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Virtual Group Learning Effectiveness via E-Learning Mediums

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ABSTRACT

Online learning provides the potential for more differentiated, integrated, and open learning environments to solve team project assignments. We argue that although it is feasible to increase information richness via adopting multimedia technologies, the effectiveness to promote interpersonal skills, critical thinking, and cognitive learning processes via virtual group discussion is uncertain. To substantiate the argument, we invited 156 subjects, divided into 46 groups, to resolve decision- and intellectual-tasks in text-messaging and audio-conferencing e-learning environments. A pedagogical interpretation of how we can use these two e-learning systems to improve effectiveness for group-based tasks was posited.

Keywords

Intellectual, decision-making, text-messaging, audio-conferencing, group learning

INTRODUCTION

Electronic learning (e-learning) systems radically reduce the need for the trade-off between richness and reach from the perspective of information economics (Evans and Wurster, 2000). The availability of rich information objects, knowledge repository, and the directory of domain experts considerably affects the creation of new knowledge and innovative ideas. E-learning systems untangle the geographical limitations of the traditional face-to-face (F2F) learning and, therefore, increase the number and diversity of participants. These features provide the potential for a more differentiated, integrated, and open learning experience. An increasing number of learners acquire knowledge via e-learning systems. However, the potential for developing and sharing new knowledge and ideas through e-learning systems is largely ignored.

Many e-learning media can be used to foster an innovative learning environment. An instructor can use asynchronous e-learning media, such as discussion forums and online quizzes, to facilitate group discussion and self-evaluation, respectively. Text –messaging, as well as video- and audio-conferencing, are useful synchronous e-learning media for instructors and students to meet virtually. To understand how e-learning systems can foster an innovative learning environment, it is imperative to explore the relationship between e-learning media and learning performance. This manuscript aims to understand the potential impact of the group learning tasks and the information richness of e-learning media on group learning performance.

THEORETICAL FOUNDATIONS

In a virtual community, the principles of rationality and reciprocity regulate the social exchange behaviours (Turner, 1998). Due to the ambiguous nature of the social goods, it takes time to establish trust and create norms (Coleman, 1988) in a virtual community before members begin valuing collective interests over their own. Unlike many successful virtual communities, a semester-long duration to manage a discussion forum for a particular online course may be insufficient to cultivate trust and altruism. While social exchange does occur in the virtual learning environment (Kim, 2000), instructors and individual students feel less obligated to engage in the process. In addition, information richness elements such as positive or negative physical expressions (e.g. tones, facial expressions, and body languages) which act as effective enforcements in the learning process are lost in the e-learning environment. We argue that although it is feasible to increase information richness via adopting multimedia technologies, the effectiveness to promote interpersonal skills, critical thinking, and cognitive learning processes via virtual group discussion is uncertain. A pedagogical interpretation of how we can use e-learning systems to improve effectiveness for group-based tasks is imperative.

Information Richness of E-Learning Media

Critical to the effectiveness of an online synchronous learning system is the promotion of the virtual social interaction. Text messaging, animation, audio-conferencing, and video-conferencing are a few examples of ways to deliver the virtual social interaction synchronously. It is unclear if enhancing the information richness of e-learning media can correspondingly promote the virtual social interaction, whereby contributing to the efficacy of group-based learning.

Information richness is “the ability of information to change understanding within a time interval” (Daft and Lengel, 1986). Many factors, such as the medium’s capacity for instant feedback, social cues, communication channels, personalization, and language variety, are effective conduits of information richness. The richness of an e-learning medium should not be treated as “an invariant, objective property of the medium itself” (Lee, 1994 p. 145). The richness varies in different contexts from the hermeneutic perspective. In the context of e-learning for group performance, e-mail, considered as a “lean medium” by the information richness theory, could become a “rich medium” if used properly (El-Shinnawy and Markus, 1991). This provides room for interpretation about the richness of e-learning media. The conduits of information richness closely related to the context of e-learning include feedbacks, clues, content formats, personalization, richness of mediums, and interactivity. Information mediums with a higher richness like audio and video can deliver a higher learning capacity, whereas those with a lower richness like text can deliver a lower learning capacity (Daft and Lengel, 1986)

The choice of e-learning media must be based upon the learning objective. When learning objectives are ambiguous and complicated, media delivering rich information could be superior to those delivering lean information. On the other hand, when learning objectives are clear-cut, media delivering lean information could be superior to those delivering rich information (Trevino, Lengel, Bodensteiner, Gerloff and Muir, 1987). Learning objectives can be achieved by having e-learners solve different tasks. It is important to know the differences between task typologies and assess the efficacy of e-learning media with different degrees of information richness, to resolve group-based tasks.

E-learning Task Typologies

McGrath and Altman (1996) asserted that differences in group performance could be explained better by taking into consideration the “task” and “group” at the same time. McGrath (1984) recommended that tasks be analyzed “in ways that relate meaningfully to how groups perform them” (p. 53). An e-learning system is an alternative vehicle to facilitate communication and decision-making within a group and between groups. This manuscript attempts to investigate the potential impact of task typology on the group performance via e-learning systems.

Task typology has salient effects on group learning processes and performance in the literature of group support systems (GSS) (Ellis and Fisher, 1994). GSS have been assimilated to increase the participation rate of group discussion (Fjermestad, Hiltz and Turoff, 1995). However, there is no evidence showing that e-learning systems would have similar effect on the participation rate. Additionally, whether e-learning can contribute to the quality of group learning performance is uncertain. E-learning systems may inadvertently introduce unproductive factors, such as the loss of information richness, into group-based learning.

McGrath (1984) defined solving problems with a correct answer as “intellective tasks” and those with a preferred answer as “decision-making tasks.” Decision-making tasks require students to process information and to structure information processes. Decision tasks may be such as “how to leverage information technology for the company to compete with its competitors with respect to product innovation, growth, cycle time reduction, and cost leadership?” In contrast, in solving an intellective task, a correct solution is needed. Intangible and ambiguous solutions such as end-user satisfaction, social interaction, and individual preference that are acceptable in the decision-making tasks are intolerable for intellective tasks. A quantifiable solution is the best-fit model for intellective tasks. The majority of the GSS literature asserts that the validity of a research question depends heavily on the task selection and congruence. This study establishes the validity of these assertions by examining intellective versus decision tasks against group learning performance in synchronous e-learning environments.

Team-Based E-Learning

Just as social interdependence between citizens is necessary for a society, the social interdependence between students and instructors is important to the success of a virtual learning community. Johnson and Johnson (1994) classified three types of learning based on the degree of social interdependences: individual, competitive, and cooperative learning. Social interdependence does not exist for individual learning. The “curving” is a class policy to encourage the *zero-sum* competitive

learning. This type of learning concurs to a reactive social interdependence. Cooperative learning asserts that students team up to achieve a common learning goal. A single team member cannot succeed in a group assignment unless all team members succeed. The relationship between team members concurs to a proactive social interdependence.

This study investigates how to enhance cooperative learning via an e-learning system. When working as a team, learners are exposed to similar and/or divergent views of team members. Similar views are reinforcements for the existing mental models. Divergent views can challenge a learner's mental model and extend metacognition (Glaser and Bassok, 1989), thereby extending the existing mental models. Either view can lead to cognitive and motivational gains (Brown and Palincsar, 1989) as well as social support and encouragement for individual team members (Alavi, 1994). Positive attitudes can trigger a higher level of cognitive gains.

In the synchronous e-learning environment, team members meet virtually via text-messaging, audio-conferencing and video-conferencing where they exchange messages on a real time basis. The choice of a particular synchronous e-learning medium is the result of an e-learner's objectively rational process (Fulk, 1993). The choice of media can also be the product of complex social interactions from the emergent (Contractor and Eisenberg, 1990) and network (Markus and Robey, 1988) perspectives. As such, the properties of e-learning media could vary from one learner to another. One e-learner may have a higher perceived value for text-messaging, while another for video-conferencing.

Group Learning Outcomes

It is commonly agreed that interaction is a more important factor in e-learning than in F2F learning. With a proper course design, e-learning can be superior to the traditional F2F learning in terms of quantity and quality of interaction by providing personalized and timely feedback (Horn, 1994; Hirumi and Bermudez, 1996). There are four types of e-learning interactions: student-content interaction, learner-instructor interaction, learner-learner interaction (Moore, 1989), and learner-interface interaction (Hillman, 1994). E-learning media can be used to facilitate these interactions, thereby influencing the participation rate of learners (McHenry and Bozik, 1997).

Another learning outcome is learning satisfaction, which is a feeling or attitude towards learning activity. A learner has a high learning satisfaction when the learning activity satisfies and meets his/her learning needs and expectation (Tough, 1982). In a pleasant experience with a high level of learning satisfaction, a student is more likely to be akin to group discussion, which helps establish a proactive learning attitude between students. Discussants participate in group discussion based on their personal abilities, needs, and preferences. The personalized learning experience is one key to the learning satisfaction of group discussion (Douglass, 1970). Hiltz (1994) modified Doll and Torkzadeh's (1988) end-user computing satisfaction (EUCS) instrument and proposed a survey to measure the satisfaction of the collaborative learning process via e-learning system. She asserted that collaborative learning via e-learning systems would result in a higher level of student involvement (Hiltz, 1994) and engagement (Harasim, 1990) in the learning process. These productive learning processes will transpire into a higher satisfaction for students.

RESEARCH METHODOLOGY

An empirical study was conducted with the subjects of the study being students in an introductory MIS course using an online synchronous learning system in a university in Taiwan, Republic of China. The independent variable in the study is information richness, with text messenger (low information richness) and audio-conferencing (high information richness) as the e-learning media. The dependent variables are group learning satisfaction and group learning performance. Learning satisfaction is a feeling or attitude towards learning activity. A learner has a high learning satisfaction when the learning activity satisfies and meets learning needs and expectation (Tough, 1982). In a pleasant experience with a high level of learning satisfaction, a student is more likely to be akin to group discussion, which helps establish a proactive learning attitude between students. Discussants participate in group discussion based on their personal ability, needs, and preferences. The personalized learning experience is one key to the learning satisfaction of group discussion (Douglass, 1970). The authors scored the group discussion results as the measure of group learning performance. The higher the score, the better the group learning performance is. The moderating variable is group task type, consisting of intellectual and decision tasks. Figure 1 is the research framework.

Hypotheses

According to McGrath's classification (McGrath, 1984), problem-solving can fall into one of two categories, "intellectual tasks" or "decision-making tasks." Due to the respective focus of tasks of these two types, the richness of a medium would have different impacts on the performance of the task. For intellectual tasks, a rich medium such as audio-conferencing would be distractive with irrelevant information, which could lead to information overload, but would not affect the

effectiveness of the task. For decision-making tasks, conversely, a “lean medium” (such as text-based computer system) would be incapable of transferring sufficient information, which could lead to lower efficiency and effectiveness. In addition, using text-based chat rooms would require more time spent on the communications, which would affect the users’ perception of the efficiency and effectiveness of the communication medium. Therefore, the current study attempts to explore the impact of media on the performance of cooperative learning. Hypotheses are proposed as follows:

Decision-Making Task

H1a: The audio-conferencing group has a higher satisfaction level than the text-messaging group in the decision-making task.

H1b: The audio-conferencing group performs better than the text-messaging group in the decision-making task.

Intellective Task

H2a: The audio-conferencing group has the same satisfaction level than the text-messaging group in the decision-making task.

H2b: The audio-conferencing group has the same performance as the text-messaging group in the decision-making task.

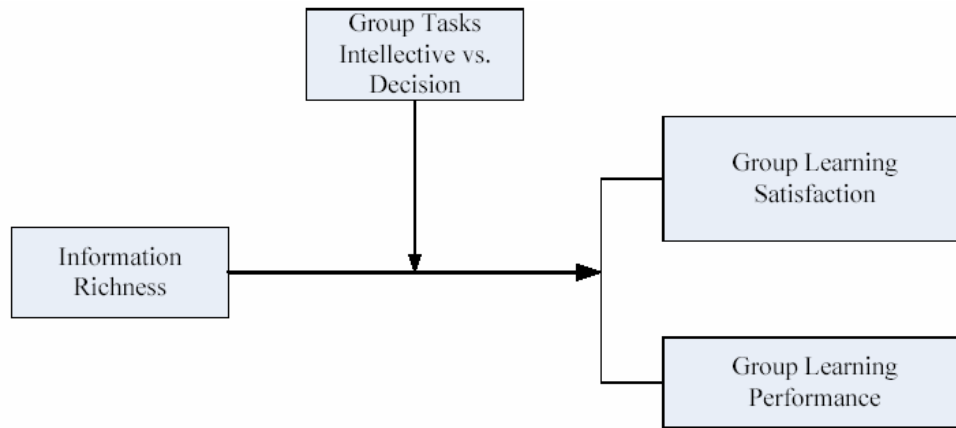


Figure 1. Theoretical Framework

Experimental Design

The subjects of this study were students enrolled in an introductory MIS course offered on a synchronous distance learning system in fall semester of 2003. Students of the class were mostly MIS majors or minors. All students had taken an introductory computing course and had reasonable computer skills. Survey forms were collected from 156 subjects who were randomly assigned to 46 groups, 24 using text messaging and 22 using an audio conferencing platform (Table 1). The groups discussed their tasks and then filled out the survey form for the study. This two-factorial design administered two media and two task types.

	TEXT MESSAGING	AUDIO CONFERENCING
Decision-making task	12 groups	11 groups
Intellective task	12 groups	11 groups

Table 1: Two-Factor Experiment design

After the random assignment of the subjects to their groups, the tasks for the groups were given, and each group would set up a commonly agreeable time to conduct online discussions. Every member of a group would log in to the experimental system and conduct a discussion on the given topic with his/her teammates for a period of 50 minutes. During the interaction, members communicated and exchanged through text or audio means in Chinese. Since all participants were native Taiwanese, communicating via either means in Chinese potentially had no effect on the communication and learning results. Once an agreement was reached, the group would fill out the survey form as well as prepare and submit a summarized report. In addition, the investigator also stored all information of the discussion for future analyses. Every team must finish two tasks (one intellectual and one decision-making). Therefore, the same process would repeat except that the content and nature of the tasks would change. The theme of the decision-making task was:

“Describe information systems applications for different levels of an organization according to the pyramid model. In your opinion, what information systems can be used to support the duties of the department chair of the MIS department in a university?”

There was no single correct answer to the question. Individual group members had their own preferred answers because of their differences in perception and decision-making rationales. Group members needed to rely on the online audio- or text-based chatting to exchange opinions and decided on a preferred answer after reconciling opinions of members. In contrast, the theme of the intellectual task was:

“Study two company cases (given separately) and analyze their market environments. Identify the competitive strategy adopted by these two companies. Decide which competitive force will be addressed by the adopted competitive strategy, according to Michael Porter’s five-force model.”

There was a correct answer to the question. Group members must find a definite answer based on factual and theoretical backgrounds. Group members needed to resort to logical inference and their own judgment in order to locate the answer.

The question items in the survey form used for this study were extracted from surveys in published research that were tested over time. The questions were translated to Chinese and rearranged into the survey form used for this study. Chronbach’s α was computed to test the reliability of the survey items. Table 2 shows that the α values for all the constructs are greater than 0.6. Therefore, the survey form has sufficiently high reliability.

CONSTRUCT	α
Perceived learning growth	0.8803
Self-described learning	0.8820
Learning interest	0.8565
Group evaluation	0.7745
Attitude toward computer use	0.6945
System interactivity	0.7755
Overall	0.8600

Table 2 Chronbach’s α for the constructs

RESULTS OF DATA ANALYSES

This study used ANCOVA to assess the impacts of online synchronous learning media on group learning outcomes in intellectual and decision-making tasks. Two online synchronous learning media—audio-conferencing and text-messaging—were compared in the experimental study. Learning outcomes including satisfaction level and group learning performance were measured. The ANCOVA results show that the audio-conferencing group has a significantly higher satisfaction level

than the text-messaging group for the decision-making task (Table 3). This indicates that the factor of information richness – which is higher in audio-conferencing and lower in text-messaging - has impacts on the satisfaction level of online group when the groups undertake decision-making tasks. Hypothesis H1 was supported. However, the factor of information richness apparently has little impacts on the group learning performance given the result that audio-conferencing and text-messaging groups have the same group performance statistically. Therefore, our findings did not support Hypothesis H1b.

DV	Systems	Text-Messaging	Audio-Conferencing	Sig.
		Mean (S.D.)	Mean (S.D.)	
Group learning satisfaction		19.752(0.885)	20.133(0.928)	0.021*
Group learning performance		74.667(8.773)	78.273(11.464)	0.404

* p<0.05

Table 3: ANCOVA results for decision-making tasks

The ANCOVA results show that the audio-conferencing group has same satisfaction level, as well as group learning performance, as the text-messaging group for the intellectualive task. This indicates that the factor of information richness has little impact on the satisfaction level of online groups when the groups undertake intellectualive tasks. Hypothesis H2a was supported. The factor of information richness also has little impact on the group learning performance. Therefore, our findings supported the Hypothesis H2b. Table 5 summarized the results of the hypotheses tests.

DV	Systems	Text-Messaging	Audio-Conferencing	Sig.
		Mean (S.D.)	Mean (S.D.)	
Group learning satisfaction		19.779(1.481)	19.593(1.279)	0.752
Group learning performance		72.417(12.280)	73.909(11.211)	0.765

* p<0.05

Table 4: ANCOVA results for intellectualive tasks

Hypothesis 1: Decision-Making Tasks		p-value	Sig	Supported
H1a	H1a: The audio-conferencing group has a higher satisfaction level than the text-messaging group in the decision-making task.	0.021*	P<0.05	Yes
H1b	H1b: The audio-conferencing group performs better than the text-messaging group in the decision-making task.	0.404	n.s.	No
Hypotheses 2: Intellectualive Tasks		p-value	Sig	Supported
H2a	H2a: The audio-conferencing group has the same satisfaction level than the text-messaging group in the decision-making task.	0.752	n.s.	Yes
H2b	H2b: The audio-conferencing group has the same performance as the text-messaging group in the decision-making task.	0.765	n.s.	Yes

Table 5: Summary of Hypotheses testing

DISCUSSION

The group performing on the audio-conferencing platform had a higher satisfaction level than the group performing on text messaging platform. Given the same time interval, audio-conferencing is more effective than text-messaging in improving a

group's satisfaction level for decision-making tasks. This indicates that information richness is an important factor in improving a group's satisfaction level for decision-making tasks. A shorter response time, tone expressions as stronger social cues, personalized learning experiences, and a closer F2F interaction, are effective conduits of information richness in the audio-based medium. A text-messaging media platform is thinner in these conduits and, thereby, contributes to a less satisfactory group learning experience. Although an audio-conferencing media platform can also deliver a higher group learning performance than text messaging in conducting decision-making tasks, it had no significant differences between these two online synchronous learning media. This finding is contrary to Hypothesis H1b and indicates that the factor of information richness has psychological effects but not necessarily on the group learning capability.

For decision-making tasks, audio conferencing has significant impact on group learning satisfaction but not on group learning performance; for intellectual tasks, neither audio conferencing nor text messaging has an impact on group learning outcomes. There are no cross-effects between platforms and task types on group learning outcomes. This result indicates that the main effects of information richness and task types are independent. In other words, the impact of information richness on group discussion processes can be examined without the need of considering task types, since the latter will not affect the impacts of information richness. Likewise, the impact of task types on group discussion processes can be examined independently, since the online synchronous learning media used to facilitate group discussions will not affect the impacts of task types.

Although the study was conducted with a limited sample size, the findings maintain merits to some extent because of the appropriate experimental design and execution of the experiments, as well as the data analyses performed. Therefore, the findings imply that while being independent from each other (without cross effects), the impacts of information richness and task types on group learning outcomes can be independently identified and then added together to find combined effects. The study and prediction of the impacts of system media and task types on group learning outcomes can then be relatively straightforward tasks. This finding has theoretical as well as operational significance for future studies. Due to the fact that distance learning based on computer-facilitated systems was in its fledgling stage in the university, the subjects were limited to students of the introductory MIS course, which in turn limited the number of available subjects. Not all groups had the same number of students, which led to the reduced number of groups that could be used as reliable sources of data collection and observation. Because of the above limitations, the sample may not be sufficiently representative to allow wider generalization of the findings of this study. Therefore, caution should be used when the findings of this study are being generalized. There is a potential problem that the subjects might not have gained sufficient expertise in using the systems due to the short time-span of each session of the experiment, and therefore, might actually be getting familiar with the system during the intended experiment duration rather than using the system in a "normal operational mode." This can potentially affect the consistency of the subjects' perception and performance on the systems.

In the current study, only text- and audio-based online learning systems were involved in online discussions. If video systems are introduced, more clues and richer socialization processes may be present, which may be closer to the natural personal interactions that the subjects may be more accustomed to. It is yet to be found whether the same results will be reached with video-based systems added for online discussions. In addition, this study had college students using online instruction systems as subjects. With the growing popularity of distance learning for corporate training, determining whether or not the results would be different for corporate users is a direction worth probing. Future research may study other task types (other than decision-making or intellectual), as well as employ longer experiment times (both the number of sessions and the length of each session) and different task formats (other than projects). New results may be found in those new settings of research. To achieve a higher generalizability, future studies can also use multiple decision-making and intellectual tasks to replicate the pattern of results.

CONCLUSIONS

This empirical study created a controllable environment to allow the interaction of factors involved in computer-mediated group learning processes to occur and unfold. Group discussions for different types of tasks on different synchronous distance learning systems were observed. Possible effects on group learning satisfaction and performance by different types of tasks and/or on different media were identified and inferred. Firstly, data analyses based on our experiments indicate that decision-making tasks conducted on an audio conferencing platform would result in higher learning satisfaction. Compared to using text messaging in which the slower typing speed of some members may cost the group longer waiting time, conducting group discussion on audio conferencing platforms fits the accustomed oral communications and increases the ease of use and therefore the satisfaction of group learning. Secondly, our data analyses show that media (the artifact of information richness) or task types do not have an impact on the performance of group learning. In other words, group learning performance does not gain or lose by using synchronous computer-mediated communication systems, and does not vary among different task

types. This is an interesting result with potentially far-reaching implications. Thirdly, the learners' attitude toward the synchronous learning system significantly affects the satisfaction of synchronous online group learning. Results of data analyses show that the groups with more positive attitude toward the computer systems, the reliability of computer systems, the interactivity of the system, and the interface user-friendliness, have higher learning satisfaction. Consequently, before the learners conduct learning activities using the synchronous discussion systems, they should be encouraged to get familiar with and to practice the related methods of using the specific learning systems so that the synchronous discussion systems will not inadvertently become a hurdle to learning resulting in process loss.

REFERENCES

1. Alavi, M. (June 1994). Computer-Mediated Collaborative Learning: An Empirical Evaluation. *MIS Quarterly*, 159-174.
2. Brown, A. L., and Palincsar, A. S. (1982). Inducing Strategic Learning from Texts by Means of Informed, Self-control Training. *Topics in Learning and Learning Disabilities*, 2(1), 1-17.
3. Coleman, J. S. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*, 94(95-120).
4. Contractor, N. S., and Eisenberg, E. M. (Ed.). (1990). *Communication Networks and New Media in Organizations*. Newbury Park, CA: Sage.
5. Daft, R. L., and Lengel, R. H. (Ed.). (1984). *Information Richness: A New Approach to Managerial Information Processing and Organization Design*. Greenwich, CT: JAI Press.
6. Daft, R. L., and Lengel, R. H. (May 1986). Organizational Information Requirements, Media Richness and Structural Design. *Management Science*, 554-571.
7. Doll, W. J., and Torkzadeh, G. (1988). The Measurement of End-User Computing Satisfaction. *MIS Quarterly*, 12, 259-274.
8. Douglass, M. (1970). Some Perspectives on the Phenomena of Participation. *Adult Education*, 20(2).
9. El-Shinnawy, M. M., and Markus, M. L. (1997). The Poverty of Media Richness Theory: Explaining People's Choice of Electronic Mail vs. Voice Mail. *International Journal of Human-Computer Study*, 46(2-3), 443-467.
10. Ellis, D. G., and Fisher, B. A. (1994). *Small Group Decision Making-Communication and Group Process* (4th ed.). New York: McGrath-Hill, Inc.
11. Evans, E., and Wurster, T. (1999). *Blown to Bits: How the New Economics of Information Transforms Strategy*. Boston: Harvard Business School Press.
12. Fjermestad, J., Hiltz, S. R., and Turoff et, M. (1995). *Group Strategic Decision Making: Asynchronous GSS using Structured Conflict and Consensus Approaches*. Paper presented at the HICSS.
13. Fulk, J. (1993). Social Construction of Communication Technology. *Academy of Management Journal*, 3(6), 921-950.
14. Glaser, R., and Bassok, M. (1989). Learning Theory and the Study of Instruction. *Annual Review of Psychology*, 40, 631-666.
15. Harasim, L. (1990). *On-line Education: Perspectives on a New Environment*. New York: Praeger.
16. Hillman, D. C., Willis, D. J., and Gunawardena, C. N. (1994). Learner-Interface Interaction in Distance Education: An Extension of Contemporary Models and Strategies for Practitioners. *The American Journal of Distance Education*, 8(2), 30-42.
17. Hiltz, S. R. (1993). *The Virtual Classroom: Learning without Limits via Computer Network*. New Jersey: Albex Publishing Corporation.
18. Hirumi, A., and Bermudez, A. (1996). Interactivity, Distance Education, and Instructional Systems Design Converge on The Super Information Highway. *Journal of Research on Computing in Education*, 24(1), 1-16.
19. Horn, D. (1994). Distance Education: Is Interactivity Compromised? *Performance and Instruction*, 33(9), 12-15.
20. Johnson, D. W., and Johnson, R. T. (1994). *Learning Together and Alone: Cooperation, Competition, and Individualization*. Needham Heights, MA: Allyn & Bacon.
21. Kim, A. J. (2000). *Community Building on the Web: Secret Strategies for Successful Online Communities*. Berkeley, CA: Peachpit Press.
22. Lee, A. S. (1994). Electronic Mail as a Medium for Rich Communication: An Empirical Investigation Using Hermeneutic Interpretation. *MIS Quarterly*, 18(2), 143-157.
23. Markus, L. M., and Robey, D. (1988). Information Technology and Organizational Change: Causal Structure in Theory and Research. *Management Science*, 35(5), 583-598.
24. McGrath, J. E. (1984). *Group: Interaction and Performance*. Englewood Cliff, NJ: Prentice Hall.
25. McGrath, J. E., and Altman, I. (1996). *Small Group Research: A Synthesis and Critique of the Field*. New York: Holt, Rinehart & Winston.
26. McHenry, L., and Bozik, M. (1997). From a Distant Student Voices from the Interactive Video Classroom. *TechTrends*

- for Leaders in Education and Training*, 42(6), 20-24.
27. Moore, M. G. (1989). Three Types of Interaction. *The American Journal of Distance Education*, 3(2), 1-6.
 28. Tough, J. (Ed.). (1982). *Language, Poverty, and Disadvantage in School*. New York: Academic Press.
 29. Trevino, L. K., Lengel, R. H., Bodensteiner, W., Gerloff, E.A., and Muir, N. K. (1990). The Richness Imperative and Cognitive Style. *Management Communication Quarterly*, 4(2), 176-197.
 30. Turner, J. H. (1991). *The Structure of Sociology Theory* (5th ed.). Belmont, CA: Wadsworth.