Direct and indirect effects of online learning on distance education

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Abstract

This paper presents an exploratory study that investigates the effects of online learning on distance education students in an open university context. Two hypotheses are posited: (1) a direct relationship exists between students' involvement in online learning and distance learning outcomes, and (2) an indirect relationship exists between these two domains via the mediating variable of an institutional Transactional Presence (TP), that is, a student's sense of the availability of and connectedness with an educational institution. Student learning achievement, satisfaction and intent-to-persist are used as indicators of outcomes of distance learning. The analysis of data garnered from 285 distance students reveals multifaceted relationships between students' engagement in online learning, their perceptions of institutional TP and the three learning outcome variables. Besides the findings, the paper will discuss factors affecting students' engagement in online learning in relation to different requirements, that is, optional or compulsory online use as well as the level of the course (undergraduate or postgraduate).

Introduction

This paper presents an exploratory study that is part of a research project investigating the effects of online learning on various aspects of distance education at the Open University of Hong Kong (OUHK). To support its students, the OUHK has developed an Online Learning Environment (OLE) for both English and Chinese courses. The aim of the OLE is to provide distance students with rich resources for learning as well as a more flexible mode of interaction with teachers and other students, thereby enriching students' learning experiences. This has been the standard rhetoric of distance education programme providers when they adopt online technology partly, or entirely, in a course delivery system. This belief, however, may weaken unless buttressed by valid evidence.

Researchers, nonetheless, appear to be more keen on finding out users', that is, students' and teachers', perceptions of the relatively new experience of online teaching and learning (eg, Angulo and Bruce, 1999; Daugherty and Funke, 1998; Goh and Tobin, 1999; Zafeiriou *et al*, 2001) rather than on delving into what sort of effect can be brought about in education by such Internet applications. Nevertheless, our limited review of literature discovered a few approaches to the theme relating to the effects of online learning. One of the exemplars would be Lu *et al*'s (2000) research concerning Hong Kong college students in web-based instruction. On the basis of longitudinal survey research, they found that, among available technical functions of their OLE, only the frequency of visits to lecture notes featured on their course site contributed to students' final exam scores. A more interesting but challenging finding from this study was that the frequency of general web surfing had a negative impact on final exam scores, which led the researchers to suggest that a purposeful use of the Internet for the course should be contemplated on the part of students rather than merely spending more time on it.

Ahern and Repman (1994) took a rather micro-approach to the issue of the effect of online learning, looking at how interface design could affect students' participation in online activities. When students using a graphic interface were compared to students in a text-based mode of asynchronous computer-mediated communication, the former group generated significantly more messages than the latter group. In addition, the group of students who had graphic organisers on the screen was more active in visiting the site, and addressed more messages to individual students than to the whole class, compared to their counterparts in a text-based mode. The researchers, therefore, argue that designing online interaction that provides a clear visual indication of new and stored messages from class members can facilitate students' participation in online discussion.

Woods and Keeler's (2001) study lies also within the line of research investigating the effect of instructional design on online learning. Hypothesising that the use of audio messages, as a supplement to text-based communication, can enhance student participation in online discussion, the researchers compared four treatment groups receiving a different number of audio messages attached to an email, including one control group that received text messages only. To the researchers' surprise, the result did not support previous research and literature suggesting that the additional use of audio messages could increase the level of student participation, positive perceptions of the course and student satisfaction. Anecdotal evidence, however, disclosed that the use of the audio email messages helped the distance students gain a sense of class community and feel connected to the group as a whole.

Apart from the instructional elements, individual differences have been investigated as factors affecting the process of student learning in courses involving Internet applications. Among the factors is gender, as is found in Barrett and Lally's study (1999). By analysing the frequency and content of messages in an online seminar, they found that

men sent more messages than women, wrote twice as much as women and made more socio-emotional contributions than women. Women's contributions were geared towards more interactive messages than those from men.

In an open university context, too, researchers have been keen to see how Internet technology is shaping their practice differently from previous approaches to distance teaching and learning. For example, Carswell *et al*'s (2000) study reports that, as far as students' final grades are concerned, no significant difference exists between the student group in a conventional instruction that the Open University UK provides and the student group taught exclusively through the Internet. However, other data and anecdotal evidence support the notion that students in both groups inevitably go through different learning experiences influenced by the different media used for instruction as well as by the management of instruction.

Despite the valuable individual contributions of the reviewed studies, a coherent theoretical frame seems lacking across the studies that can help distance education researchers put empirical studies into perspective. Given this problem, this paper aims to map out the relationships among theoretical variables related to students' experiences of online learning as well as selected elements of distance learning outcomes using survey data garnered from OUHK students.

Theoretical framework
Building on previous relevant studies (Shin, 2001, 2002a, 2002b), we set forth two hypotheses on the design and analysis of the survey research presented in this paper. One concerns a direct positive relationship between students' engagement in online learning and learning outcomes, given the general advocacy that online learning would enhance distance learning by giving students more opportunities to interact with teachers or peer students and by providing increased access to information available on the Web. Besides learning outcomes, students' satisfaction with overall distance learning experience as well as their intent to persist with distance learning was examined in relation to the use of online learning, as these are widely regarded as indicators of successful distance learning programmes or courses (Gibson, 1991).

Secondly, given the OUHK's integrated approach to course delivery and the provision of student support and administrative services via the World Wide Web, it was conjectured that students who were active in the use of the OLE would have a stronger sense of institutional presence compared to the students less interested in gaining information from the OLE. This sense of institutional presence was defined as the degree to which a distance student perceives the availability of support services, and the degree of connectedness with the institution (Shin, 2002a).

Research questions
Given this background, the following research questions were developed:

1. Is a distance student's engagement in online learning related to (a) learning outcomes, (b) satisfaction with distance learning experience at the institution, and (c) intent-to-persist with distance learning in future?
2. Is a distance student's involvement in online learning related to his/her perception of institutional presence?
3. Is a distance student's perception of institutional presence related to(a) learning outcomes, (b) satisfaction with their distance learning experience at the institution, and (c) intent-to-persist with distance learning?

The Online Learning Environment (OLE)
The OLE implemented at OUHK uses a modified WebCT platform, known as 'a versatile management tool for Web-based teaching and learning' (Lu *et al*, 2000, 202). Figure 1 shows the technical features available via the OLE such as 'News', 'Administrative Information', 'Course Material', 'Assignments', 'Interactive Tools', 'Multimedia', 'Personal Folder', 'Evaluation', and 'Help'. There is also a Chinese version of the OLE, based on Lotus Notes, which provides virtually identical functions. Since the OLE was introduced into the institution as part of an instructional support system for creating a flexible learning environment rather than replacing the backbone of correspondence in delivering courses, use of the OLE is either optional or compulsory in demanding students to have Internet access. This is determined mostly on the basis of the nature of subject matter.
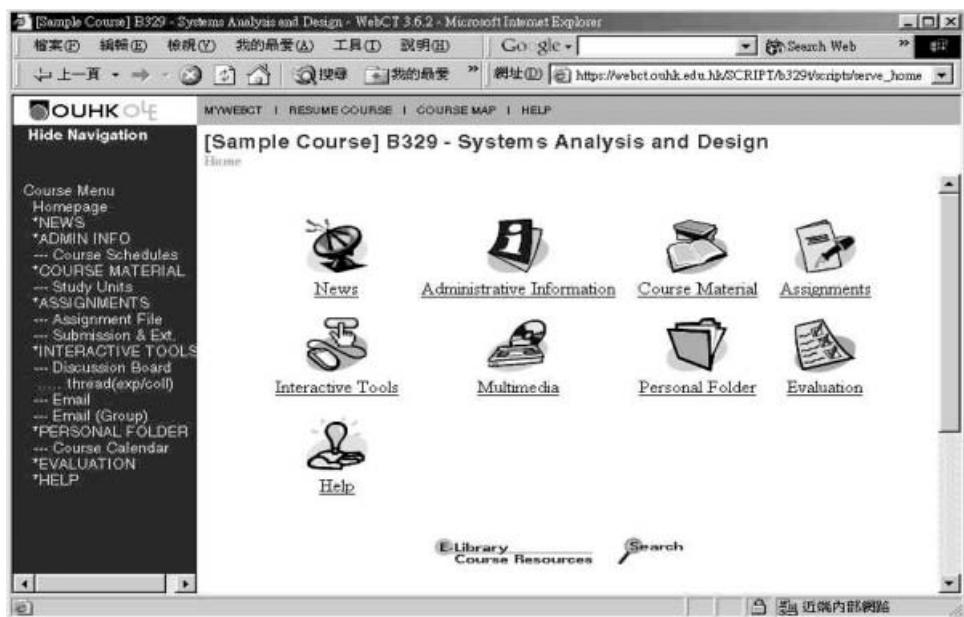

Figure 1: The online learning environment (OLE)

Research design

Measurement

Drawing from previous research studies (Shin 2001, 2002a), we developed a survey instrument measuring the major constructs of concern in the research questions. The measures are composed of items, most of which begin with phrases such as 'I believe' or 'I feel' in order to capture a respondent's subjective state of mind. Respondents are asked to indicate to what extent they agree with the listed items on a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'.

Engagement in the OLE was measured by the frequency of a student's log-in to the course site per week. Five intervals were given on the scale, ranging from 0–3 times through to 16 times or more.

Institutional presence was defined as the degree to which a distance student perceives the availability of support services in the institution while feeling connected to the institution, and was measured with nine items. The reliability of the institutional presence scale was checked with Reliability Analysis embedded in the Statistical Package for Social Science (SPSS) software, and turned out to be moderately acceptable (*alpha* = .845). The items are:

- I find it easy to contact student support staff at OUHK
- When I see OUHK's symbol, or logo, I feel pride
- I have a strong sense that I am an OUHK student
- I believe that student support staff are willing to help me if I have technical problems while taking the course
- I feel a sense of belonging to the OUHK
- I believe that Registry staff are willing to help me with scheduling courses at OUHK
- I believe that library staff will be willing to help me find learning resources
- I find it convenient to get information about OUHK courses
- I feel attached to the OUHK

Learning outcomes were defined as what individual students perceived as gains from taking an OLE course. The gains were concerned with either professional development at the workplace or more general intellectual development or growth. Drawn from Kember *et al*'s (2001) item pools regarding learning outcomes, 10 items were chosen to constitute the scale of learning outcomes. The alpha coefficient (.893) scored the highest amongst the construct scales included in the instrument.

- I gained practical ideas to be applied to my work
- The course provided me with professional knowledge for work
- The course provided me with an opportunity to develop time management skills for learning
- The course enhanced my thinking skills
- The course helped my intellectual growth
- My views of work were enriched with insight gained from the course
- The course allowed me to look at things in different ways

- The course provided me with knowledge that allowed me to work more effectively
- From the course I gained new perspectives of my work
- The course enabled me to enhance my learning ability

Satisfaction was defined as the degree to which individual students sensed a positive association between the courses they have taken and overall distance learning experiences. Six items were drawn from Shin (2002a); the reliability coefficient was .842.

- Taking a course at OUHK is a valuable experience for me
- I have been able to learn a lot from the courses OUHK provides
- I don't regret enrolling in distance learning courses that OUHK provides
- I feel that I am continuously growing due to a variety of activities that I've been engaged with at the OUHK
- I feel a sense of accomplishment while studying at the OUHK
- I like the fact that I am taking OUHK courses

Intent-to-persist was defined as the estimated likelihood of one's continued enrollment at an educational institution. Four items were used for the analysis of data (*alpha* = .634).

- It is important for me to earn the intended degree at the OUHK
- I will try hard to overcome obstacles encountered in the course of studying at the OUHK
- I will enrol for the next semester, if I have courses to complete
- I will finish my studies at OUHK no matter how difficult it may be

Apart from the reliability test, the content of the instrument was validated by a panel of experts from Hong Kong, Canada and the US, whose speciality areas were concerned with educational assessment or distance learning. The questionnaire also included items concerning a respondent's background such as the level of previous education, experience of online courses, the level of Internet skill, gender, age and so forth.

Study participants
Considering the exploratory nature of the study, the project team decided to include study participants who represent an array of courses from both undergraduate and graduate levels, and from both optional and compulsory OLE component courses. To this end, we sampled four courses offered by the School of Business and Administration, where choosing the range of OLE courses was readily feasible at the time of the research survey. The courses were 'Electronic Commerce for Managers' (B870), 'Creativity, Innovation and Change' (B822), 'Auditing' (B406), and 'Networking Applications and Electronic Commerce' (B322), all of which were two-semester courses commenced in April 2001. This sampling strategy of was also intended to control for compounding variables other than the effect of student engagement in the OLE. Table 1 illustrates the nature of each course, the number of enrolments and the number of students who actually participated in the survey.

Table 1: Study participants

Course	Mode of the OLE	Degree level	Enrolment	Survey respondents	Response rate
B322	Compulsory	Undergraduate	248	91	36.7%
B406	Optional	Undergraduate	161	60	37.3%
B822	Compulsory	Postgraduate	254	105	41.3%
B870	Optional	Postgraduate	83	29	34.9%
Total			746	285	38.2%

Study procedure

The survey questionnaire was mailed by post to all those enrolled in the chosen four courses in late February 2002. The students were also able to participate in the survey online by accessing a designated web site linked to the Centre for Research on Distance and Adult Learning at the OUHK. This information was posted in 'News' or the discussion board of the OLE courses by each course coordinator. The responses (145, 120 via post and 25 online) were collected from 746 cases for the first round of the survey. Surprisingly, almost as many responses (140, 135 via post and 5 online) were submitted when the students were reminded of the survey two weeks later, by receiving a soliciting letter and another copy of the questionnaire. In total, 285 completed questionnaires were collected, giving a 38.2% response rate.

Data analysis

The analysis of data was conducted using SPSS version 10.1. Before testing the proposed hypotheses, a preliminary analysis was run to obtain general understanding about the study participants, particularly with respect to their involvement with online learning. Not surprisingly, mean scores of students in compulsory courses were higher than those of students in optional courses in the areas of frequency of log-ins per week, average time spent in the OLE per visit, perception of one's activity in using the OLE and self-reported Internet skill (Table 2). The differences were all statistically significant at a confidence level of. 05 (Table 3).

In making sense of the mean scores reported in Table 2 and Table 4, however, a little caution is needed due to the use of interval scales. For example, the minimum score of '1' represents '0–3 times' and the maximum score of '5' indicates '16 times or above' in the scale measuring the frequency of log-in times per week. When appropriately converted, it can be claimed that students in an optional mode logged-in to the OLE 5.5 times per week, whereas students in a compulsory mode visited their relevant OLE 7.3 times per week. Likewise, when the scale measuring the average time spent in the OLE per visit ('1' indicates 'less than 0.5 hour' and '5 indicates '2 hours and more') was converted, it was found that students in optional courses spent about 50 minutes, whereas students in compulsory courses spent about 56 minutes on average. In perceiving one's own level of activity in using the OLE, students in the optional mode described themselves somewhere between 'inactive' and 'neutral', whereas students in the compulsory

mode fell between 'neutral' and 'active'. Regarding self-reported Internet skill, both groups of students ranked themselves between 'fair' and 'good'; however, a slight difference between the mean scores shown in Table 2 was statistically significant enough to distinguish the two groups.

Table 2: Comparisons between students' OLE use in optional and compulsory OLE courses

Items	OLE component	N	Min	Max	Mean	SD
Frequency of log-ins per week	Optional	165	1	5	1.61	1.004
	Compulsory	120	1	5	2.06	1.239
Average time spent in the OLE per visit	Optional	165	1	5	1.67	.806
	Compulsory	120	1	5	1.88	.999
Activity in using the OLE	Optional	165	1	5	2.72	1.011
	Compulsory	120	1	5	3.03	.934
Self-reported Internet skill	Optional	165	1	5	3.45	.880
	Compulsory	120	1	5	3.84	.860

Table 3: Independent samples t-test for the comparisons between optional and compulsory OLE courses

	Levene's test for equality of variances		t-test for equality of means		
	F	Sig.	T	df	Sig. (2-tailed)
Frequency of log-ins per week	3.433	.065	−3.400	283	.001
Average time spent in the OLE per visit	.188	.665	−2.034	283	.043
Activity in using the OLE	3.596	.059	−2.708	283	.007
Self-reported Internet skill	.400	.527	−3.703	283	.000

Table 4: Comparisons between undergraduate and postgraduate courses in students' use of the OLE

Items	Course level	N	Min.	Max.	Mean	SD
Frequency of log-ins per week	Undergraduate	151	1	5	1.70	1.095
	Postgraduate	134	1	5	1.91	1.160
Average time spent on the OLE per visit	Undergraduate	151	1	5	1.77	.844
	Postgraduate	134	1	5	1.75	.947
Activity in using the OLE	Undergraduate	151	1	5	2.77	.932
	Postgraduate	134	1	5	2.93	1.049
Self-reported Internet skill	Undergraduate	151	1	5	3.62	.886
	Postgraduate	134	1	5	3.62	.899

Table 5: Independent samples t-test for comparisons between undergraduate and graduate courses

	Levene's test for equality of variances		t-test for equality of means		
	F	Sig.	T	df	Sig. (2-tailed)
Frequency of log-in time per week	.178	.674	−1.609	283	.109
Average time spent on the OLE per visit	2.192	.140	.207	283	.836
Activity in using the OLE	.666	.415	−1.346	283	.179
Self-reported Internet skill	.013	.910	−.033	283	.974
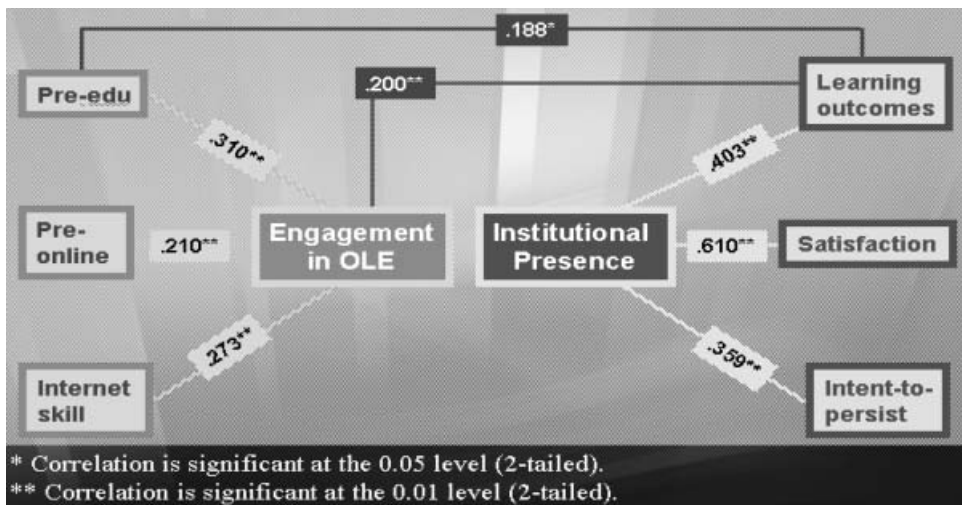
Figure 2: Analysis of optional OLE courses

No such differences were significant, however, when the comparison was made between undergraduate and postgraduate courses (Tables 4 and 5). Given the distinctive natures among study participants, further analysis on the posed research questions was conducted separately between the group of students in optional OLE courses and the group of students in compulsory OLE courses.

Findings

Students in optional mode of the OLE

Figure 2 summarises correlations among the variables under investigation for the students in the optional mode of the OLE. For students who could opt for the OLE on their needs basis, the frequency of use was moderately, but significantly, related to their perceptions of learning outcomes. In other words, students active in logging in to their
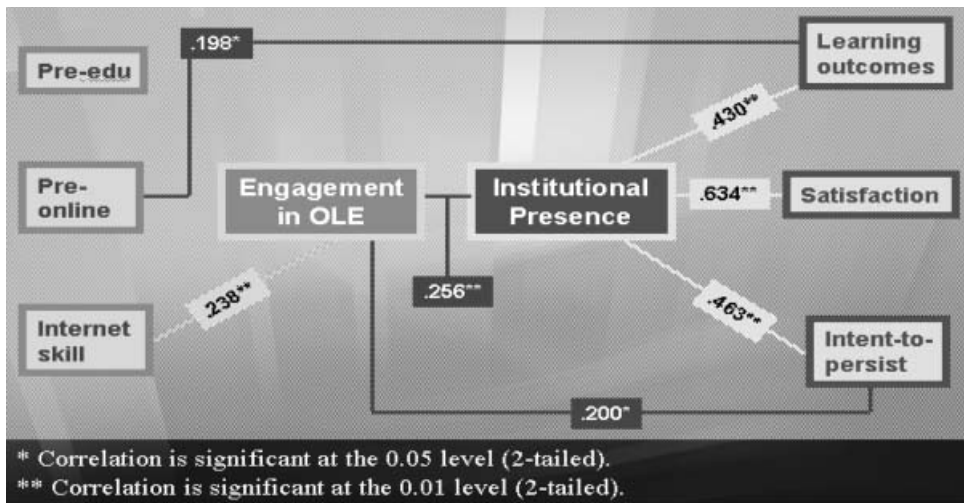
Figure 3: Analysis of compulsory OLE courses

course web site tended to report greater gains from the course than students less active in the same course. In addition, the analysis suggests that students with a higher level of educational background are likely to be more positive about learning outcomes than are students with low levels of education.

However, the hypothesised relationship between the students' involvement in the OLE and their perceptions of institutional presence was not supported by this group of students. What is remarkable, instead, is the multiple relations between the institutional presence variable and all the criteria variables of the study, that is, learning outcomes ($r = .403$, $p < .01$), satisfaction ($r = .610$, $p < .01$) and intent-to-persist ($r = .359$, $p < .01$). In this paper the correlation coefficient is indicated by Pearson's r.

Among the student background variables, level of education, experience with previous online learning and self-assessed Internet skill were found to be related to the extent to which the students made use of the OLE.

Students in compulsory mode of the OLE
The analysis of data from students in compulsory OLE courses resulted in different patterns from those noted above with respect to the optional OLE courses. One of the differences was that the level of students' engagement in the OLE was unrelated to their perceptions of learning outcomes. While previous educational level and previous experience with online learning were related to the level of students' use of the OLE regarding the optional OLE courses, this was not the case for the compulsory OLE courses. Nevertheless, the level of student Internet skill was related to the frequency of their visits to the OLE. In addition, for the students in compulsory OLE courses, their involve-

ment in the OLE was significantly linked to their perceptions of institutional presence. Given the significance and direction of the correlation coefficient, it is assumed that the more he/she engages with the OLE, the stronger the student senses the availability of the institutional support while feeling connectedness with the institution, or perhaps, vice versa.

One similarity found in the analyses between the two modes of online courses was the stability of the institutional presence variable regarding its relationships with students' perceptions of learning outcomes, satisfaction with distance learning experiences and willingness to continue being enrolled in courses at the institution. Data from students in the compulsory courses, too, confirm moderately high correlations between the perceptions of institutional presence and learning outcomes ($r = .430$, $p < .01$), satisfaction ($r = .634$, $p < .01$) and intent-to-persist ($r = .463$, $p < .01$).

Discussions and implications

This research study provides some 'food for thought' on researching and practising online learning in a broader distance education system such as an open university rather than within a single unit of a course. Considering the different mixture of study participants, the analysis of data was carried out separately between students who can opt for using the OLE and students required to access the OLE on a regular basis. The analysis confirmed the assumption that students in compulsory OLE courses are generally more active users than students in an optional mode of the OLE. However, there were no significant differences between undergraduate and graduate students in web-related behaviours such as log-in frequency, average time spent per visit, and self-evaluation of level of activity in using the OLE as well as level of Internet skill. This finding appears to challenge some of the course coordinators' perspectives that the OLE can be used more effectively for graduate courses than for undergraduate ones due to the relatively more mature and serious attitudes that graduate students project towards course participation (Shin, 2002c). At present, however, it is difficult to determine which data are more valid and reliable; given potential impact of these findings on institutional policy, further investigation is required.

Another disputable point is the statistically unsupported relationship between student's engagement in the OLE and perceived learning outcomes, found in the analysis of the compulsory OLE courses. One possible explanation for this is that for the students who are required to access the OLE on a regular basis, what matters to their learning is not so much the sheer frequency of visits to the course site as a measure of the quality of engagement in course activities. Given the usage of the compulsory mode, tutors or course coordinators may well try harder to engage students in the OLE than do the tutors and course coordinators in optional OLE courses. Future studies should take notice of this point, using more sophisticated measures of students' engagement in the OLE, either quantitatively or qualitatively.

When the use of the OLE was a matter of a student's choice, however, the effect of the OLE seems to be direct in relation to learning outcomes. This finding hints that students

who are active in making use of the virtual component of learning materials or course activities may actually gain more from the course than students less interested in what the additional medium of instruction offers. But a subtle caution is needed in putting this observation into practice, for the finding was only true for the students in an optional mode of the OLE. This would imply that while it is important to encourage students to be autonomous in participating in the OLE, worrying too much about the possible low level of participation may be unnecessary.

The data also reveal information about individual student backgrounds that can result in varying levels of engagement in online learning, including level of previous education, previous online learning experience and level of competence using the Internet. Among these, self-assessed Internet skill was the strongest variable affecting both groups of students. Given this finding, the institution's current practice of providing students with the 'Online User's Guide' or 'OLE training video' is viewed as helpful to students in using the OLE (OUHK Working Group, 1999). Literature, too, stresses that ensuring a smooth 'learner-Interface interaction' with instructional media should be a prerequisite for distance students to effectively communicate with course content, instructors or peer students (Hillman *et al*, 1994).

Apart from the aspects related to the OLE, what may be noteworthy for distance education researchers are the observed significant connections between students' sense of institutional presence and the three indicators of involvement with distance learning (Figures 2 and 3). Put simply, distance students who have a stronger sense of availability of, and connectedness with, educational programme providers are likely to be more positive about learning outcomes, more satisfied with their learning experiences and more willing to continue being involved in distance learning than are students with a weaker sense of institutional presence. This finding backs the assertion that established 'studentship' can be crucial to distance students' academic success as well as course or programme completion, particularly for the students involved in an open university system (Shin, 2002b; Student Research Centre I E T OU, 1986). From this, practical lessons may be drawn such as that distance education programs or institutions need to be in continual communication with their students and should assure the students that their needs are taken care of despite the distance element. On the research side, too, the confirmed significance of institutional presence on various aspects of distance learning should compel researchers to attend to the 'totality of students' experience' rather than focusing on the use of individual technologies within a course (Gibbs, 2002, 101).

Conclusions

Given the growing expectations of online technology as a tool for providing distance students with a flexible learning environment, this paper reported a case of survey research exploring what effect online learning can bring to distance education. Admittedly, the term 'effect' was used rather loosely in this paper, mainly referring to the co-occurrence between two or more attributes or events, not in a strict sense of causality. The analysis of survey data from selected OUHK courses indicates that the effect of

online learning can vary across individual courses, largely affected by the way in which the OLE is integrated into the course as a whole. For example, when the function of the OLE was supplementary, a direct relationship was found between the frequency of students' visits to the course site and their perceptions of learning outcomes. In compulsory OLE courses, however, the effect of students' involvement in the OLE appeared to be rather indirect, mediated by their sense of institutional presence. In addition, the analysis suggests that it is critical for distance students involved in an open university to have a sense of belongingness to or connectedness with the institution as a whole. Replication studies are required to validate the results of the analysis, and it is noted that subsequent research is currently underway in the institution, involving a wider range of OLE courses including the Chinese OLE.

Acknowledgements

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