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Effectiveness of Asynchronous Learning Networks in Teaching as a Supplement to Classroom Teaching: A Study from Perspective of Lecturers in National University of Singapore*

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Asynchronous Learning Networks (ALN) has become a kind of prevalent information systems to supplement or even substitute a traditional classroom face-to-face teaching method. In this paper, we investigate the impacts of types of courses, lecturers' instruction models and computer self-efficacy on the ALN effectiveness in teaching from lecturers' perspective. We conducted survey to professors in various faculties such as School of Computing, Faculty of Arts, Science, Business, Law and Engineering in the National University of Singapore. According to the responses from ninety-eight professors, instruction modes positively influence the usage of ALN; types of course and lecturers' computer-efficacy influence lectures' satisfaction of ALN in teaching. Both the usage of ALN and satisfaction of ALN positively influence the effectiveness of ALN. The results of this study fill the gap of ALN researches in education by examining it from lecturers' perspective and enable schools to improve their implementation of ALN systems based on our findings.

Keywords : IS Education and Research, Improving Classroom Teaching, Interactive Learning Environments, Computer-Mediated Communication, Cooperative/Collaborative Learning

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Ⅰ. Introduction

"Asynchronous" means not occurring or existing at the same time. It refers to "anytime, anywhere" use of technology rather than at the same time or at the same place. Asynchronous Learning Network (ALN) is a form of "e-learning" that emphasizes the use of Information Technology to support class discussions and activities. In using ALN, an instructor structures online discussions and/or group assignments and activities as a substantial part of the coursework [Hiltz, 2002]. Moreover ALN is becoming increasingly prevalent as a supplement to traditional face-to-face teaching in various levels of education. In Singapore, ALN systems are implemented in the education system from primary to tertiary. Some institutions and their respective ALN systems are listed in <Table 1> below:

<Table 1> Example of Schools and Their ALN Systems

Name of the School	Name of the ALN system
Anglo-Chinese Junior School	EduLearn
St Andrew's School	the online E-Learning
Victoria Junior College	Blackboard
St. Francis Methodist School	Elearning
Republic Polytechnic	MyRP
National University of Singapore	IVLE
National Technological University	EdveNTUre

National University of Singapore (NUS) implemented an ALN system called **Integrated Virtual Learning Environment** (IVLE) in 1998. The system grew to Version 7.7 by December 2005. It contains discussion forums, chat rooms, e-mail distribution lists, lecture notes and assignment repositories, online quizzes, course readings reserve and so on. Since its inception, it has been observed that different professors use IVLE at different levels: some use many of the available functions while some use none at all; frequency of the usage also differs. The similar observation can be found in the research paper of Webster [1997]. She observed in her research on Technology-Mediated Distance Learning that not all instructors used all media. She found that an instructor used every function ranging from conference-style discussion and multimedia software system to online examinations, while another instructor used printed class notes which he distributed earlier to students and displayed through a document camera [Webster, 1997].

Reasons for these differences in usage are lacking from the literature; and until they are better understood, development and implementation of ALN will be restricted. It is therefore the purpose of this paper to investigate improving ALN effectiveness for lecturers in their teaching by examining:

i) Factors that influence the lecturers' usage of ALN;
ii) Satisfaction of lecturers in using ALN; and
iii) The subsequent impact on effectiveness of ALN teaching of (i) and (ii).

This paper is structured into 7 chapters. In this opening chapter, we introduced the concept of ALN, its current trends in Singapore, deficiencies in understanding ALN implementation, and the possible contribution of this paper to ALN implementation. In chapter 2, we review the literature of related topics, including instruction model, type of course, computer self-efficacy and satisfaction of Information System and ALN.

In chapter 3, we propose our research model and hypotheses. In Chapter 4, we present our da-

ta collection procedure; analyze our data validity and reliability based on the collected data.

In chapter 5, we determine which hypotheses are supported by our data. In chapter 6, we discuss the results and findings; explore the possible improvement on effectiveness of ALN. Finally chapter 7 is some concluding remarks.

Ⅱ. Literature Review

Each medium of communication has its advantages and disadvantages for pedagogical strategies. Implementations that capitalize on the strengths of a medium, and circumvent or adjust for its limitations, are more successful in outcomes than the ones that disregard its strengths and weaknesses [Benbunan-Fich and Hiltz, 2002]. There are other factors incorporated with the technology playing an important part in deciding the success of implementation of an information system. Some of these factors in implementation of ALN systems are related to the lecturers of the course. We identify three important factors: type of course, instruction model of the lecturers and lecturer's computer self-efficacy.

2.1 ALN

Many research questions have been addressed with respect to the influence of ALN. For example, Arbaugh [2000] investigated participation patterns of students using ALN and learning outcomes compared to traditional classroom learning. Arvan *et al*. [1998] found that compared to those without ALN, students' studying outcomes and satisfaction using ALN were either not significantly different from the non-ALN sections or increased by using ALN. Benhunan *et al*. [1999] discussed the impacts of ALN on individual and group problem solving. Blum [1999] discussed about the gender differences in ALN education. Recently, Chae *et al*. [2009] empirically studied the effect of lecturers' avatars on learning performance.

The Mini-track of ALN 2001 by Hilz and Fjermestad [2001] summarized two main groups of research questions on ALN. The first group is on how software, teaching and the role behavior of both students and lecturers have to change in order to be most effective online. One example of this group is "Becoming a Virtual Professor: Pedagogical Roles and ALN." by Coppola, Hiltz, and Rotter, N. [2001]. A second research question is how effective ALN courses are, particularly compared with courses delivered by traditional face-to-face mode. One example of this group is "Correlates of Effectiveness of Learning Networks" by Benbunan-Fich, Raquel and Hiltz [2002].

A summary of previous research was done by Spencer and Hiltz in 2001. They surveyed thirty published empirical studies of ALN; fifteen of them compared delivery modes of ALN with the traditional classroom. Five reported that ALN is as effective as traditional delivery mode, and ten reported that the results are better in some way [Hilz and Fjermestad, 2001].

2.2 Type of Course

Subjects differ not only in content but also in means of presentation of content: circuit diagrams need to be drawn for Electric Engineering courses; formulas with Latin letters need to be written for mathematics courses; sketches of maps need to be given for illustration in geography courses etc. The versatility of ALN systems

in providing for different courses is worth investigating. A recent research paper which investigated type of course and students' learning outcomes through ALN showed there is no significant relationship between the two [Benbunan-Fich and Hiltz, 2002]. We would like to extend the investigation to lectures' perspective to see whether lectures' usage and satisfaction of ALN is related to type of course.

Benhunan-Fich and Hiltz [2002] classified courses according to the technical nature of the material and divided them into two types: technical and less technical. More technical courses would include substantial mathematical analysis (e.g. algorithms, programming, and all Engineering and Mathematics courses) while less technical courses would be more oriented towards qualitative analysis and discussion (e.g. Computers and Society and Computer Systems Management; all of the Humanities and Social Sciences courses, and all of the Management courses) [Benhunan-Fich and Hiltz, 2002].

2.3 Instruction and Learning Model

The ways to conduct classes and the roles in their teaching determine lecturers' instruction models and they could also affect the usage and effectiveness of ALN. As learning models, instruction models can be placed on a continuum ranging from objectivism to constructivism.

Objectivism, also referred to as the traditional model of learning, is the behavioral model of learning and represents a traditional view of learning. The tenet of the objectivist model is that there is an objective reality and that the goal of learning is to understand this reality and modify behavior accordingly [Jonassen, 1993]. In the process of teaching and learning, objectivist model is teacher-centered. In terms of instruction, the model assumes that the goal of teaching is to efficiently transmit knowledge from the expert to the learners. Instructors structure reality into abstract or generalized representations that can be transferred and then recalled by students [Yarusso, 1992]. The objectivist model also assumes that the instructor is the source of objective knowledge that is related, rather than created, during class. The instructor should be in control of the material and pace of learning. Via questions, the instructor assesses whether transfer occurred. In the academic environment, traditional delivery like lectures with little room for discussions is an example of this model. For an online training course, objectivism means that the instructor would act as a controller for learning through the distribution and development of course material and controlling the pace for the course [Arbaugh *et al.*, 2003].

The constructivist model is a learner-centered instruction: individuals are assumed to learn better when they are forced to discover things themselves rather than when they are told or instructed. Students must control the pace of instruction. Learners must have experience with hypothesizing and predicting, manipulating objects, posing questions, researching answers, imagining, investigating, and inventing, in order for knowledge construction to occur [O'Loughlin, 1992]. The instructor serves as the creative mediator of the process.

2.4 Computer Self-Efficacy

Self-efficacy is the belief in one's capabilities to organize and execute the courses of action re-

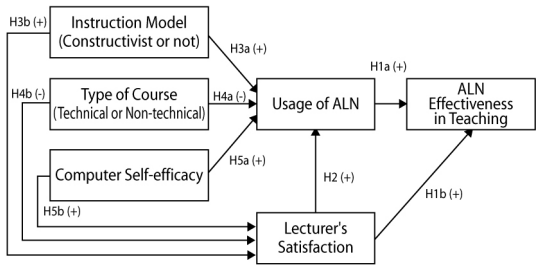
quired to manage prospective situations [Bandura, 1995]. It is concerned not with the skills one has but with judgments of what one can do with whatever skill one possesses [Bandura, 1986]. After the concept of self-efficacy was introduced by Bandura, it became a popular research topic in psychology, health, and other fields. It is studied with relation to human function, human development, stress and emotions, health behaviors and computer-assisted instruction [Compeau and Higgins, 1995]. Some research topics of self-efficacy in relation to teaching have been discussed. Two examples are "Development of lecturer's self-efficacy beliefs" [Schmitz, 1998], and "Perceived self-efficacy of teachers" [Schmitz, 2000].

Computer Self-Efficacy (CSE) is defined as "an individual's perception of efficacy in performing specific computer-related tasks within the domain of general computing" [Marakas *et al*., 1999; Garrison *et al*., 2010]. According to Marakas *et al*. [1999], computer self-efficacy, perception of one's capability to use a computer, is a multilevel construct, operating at two distinct levels: at the general computing level (general CSE) and at the specific application level (application-specific self-efficacy). General CSE is defined as an individual judgment of efficacy across multiple computer domains and application-specific self-efficacy is defined as an individual perception of efficacy in using a specific application or system within the domain of general computing. Many IS studies have demonstrated computer self-efficacy lead to positive outcome [Garrison *et al*., 2010] such as greater adoption of technology [Hill *et al*., 1986], increased use of technology [Gallivan *et al*., 2005; Easley *et al*., 2003], innovations [Burkhardt and Brass, 1990] and performance improvement [Webster and Martocchio, 1993].

Ⅲ. Model and Hypotheses

3.1 Proposed Model

The research model below <Figure 1> was based on the literature review. In the model, we have six constructs. Instruction model, Type of course, Computer self-efficacy are the three independent variables, usage of ALN, lecturer's satisfaction are mediating variables and ALN effectiveness in teaching is the dependent variable.

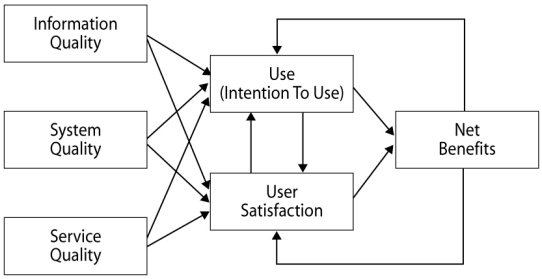


<Figure 1> Research Model

3.2 Hypotheses

3.2.1 Usage of ALN, Lecturers' Satisfaction of ALN, and ALN Effectiveness in Teaching

Delone and Mclean brought up an IS Success Model which systematically combines measures from six IS success categories. The D&M IS Success Model has become a standard for the specification and justification of the measurement of the dependent variable in information systems research. Delone and McLean revisited the model by reviewing 150 articles which have the reference to their Success Model and reformulate the model as shown below [Delone and McLean, 2002].



<Figure 2> Delone and McLean Reformulated IS Success Model

According to Delone and Mclean, certain Net Benefits will occur as a result of Use and User Satisfaction, which means there is a causal relationship from Use and User satisfaction to Net Benefits. Because satisfaction is short-term and a transaction specific affect, practitioners should provide sustainable benefits and reasons for users to use system [Lee *et al.*, 2010]. In our model, Use, User Satisfaction and Net Benefit are expressed as the Usage of ALN, Professors' satisfaction and ALN effectiveness respectively. Usage of ALN is defined as the time and frequency of ALN system usage. Satisfaction is the perceived satisfaction by lecturers on function, stability and accuracy of the systems. ALN effectiveness is defined as level of help provided by ALN compared to teaching without ALN. We propose a positive relationship from usage of ALN to ALN effectiveness and from satisfaction to ALN effectiveness in teaching:

H1a: Higher usage of ALN causes higher ALN Effectiveness in teaching.

H1b: Higher Satisfaction causes higher ALN Effectiveness in teaching.

3.2.2 Usage and Satisfaction of ALN

Delone and Mclean found out that the relationship of Use and User satisfaction are closely interrelated: positive experience with Use will lead to greater User satisfaction, and increased User satisfaction will lead to increased intention to use and thus use.

In our model, use is measured by frequency and length a lecturer uses a system, which is more focusing on on-going usage of the system. Therefore, we assume that user satisfaction will lead to increased use in the frequency and length. Hence, we propose:

H2: Higher satisfaction of the ALN will cause higher usage of ALN.

3.2.3 Instruction Model

ALN supports the interactive and asynchronous communications between students and lecturers with forums, lecture notes and assignment repositories, group support systems, web-lectures, and so on. These functions allow students flexibility in study times. For example, students can post questions in the forum or download lecture notes to preview or review at the choice of their own time, either in the early morning or at late night. As a result, ALN assists lecturers to function as course mediators. So we hypothesize:

H3a: Lecturers with constructivist model have higher usage of ALN in teaching.

H3b: Lecturers with constructivist model have higher satisfaction of ALN in teaching.

3.2.4 Type of Course

Benhunan-Fich and Hiltz [2002] proposed that

less technical courses, because of their qualitative nature, are more suited to a text-based ALN environment, because composing equations, flow charts, etc. online is much more tedious than writing on a blackboard or paper. They hypothesized that 1> the use of ALN in less technical courses will result in higher students' grades; and 2> Students taking less technical courses and using and ALN will report better learning perceptions than students in other conditions. However, the results showed ALN neither influences the students' grades nor students' learning perceptions; hence type of course does not influence the effectiveness of ALN from the students' perspective. It is not known whether the same results occur for ALN effectiveness from lecturers' perspective. Thus in order to find out, we make similar hypotheses as the ones of Benhunan-Fich and Hiltz:

H4a: Lecturers who teach less technical courses have higher usage of ALN in teaching.
H4b: Lecturers who teach less technical courses have higher satisfaction of ALN in teaching.

3.2.5 Computer Self-efficacy

In addition to the impacts of type of course and instruction models, the impact of self-efficacy is examined in this study because professors' ability to use the ALN system (ability to perform) and the usage outcome (performance) could affect the usage of ALN system in teaching.

The particular domain of self-efficacy in this paper is the technical skills of the teachers, with which they utilize ALN systems. Social Cognitive Theory [Bandura, 1986] predicts that self-efficacy expectations will influence individuals' actual ability to perform the behavior. Gist *et al*. [1989] found a positive relationship between self-efficacy and performance in a computer training course. Garrison *et al*. [2010] found self-efficacy is negatively related to perceptions of differentiation (i.e. foreignness) and eventually increasing satisfaction..

Compeau and Higgins [1995] found a positive relationship from computer self-efficacy to performance. Social Cognitive Theory [Bandura, 1986] also predicts that self-efficacy expectations will influence individuals' actual ability to perform the behavior. Thus, we hypothesize:

H5a: Lecturers who have higher computer self-efficacy have higher usage of ALN in teaching.
H5b: Lecturers who have higher computer self-efficacy in technical skills have higher satisfaction of ALN in teaching.

Ⅳ. Measurement and Data Collection

4.1 Procedure and Data Collection

Integrated Virtual Learning Environment is the ALN system implemented in the National University of Singapore (NUS) since 1998. It is widely used throughout NUS by professors in every department. Hence, we chose professors in NUS as our survey sample group for data collection and we use IVLE to represent ALN system in our questionnaire.

We created and conducted the survey online through an online survey provider. Because sending mass email for invitation to the survey is needed, we firstly sent an email asking for permission from deans of the departments. All of the deans who responded granted permission.

<Table 2> Demographics of the Respondents

Demographics		Number of Response	Percentage
Age	< = 30	2	2.0
	31~35	20	20.4
	36~40	21	31.4
	41~45	21	22.4
	46~50	10	10.2
	51~60	19	19.4
	> 60	3	3.1
	None response	2	2.0
Gender	Male	72	73.5
	Female	26	26.5
Department	School of Computing	16	16.3
	Arts and Social Science	37	37.8
	Law	4	4.1
	Business	11	11.2
	Science	5	5.1
	Engineering	3	3.1
	None Response	22	22.4

We then sent an email with the link of the online survey website. A reminder email was sent two weeks later. The survey lasted three weeks and one hundred and six professors responded, ninety-eight of whom completed the survey. These professors were from departments of Computing, Law, Arts and Social Science, Engineering and Business. The response rate is proximately 10%. Please see <Table 2> for the demographics of the respondents.

4.2 Measurements of Variables

4.2.1 Reliability

The reliability of each construct was measured with Cronbach Alphas and Composite Reliability. The acceptable level of this alpha value is at least 0.7 [Nunnally, 1978], which indicates the minimum acceptable level of internal consistency. Composite Reliability is more generous than Cronbach Alphas. Its acceptable level is also 0.7 [Nunnally, 1978].

Formative indicators need not be correlated nor have high internal consistency such as Cronbach Alpha [Bollen, 1984; Bollen and Lennox, 1991]. We are not going to examine the reliability of Usage. The reason is that the usage construct is formative and the frequencies of functions in IVLE systems are formative measures of the latent variable. The data may not be consistent since the increase of one indictor does not necessarily reflect the increase of other indictors. One case can be that some lecturers may use a few particular functions with high frequency and another may use all functions at a very low frequency. However, these two lecturers have the same level of IVLE usage.

<Table 3> Statistical Summaries on Reliability and Validity of the Instrument

Construct	Items	Loadings/ Weights	Cron-bach's Alpha	Cronbach's Alpha if Item Deleted	Composite Reliability	Average Variance Extracted	Corrected Item-Total Correlation
Effectiveness	Eff1	0.8094	0.830	0.776	08840	0.6561	0.678
	Eff2	0.8071		0.829			0.558
	Eff3	0.8456		0.755			0.723
	Eff4	0.7763		0.777			0.677
Satisfaction	Satf1	0.9548	0.799	N.A.	0.9032	0.8239	0.667
	Satf2	0.8580		N.A.			0.667
Usage	FreqIVLE	1.0000	N.A.	N.A.	1.000	1.000	1.000
Instruction Model	Obj/Const	1.0000	N.A.	N.A.	1.000	1.000	1.000
Type of Course	Tech/Non	1.0000	N.A.	N.A.	1.000	1.000	1.000
Self-Efficacy	SE1	0.8206	0.888	0.868	0.9276	0.7630	0.721
	SE2	0.9252		0.827			0.831
	SE3	0.9404		0.825			0.854
	SE4	0.7989		0.905			0.655

<Table 4> Summary of the Deleted Items

Deleted Items	Cronbach alpha Before Deletion	Cronbach alpha After Deletion	Average Variance Extracted Before Deletion	Average Variance Extracted After Deletion
Effectiveness of ALN ◦ Teaching through IVLE is overall effective ◦ IVLE is an effective supplement in my teaching ◦ I may be able to teach my course only through IVLE	0813	0.830	**0.4048**	0.6561
Computer Self-efficacy ◦ I believe I am able to use new functions in IVLE only if someone else has shown me how to use them. ◦ I believe I am able to use new functions only if I have only the manual for reference	**0.499**	0.888	0.6808	0.7630

<Table 3> is the Statistical Summaries on Reliability and Validity of the Instrument. From the table, we can see the measurements of both Cronbach Alpha and Composite Reliability are above 0.7 for all six constructs, indicating good reliabilities.

We excluded three items from *ALN Effectiveness* construct and two items from *computer self-efficacy* construct in order to have an acceptable convergent validity. Please refer to <Table 4> for deleted items and data results before and after deletion.

4.2.2 Validity

Content Validity: The questionnaire contains sets of items designed to measure Instruction Model and Type of Course. We adopted questions from previous study for Self-efficacy, Use, Satisfaction and ALN effectiveness to ensure content validity. Some modifications were made to fit the questions into our study, especially for construct the effectiveness of ALN in teaching. Previous studies have measured the effectiveness by examining students' responses, exam results, etc. However, our intention is to examine the teachers' perspective, so special changes have been made to ask lecturers of their response on effectiveness. For example, there was one item in a previous study: "I learnt more using ALN." Here we changed it to: "ALN helps student to learn more about it."

We adopted the seven-point Likert Scale for rating questions. The questionnaire item sources can be found in <Table 5>.

Convergent Validity: There are two ways to assess convergent validity. One of them is to have Average Variance Extracted (AVE) exceed an acceptable level of 0.5 (Fornell and Larcker 1981). The condition is satisfied for all the six constructs after taking away some items. [Please refer to <Table 3>] Our Corrected Item-Total correlation for every item of the six constructs exceeds 0.5. We can see the data satisfy both testing of AVE and Item-Total methods.

Discriminant Validity: Two measures are used to decide the discriminant validity [Baker *et al*., 2002]. One of the measures requires that the square root of each construct's average variance extracted (AVE) is larger than the construct's correlation with every other construct [Fornell and Larcker, 1981; Hult *et al*., 2000]. We have AVE

<Table 5> Constructs and Item sources

Constructs	Operational Definition	Measurement
Instruction Model	◦ Objectivist model is to facilitate the transfer of knowledge from an expert to learners. ◦ Constructivist model is to facilitate the creation of knowledge by learners rather than transmitted to learners.	O'Loughlin [1992], Yarusso [1992], Arbaugh *et al*. [2003]
Type of Course	◦ Technical courses include substantial mathematical analysis (e.g. algorithms, programming, and all Engineering and Mathematics courses). ◦ Non-technical courses are oriented towards qualitative analysis and discussion (e.g. Computers and Society and Computer Systems Management; all of the Humanities and Social Sciences courses, and all of the Management courses).	Benhunan-Fich and Hiltz [2002]
Computer Self-Efficacy	◦ The perception of lecturer's capability to use a computer.	Johnson and Marakas [1999]
Usage of ALN	◦ Instructor's usage of ALN system for online discussions, group assignments, and other activities related the coursework.	Srinivasan [1985]
Lecturer's Satisfaction	◦ The attitude of a lecturer to the ALN system (s)he employs in the context of his/her work environments.	Baroudi and Orlikowski [1988], Bailey and Pearson [1983]
ALN Effectiveness in Teaching	◦ The accuracy and completeness of lecture's instruction while using an ALN system.	Hiltz *et al*. [2002]

<Table 6> Correlation Matrix

	Instruction Model	Type of Course	Self-efficacy	Usage	Satisfaction	Effectiveness
Instruction Model	1.000					
Type of Course	-0.310	1.000				
Computer Self-efficacy	0.139	0.175	0.8735			
Usage of ALN	0.136	0.081	0.193	1.000		
Lecturer's Satisfaction	0.003	-0.19	0.128	-0.041	0.9077	
ALN Effectiveness in Teaching	0.200	-0.128	-0.039	0.219	0.274	0.8100

Note) The shaded numbers in the diagonal row are the square root of the average variance extracted.

in <Table 3>. Comparing the square root of AVE with other correlations in <Table 6>, the condition is satisfied. Another method is factor analysis. Factor analysis is stricter than the method of square root of AVE. We take away three items from Satisfaction construct in order to have a one-dimensional grouping. The items of one construct are gathered under the same component after deletion of some items. Please refer to <Table 6> for the items and their component groupings.

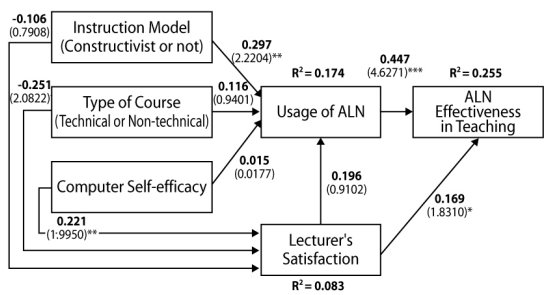
<Table 7> Rotated Component Matrix

Construct	Items	Component		
		1	2	3
Computer Self-Efficacy	SE3	.913		
	SE2	.904		
	SE1	.839		
	SE4	.792		
ALN Effectiveness in Teaching	effect3		.852	
	effect1		.827	
	effect4		.801	
	effect2		.659	
Lecturer's Satisfaction	satf1			.898
	satf2			.839

Note) 1) Extraction Method: Principal Component Analysis.
2) Rotation Method: Varimax with Kaiser Normalization.
3) a Rotation converged in 5 iterations.

V. Data Analysis and Results

The proposed hypotheses were tested using partial least square (PLS Graph Version 3.0). We chose to use PLS because of its robustness with respect to possible deficiencies in model specifications) and the small sample size [Cassel, Hakl, and Westlun, 2000].



Note) Significance levels: $^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$.

<Figure 3> Results from PLS Analysis

We have ninety-eight respondents in total. Six of whom do not use IVLE at all, so there was not any data for IVLE usage and satisfaction from them. These respondents, in addition to answering the questions on instruction model, type of course and computer self-efficacy, were asked to explain why they do not use IVLE. Our aggregated data were generated based on 92 re-

spondents who use IVLE.

Our data results supported five out of nine hypotheses. The hypothesis H1a: A higher lecturer's usage of ALN will lead to higher ALN effectiveness in teaching is supported. The causal relationship is strongly significant with a T-stat of 4.6271. Hypothesis H1b: Higher satisfaction causes higher ALN Effectiveness in teaching, is significant with T-stat of 1.8310. The relationship of hypothesis H3b: Lecturer with constructivist model has higher satisfaction of ALN in teaching, is comparatively strong with a T-stat of 2.2204. The hypothesis that lecturers who teach less technical courses have higher satisfaction of ALN in teaching is also supported with a T-stat of 2.0822. Self-efficacy and lecturers' satisfaction have a comparatively strong positive relationship with a T-stat equal to 1.9950. The summary of the findings can be found in <Table 8>.

Usage of ALN is only influenced by teachers' instruction model, which ranges from objectivist to constructivist. If a lecturer has a more constructivist teaching mode, he or she tends to have more usage of ALN. Type of course and teachers' self-efficacy do not influence usage of ALN; however, they influence teachers' satisfaction of using ALN. Interestingly, lecturers' satisfaction does not affect the usage of ALN, which does not support the positive relationship between Use and User satisfaction in Delone and Mclean Model [2002].

<Table 8> Summary of Hypothesis Testing Results

Hypotheses	Result
H1a: Higher usage of ALN causes higher ALN Effectiveness in teaching.	**Supported**($P < 0.01$)
H1b: higher Satisfaction causes higher ALN Effectiveness in teaching.	**Supported**($P < 0.10$)
H2: Higher satisfaction of the ALN will cause higher usage of ALN.	Not supported
H3a: Lecturers with constructivist model have higher usage of ALN in teaching.	**Supported**($P < 0.05$)
H3b: Lecturers with constructivist model have higher satisfaction of ALN in teaching.	Not supported
H4a: Lecturers who teach less technical courses have higher usage of ALN in teaching.	Not supported
H4b: Lecturers who teach less technical courses have higher satisfaction of ALN in teaching	**Supported**($P < 0.05$)
H5a: Lecturers who have higher computer self-efficacy in technical skills have higher usage of ALN in teaching.	Not supported
H5b: Lecturers who have higher computer self-efficacy in technical skills have higher satisfaction of ALN in teaching.	**Supported**($P < 0.05$)

Ⅵ. Discussion and Implication

6.1 Implication to Schools

The data and results of this research paper should assist schools optimize the effectiveness of ALN. We will continue to use IVLE as an example of ALN systems as the basis for our discussion. As mentioned in chapter 5, there are six respondents out of ninety-eight who do not use IVLE for their teaching at all. However, fourteen professors responded to the question which asked: "What is the reason you don't use IVLE as supplement to your teaching?" The question was intended for those who do not utilize IVLE in their teaching, yet eight professors responded to this

question even though they do use IVLE. These eight responses are also valuable for they may reflect the areas of IVLE which the existent users wish to improve. For instance, eight of them believe traditional face-to-face teaching is sufficient for teaching and ALN is not needed. One feels it wastes time to use the system and another one does not like the functions available. <Table 9> lists the summary of the statistics.

Respondent number 3 gave us information related to the ease-of-use of IVLE compared to homepage. Here we regard homepage as a kind of ALN systems, too, due to its purpose. Lecturers tend to choose the ALN systems which are easier, if they have the choice, despite what is implemented by the school. However, IVLE allows lecturers to put their homepage or course link in the course main page, which integrated other forms of ALN with IVLE.

We see from the feedback that the poor design, unstable availability, poor ease-of-use, and low uploading limit of the ALN system are also some

<Table 9> Summary of Reasons of Why ALN is Not Adopted

Please skip this question if your answer to question 4 is Yes (Question 4 asks whether you use IVLE to supplement your classroom teaching). What is the reason you don't use IVLE as supplement of your teaching? Please tick the answer(s) (You can choose more than one answer).		Response Percent	Response Total
1	I think Face-to-Face teaching is efficient and enough for the students.	57.1%	8
2	It wastes time to use IVLE.	7.1%	1
3	I don't know how to use IVLE.	0%	0
4	I don't like the available functions in IVLE.	7.1%	1
5	Other	64.3%	9

There are other reasons provided by respondents. They are listed in <Table 10> below.

<Table 10> Other Reasons Provided by Respondents

	OTHER Reasons of Not Using IVLE for Supplementing Teaching
1	Bad UI (User Interface) design
2	IVLE is slow outside the school network, and always down
3	The school of Computing also provides a course-webpage which is used for many functions which also exist in IVLE, thus IVLE is less used than you might have expected; homepages (personal or course one) are easier to use than IVLE
4	It is an imposition for professors to do the uploading themselves, in particularly when IVLE accepted only 5 MB portions. I had to breakdown my lectures in to appropriate chunks and convert to PDF, this all takes unnecessary time: the placement of lecture notes on IVLE contributes to spoon feeding and entrenches the lack of inadequate note-taking, the system is not self-explanatory and anything that needs a tutorial or a manual is not well engineered
5	I teach a language and it requires face-to-face teaching.
6	Students have to come in class and be trained to understand fast

of the reasons lecturers refuse to use IVLE. Lecturers expect a time-saving and trouble-free system.

A respondent said that the system is not self-explanatory and tutorial and manual are not sufficient. This relates to the training provided to the users, especially the users with not much technical background. ALN system training should be available for users who need such help. The training can be in form of face-to-face, user manual or online tutorial.

Other factors that influence ALN effectiveness are related to the nature of the course and the teachers' teaching methodology. As respondent number 4 said, he believes students ought to improve their note-taking skills. It is possible that the asynchronous learning is not suitable for some courses' nature or methodology of teaching. We suggest that the focus of improving ALN effectiveness should be on the lecturers who require ALN to supplement their teaching instead of on changing lecturers' belief of their adopted methodology in order to suit ALN systems.

A strong positive relationship from usage of ALN to ALN effectiveness (H1a) is proved by our quantitative data. Usage of ALN includes the length of usage per visit and frequency of most of the functions available in ALN system. Details of these functions can be found in our questionnaire which is attached in appendix A. Among the twenty-one functions available in IVLE, four functions: Workbin, Announcement, Forum and Lesson Plan, are the most frequently used functions. Workbin is the most frequently used with 57.9% of respondents choosing "Always" (the highest in the seven-point Likert scale). Workbin is a function with which professors can upload lecture notes and other materials and allow students to upload their assignments. This gives us an idea of what professors utilize most with ALN system. Among the four items which measure ALN effectiveness, "IVLE allows me to provide more material to students than face-to-face traditional teaching" has the highest rating. This corresponds to the highest rate of Workbin. The signal is clear here: To the professors in NUS, the most important function ALN systems can provide is lecture notes uploading function and assignment repository. The schools are suggested to firstly meet this need by improving it as a more convenient, faster, more user-friendly function for material uploading and downloading. In particular to allow professors to upload the whole file at one time instead of having to segment the file and to upload one by one; and allow the professors to upload files with various formats.

A positive relationship from satisfaction of ALN to ALN effectiveness in teaching (H1b) is supported by the data. We measure teachers' satisfaction by asking their satisfaction about the reliability of the system and accuracy of output information. Respectively, 33.7% and 32.6% rated them as high (the highest in the seven-point Likert scale). 1.1% rated the reliability of the IVLE as low (lowest in the seven-point Likert scale). A professor's response about the reason of not using ALN system was also about stability and reliability (<Table 10>, respondent No. 2). We conclude from this relationship that by improving stability and reliability of ALN systems, schools will increase the satisfaction of lecturers and subsequently the effectiveness of ALN in supplementing teaching.

We proposed that lecturers with constructivist model have higher usage of ALN in teaching

(H3a). The hypothesis is supported by our data. The constructivist model is learner-centered; students must control the pace of instruction. The instructor serves as the creative mediator of the process. The constructivist model can be well-supported by ALN since the nature of ALN is to allow students to learn asynchronously and take control of their own study. The same applies to instructors: if the lecturers adopt the constructivist model, they move the control from themselves to students and ALN provides a suitable environment for lecturers to act as a mediator providing material, organizing and managing the subject through ALN. We can say there is a higher usage, and therefore effectiveness, of ALN for lecturers who adopt the constructivist model. In another word, a lecture uses ALN more because the needs which result from the instruction model. In order to improve the ALN effectiveness, the school can focus on serving the needs of lecturers who adopt the constructivist model since their courses are better supported by ALN.

Hypothesis H4b is also supported by our data. It proposes that lecturers who teach less technical courses have higher satisfaction with ALN in teaching. The satisfaction is only limited to technical perspective in reliability and accuracy of output information because we removed three other items to ensure the validity and reliability of the data. Only two items are left for analysis: Reliability of the IVLE system and Accuracy of output information. Therefore, we cannot generalize the satisfaction here to satisfaction in every aspect of teaching. We can only treat the satisfaction as technical satisfaction. Hence, we can say that lecturers who teach less technical courses perceive higher technical satisfaction of ALN system. On the other hand, those who teach more technical courses like Mathematics, Computer science and other science module have higher requirement on the reliability and accuracy of the system. This is not hard to understand due to the nature of the courses. For example, if a computer science professor posts a program sample code in the Workbin or forum, a minor mistake due to the ALN system can cause the program unable to run. In order to improve the effectiveness of ALN for technical courses, schools are advised to take special note to system accuracy and reliability.

The hypothesis H5b is supported by the data: lecturers who have higher self-efficacy in technical skills have higher technical satisfaction of ALN in teaching. Lower computer self-efficacy may result in unwillingness to accept using an information system, and thus low satisfaction inevitably appears. In order to improve satisfaction and hence effectiveness of ALN, proper technical training should be provided to professors who have lower computer self-efficacy.

The hypotheses which are not supported by data are: H2: Higher satisfaction of the ALN will cause higher usage of ALN; H3b: Lecturers with constructivist model have higher satisfaction of ALN in teaching; H4a: Lecturers who teach less technical courses have higher usage of ALN in teaching and H5a: Lecturers who have higher computer self-efficacy in technical skills have higher usage of ALN in teaching.

The result of H2 is not a surprise because technical perspective is incorporated with other factors which decide the usage and success of an information system. Firstly, these factors may include presentation (format and mode), ease of use and flexibility [Beily and Person, 1983] and

etc. We did not measure the other factors besides technical satisfaction. The result shows that only good technical support of ALN to lecturers is not enough to increase their usage of the systems. Hence the result is reasonable.

Secondly, we can find the contextual reason that hypothesis 2 doesn't support. Since ALN system has been implemented in NUS, school administration strongly urges professors to use system and provides education for system use. In other words, it is not a situation where users voluntarily involve in using the system whether they are satisfied with using an ALN system or not. Also within this context, it is also quite meaningful that H1b supports within the 0.1 level ($P < 0.1$). Because this is an exploratory study, we can explain the H1b results with 0.1 level. If we collected more sample data, it is expected H1b would be supported with 0.05 level.

We see from the result of H3b that instruction model has no impact on satisfaction. This means whether objectivist or constructivist model a lecturer has, it does not affect the perceived satisfaction in technical aspects of ALN systems; however, it affects usage of ALN as H3a is supported. The needs of lecturers who adopt constructivist model directly decide the usage but do not have any relationship with what lecturers feel about the system technically. What ALN systems can provide for the instruction model is more important than what they make the lecturers feel about them.

H4a is not supported. One of the respondents said that the course she/he teaches in language course and it requires face-to-face teaching (<Table 10>, respondent No. 5). Language course is a less technical course, but it differs to the other less technical courses which are discussion based. Language courses require listening and oral practices with others and face-to-face demonstration, correction and practices. H4a does not separate language courses from other arts courses. This may be the reason that the hypothesis is not supported.

H5a and H5b are not supported. The reason we hypothesize is that self-efficacy expectations will influence individuals' actual ability to perform the behavior and in this case is the behavior of using ALN. Users also have tendency to avoid using systems in order to avoid wasting time and trouble. Why the hypothesis is not supported by the data needs to be explored further.

6.2 Implication to Academics

In the ALN literature review we discussed research concerning how professors or lecturers can change their teaching styles to accommodate the advent of ALN. This paper suggests how ALN can be designed and implemented to suit different characteristics of lecturers in order to optimize effectiveness. Other research investigates ALN effectiveness compared to traditional classroom teaching from a students' perspective: whether the students are learning as well or better. This paper fills the gap between existing researches which do not cover an important research question from professors' perspective.

Further research topics can extend to a specific group of professors or specific type of course, for example, into the factors which influence the effectiveness of ALN for more technical courses. Our recommendation is that schools focus more on the needs of the lecturers who adopt the constructivist model. Another interesting topic to be pursued is details on computer self-efficacy and

professors' adoption of ALN.

Our research is limited in its measurement of satisfaction. We were only able to measure technical satisfaction. The result of hypothesis H2a: Higher satisfaction of the ALN will cause higher usage of ALN shows us that only good technical support of ALN to lecturers is not enough to increase their usage of the systems. Therefore, further research can focus on finding the other factors of satisfaction which will impact the usage of ALN systems. The Satisfaction can extend to the area of content (accuracy and relevance), presentation (format and mode), service quality (support for maintenance), training [Melone, 1990], ease of use and flexibility [Beily and Person, 1983] and etc. In addition to the measurement problems, there is limitation of data collection obtained with a single point of source as ALN in NUS. Further research with various ALNs in different institutions can provide more accurate results. Also we didn't identify threats to our model from outside the study setting because we focused on NUS only. However, there might be other variables such as lecture's age, tenure, background, or other factors that we should control.

Ⅶ. Conclusion

Improving IS effectiveness is one of the greatest goals of IS research. Information systems are increasingly involved in education as pedagogical tools and are having a greater impact on teaching and learning outcomes. We proposed three factors that influence the ALN effectiveness and we conducted survey for quantitative data collection. The sample group was professors of National University of Singapore. The results shows that type of course, lecturers instruction model, and computer self-efficacy have influence on the usage and technical satisfaction of ALN system, and hence the effectiveness of ALN. Discussion and suggestions on how to improve implementation of ALN in schools based on our finding have been given. We believe our research fills up a gap in researches on ALN and is able to contribute to the studies in the field of technology and education.

〈References〉

[1] Arbaugh, J.B. and Benbunan-Fich, R., "Testing the applicability of learning theories to web-based MBA courses," *Academy of Management Proceedings*, 2003, pp. A1-A6.

[2] Arvan, L., Ory, J.C., Bullock, C.D., Burnaska, K.K., and Hanson, M., "The SCALE Efficiency Projects," *JALN*, Vol. 2, No. 2, 1998, pp. 33-60.

[3] American Psychological Association, "Standards for educational and psychological testing," *American Educational Research Association*, Washington, DC., 1985.

[4] Bailey, J.E. and Person, S.W., "Development of a Tool for Measuring and Analyzing Computer User Satisfaction," *Management Science*, Vol. 29, No. 5, 1983, pp. 530-545.

[5] Bandura, A., "Social Foundations of Thought and Action: A Social Cognitive Theory," Englewood Cliffs, NJ: Prentice-Hall, 1986.

[6] Bandura, A., "Self-efficacy," In V.S. Rama-

chaudran (Ed.), Encyclopedia of human behavior, Vol. 4, 1994, pp. 71-81, New York: Academic Press. (Reprinted in H. Friedman (Ed.), Encyclopedia of mental health. San Diego: Academic Press, 1998).

[7] Baker, J., Parasuraman, A., Grewal, D., and Voss, G.B., "The Influence of Multiple Store Environment Cues on Perceived Merchandise Value and Patronage Intentions," *Journal of Marketing*, Vol. 66, No. 2, 2002, pp. 120-141.

[8] Benbunan-Fich, R. and Hiltz, S.R., "Educational Applications of CMC's: Solving Case Studies Through Asynchronous Learning Networks," *JCMC*, Vol. 4, No 3, 1999, p. 18.

[9] Benbunan-Fich, R. and Hiltz, S.R., "Correlates of Effectiveness of Learning Networks: The Effects of Course Level, Course Type, and Gender on Outcomes," *Proceedings of the 35th Hawaii International Conference on System Sciences,* IEEE Computer Society Press, Los Alamitos, CA., 2002.

[10] Bhattacherjee, A. and Barfar, A., "Information Technology Continuance Research: Current State and Future Directions," *Asia Pacific Journal of Information Systems*, Vol. 21, No. 2, 2011, pp. 1-18.

[11] Blum, K.D., "Gender Differences in Asynchronous Learning in Higher Education: Learning Styles, Participation Barriers and Communication Patterns," *JALN*, Vol. 3, No. 1, 1999, p. 24.

[12] Bollen, K.A., "Multiple Indicators: Internal Consistency or No Necessary Relationship?," *Quality & Quantity,* Vol. 18, No. 4, 1984, pp. 377-385.

[13] Bollen, K.A. and Lennox, R., "Conventional Wisdom on Measurement: A Structural Equation Perspective," *Psychological Bulletin,* Vol. 110, No. 2, 1991, pp. 305-314.

[14] Burkhardt, M. and Brass, D.J., "Changing patterns or patterns of change: The effects of a change in technology on social network structure and power," *Administrative Science Quarterly*, Vol. 35, No. 1, 1990, pp. 104-127.

[15] Cassel, C.M., Hackl, P., and Westlun, A.H., "On Measurement of Intangible Assets: A Study of Robustness of Partial Least Squares," *Total Quality Management*, Vol. 11, No. 7, 2000, pp. 897-907.

[16] Chae, S.W., Lee, K.C., and Lee, K.Y., "Empirical Analysis of the Effect of Avatars on Learner's e-Learning Performance: Emphasis on Trust Transference between Avatars and Contents," *Asia Pacific Journal of Information Systems*, Vol. 19, No. 4, 2009.

[17] Compeau, D.R. and Higgins, C.A., "Application of Social Cognitive Theory to Training for Computer Skills," *Information Systems Research*, Vol. 6, No. 2, 1995, pp. 118-143, 26p, 6 charts, 4 diagrams; (AN 4431073).

[18] Coppola, N., Hiltz, S.R., and Rotter, N., "Becoming a Virtual Professor: Pedagogical Roles and ALN," *Proceedings of the 34th Hawaii International Conference on Systems Sciences*, IEEE Computer Society Press, Los Alamitos, CA., Maui, January 3-6, 2001, CD-Rom.

[19] DeLone, W.H. and McLean, E.R., "*Information Systems Success Revisited*," Proceedings of the 35th Hawaii International Conference on System Sciences, Big Island, Hawaii, 2002, p. 238; p. 12.

[20] Dooley, D., "Social Research Methods," Fourth Edition, Prentice-Hall, Inc, New Jersey, 2001.

[21] Easley, R.F., Devaraj, S., and Crant, J.M., "Relating collaborative technology use to

teamwork quality and performance: An empirical analysis," *Journal of Management Information Systems*, Vol. 19, No. 4, 2003, pp. 249-270.

[22] Fornell, C. and Larcker, D.F., "Structural Equation Models with Unobservable Variables and Measurement Errors," *Journal of Marketing Research*, Vol. 18, No. 2, 1981, pp. 39-50.

[23] Gallivan, M.J., Spitler, V.K., and Koufaris, M., "Does information technology training really matter? A social information processing analysis of coworkers' influence on IT usage in the workplace," *Journal of Management Information Systems*, Vol. 22, No. 1, 2005, pp. 153-192.

[24] Garrison, G., Wakefield, R.L., Harvey, M., and Kim, S.H., "Exploring Perceptions of 'Foreignness' in Virtual Teams: Its Impact on Team Member Satisfaction and Turnover Intention," *Asia Pacific Journal of Information Systems*, Vol. 20, No. 1, 2010, pp. 101-125.

[26] Hill, T., Smith, N.D., and Mann, M.F., "Communicating Innovations: Convincing Computer Phobics to Adopt Innovative Technologies," *Advances in Consumer Research*, Vol. 13, 1986, pp. 419-422.

[26] Hiltz, S.R. and Fjermestad J., "Introduction to the Asynchronous Learning Networks Mini-Track," *Proceedings of the 34th Hawaii International Conference on Systems Sciences*, IEEE Computer Society Press, Los Alamitos, CA., Vol. 1, 2001.

[27] Hong, S.J., Thong, J.Y.L., and Tam, K.Y., "Understanding continued information technology usage behavior: A comparison of three models in the context of mobile internet," *Decision Support Systems*, Vol. 42, No. 3, 2006, pp. 1819-1834.

[28] http://www.aln.org/alnweb/journal/vol2_issue2/arvan2.htm.

[29] Jonassen, D.H., "Thinking Technology," *Educational* Technology, 1993, pp. 35-37.

[30] Kim, S.S. and Son, J.Y., "Out of Dedication or Constraint? A Dual Model of Post-Adoption Phenomena and Its empirical Test in the Context of Online Services," *MIS Quarterly*, Vol. 33, No. 1, 2009, pp. 49-70.

[31] Lee, G.D., Lee, J.E., and Sanford, C., "An Exploratory Study on Maximizing Tendency and Continuance Intention of Web Sites," *Asia Pacific Journal of Information Systems*, Vol. 20, No. 3, 2010, pp. 73-90.

[32] Marakas, G.M., Johnson, R.D., and Yi, M.Y., "The importance of divergent validity in measurement development: Development of a measure of computer self-efficacy at the general and task specific level," *Working paper*, Indiana University, Bloomington, IN, 1999.

[33] Melone, N.P., "A Theoretical Assessment of the User-Satisfaction Construct in Information Systems Research," *Management Science*, Vol. 36, No. 1, 1990, pp. 76-91.

[34] Nunnally, J.C., "Psychometric theory," (2nd ed.), New York: McGraw-Hill, 1978, p. 245.

[35] O'Loughlin, M., "Rethinking Science Education: Beyond Piagetian Constructivism Toward a Sociocultural Model of Teaching and Learning," *Journal of Research in Science Teaching*, Vol. 29, No. 8, 1992, pp. 791-820.

[36] Schmitz, G.S., "Entwicklung der Selbstwirksamkeitserwartungen von Lehrern (Development of lecturer's self-efficacy beliefs)," *Unterrichtswissenschaft*, Vol. 2, 1998, pp. 140-157.

[37] Schmitz, G.S. and Schwarzer, R., "Selbstwirksamkei-tserwartung von Lehrern: Längsschnittbefunde mit einem neuen Instrument

(Perceived self-efficacy of teachers: Longitudinal findings with a new instrument)," *Zeitschrift für Pädagogische Psychologie*, Vol. 14, No. 1, 2000, pp. 12-25.

[38] Spencer, D. and Hiltz, S.R., "Studies of ALN: An Empirical Assessment," *Proceedings of the 34th Hawaii International Conference on System Sciences*, January 2001.

[39] Thong, J.Y.L., Hong, S.J., and Tam, K.Y., "The effects of post-adoption beliefs on the expectation-confirmation model for information technology continuance," *International Journal of Human-Computer Studies*, Vol. 64, No. 9, 2006, pp. 799-810.

[40] Trochim, W.M., "Research Method Knowledge Base," Cornell University Atomic Dog Publishing, 2002.

[41] Webster, J., "Teaching Effectiveness in Technology-Mediated Distance Learning," *Academy of Management Journal*, Vol. 40, No. 6, 1997, pp. 1282-1309.

[42] Webster, J. and Martocchio, J.J., "Turning work into play: Implications for microcomputer software training," *Journal of Management*, Vol. 19, No. 1, 1993, pp. 127-146.

[43] Yarusso, L., "Constructivism vs. Objectivism," *Performance and Instruction Journal*, 1992, pp. 7-9.

Appendix A. Questionnaire

Dear Professor,

Thank you for participating in this survey. The survey is entirely anonymous and your response will be kept confidential.

The objective of this survey is to measure the factors that influence teachers' use and satisfaction of IVLE, and the effectiveness of IVLE in teaching as a supplement of traditional classroom face-to-face teaching.

Your response is very valuable and important to this research. We appreciate your participation very much.

Hannah YANG Shuo
Dr. Bock Gee Woo

Instruction model: (words in italic do not appear in the actual questionnaire)

1. If the way you instruct/teach can be classified as objectivist model and constructivist model, how will you rank your instruction model in a continuum from objectivist model (1) to constructive model (7)? Please Circle the number.

Objectivist model assumes that there is an objective reality and the goal of learning is to understand the reality and modify behavior accordingly. The purpose of teaching is to facilitate the transfer of knowledge from an expert to learners.

Constructivist model advocates that knowledge is created by learners rather than transmitted to learners. A lecturer serves as the creative mediator of a knowledge construction process to help learners construct their own perception of reality.

Objectivist mode				**Constructivist model**		
1	**2**	**3**	**4**	**5**	**6**	**7**

Course type:

2. If courses can be classified according to the technical nature of the material they cover, there would be more technical course and less technical course. How will you rank the course you teach in a continuum from non-technical (1) to totally technical (7)? Please circle the number. **More technical** courses would include substantial mathematical analysis while **less technical courses** would be more qualitative analysis and discussion.

Non-technical					Totally Technical	
1	**2**	**3**	**4**	**5**	**6**	**7**

A-2

Self-efficacy:

3. Please read each questions carefully and circle the number based on your personal feelings.

	Not at All Confident						Totally Confident
1) I believe I have the ability to use IVLE on my own(SE1)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2) I believe if I want to, I can easily operate any of the functions in IVLE(SE2)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3) I believe I have enough under-standing of IVLE.(SE3)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4) I believe I am able to learn new functions on my own if they are available in IVLE(SE4)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5) I believe I am able to use new functions in IVLE only if someone else has shown me how to use them.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6) I believe I am able to use new Functions only if I have only the manual for reference	**1**	**2**	**3**	**4**	**5**	**6**	**7**

A-3

4. Do you use IVLE to supplement your classroom teaching (lecture)? Please circle

Yes/No

(If your answer is yes, please proceed to question 5, if no, please go to the question 9)

Usage of IVLE (Frequency and Functions):

5. How often do you use IVLE during working days (Monday-Friday)?
   a. Once a week b. 2~4 times a week c. Once a day
   d. 2~4 times a day e. 5 times a day or above

6. How many minutes on average do you spend on using IVLE per visit? (Length)
   _____ minutes/visit

7. Please rank the frequency you use the following functions in IVLE and circle the number. (Frequency increases from 1 to 7)
   You may wish to refer to IVLE while answering this question.

	Not at all	rarely	seldom	medium	sometimes	often	Always	
1. Class Management	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc1)
2. Distribution List	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc2)
3. Grade Book	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc3)
4. Announcement	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc4)
5. Lesson Plan	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc5)
6. Forum	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc6)
7. Workbin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc7)
8. Project	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc8)
9. Assessment	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc9)
10. Survey and Polls	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc10)
11. Module FAQ	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc11)
12. Multimedia	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc12)
13. Chat room	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc13)
14. Resources	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc14)
15. Content Cabinet	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc15)
16. My Community	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc16)
17. eModules	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc17)
18. IT Security	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc18)
19. Plagiarism.NUS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc19)
20. Anonymous feedback	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(Freqfunc20)

Lecturer's satisfaction:

8. The purpose of following questions is to measure how you feel about certain aspects of IVLE. Please circle the number that describes your evaluation of the factor being judged.

1) Reliability of the IVLE system (satf1)

Low			Neutral			High
1	2	3	4	5	6	7

2) Accuracy of the output information (satf2)

Low			Neutral			High
1	2	3	4	5	6	7

3) Degree of IVLE training provided to teachers

Insufficient			Neutral			Sufficient
1	2	3	4	5	6	7

4) The functions provided by IVLE

Insufficient			Neutral			Sufficient
1	2	3	4	5	6	7

5) Your feeling of using IVLE

Negative			Neutral			Positive
1	2	3	4	5	6	7

A-5

Effectiveness of IVLE in Teaching:

9. Please circle the number that describes your evaluation of the factor being measured, based on how you feel.

	Strongly disagree						Strongly agree
IVLE allows me to raise more questions which can improve students' critical thinking capability.	**1**	**2**	**3**	**4**	**5**	**6**	**7**(effect1)
IVLE allows me provide more material to Students.	**1**	**2**	**3**	**4**	**5**	**6**	**7**(effect2)
IVLE helps me make students interested in my subject	**1**	**2**	**3**	**4**	**5**	**6**	**7**(effect3)
IVLE helps students learn through the use of it.	**1**	**2**	**3**	**4**	**5**	**6**	**7**(effect4)
Teaching through IVLE is overall effective	**1**	**2**	**3**	**4**	**5**	**6**	**7**
IVLE is an effective supplement in my teaching	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I may be able to teach my course only through IVLE	**1**	**2**	**3**	**4**	**5**	**6**	**7**

A-6

10. Please skip this question if your answer to question is 4)
What is the reason you don't use IVLE as supplement of your teaching? Please circle your answer(s)y
(You can choose more than one answer)

a. I think Face-to-Face teaching is efficient and enough for the students.
b. It wastes time to use IVLE.
c. I don't know how to use IVLE.
d. I don't like the available functions in IVLE.
e. others

If other, please specify:_____

A-7

11. What is your gender please? Please circle:

Male/Female

12. What is your age please? _____

◆ About the Authors ◆

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