-way information sharing found on course websites to much more interactive technologies such as social media—as all being tools relevant to the Net Generation of digitally-engaged students. We hope the research reported here is a useful step in this direction.

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**ADDITIONAL READING**


**KEY TERMS AND DEFINITIONS**

**Computer-Mediated Communication (CMC):** Communication that is mediated through some form of electronic or computer-based system.

**Distance Learning / Education:** The acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance.

**E-Learning:** Education environments that are primarily technology- or web-based in nature that allow learning to occur without the instructor and students being co-present in the same physical location.

**Face-to-Face Communication (FtF):** Communication that occurs between individuals who are co-present in the same location and are able
to send and receive both verbal and non-verbal messages without mediation.

**Hybrid Learning:** Education environments that blend traditional educational methods with those based on technology and/or online tools.

**No Significant Difference Phenomenon:** Education phenomenon based on a comprehensive research project (Russell, 1999) examining more than 350 studies that document no significant differences in student outcomes between alternate modes of education delivery.

**Technology Enhanced Classroom (TEC) Education:** Education that occurs in classrooms where students are co-located with one another and the instructor on regular basis, but with use of computer-based technology in the class.

**Technology Enhanced Online (TEO) Education:** Education that occurs when students are rarely, if ever, co-located with one another or the instructor for class purposes, but are connected with use of computer-based technology as a primary tool in the course.

**Traditional Learning:** Education environments that require that both instructor and students are co-present, where the majority of instruction occurs through direct interaction between instructor and students, and where little if any modern technology is used.