DO BUSINESS COMMUNICATION TECHNOLOGY TOOLS MEET LEARNER NEEDS?

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While institutions of higher education are enthusiastically embracing technology-mediated learning (TML), little research has been conducted to identify factors that influence student use of TML tools or determine whether use of them increases student learning. This study of business communication students at two universities found that (1) students tend to be sensing, visual, active, and sequential learners; (2) perceived usefulness and perceived ease of use of TML tools are positively associated with perceived learning success; (3) learning styles do influence the students' usage behavior of certain TML tools; and (4) students' sensing/intuitive learning style is related to their perceived learning success.

Keywords: *learning styles; cognitive styles; technology-mediated learning; virtual learning environment*

INSTITUTIONS OF HIGHER education are investing widely in instructional technology, with the number of online courses, blended or hybrid courses, and technology-assisted (mediated) courses increasing dramatically (Allen, Seaman, & Garrett, 2007). Instructors are challenged to increase their competency and rethink instructional strategies. Yet, limited research has been conducted to identify factors that influence student propensity to use tools provided through technology-mediated learning (TML) systems or determine whether use of such technologies increases student learning (Hsiao, Kuo, & Chu, 2006).

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Preliminary research indicated that students' intention to use technology positively affects student learning and that successful classroom implementation of technology requires active professor support of technology, adequate student computer proficiency, and development of classroom technology that is easy to use and directly related to course outcomes. We determined that further research was needed to identify a blend of TML aids that addresses the learning styles of students. This identified need gave rise to the current study.

PURPOSE OF THE STUDY

The purpose of this study was to investigate the relationship of students' learning styles to the use of TML in business communication and the students' perceived learning success. The research is useful in identifying factors that influence student use of available technology tools, benefits for students who use available technology, and the instructor's role in enabling students to successfully use TML.

LITERATURE REVIEW

Technology is increasingly used as a primary delivery system in management education today, not only for online distance classes but also for more traditional face-to-face course delivery (Dillon, 2000; Dos Santos & Wright, 2001). Electronic delivery systems, also known as virtual learning environments, can enhance traditional class settings by extending the classroom experience and improving information efficiency (Parikh & Verma, 2002; Salmon, 2000). While many campuses are offering totally online courses, popularity is also growing for a blended, mixed-mode of instruction in which face-to-face instruction is enhanced with electronic delivery tools (Bigelow, 1999; Dos Santos & Wright, 2001; Parikh & Verma, 2002).

TML refers to a learning environment that is significantly moderated through the use of information technology. Such systems typically enable students to complete some or all of the following types of activities online: continue discussion of course concepts and cases outside the classroom; conduct group work; review information in creative ways; take quizzes; listen to and view audiovisual downloads; and access lecture notes, handouts, assignments, and grades online. Use of such online resources frees up class time for

faculty and students to promote discussion and critical thinking activities. TML redraws the physical boundaries of the classroom, substantially enhancing access to learning content and resources and enhancing the instructor's access to feedback concerning understanding of material (Alavi & Gallupe, 2000).

A growing number of business communication textbooks are comprised of a print component complemented by electronic elements delivered either on CD or via the Web. While large amounts of resources are being poured into the development of course technologies (Milliot, 2004), some researchers have reported disappointing results concerning business students' use of such resources (Miesing, 1998; Scifres, Behara, & Gundersen, 1998). Others have reported a high degree of student acceptance (Bilimoria, 1997; Parikh & Verma, 2002). However, research has yet to show factors that influence students' propensity to utilize the TML systems and whether the usage translates into higher grades for the students.

Relative to most traditional classrooms, TML environments are more student-focused than instructor-focused. Thus, the role of the student tends to be more that of an active participant rather than that of a passive spectator (Gemeinhardt, 2002). Just as instructors need new skills for teaching in TML environments, students also need specific skills to facilitate learning in these environments. Although students often report positive perceptions about individualized learning provided by Web-based instruction, the unstructured environment is problematic for some students (Mitchell, Morse, & Sharma, 2003; Ng & Gunstone, 2002). To assure that TML programs effectively enhance functionality and thus lead to increased learner satisfaction, learner needs must be addressed adequately (Carter, 2002; Ke, Kwakkelaarb, Taic, & Chenc, 2002). This finding highlights the importance of designing user-friendly instructional technology that minimizes students' intimidation and frustration with the technology itself and focuses students' attention on achieving course goals.

Cognitive styles, or learning styles, are individual preferences and tendencies that influence learning (Smith, 1982). Learning style has been shown to play an influential role in students' reactions to a Web-based instructional program, with students exhibiting different cognitive styles showing varying preferences with respect to the features of TML (Chen, Chen, & Xin, 2004). Versatility in program

design allows for effective use by a variety of learners with differing cognitive styles. Instructor-student contact is another key component in the successful implementation of technology-mediated instruction, and faculty support that goes beyond requiring participation but also promotes acceptance of the system tends to produce better overall results (Concannon, Flynn, & Campbell, 2005; Venkatesh & Davis, 2000). Indeed, perceived faculty encouragement to use the system has been shown to be positively related to perceived usefulness of the system and student acceptance of the system (Martins & Kellermanns, 2004).

Cognitive learning researchers agree that students have different strengths and preferences in the way they receive and process information. Various learning style models have been proposed for identifying and categorizing student differences (e.g., Curry, 1990; Felder & Silverman, 1988; Kolb, 1976; Marton & Säljö, 1976; Owens & Barnes, 1992). Felder and Soloman (1991) developed the Index of Learning Styles (ILS) that has been widely used to assess student learning styles. The ILS is a 44-item forced-choice instrument developed in 1991 to assess student preferences on the four dimensions of the Felder-Silverman learning style model. The self-scoring instrument is available online and is free; it has been translated into six languages, and its Web site reports more than 100,000 hits per year (Genovese, 2004).

Though not without its criticism (Cook & Smith, 2006; Van Zwanenberg, Wilkinson, & Anderson, 2000), the ILS has been judged reliable and valid for assessing learning styles in various studies (Felder & Spurlin, 2005). The ILS classifies students as having preferences for one category or the other in each of the following four dimensions:

- *Sensing* (concrete thinker, practical, oriented toward facts and procedures) or *intuitive* (abstract thinker, innovative, oriented toward theories and underlying meanings)
- *Visual* (prefer visual representations of presented material, such as pictures, diagrams, and flow charts) or *verbal* (prefer written and spoken explanations)
- *Active* (learn by trying things out, enjoy working in groups) or *reflective* (learn by thinking things through, prefer working alone or with a single familiar partner)

- *Sequential* (linear thinking process, learn in small incremental steps) or *global* (holistic thinking process, learn in large leaps)

More information about the ILS is available at http://www4.ncsu.edu/unity/lockers/users/f/felder/public/ILSpage.html The ILS instrument can be accessed and completed at http://www.engr.ncsu.edu/learningstyles/ilsweb.html.

HYPOTHESES

Speculating that TML might be better suited to some learning styles, we formed several hypotheses that related to learning style and the success of TML:

Hypothesis 1: Learning styles influence perceived learning success in TML environments.
Hypothesis 1a: Sensing learning styles rather than intuitive learning styles are positively related to perceived learning success.
Hypothesis 1b: Visual learning styles rather than verbal learning styles are positively related to perceived learning success.
Hypothesis 1c: Active learning styles rather than reflective learning styles are positively related to perceived learning success.
Hypothesis 1d: Sequential learning styles rather than global learning styles are positively related to perceived learning success.

Educational practice strongly supports that the best learning strategies for a student are determined by his or her learning style (Loo, 2004). The various types of learning tools in the TML package used in the research might be seen as more useful to users with different learning styles.

Hypothesis 2: Learning styles influence usage behavior of technology-based learning aids.

The technology acceptance model (TAM) has been used previously in various studies to assess students' technology learning behavior and use of a variety of information technology tools (Davis, 1989; Lederer, Maupin, Sena, & Zhuang, 2000; Moon & Kim, 2001). Although used most frequently in the information systems research, the theoretical foundation of TAM also has been

successfully applied in business education research (e.g., Arbaugh, 2000; Martins & Kellermanns, 2004). The basic premise of the model is that students' higher perceptions of usefulness and perceptions of ease of use lead to a positive attitude or intention to use the technology in question (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Karahanna & Straub, 1999). Accordingly, these TAM-related hypotheses were proposed:

Hypothesis 3: The perceived usefulness of the textbook technology is positively related to perceived learning success in TML environments.

Hypothesis 4: The perceived ease of use of the textbook technology is positively related to perceived learning success in TML environments.

RESEARCH DESIGN AND PROCEDURES

Research participants in this study were a convenience sample of students enrolled in five sections of an introductory business communication class at a large public university and two sections at another large public university. Institutional review board approval to conduct the study was granted at both institutions. The TML package used for the study was that which accompanies *Business Communication* by Lehman and DuFrene (2005). This package includes a wide assortment of learning aids, including interactive quizzes, puzzles and games, streaming video cases, and voice-narrated PowerPoint slides delivered via a publisher Web site, WebCT course site, and Student CD. The robustness and variety of the selected TML package address the various learning styles and preferences of students.

Students at both universities were informed at the beginning of the semester of the opportunity to participate in the study by answering a series of three Web-based questionnaires. Students were provided an opportunity to participate in the study and to earn five points toward the final exam grade for completing all three questionnaires in the study. The inducement was considered low enough not to influence the overall grade in the course but high enough to motivate students to participate in the study.

The research process included the following steps:

1. Students received a brief instruction sheet describing the study and outlining the specific technology features available with the textbook and accompanying technology tools. Students choosing to participate accessed the questionnaires online for quick, convenient participation in this research.
2. Students completed an online questionnaire as a baseline measure of their learning style and perceptions toward the value of TML. Other collected data included age, gender, grade point average, and major area of study.
3. At two other intervals in the semester, students completed online questionnaires to assess changes in their attitudes as they continued participation in the course and their use of the accompanying technology. The second questionnaire also confirmed that the student had obtained the textbook and technology component. Of the 223 total students enrolled in the courses, 95 completed all three questionnaires, resulting in a response rate of 43%. To investigate potential biases, we conducted a one-way ANOVA that showed no significant differences in grade point average between the first group of respondents ($N = 183$) and our final group ($N = 95$). Differences were also not observed in ages of the two groups. However, we did find that male students stopped participating at a higher rate than female students, with 44.3% males vs. 54.6% females in the final sample (the initial sample consisted of 58.5% males and 41.5% females).
4. At the end of the semester, the researchers asked the students to assess their perceived learning success in the course. Individuals were identified by their student identification numbers in order to match the data over the three sampling periods. After the data compilation, identifiers were removed and the anonymous data were analyzed.

MEASURES

All of the constructs used in the research model were adapted using versions of previously validated scales. Factor and reliability analysis of the final constructs indicated strong internal validity, with Cronbach's alphas equal to or higher than .85 for the TAM variables and the perceived learning success constructs. A list of items and corresponding alphas of the construct is available from the authors by request.

Table 1. Student Learning Styles ($N = 95$)

	Learning Style	*Number of Students*	*Percent*
Dimension 1	Sensing	75	78.9
	Intuitive	20	21.1
Dimension 2	Visual	74	77.9
	Verbal	21	22.1
Dimension 3	Active	64	67.4
	Reflective	31	32.6
Dimension 4	Sequential	78	82.1
	Global	17	17.9

Learning style preferences were assessed with the ILS, developed by Felder and Soloman to assess preferences on the four dimensions of the Felder-Silverman learning style model (Felder & Soloman, 1991). The model was used to classify students as having preferences for one category or the other in each of the following four dimensions: sensing/intuitive, visual/verbal, active/reflective, and sequential/global.

The TAM variables, Perceived Ease of Use and Perceived Usefulness, were measures initially developed by Davis (1989) and later used and validated in various information systems-centered studies (e.g., Venkatesh, 2000) and in learning journals (e.g., Martins & Kellermanns, 2004). Except where noted, all items were measured on a 7-point Likert-type scale.

FINDINGS

Data analysis shown in Table 1 reveals the breakdown of learning styles among participating students.

Data indicated that the learning style of the majority of students was characterized as sensing, visual, active, and sequential. That is, students were most likely to (1) be concrete thinkers, practical, and oriented toward facts and procedures; (2) prefer visual representations of presented material, such as pictures, diagrams, and flow charts; (3) learn by trying out things and enjoy working in groups; and (4) use a linear thinking process, learning in small incremental steps.

We analyzed the data using ordinary least square (OLS) regression analysis. In Model 1, Table 2, we entered the controls of our study.

Table 2. Results of Ordinary Least Square Regression Analysis

	Regression Coefficients (beta)[a]					
	Perceived Learning Success				*Perceived Usefulness*	*Perceived Ease of Use*
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
Control						
Teacher Dummy 1	–.24*	–.21	.01	.03	–.27*	–.47***
Teacher Dummy 2	–.39***	–.35**	–.14	–.11	–.37**	–.29***
Variables						
Sensing/intuitive[a]		–.29***		–.18†	–.21*	–.15*
Visual/verbal[a]		–.13		–.17†	.06	–.16
Active/reflective[a]		.05		.09	–.10	–.02
Sequential/global[a]		.13		.14	.13	–.14
Perceived ease of use			.38***	.30**		
Perceived usefulness			.28**	.33**		
R^2	.14	.23	.40	.46	.19	.30
Adjusted R^2	.10	.15	.36	.39	.11	.24
F	3.582**	3.119**	.9883***	7.107***	2.484*	4.636***

NOTE: $N = 95$. DV (dependent variable) = learning success.
a. Negative betas indicate a positive relationship for sensing, visual, active, and sequential learning styles, while positive betas indicate a positive relationship for intuitive, verbal, reflective, and global learning styles.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

In Model 2, we entered the four learning styles in order to analyze their relationship with perceived learning success. The sensing learning style was directly related to learning success ($\beta = -.29$, $p < .001$), thus supporting Hypothesis 1a. However, none of the other three learning styles were directly related to perceived learning success; thus, Hypotheses 1b, 1c, and 1d were not supported.

Our second hypothesis stated that the learning styles were related to technology use. As data in Table 3 indicate, learning styles do not influence usage behavior of students who are users of videos or threaded discussions. However, learning styles influence the usage behavior of those who are users of PowerPoint, e-lectures, and interactive study aids. Active learning style is marginally related to PowerPoint use ($\beta = -.17$, $p < .10$) and significantly related to the use of e-lectures ($\beta = -25$, $p < .05$). Sensing learning style is significantly related to the use of PowerPoint slides ($\beta = -.26$,

Table 3. Results of Ordinary Least Square Regression Analysis

	Regression Coefficients (beta)				
	PowerPoint Slides	*e-Lectures*	*Interactive Study Aids*	*Streaming Videos*	*Threaded Discussions*
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Control					
Teacher Dummy 1	–.04*	–.08	–.21†	.14	–.22†
Teacher Dummy 2	–.31**	–.30**	–.34**	–.01	.01
Variables					
Sensing/intuitive[a]	–.26*	–.19†	–.24*	–.16	.05
Visual/verbal[a]	–.05	–.04	–.01	–.01	–.03
Active/reflective[a]	–.17†	–.25*	–.04	–.03	–.10
Sequential/global[a]	.11	.24*	.01	.13	.08
R^2	.19	.24	.15	.08	.12
Adjusted R^2	.12	.18	.08	.01	.05
F	2.774**	3.802**	2.094*	.408 *ns*	1.648 *ns*

NOTE: $N = 95$. DV (dependent variable) = technology use.
a. Negative betas indicate a positive relationship for sensing, visual, active, and sequential learning styles, while positive betas indicate a positive relationship for intuitive, verbal, reflective, and global learning styles.
†$p < .10$. *$p < .05$. **$p < .01$.

$p < .05$) and interactive study aids ($\beta = -.24$, $p < .05$) and marginally related to the use of e-lectures ($\beta = -.19$, $p < .10$). Lastly, global learning style is significantly related to the use of e-lectures ($\beta = .24$, $p < .05$). However, visual and verbal learning styles do not influence the usage behavior of the TML tools in question.

Hypotheses 3 and 4 argued that perceived usefulness and perceived ease of use are positively related to perceived learning success. First, we analyzed the direct relationship between perceived usefulness and perceived ease of use of the textbook technology and perceived learning success. Indeed, both perceived usefulness ($\beta = .28$, $p < .001$) and perceived ease of use ($\beta = .38$, $p < .001$) were positively associated with perceived learning success, thus supporting Hypotheses 3 and 4 (Model 3 in Table 2).

Lastly, although not explicitly argued, we tested for mediation of the relationship between the learning styles and perceived learning success through perceived ease of use and perceived usefulness (Baron & Kenny, 1986). We discussed previously that perceived

ease of use and perceived usefulness are related to perceived learning success. However, when we investigated whether the learning styles were directly related to perceived ease of use and perceived usefulness, only the sensing learning style was directly related to perceived usefulness of the technology ($\beta = .21, p < .15$). Accordingly, only the effects of sensing learning styles could be mediated by perceived ease of use and perceived usefulness. Indeed, in the full model (Model 4, Table 2), the relationship between the sensing style and learning success ($\beta = -.18$, $p < .10$) drops to marginal significance, suggesting partial mediation. Lastly, we note that in the full model, the relationship of visual learning style and learning success was also marginally significant ($\beta = -.17$, $p < .10$).

CONCLUSIONS

Results of the study reveal several important messages for TML:

1. Our study suggests that the learning style of business communication students studied in this research was predominantly sensing, visual, active, and sequential. Thus, if instructors can obtain knowledge about their students' learning styles at the beginning of the course, they can tailor in-class learning experiences to meet the dominant learning style, while relying on online experiences to provide a wide array of experiences in a variety of learning modes. We further conclude that if instructors could ensure that essential course content were covered by two or more technology-delivered strategies provided with their textbook that cater to different learning styles, overall student success could be facilitated and students' motivation could be increased (Quible, 2006). To facilitate these benefits, we recommend that instructors have students assess their individual learning styles to determine appropriate learning strategies inside and outside the classroom. Table 4 provides examples of various strategies and learning styles for which they are most appropriate (adapted from Houghton, 2004).
2. Our study showed that the regression models containing learning styles explain up to 24% of the variance in usage behavior of the selected technology. We conclude that future studies on TML should control for learning styles, since students respond differently to the provided technology based on their learning predisposition. Thus, providing technology that is not suited for the learning style of the student may not lead to the desired learning effects. Indeed, in a post

Table 4. Learning Style Appeal of Various Instructional Strategies

Strategy	*Learning Style Appeal*
Relate information to what has come before, to what is still to come, to material in other courses, and to real world experiences	global
Present concrete, practical information and examples	sensing/active
Relate theories and models	intuitive
Use video, pictures, diagrams, and graphs	sensing/visual
Provide demonstrations and hands-on experience	sensing/visual/active
Use multimedia and computer activities	sensing/active
Provide intervals in lecture for students to think about or write down what they have heard	reflective/verbal
Allow for small-group brainstorming activities	active/global
Use team learning exercises	active
Test for recall and understanding	sensing/sequential
Test with open-ended problems and exercises	intuitive/reflective/global

hoc test not reported in this article, we were also able to show that the use of the technology in question was related to both perceived and actual student performance.

3. Our findings indicate that the impact of learning styles is partly mediated by perceived usefulness of the technology. We conclude that since student perceptions of perceived usefulness can potentially be influenced positively by the faculty member, instructors can play two critical roles in the technology adoption process of the students. We recommend that instructors educate the students about the availability of the content provided in the supplied technology so that benefits of utilizing the technology can be better understood, which should enhance perceived usefulness of the material. Second, we recommend that instructors review the technology features provided and explain the technology in the classroom, which should enhance the perceived ease of use of the material by the students. Faculty may have a particularly positive impact on students in freshman and sophomore classes, where exposure to supplemental technology has been limited and the students' long-term behavior can be positively influenced.

LIMITATIONS AND FUTURE RESEARCH OPPORTUNITIES

Before we outline future research opportunities of our study, we acknowledge several limitations of our study. While 223 students were enrolled in the classes in which the study was administered,

only 95 students completed questionnaires at all three points in time. While we did not detect any differences between completers and noncompleters that we believe would affect our findings, a higher participation rate at the three survey points would have been more desirable. For the purpose of our study, we used only bonus points on the final exam as an incentive for participation. In future studies with a longitudinal design, the researchers may consider increasing the attractiveness of the potential reward for students by possibly offering a drawing for a cash prize in addition to or in lieu of the nominal academic credit incentive.

For the purpose of the study, we deliberately chose a single textbook in the first semester of its adoption with coordinated classes. These conditions served as a quasi-experimental design and thus indirectly controlled for many potential confounds (e.g., Campbell & Stanley, 1963; Cook & Campbell, 1979). However, we acknowledge that focusing on a single textbook potentially reduces the generalizability of our findings. Thus, future research is needed to replicate our study with a variety of textbook supplements to show the generalizability of our findings and to assess whether certain media mixes prove superior to others. This research and others like it should provide guidance for the development of future textbook supplements.

Our study did not capture actual use of the specific textbook technology but relied on self-reported measures, which is a common practice in technology-related research. While self-reported use has been found to be highly correlated with actual use in technology research (Barnett, Kellermanns, Pearson, & Pearson, 2006-2007), actual usage data would have been preferable. Future research may expand on these findings by creating learning assessments for students that would link technology usage behavior and learning style to class performance.

Additional research related to TML is needed. In addition to researching further the impact of TML on students with various learning styles, more study is needed as to how students respond to strategies designed for learning styles other than their preferred ones. Expanding students' exposure to a variety of learning methods may enrich their ability to obtain and use information, thus increasing the number of avenues they have for effective learning. Furthermore, a careful analysis of the interaction of utilized learning style,

technology, and grade earned (see also Quible, 2006) could provide worthwhile insights.

Further research may also focus on other measures of learning styles. For example, the Motivated Strategies for Learning Questionnaires (MSLQ) (Pintrich, Smith, Garcia, & McKeachie, 1993) and the Learning and Study Strategies Inventory (LASSI) (Weinstein, 1987) offer viable alternatives to our utilized measure (e.g., Muis, Winne, & Jamieson-Noel, 2007). Future studies might also focus on different administration strategies. As mentioned in our discussion of limitations, our longitudinal study's sample suffered from a significant degree of attrition. It would thus be enlightening to determine whether shifting the data collection mode to a pencil and paper method would increase the response rate or if differences in survey administration or provided incentive would lead to noticeable method effects. As the availability of technology tools increases, continued research will be needed about how business communication students use them and the benefit gained from doing so.

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