

Effects of Different Types of Interaction on Learning Achievement, Satisfaction and Participation in Web-Based Instruction

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SUMMARY

This study investigated the effects of three types of interaction (academic, collaborative and social interaction) on learning, satisfaction, participation and attitude towards online learning in a Web-based instruction (WBI) environment. Academic interaction includes interaction between learners and online resources as well as task-oriented interaction between learners and instructor. Collaborative interaction among learners becomes possible when a group of learners work collaboratively on a specific topic or share ideas and materials to solve a given problem. Social interaction between learners and instructors occurs when instructors adopt strategies to promote interpersonal encouragement or social integration. The results indicate that: the social interaction group outperformed the other groups; the collaborative interaction group expressed the highest level of satisfaction with their learning experience; the collaborative and social interaction groups participated more actively in posting their opinions than the academic interaction group; and Web-based learning experiences brought positive attitude changes with respect to the use of the Web in learning – regardless of the type of interaction. It is concluded that even for adult learners, social interaction with instructors and collaborative interaction with peer students are important in enhancing learning and active participation in online discussion.

INTRODUCTION

Web-based instruction (WBI) is known as a media-rich, online environment allowing people to interact with others asynchronously or synchronously in collaborative and distributed environments (Dede, 1995; Harasim *et al.*, 1995), to gain access to remote multimedia databases for active and resource-based learning (Hiltz, 1994; Jung and Leem, 1999), and to manage self-paced individual learning in a flexible way (Naidu, 1997; Reeves and Reeves, 1997).

Among these features of WBI, expanded interactivity is especially important in overcoming one of the shortcomings of traditional distance education, that is, lack of interpersonal interaction (Jung *et al.*, 1998). WBI allows people to interact with each other, with instructors or outside experts, and with multimedia resources. Asynchronous communication features of the Web such as e-mail, listservs and computer conferencing allow for time- and place-independent interactions. Synchronous communication features

such as chatting and real-time conferencing tools allow for real-time interaction. Additionally, information and online resources from around the world can be accessed by anyone from anywhere as long as the person has a computer with an Internet connection.

This study focuses on three types of asynchronous interaction in a Web-based learning environment: content-centred academic interaction which occurs between learners and instructor or between learners and online resources; collaborative interaction among learners; and social interaction between learners and instructor.

RESEARCH ON INTERACTION

Interaction has been recognized as one of the most important components of learning experiences both in conventional education and distance education

(Vygotsky, 1978; Holmberg, 1983; Moore, 1993). There have been studies examining the conceptual framework underlying interaction in distance education. Bates (1995) categorized interaction according to the time of interaction and context for interaction: synchronous vs. asynchronous, and personal vs. social interaction. He further argued that different educational objectives and needs require different types of interaction. Paulsen (1995) provided four types of interaction in a computer-mediated communication environment: one-alone, one-to-one, one-to-many, and many-to-many interaction.

Moore (1993; Moore and Kearsley 1996) provided the distinction between three types of interaction: learner–content, learner–teacher and learner–learner interaction. These types of interaction can occur either synchronously or asynchronously. Hillman *et al.* (1994) added learner–interface interaction acknowledging the fact that the learner in a distance education environment has to interact with the medium. Moller (1998), based on types of online interaction, identified three types of virtual community in WBI: academic community provided by interaction between learners and instructors, intellectual community provided through peer interaction or collaborative work, and interpersonal community developed through interpersonal encouragement and assistance.

In addition to these studies, which have tried to clarify the concept of interaction in distance education, there have also been empirical studies that examined factors influencing online interaction and identified emerging types of interaction in WBI. Vrasidas and McIsaac (1999) found that the structure of the online course, class size, feedback and prior experience with computer-mediated communication all influenced interaction in an online course. Anderson and Harris (1997) also identified factors associated with amount of use and benefits obtained by users of an online network. The study identified that socially-oriented factors contributed to the prediction of both uses of the network and outcomes and suggests the importance of implementing strategies to promote social interaction among users and of enhancing perceptions of a network user's social presence. Similarly, a study conducted by Gunawardena and Zittle (1997) revealed that social presence contributed more than 60% of learner satisfaction with computer conferencing courses. Kanuka and Anderson (1998) found that social-cognitive processes among participants in the online forum included significant time engaged in social interchange.

As for emerging patterns of online interaction,

McDonald and Gibson (1998) found that interpersonal issues remained prominent through the asynchronous computer conferencing course. Besides interpersonal interaction, Adelskold *et al.* (1999) found that collaboration among the students occurred during problem-based learning via a computer network. Similarly, the effective collaborative application of a computer-mediated communication system was observed in distance education business courses (Salmon, 1999). Students' effort to establish various forms of social presence in instructional electronic chats was identified by Murphy and Collins (1997).

From these previous studies, three types of interaction are prominent in WBI. First, academic interaction occurs when learners study online materials and when learners get task-oriented feedback from the instructor (Moore, 1993; Moller, 1998). This type of interaction is content-centred. Academic interaction is a basic type of interaction in WBI since it occurs when the learner reads online materials or participates in task-oriented learning activities provided in WBI. Second, collaborative interaction occurs when learners are discussing issues that are related to their learning on the bulletin board or solving problems collaboratively (Moller, 1998; Adelskold *et al.*, 1999). Even though this type of interaction is encouraged in a task-oriented learning situation, it has a social dimension also. Third, interpersonal or social interaction occurs especially when learners get social feedback from the instructor or their peers through personal encouragement and motivational assistance (Gunawardena and Zittle, 1997; McDonald and Gibson, 1998).

Some prior studies revealed that each type of interaction could have different effects on different aspects of learning in WBI. For example, as Adelskold *et al.* (1999) suggested, collaborative interaction among learners could have greater effects on learning in a problem solving situation than other types of interaction whereas, as Gunawardena and Zittle (1997) and Kanuka and Anderson (1998) noted, interpersonal or social interaction between learners and instructor could contribute to learner satisfaction and frequency of interaction in WBI.

Little investigation, however, has been done to compare the effects of different types of interaction on learning in a Web-based learning environment. In some studies (Hiltz, 1994; Daugherty and Funke, 1998; Jonassen *et al.*, 1999), online instruction that provided various types of online interaction was compared with traditional courses as to its effectiveness. Online instruction showed significantly better results on an

examination, solving complicated problems, or perceived learning outcomes than traditional courses. However, none of these studies examined the individual effects of each type of interaction on online learning.

THE PURPOSE OF THE STUDY

This study attempts to investigate the effects of three types of interaction on learner achievement, satisfaction, participation, and attitude towards online learning in a WBI environment. The three types of interaction focused on in this study are academic interaction, collaborative interaction among learners and social interaction between learners and instructors. For the purpose of this study, academic interaction includes interaction between learners and online resources as well as task-oriented interaction between learners and instructor. This content-centred, or academic, interaction is considered as a basic form of interaction in WBI and is, thus, used as the control in this study. That is, academic interaction is included in the other two types. Collaborative interaction for this study is limited in interaction among learners that takes place when a group of learners work collaboratively on a specific topic or share ideas and materials to solve a given problem. Social interaction is defined as interaction between learners and instructors that occurs when instructors adopt strategies to promote interpersonal encouragement or social integration.

This study sought to investigate the following questions:

- Does the level of learner satisfaction differ according to the types of asynchronous interaction in WBI?
- Do students who are engaged in either collaborative or social interaction (in addition to academic interaction) achieve more than those who are just engaged in academic interaction?
- Do students participate more actively in online

discussion within collaborative or social interaction environment than within academic-only interaction environment?

- Do students change their attitude towards online learning according to the types of interaction in which they are engaged?

METHOD

Participants

The 124 participants of this study were all undergraduate students from three courses of a university located in Seoul, Korea. Demographically, 66% were females, and the mean age was 21 years old. The students in each course were assigned to one of three interaction groups. A pre-test was conducted to ensure that each group was similar in terms of prior experience with WBI, attitude towards online learning, and motivation level. No significant differences between or within the groups were found (see Table 1). For the final data analysis, 120 students were included. Forty-eight students were in the academic interaction group (control group), 45 students were in the collaborative interaction group, and 27 were in the social interaction group.

Design

Three types of interaction served as the independent variable in this study: academic interaction group, collaborative interaction group and social interaction group. The dependent variables included learner achievement on five assignments, learner satisfaction after completing the WBI course, participation in an interactive activity (posting messages on discussion board), and attitude change after taking the WBI course.

Procedure

Participants in this study were responsible for completing a WBI course that consisted of five modules. After completing each module, each student was required to turn in an assignment, which would be given a grade by the instructor. Five assignments measured the students' learning achievement.

Before starting the WBI course, all of the students received face-to-face training regarding how to use the various functions of the WBI course, and they were given three days to familiarize themselves with the computer system. After receiving a pre-test on their

Table 1 One-way ANOVA on the pre-test

Source	df	SS	MS	F	p
Between Groups	2	253.727	126.864	.970	.382
Within Groups	117	15307.864	130.836		
Total	119	15561.592			

prior experience with WBI, attitudes toward online learning and motivation levels, the students in each group began the course and were required to complete it within six weeks – one week per module and the last week for handing in the last assignment and wrapping up the course. The students in each group were asked to spend 30 minutes to one hour every day working on the course.

The three interaction groups studied the same content on the Web. All the groups were allowed to use the free discussion board for voluntary interaction within each group's members. The only difference among the groups was the interaction type allowed. The academic interaction group served as the control group in the study and made interactions with the instructor only for content-related matters. No other kinds of instructor feedback, such as motivational or interpersonal encouragement, were given to the control group. The collaborative and social interaction groups were the treatment groups and were involved in collaborative or social interaction respectively, in addition to the academic interaction. The collaborative interaction group was given an opportunity to participate in one or more of the discussion activities. The instructor presented a list of discussion topics to the students and told them to participate in online discussions where they should share ideas and information and to work collaboratively during these online activities. The social interaction group was provided with various kinds of interpersonal and social feedback from the instructor. In addition, the social presence of the instructor was emphasized for this group. For all of the interaction groups, a detailed set of training directions and interaction strategies was developed by the research team prior to the implementation of the WBI course. Three members of the research team served as instructors for the course. The instructors communicated with each other throughout the experiment.

After completing the course, a post-test that measured attitude and a questionnaire that measured satisfaction were given to all three groups. Also, the students' achievement scores from the five assignments were calculated. The numbers of messages posted on the discussion boards was then gathered in order to examine the participation level for each interaction group.

Instrumentation

A WBI course on how to teach career-development skills for undergraduates and adult students was developed by a research team with the help of two programmers, who used Lotus LearningSpace, a tool

for developing and delivering WBI. The five modules in the course covered such topics as analysing yourself, exploring job possibilities, writing an effective resume, improving interview skills, and integrating all of these skills together. Text materials, along with some graphics, were provided to present the content to the students. Then, individual online activities allowed them to apply the skills that they gained from the text materials. Hyperlinks, e-mail and online discussions were incorporated into the course.

The Computer-Mediated Communication (CMC) attitude questionnaire was developed based on Clarke's (1991) instrument, which assessed student motivation, attitude and confidence in using CMC. The content validity of the items in Clarke's instrument was measured by experts in educational technology, and the items were revised based on the experts' feedback. The internal consistency of the resulting 20 items was computed using Cronbach's Alpha (Alpha = .91). This CMC questionnaire was used to measure learners' attitudes and motivation before and after a WBI course. Some other data, including demographics and prior experience, were also gathered during the pre-test. The results of this pre-test showed that the three groups were statistically similar in their attitude towards online learning, motivation level, and prior experiences with CMC. Attitudes at the time of the pre-test and the post-test were compared to measure the students' changes in attitude after their WBI experiences.

A questionnaire assessing the students' satisfaction with WBI was developed based on Jung and Leem's (1999) WBI satisfaction scale. The questionnaire included 15 items asking about the students' satisfaction with their experiences during the learning process, their perceived learning outcomes and WBI in general. Once again, experts in educational technology measured the content validity of the items, and the questions were revised based on this measurement. The internal consistency of these items was also measured using Cronbach's Alpha (Alpha = 0.84). This questionnaire was given to the students in the classroom after they completed WBI.

To measure the students' learning achievement, the scores on the five assignments were calculated. These assignments were developed by the research team and reflected the learning objectives of the course. Each group's level of participation during interaction was assessed based on the number of messages posted on the discussion boards. The Lotus LearningSpace database program provided the number of posted messages by both each student and each group. The

data collected for the study were analysed using ANOVA and Post-hoc Scheffé analysis to determine whether there were significant group differences in the dependent variables. For data analyses, the Statistical Package for Social Sciences (SPSS) was used. For this study, the significance level was set at $\alpha = 0.05$.

RESULTS

A one-way ANOVA was performed to identify the group differences in learner satisfaction, and the results revealed no significant difference between the groups' general satisfaction level with WBI and their satisfaction with perceived learning outcomes. However, there were significant differences among the groups regarding their satisfaction with the learning experience (see Table 2). Post-hoc Scheffé analysis indicated that the differences in the groups' satisfaction with their learning experience appeared between academic and collaborative peer interaction groups (see Table 3). This shows that the learners' satisfaction with the WBI experience was more strongly related to the amount of active interaction with other students than with the amount of interaction with the instructor.

To answer the question of whether there was a difference among the three interaction groups in terms of learning achievement (see Table 4), one-way ANOVA and Post-hoc Scheffé analyses were conducted. The results of the analyses revealed that there were significant differences between the groups

in terms of learning achievement and that there were significant differences in the learning achievements of the academic interaction group and social interaction group. These results show that social interaction between learners and the instructor contributed to increased learning achievement, whereas collaborative interaction among students did not.

The number of messages posted on the discussion boards in each interaction group was counted, and a one-way ANOVA analysis was conducted to examine the differences among the three interaction groups in terms of participation in interaction. The result showed that there were significant differences among the groups. A Post-hoc Scheffé analysis found that there were differences between the academic and social interaction groups and also between the academic and collaborative interaction groups with regards to interaction participation level. These results suggest that it is important for an instructor to verbally indicate his or her expectations regarding students' participation in discussion or that it is important for the instructor to recognize students' involvement in discussion by using motivational feedback aimed at promoting learner participation in interaction.

The one-way ANOVA conducted on the post-CMC attitude test showed no significant differences among the groups in terms of their attitude towards online learning. However, an additional ANOVA revealed that there were in fact changes in the students' attitudes toward online learning after receiving WBI

Table 2 One-way ANOVA on satisfaction with perceived learning outcomes, learning process and WBI in general

Source		Df	SS	MS	F	p
Perceived Learning Outcomes	Between	2	9.745	4.872	1.668	.194
	Within	99	289.128	2.920		
	Total	101	298.873			
Learning Experience	Between	2	49.582	24.791	7.643	.001**
	Within	99	321.124	3.244		
	Total	101	370.706			
WBI General	Between	2	9.186	5.093	1.259	.289
	Within	99	400.569	4.046		
	Total	101	410.755			

** $p < 0.01$

Table 3 Post-hoc Scheffé analysis on learning achievement, satisfaction and participation

Treatment conditions	AIG	SIG	CIG
Learning Achievement Mean (SD)	67.35	87.30	75.09
AIG = 67.35 (27.97)	–	.012*	.701
SIG = 87.30 (18.99)		–	.079
CIG = 75.09 (22.39)			–
Satisfaction Mean	5.95	6.30	7.47
AIG = 5.95 (1.70)	–	.724	.001**
SIG = 6.30 (2.42)		–	.053
CIG = 7.47 (1.43)			
Participation Mean	.63	8.44	6.04
AIG = .63 (1.09)	–	.001**	.001**
SIG = 8.44 (5.22)		–	.129
CIG = 6.04 (6.68)			–

Note: AIG = Academic Interaction Group

SIG = Social Interaction Group

CIG = Collaborative Interaction Group

* $p < 0.05$; ** $p < 0.01$

Table 4 One-way ANOVA on learning achievement, satisfaction, participation and attitude

Source		df	SS	MS	F	p
Learning Achievement	Between	2	4565.03	2282.519	4.706	.011*
	Within	117	8	485.058		
	Total	119	56751.753			
Satisfaction	Between	2	177.406	88.703	2.058	.133
	Within	99	4267.937	43.110		
	Total	101	4445.343			
Participation	Between	2	1224.70	612.351	26.216	.001**
	Within	117	1	23.358		
	Total	119	2732.890			
Attitude towards CMC	Between	2	248.642	124.321	.904	.408
	Within	97	13341.948	137.546		
	Total	99	13590.590			

* $p < 0.05$; ** $p < 0.01$

(see Table 5). This result indicates that taking a Web-based course can cause learners to view online learning more positively regardless the type of interaction the learners experienced.

DISCUSSION

Additional research will need to be conducted to determine the extent to which the findings of this study are applicable to other settings or types of WBI. That notwithstanding, the results of this study suggest that different types of interaction in WBI courses may differ in terms of their effects on learning achievement, satisfaction and participation in interaction. The results also indicate that participants in all three of the interaction groups showed positive attitude changes towards online learning after their Web-based learning experience. As in other studies, there is the possibility that confounding variables, rather than the predictor variables of this study, are responsible for some of the reported results; however, the findings of the present investigation generally support prior research that argued for the importance of collaborative learning and social integration in enhancing learning outcomes, increasing learner satisfaction and promoting the use of CMC (Anderson and Harris, 1997; Gunawardena and Zittle, 1997; Murphy and Collins, 1997; McDonald and Gibson, 1998; Hillman, 1999; Salmon, 1999).

From the current study, it is concluded that social interaction is related more to learning outcomes than to learner satisfaction, whereas collaboration among the learners is related more to learner satisfaction than to learning outcome in WBI. Previous studies on social presence or social integration, such as Gunawardena and Zittle (1997) and Anderson and Harris (1997), found that social presence, being defined as the degree to which a person is perceived as a 'real person' in mediated communication (Gunawardena and Zittle, 1997, p. 9), was closely related to learner satisfaction, use of the learning network environment and perceived learning benefits in this environment. The effects of

social factors on actual learning outcomes were not investigated in those studies. In addition, those studies examined the effects of social presence in a conferencing environment, not in a WBI that had specific learning objectives and contents, as was the case in the present study. If, in a Web-based learning environment, there was a set of learning objectives and contents to study, then social feedback by an instructor or some other social presence may affect students' learning outcomes. This was found in previous studies (Gillani and Relan, 1997; Leem, 1999; Jung, 2000) that argued for the importance of instructors' social or interpersonal feedback when attempting to improve learning achievement in WBI. One possible interpretation of the strong relationship between social interaction and learning achievement in WBI may be that an instructor's social or interpersonal feedback and the students' responses to that feedback, lead the students to pay more attention to the instructor's academic feedback and, thus, to focus more on the content and learning activities of WBI. However, this interpretation needs confirmation in future research.

Another area for future research concerns the effects on learning achievement of grouping students in online discussion environments. In this study, the students of the collaborative interaction group could choose to participate in any of the discussion groups. If a certain grouping strategy was adopted, there may have been a more significant difference between the academic and collaborative interaction groups with respect to learning performance. There are studies that have investigated the effects of different grouping methods on performance, attitude, and interaction (Dalton, 1990; Hooper and Hannafin, 1990; Hooper, 1992). These studies found that grouping methods influenced performance, attitude and interaction in certain computer-based learning environments.

This hypothesis was not formulated previously in this paper; we expected that the collaborative and social interaction groups would show a higher level of satisfaction with their learning as compared to the academic interaction group. Even though there were no significant differences in general satisfaction level and level of satisfaction with perceived learning outcomes among the three interaction groups, there were significant differences between the academic and collaborative interaction groups regarding satisfaction with the learning experience. In addition, the differences between the academic and social interaction groups in terms of satisfaction with their learning experience were close to statistical significance ($p=.053$). These results support previous

Table 5 Means, standard deviations and *t*-test comparison of pre- and post-CMC attitude tests

Source	N	M	SD	t	df	p
Pre-test	100	51.64	11.67	-4.096	99	0.001**
Post-test	100	54.71	11.72			

** $p < 0.01$

studies (Hedberg *et al.*, 1997; Relan and Gillani, 1997; Thompson and Chute, 1998; Thorpe, 1998) that argued that small-group activities are important in WBI to enhance learning motivation. Learning motivation is considered more important in distance education courses than in conventional courses, because distance learners with low motivation have more of a tendency to drop out or fail (Moore and Thompson, 1997; Keller, 1999). Active interaction with other students and collaboration in solving given problems during the WBI process may have helped some students with a lack of motivation to get others' help and, thus, overcome their motivational problems. Those students who were able to express themselves freely during the online peer interactions or those who helped other students with their problems may have developed enhanced motivation and may have become more involved in the learning process. Enhanced learning motivation due to interaction with other students seems to have led to high satisfaction with the WBI process for the collaborative interaction group.

Participation in interaction can be measured in several ways. Reading others' messages, posting one's own messages, responding to others' opinions, and sharing one's own information with others can all be used to indicate participation level. In this study, we used the number of messages posted to the discussion board in each group to measure participation in interaction and found that both collaborative and social interaction affected students' participation in the online discussion. This result indicates that active participation in interaction does not simply occur, but must be intentionally integrated into the course (King and Doerfert, 1996; Berge, 1999). In the control group for this study, no explicit attempts had been made to encourage students to participate in the online discussions, whereas in the other two groups, explicit directions (in the collaborative interaction group) or encouragement through the instructor's feedback (in the social interaction group) were given to promote participation in the discussions. Several previous studies (Shin, 1998; Leem, 1999; Lim, 1999) proved that a learner's prior knowledge with online learning or a given subject area, a learner's personality traits, instructor facilitation and appropriate feedback are among the most influential factors affecting active participation in online interaction. The findings of this study confirm that facilitation and directions provided by instructors are certainly factors promoting online participation. Researchers may be interested in further investigating the extent to which the instructor can provide explicit directions to enhance participation without interfering with the self-regulatory learning

skills of learners or learner autonomy in WBI, and the effects of physical interaction between students and instructor and among students in a Web-based learning environment.

Even though there are several areas of future research, the present investigation did show that content-oriented academic interaction was not enough to enhance learner achievement, learner satisfaction, or active participation. It also revealed that collaborative peer interaction, interpersonal encouragement and instructor assistance needed to be built in order to create a more effective and more satisfactory Web-based learning experience.

CONCLUSION

This study showed that different types of interaction in a Web-based learning environment differ in terms of their effects on learner achievement, satisfaction and participation in interaction. It also proved that, regardless of the type of interaction, WBI experiences resulted in a more positive view of online learning. Specifically, the results of the study show that:

- the social interaction group outperformed the other groups;
- the collaborative interaction group expressed the highest level of satisfaction with their learning process;
- the collaborative and social interaction groups participated more often in posting their opinions to the discussion board than did the academic interaction group; and
- regardless of the type of interaction, Web-based learning experiences brought about a positive attitude change concerning the use of the Web for learning.

These findings have some implications for the development and implementation of WBI where attention must be paid to incorporating various types of interaction into the Web-based learning processes. Even for adult learners, social interaction with their instructors and collaborative interaction with peers are important to enhance their learning and increase their participation in online discussions. This study also adds to the body of prior research in examining the roles of interaction in online learning environments and the factors affecting learning performance, satisfaction and participation in WBI.

Moreover, several directions for future research

are suggested by this study. Further investigation, specifically a qualitative message analysis, is needed to examine how social and collaborative interaction in WBI affects learner achievement and satisfaction. In this study, the contents of the corresponding messages between learners and their instructor and among learners were not analysed. What specific messages from the instructor or peers stimulate the learner to be involved in learning and interaction? An answer can be found by conducting a structured message analysis or discourse analysis. The effects on learning achievement of grouping in online discussion environments should also be investigated.

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