NEEDS OF THE LEARNING EFFECT ON INSTRUCTIONAL WEBSITE FOR VOCATIONAL HIGH SCHOOL STUDENTS

Hung-Jen Lo
Center of Teacher Education, National Taiwan University of Physical Education and Sport, Taiwan
g9843803@yuntech.edu.tw

Gwo-Liang Fu
Graduate School of Technological and Vocational Education, National Yunlin University of Science and Technology, Taiwan
g9943803@yuntech.edu.tw

Kuei-Chih Chuang (Corresponding author)
Graduate School of Technological and Vocational Education, National Yunlin University of Science and Technology, Taiwan
chuangkc@yuntech.edu.tw

ABSTRACT
The purpose of study was to understand the correlation between the needs of the learning effect on instructional website for the vocational high school students. Our research applied the statistic methods of product-moment correlation, stepwise regression, and structural equation method to analyze the questionnaire with the sample size of 377 participants. The empirical results showed that the explanatory factors representing the needs for instructional website can be orderly ranked as: the content and structure of teaching materials, the interactive design, the establishment of system configuration, the layout design, and the interface design. The explanatory factors representing the learning effect of the instructional website can be orderly ranked as the learning environment and equipment, the system learning, the courses interactive, the teaching effect. In addition, the needs for instructional website were positively correlated to the learning effect. The interaction design was intermediately correlated to establishment of system configuration.
Keywords: Instructional Website, Learning effect, e-learning

The improvement of technology brings up the unprecedented challenges for education. In 2009, the survey on the use of broadband network in Taiwan disclosed that the population of Internet user in Taiwan was more than 16,000,000 people. There were about 5,600,000 families in Taiwan accessible to the Internet. The penetration rate of Internet access was 75%. Considering the ages (above 12) of the once used the Internet, 99.45% of the users age between 15 and 19 (the teenagers). This is the highest percentage comparing to users of other ages (Taiwan Network Information Center, 2009). The evidences showed that the application of the Internet has been deeply rooted in our daily life, and has become the channel of the youth generation to acquire knowledge. E-learning makes it possible for students to acquire knowledge from the in-class teaching, and via the Internet as well. Kiliç-Çakmak (2010) define E-learning as an on-line activity of synchronies or asynchronies for students and teachers within the same time interval to apply specialized technological learning environment. E-learning is a teaching program plan based on hypermedia, using the features of Internet to create vigorous learning environment, train the students to learn independently and continuously (Khan, 1998) . Under the E-learning environment, the independent characteristics of students are more obvious and thus influence learning performance (Chen and Lin, 2002). Simultaneously, students can construct the knowledge system by other's. Moreover, E-learning is a bilateral way of communication between teachers and students (Peng, 1995).

If a set of web design indication can be provided, then it is easier to develop the useful educational resources. At the same time, web evaluation indicators can serve as the criteria for the educators, enabling the users to find the decent learning environment effectively (Chang, 2007). "Evaluation indicators for the instruction website" are established and developed to evaluate the principles of the online instruction, examining whether the ability of learner was considered, whether the learner is happy to learn, and whether the learning effect is shown (Wang & Chuang, 2003). In the US, traditional expository teaching method is not suitable for 70% students in medium school. Many students perform poorly on schoolwork or even lose their learning motives. The improper teaching strategy is the main cause of such phenomenon (Wang & Chuang, 2003). Some studies show that the use of information technology will improve the learning effect (Marki, Maki, Patterson & Whittaker, 2000; Schutte, 1997). But, other believes the use of information technology has little benefit on or even decreases learning effect (Kulik, 1985; Clark, 1985). However, when technology can provide different learning environments, we would expect different learning effect (Leidner & Jarvenpaa, 1995). Our paper assumes the relation between the assessments of instruction website and learning effect is as followed:

Assumption 1: evaluation indicators are positively correlated to the student's learning effect.
Assumption 2: evaluation indicators can predict learning effect, and have significantly explanatory ability.
Assumption 3: evaluation indicators have positive and direct effect on the student's learning effect.

LITERATURE REVIEW

Learning style changes and progresses via the Internet platform and becomes friendly, convenient, and easily accessible. Khan (1998) mentions the features of online teaching, including interactivity, teaching materials by multimedia, open system interworking, online searching, space and time transcending, global shared platforms, and controllable by learners. Pan (2006) proposes the following 4 features for online teaching: (1) the World Wide Web is universal and easy to learn and use and has large population around the world; (2) the teachers and students can use the online platform to teach and learn, transcending the limit of time and space; (3) the cross-platform feature of World Wide Web is available on any PC or Macintosh; (4) the students can learn everywhere with Internet. Yang (2000) believes the combination of the Internet and teaching can be expressed in three models. First, the "face-to-face resource model" combines the Internet and traditional classroom teaching. Second, "schoolwork guidance model" employs the instruction website to provide teaching resources, discussion on the in-class content, the announcement, and hints on the homework. Third, "online teaching model" completely utilize the Internet to carry on the distance teaching, including teaching process, teaching activity, and grading.

E-learning is a web-based learning system that utilizes World Wide Web to achieve learning goal (Chang ,2002). In general, E-learning has 3 advantages. First, the hypertext used by WWW provides the user-friendly interaction and enables the users to control the information by themselves. Second, it can transmit the multimedia, such as voice, animation, video, etc. The transmission cost is low and the users can download the information repeatedly. Third, it provides true interaction. The linkage between webpages and the interactive layout design enables the interaction and communication between Internet users and server (Starr,1997). American Society of Training and Education (ASTD) indicates that E-learning is the learning process for users to learn by digital media, including Internet, corporate networks, computers, satellite broadcast, tapes, video tapes, interactive televisions and disks. The application ranges from Internet learning, computer learning, virtual classes, digital collaboration (Zou, 2003 ； Xie, 1997). E-learning no longer focuses on the electronic aspect but on the education aspect. From the perspective of learners, learning can happen anytime and anywhere. Time and space are not limited anymore. It is easy to use and the users enjoy the learning experiences. E-learning improves the learning ability of students by sufficiently encouraging them to engage in the learning activities, creating an extremely different learning experiences.

Type the keyword "instruction website" in the Google search engine (www.google.com), more than 5.52 million results appear within the domain of traditional Chinese. Instruction website mainly uses hypermedia, in the other words, uses the attributes and resources of World Wide Web to establish a meaningful learning environment, aiming to train the individuals to learn independently and to continue the learning activities (Wang & Chuang, 2003). Tu (2005) proposes that the instruction website should equip 3 functions: the function of online teaching, the function of online interaction, and the function of system management. After the in-class teaching, teachers can employ online platform to interact with students or manage the homework submission with synchronies or asynchronies. Such teaching style primarily solves the problem of time limit. Students can interact with teachers on the Internet, obtain the digital teaching materials, acquire more teaching resources, or share the learning experiences with others. As for the types of instruction website, it is common to divide into three types. The first is teaching resources website, collecting the teaching and learning resources, for example, the educational information programs and teaching material resources center of Taiwan Ministry of Education. The second is online teaching website, aiming to share the knowledge. Such website provides online teaching and learning classes, for example the demonstration experimental classroom of physics teaching (http://www.phy.ntnu.edu.tw/class/demolab/indexTree.html). The third is learning social group in which learners engage in learning activities, communicate and discuss their knowledge and experiences via the Internet, for example EduCities (http://www.educities.edu.tw/). Therefore, when establishing a new instruction website, different points should be concerned in order to accommodate the differences of website users and functions (Huang, 2000).

The general assessments of instruction website are not completely the same. The primary role of instruction website is to assist the student's learning activity. Therefore, learning performance should be examined in the assessment. The assessment portfolio should focus on whether the instruction website provides the following functions of online test, learner's self-assessment, and feedback of teaching (Yu, Hsieh, Chen, and Lian, 2007). As the use of instruction website is a style of open learning, students can begin the learning activity anywhere, anytime, with any computer. The scheme of the assessment should focus on the role of assisting the students and

improving the communication among the users of instruction website. Therefore, the design of the website considers the needs of the teachers and students. The designer should examine whether learners achieve the expected learning goal or collect the specified data and information. Then the designer can modify the content of the website and establish the teaching (or learning) features of vigorous interaction and attractive content in order to improve the learning motive and interest of learners. The teaching (or learning) effect of instruction website can thus be discovered. Before studying the indicators of instruction website, we must have a basic idea about the "indicator." Indicator is a set of characteristics that we use to evaluate a concept or an abstract subject. It can be specifically described and clearly defined, and thus becomes a criterion to judge whether the abstract subject is good or bad. In addition, the specification of indicators reflects the important aspects that researchers concern with and it divide the relative aspects into different pieces. On the other words, indicator employs a subject to represent the other's status or variation. The former serves as the indicator of the latter. Indicator can simplify the abstract subject and demonstrate clearly a deeper understanding of certain concept. Therefore, indicator can be the reference of value assessment (Wang, 1998; Wang 2002). The "evaluation indicators" of instruction website is a set of criteria that we use to examine whether E-learning aligns with students' expectation and ability and whether the users are willing to utilize the instruction website to teach and learn (Chang 2007).

Local research papers have developed different evaluation indicators, as shown in Table 1. However, most researchers believe that the primary concern of the instruction website should focus on the aspect of "creditability and creditability of the website content." Lwo (2004), Yu et al. (2002) emphasize more on the teaching design, learn adaptability, proper learning assistance work. They stand in the shoes of the learners. Moreover, Chuang and Tsai (2005) propose an assessment of instruction website, considering "system configuration." For example, the system designed for individual learning material, for observation and records of learner's behavior and grade, for randomly assigned after-class test, and for simulation of virtual teaching.

Table 1: Literature review of evaluation indicators (in traditional Chinese)
Resources: collected and arranged by the authors

Authors	Topics	The aspects of assessment indicators (dimension)
Ho, Chen, and Chen (1988)	Research on the Assessment Indicator of Online Teaching System	1. Teaching material checklist 2. Collaborative interaction 3. Waiting time 4. Webpage design 5. User-friendliness
Ouyang and Lin (2002)	Assessment Indicator of the Quality on the Instruction Website for Children	1. Content 2. Layout design and structure 3. Multimedia feature 4. Feedback and support 5. Description of the website
Lwo (2004)	Assessment Indicator of Educational Multimedia Website	1. Properly correct content 2. Interactive approach and style 3. Quality and adaptability of media 4. Attractiveness 5. Quality of transmission 6. Learning adaptability 7. Proper learning assistant working 8. Build-in intelligence
Yu et al. (2002)	Assessment of the Instruction Website: Difference between Learning Assistance and Completeness of Functions	1. Creditability of content 2. Linkage between the websites 3. Usefulness of navigators 4. Teaching design 5. Visual design
Chang (2007)	The Introduction of Assessment on the Instruction Website	1. Content and structure of the website 2. Visual layout design and multimedia application 3. Interaction and interface design 4. Functions and system management
Chuang KC & Wang, J. (2003) ; Chuang, K.C. & Tsai, C.F. (2005)	Assessment Guidelines on e-Learning Websites	1. Teaching material and the structure 2. Layout design 3. Interface design 4. Interaction design 5. establishment of system configuration

Laura (1999) collects and analyzes the evaluation indicators from 12 institutes that provide the assessment service for website, as shown in Table 2. We can learn that "content" is the most important indicator in the website assessment, regardless the types of the websites. Next is design/presentation/format.

Table 2: Frequently used 12 assessment principles for instruction website assessment

Rank	Evaluation indicators	No. of Websites
1	Content	12
2	design/presentation/format	11
3	update frequency	8
4	audience/community needs	7
5	currency/timeliness	7
6	rating system	7
7	Authority	5
8	availability/speed	5
9	value/usefulness	5
10	accessibility/search ability	4
11	scope	4

Resources: Laura, G. M. (1999), Evaluating net evaluators, Searcher, 7(2), 57-66.

Khan (1997), Diagle and Furner (2004), Chung and Tsai (2005) examine the instruction website by 6 dimensions, as shown in Table 3. They agree on "students' interaction and collaboration," "layout design and multimedia integration," and "the learning assessment mechanism."

Table 3: Comparison on dimensions of instruction website assessment by local and foreign research papers

Assessment dimension	Khan (1997)	Daigle & Furner (2004)	Chuang & Tsai (2005)
1.content		✓	✓
2. students' interaction and collaboration	✓	✓	✓
3. linkage and transmission of information			✓
4. layout design and multimedia integration	✓	✓	✓
5. design suitable for learning background and daily life		✓	✓
6. learning assessment mechanism	✓	✓	✓

Resources: collected and arranged by authors

From previous literatures, we can learn that "learning assessment mechanism" is a core indicator among the evaluation indicators for instruction website. It shall have the properties of learning effect and effect evaluation. In addition, many researchers examine the functions of bulletin board, discussion board, proper learning scenarios and timely responds and the influence on learners' motive and interests to measure the indicators of "layout design" and "learners' interaction." Hence, our paper employs the 5 dimensions of assessment principles in Chuang and Tsai (2005), including the content and structure of teaching materials, layout design, interface design, interaction design, and the establishment of system configuration.

Hudspetch (1997) indicates that learning effect is based on students' ability to collect the information and achieve the course goal. Such test is carried on in the class and usually by teamwork. Chen (2003) proposes a feedback value by continuously examining the learning process and performance of the learning activity. Learning effect is something gained by the students when he/she complete learning certain knowledge or skill. The test on the learning performance is helpful for us to understand the efficacy and efficiency of learning activity. We do not have to wait until the class to examine the learning performance. The test of learning performance can be conducted within the learning process. In addition, the test should last after the learning activity. Continuous test can help understand whether the students learn how to apply the knowledge or skill taught in the class. Our paper defines learning effect as a process in which we examine whether the students can achieve their learning goal after the learning activity. E-learning is different from traditional in-class learning. It has the multiple benefits, such as convenience, initiatives, and interaction. As E-learning is not confine to time and space, students can acquire the knowledge anytime and anywhere. Concerning the relation between the frequency of using instruction website and the learning performance, many studies show that the more frequently the students use the website, the better learning effect the student can perform (Wang & Hwang, 2002; Ku, 2002; Lin, 2003; Wahlstedt, 2005; Arbaugh, 2006). However, there are some other studies reject such relation. For instance, Wu (2004) invite the 11th grade students in Ping-tung Girl's Senior High School to

conduct a research about the relation between learning portfolio and learning effect on E-learning instruction website. The result verifies merely the significantly positive relation between the time of online reading and learning effect. Other factors such as the login counts and number of classes have no significantly positive relation with learning effect. Currently, the research on E-learning primarily applies the function of information system to explain learning effect. Our paper studies the influence of necessary content and interface of the instruction website on the students' learning effect by conducting questionnaire analysis. Moreover, we search for the proper presentation style for E-learning students, and thus can improve the students' learning effect.

RESEARCH METHOD

RESEARCH SUBJECTS

We conducted a study on students from department of data management in vocational high schools, which assisted the web design course with instruction websites. Five cities (Taichung County, Taichung City, Changhwa County, Yunlin County and Nantou County) in central Taiwan were included and two schools of each city were randomly sampled. We prepared a guideline for the students to follow and asked the teacher to give an introduction prior to answering the questionnaires. A total of 400 students were enrolled to the research and 23 excluded because of data incompletion or failure in item analysis. The effective response rate reached 85%.

RESEARCH TOOL

The instruction website assessment developed by Wang & Chuang (2003) was modified into the questionnaire for our research. The questionnaire with 28 items consisted of five domains: 6 items for teaching material and the structure, 5 items for layout design, five items for interface design, 5 interaction design and 7 items for establishment of system configuration. All the questions were based on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). An item analysis indicated significantly strong internal correlation ($p<0.05$). The correlation coefficient of each item was all larger than 0.3 (Wu, 2003), ranging from 0.51 to 0.90.

Confirmatory principal factor analysis with oblique rotation was used to investigate the structure of the questionnaire. We intended to keep items with loading > 0.3 and delete items which loaded on multiple factors or diverged from the original structure. The five factors of the structure have explained 57.48% of the overall variance. The loadings in each factor were 0.57 to 0.88 in teaching material and the structure (factor one), 0.56 to 0.78 in layout design (factor two), 0.54 to 0.57 in interface design (factor three), 0.67 to 0.87 in interaction design (factor four) and 0.56 to 0.96 in establishment of system configuration (factor five). Cronbach's alpha analysis demonstrated valid internal reliability (overall coefficient=0.81), with the value ranging from 0.68 to 0.86 for each factor.

The learning effectiveness scale in our research was developed based on three studies, featuring on student learning effectiveness on web design curriculum (Li, 2008), scale of web-based instructional system (Liang, 2001) and learning effectiveness of vocational high school students (Chang, 2007). The scale with 20 items contained four domains: 6 items for instruction, 5 items for systemic learning, 5 items for course interaction and 4 items for equipment. An item analysis indicated significantly strong correlation ($p<0.05$). The correlation coefficient of each item was all larger than 0.3 (Wu, 2003), ranging from 0.49 to 0.93.

Confirmatory principal factor analysis with oblique rotation was used to investigate the structure of the scale and items with loading > 0.3 were retained. The four factors of the structure have explained 67.71% of the overall variance. The loadings in each factor were 0.40 to 0.90 in instruction (factor one), 0.45 to 0.83 in systemic learning (factor two), 0.49 to 0.82 in course interaction (factor three) and 0.63 to 0.87 in equipment (factor four). The overall Cronbach's alpha coefficient was 0.87, with the value ranging from 0.85 to 0.88 for each factor. The internal consistency of the learning effectiveness scale was high.

RESULTS AND DISCUSSION

RESULTS

1. Basic characteristics

For sex difference in the study population, 40.6% of the students were male. The percentages of each grade were 20.7% for the first, 47.7% for the second and 31.6% for the third grade. Percentages for never, < 2 years, 2 to 5 years and > 5 years in web use were 2.7%, 19.1%, 62.2% and 16.0% respectively. For distribution of average days in a week for web use, the responses from the participants were 8.0% for < 1 day, 41.4% for 2 to 4 days, 15.4% for 5 to 6 days and 35.5% for every day.

2. Instruction website assessment

The scores of each factor in instruction website assessment were 4.10 in teaching material and the structure,

3.75 in layout design, 3.63 in interface design and 3.80 in establishment of system configuration. As the scores indicated, the factor of teaching material and the structure was "important" to "very important" and the other factors were "neutral" to "important" for students to assess the instruction websites.

Table 4: Summary for instruction website assessment

Factor of website evaluation	Number of questions	n	Mean (factor)	Standard deviation	Mean (item)	rank
teaching material and the structure	5	377	20.54	3.25	4.10	1
interaction design	5	377	19.28	3.30	3.85	2
establishment of system configuration	6	377	22.80	3.86	3.80	3
layout design	5	377	18.76	3.07	3.75	4
interface design	4	377	14.54	2.58	3.63	5

3. Analysis of learning effectiveness

The scores of each factor in learning effectiveness analysis were 3.61 in instruction, 3.64 in systemic learning, 3.63 in course interaction and 3.87 in equipment. Average of all the factors were evaluated as the range between "slightly agree" and "agree".

Table 5: Analysis of learning effectiveness

Factor of learning effectiveness	Number of questions	n	Mean (factor)	Standard deviation	Mean (item)	rank
Instruction	6	377	21.69	3.84	3.61	4
Systemic learning	5	377	18.21	3.34	3.64	2
Course interaction	4	377	14.54	2.78	3.63	3
Equipment	4	377	15.51	2.86	3.87	1
Overall effectiveness	19	377	69.95	11.07	3.68	

4. Relationship between instruction website assessment and learning effectiveness

Table 6 summarized the results of correlation analysis. Correlation coefficient for the relationship between instruction website assessment and learning effectiveness was 0.64 ($p<0.05$). Due to the moderate correlation, we suggested that highly-assessed instruction website made better learning effectiveness of students. Hypothesis one had been supported by the result. The correlation coefficients among factors of instruction website assessment and learning effectiveness were all positive. Teaching material and the structure was low-correlated with all the factors of learning effectiveness. Layout design was moderate-correlated with course interaction and low-correlated with the others. Interface design was low-correlated with equipment and moderate-correlated with the other factors. Interaction design and establishment of system configuration contributed to the learning effectiveness, with a moderate correlation with all of the factors.

Table 6: Correlation coefficients among factors of instruction website assessment and learning effectiveness

	teaching material and the structure	layout design	Interface design	Interaction design	establishment of system configuration	Website assessment
Instruction	0.33*	0.37*	0.47*	0.54*	0.47*	0.57*
Systemic learning	0.28*	0.38*	0.41*	0.49*	0.45*	0.52*
Course interaction	0.27*	0.44*	0.51*	0.55*	0.47*	0.58*
Equipment	0.33*	0.35*	0.37*	0.53*	0.43*	0.53*
Overall effectiveness	0.35*	0.45*	0.51*	0.61*	0.53*	0.64*

*p<.05

5. Explanation of learning effectiveness by website assessment

As shown in Table 7, there were three explanatory variables with significant F values. The order of the variables to add into the model was interaction design, establishment of system configuration and interface design. The ß coefficients of the three explanatory variables were positive and we could infer the extent of explained variance from the value of ß. Interaction design owned the largest explained variance while establishment of system configuration and interface design were the second and the least. The overall variance of learning effectiveness explained by the model was 44%. Interaction design, the variable with the best ability of explanation, accounted

for 38% of the overall variance. The result supported hypothesis two, which assumed that factors of instruction website assessment was able to predict learning effectiveness.

Table 7: Regression analysis of website assessment on learning effectiveness

	R	R^2	ΔR^2	F value	F change	ß coefficient
Interaction design	.61	.38	.38	225.65*	225.65	.36
Establishment of system configuration	.64	.41	.04	130.51*	22.43	.22
Interface design	.66	.44	.03	96.98*	18.02	.21

*p<.05

6. Pathway analysis of the website assessment of learning effectiveness

Figure 1 displayed the influence of instruction website assessment on learning effectiveness. There were two latent variables. The first latent variable was website assessment and it was constituted of five indicators, including teaching material and the structure, interface design, interface design, interaction design and establishment of system configuration. Another latent variable was learning effectiveness and made up of instruction, systemic learning, course interaction and equipment. In order to test the fit between model and data, we conducted an analysis of structural equation modeling with maximum likelihood method based on the data of 377 students.

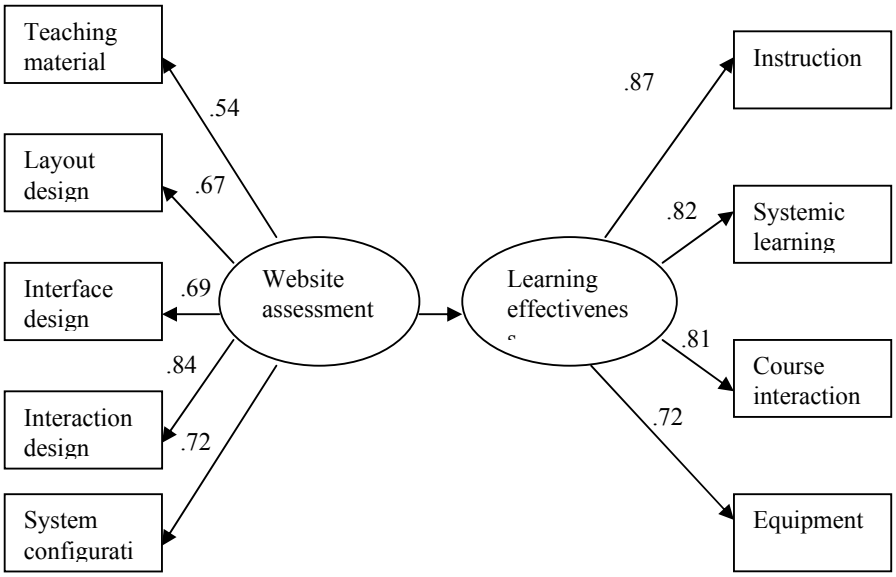

Figure 1: Factorial structure of the influence of instruction website assessment on learning effectiveness in pathway analysis

6.1 Overall model fit

Absolute fix indexes, relative fix indexes and parsimonious fix indexes were three common categories of indexes for evaluating overall model fit. The $\chi 2$ was 83.71 with df=26, which reached the significant level of 0.01. However, it is easier for $\chi 2$ to reach the significance standard in the situation of large sample size. Therefore, we need to take other indicators into consideration. Other indicators also implied significance of the effect: GFI=0.95, meeting the standard as > 0.9; SRMR=0.4 and RMSEA=0.7, both favoring the criteria as < 0.8. On the other hand, the relative fix indexes were all > 0.9; NNFI=0.95; CFI=0.97; RFI=0.93. The parsimonious fix indexes were also reach the requirement as > 0.5; PNFI=0.69; PGFI=0.7. The AIC value was 121.70 for assumed model, which was less than 1741.60 for independent model but larger than 90.00 for saturate model. In conclusion, three categories of indexes were all met and the overall model fit was satisfactory.

6.2 Fit of internal structure of model

Evaluating fit of internal structure of model contains two parts. The measurement model focuses on reliability and validity of variables while structural equation model emphasizes theory construction and cause-effect

relationship.

6.3 Measurement model validity and reliability

Bollen (1989) had pointed out that the values and significance of coefficients between latent variables and indicators, that is, factor loadings, could be used to assess the validity of each indicator (Huang, 2005). As Figure 1 displayed, the standardized factor loadings of the nine indicators on the two latent variables ranged from 0.54 to 0.87 and reached the statistical significance level at 0.01. As a result, all the latent variables could be properly measured by the indicators. The measurements of the variables were with good validity. Bagozzi & Yi (1988) stated that the reliability of each indicator should be larger than 0.5 (Huang, 2005). Among nine indicators in table 8, six indicators were demonstrating good reliability, with the values > 0.5 (reliability for each indicator: teaching material and the structure=0.29, layout design=0.44, interface design=0.47, interaction design=0.70, establishment of system configuration=0.51; instruction=0.75, systemic learning=0.67, course interaction=0.65, equipment=0.51). Despite of reliability for each indicator, Hair (1998) suggested researchers to check the composite reliability (CR) and average variance extracted (AVE) of the latent variables. The criteria were larger than 0.60 for the former and 0.50 for the latter (Huang, 2005). As website assessment was with CR=0.82 and AVE=0.49, learning effectiveness was with CR=0.88 and AVE=0.65. The criteria for CR and AVE were satisfied. According to the results of the above tests, our study was showing good fit for overall model and internal structure.

Table 8: Fit of internal structure of model

Latent variable	Indicator	Reliability for each variable (R^2)	Average variance extracted (AVE)	Composite reliability (CR)
Website assessment	Teaching material and the structure	.29	.49	.82
	Layout design	.44		
	Interface design	.47		
	Interaction design	.70		
	Establishment of system configuration	.51		
Learning effectiveness	Instruction	.75	.65	.88
	Systemic learning	.67		
	Course interaction	.65		
	Equipment	.51		

6.4 Structural equation model

We have mentioned the model for how instruction website assessment influences learning effectiveness in the previous section and the model held the hypothesis three which assumed a positive effect. The hypothesis three had been verified as the coefficient of the pathway from instruction website assessment to learning effectiveness was 0.75 and significantly positive ($t=8.57$, $p<0.01$). Therefore, we concluded that website assessment performed a direct effect on learning effectiveness.

CONCLUSION AND SUGGESTION

CONCLUSION

1. Teaching material and the structure was the main indicator of instruction website assessment

Vocational high school students saw teaching material and the structure as the most important property in assessing instruction websites. Interaction design, establishment of system configuration, layout design and interface design were relatively less emphasized. Similar to Chang (2005), practical teaching function was the crucial component of instruction websites and other special features could only play a subordinate role. In addition, the purposes of instruction websites assessment were to help students achieve the expected learning goals and to collect specific information for constructing an attractive websites with abundant interaction designs. With solid teaching material and structure, instruction websites could be a helpful media, providing flexible learning environments and encouraging active learning.

2. Improved equipment was the main learning effectiveness

Students perceived the equipment and environment as the most improved domain after assisting learning with instruction website. The other domains in learning effectiveness, including systemic learning, course interaction and instruction were less elevated. In Taiwan, information technology had overcome the limits of space and time. The wide-spread web offered on-line interactions among people, convenient ways of data collection and

communication accesses among teachers and students. Hence, students were satisfied with the equipment and environment due to well-developed web technology. Unlike equipment, instruction was the least improved domain of learning effectiveness. The possible reason was on-line teaching brought laziness in learning easily. When students were learning through internet, they must operate computers and start browsers. However, self-regulation of individual student was the key factor leading to the outcome of open learning (Hsiao et al., 2012; Liang, 2002). In the age of internet, information and education experts should work together to improve the learning effectiveness via providing an appropriate context of internet use.

3. The relationship between website assessment and learning effectiveness was positive. Interaction design explained the model best

The correlation coefficients among the five factors in website assessment and the four factors in learning effectiveness were all significantly positive. Layout design, interaction design and establishment of system configuration were even moderate-correlated with all the factors in learning effectiveness. As research of Webster & Hackley (1997) indicated, interaction design, which best explained the effect, improve the learning effectiveness of the students the most. Consequently, we could apply internet to instruction and display teaching materials in various forms by use of multimedia. We expect the application to create a new learning environment, compensate for the drawbacks of traditional teaching and improve the learning effectiveness.

SUGGESTIONS

1. Construct a professional assessment of instruction websites

In the review of international literatures, we found that the assessment of internet source played an essential role in on-line teaching. The academic assessment of on-line learning was the key to promotion of on-line teaching. Although on-line teaching has offered an abundant and convenient way of learning, it would become a shallow learning tool without objective assessment. In advance of comprehensive on-line teaching, a strict system or an independent department for internet assessment is in need.

2. Emphasize on-line teaching structure and formulate regulations

On-line teaching is a trend. The internet environment and learning attitude are important factors of on-line teaching. To improve the quality of learning, school should take the responsibility of educating students on the process and regulations of on-line teaching.

3. Future research

Due to insufficiency of time and human resource, the study population and school locations were constrained. For further research, we suggested to extend the study population to other age groups and try to include more locations. We also expected to find out more relative factors of instructional website assessment and learning effectiveness, which may make larger contributions.

REFERENCES

Arbaugh, J. B. (2006). Do Chickering and Gamson's Seven Principles also apply to online MBAs? *The Journal of Educators Online*, 3, 1-18.

Bagozzi, R. P. and Yi, Y. (1988). On the evaluation for structural equation models. *Journal of the Academy of Marketing Science*, 16, 74 - 94.

Bollen, K. A. (1989). *Structural equations with latent variables.* New York: Wiley.

Chang, Hui-Ya (2005). *Construction of Evaluation Indicators for Teaching Websites on College Base* .Unpublished master thesis, Ming Chuan University, Taipei, Taiwan. http://ndltd.ncl.edu.tw/cgi-bin/gs32/gsweb.cgi?o=dnclcdr&s=id=%22093MCU05619007%22.&searchmode=basic

Chang, Wan-Shinang (2007). A Preliminary Study of the Teaching Website Evaluation Indicators, *Journal of Living Technology Education*, 40(5),105-118.

Chang, Wu -Ting (2007). *A Study on Influence Factors upon Vocational High School Students' Study.* Unpublished master thesis. Da-Yeh University, Changhua, Taiwan. http://ndltd.ncl.edu.tw/cgi-bin/gs32/gsweb.cgi?o=dnclcdr&s=id=%22095DYU01619002%22.&searchmode=basic

Chang, Xiao-Ting (Translators) (2002). *Instructional Media and Technologies for Learning 7/E*. Taipei: Yeh Yeh Book Gallery. http://www.yehyeh.com.tw/bookchi.aspx?mode=dbView&sysid=00105445

Chen, N. S. & Lin, K. M. (2002). Factors affecting e-learning for achievement. *IEEE International Conference on Advanced Learning Technologies*, September 9-12. http://lttf.ieee.org/icalt2002/proceedings/t502_icalt148_End.pdf

Chen, Shun-Lan (2003). *E-Learner's learning motivation, learning strategy and company's knowledge- oriented culture related to the influence of its effectiveness of e-Learning.* Unpublished master thesis. National Sun Yat-sen University, Kaohsiung, Taiwan. http://ndltd.ncl.edu.tw/cgi-bin/gs32/gsweb.cgi?o=dnclcdr&s=id=%22092NSYS5007023%22.&searchmode=basic

Chuang, K. C., & Tsai, C. F.(2005).A Study of the Assessment Guidelines on E-Learning Web-sites, *2005 International Conference on E-Learning, September 24-25, 2005*, Taipei Municipal University of Education, Taipei, Taiwan.

Clark, R. E. (1985). "Evidence for Confounding in Educational Computer-Based Instruction Studies: Analyzing The Meta Analyses," *Educational Communication and Technology Journal, 33*(4).

Daigle, D. and Furner, J. M. (2004). The educational software/website effectiveness survey. *International Journal of Instructional Media, 31***(1)**, 61-77.

Hair, J. F., Anderson, R. E., Tatham, R. L., and Black,W.C.(1998). *Multivariate data analysis (5th ed.)*.Upper Saddle River, New Jersey: Prentice-Hall International.

Ho, Tsu-Feng, Chen, Jun-Rong and Chen Ming Chin (1998). A Study on the Evaluation Criteria for Network Learning Systems. *Distance Education*, **7**, 20-29. http://www.fed.cuhk.edu.hk/en/de/199800070005/0020c.htm

Hsiao, Hsien-Sheng, Tsai, Chung-Chieh, Lin, Chien-Yu and Lin, Chih-Cheng (2012). Implementing a self-regulated WebQuest learning system for Chinese elementary schools. *Australasian Journal of Educational Technology*, 28(2), 315-340. http://ascilite.org.au/ajet/ajet28/hsiao-hs.html

Huang, Fang-ming (2005).*Theory and Applications of structural equation modeling*. Taipei: Wu-Nan Book Inc. http://www.wunan.com.tw/bookdetail.asp?no=3755

Huang, Ya-ping (2000). *From the professional development of teachers to see the importance of media literacy.* Proceedings the conference on the trend 21 century teacher preparations: Reflection on teacher's professional knowledge, III51-III67. http://webpac.lib.tku.edu.tw/lib/item;jsessionid=2C31BC0844BC462FC242134FBBA7A579?id=chamo:70330&theme=tkulib

Hudspetch, D. (1997). *Testing learner outcomes in web-based instruction.* In B.H. Khan (ed.).Web-Based Instruction, 353-356. Englewood Cliffs, NJ: Educational Technology Publications.

Khan, B. H. (1998). Web-based instruction. *Educational Media International, 35*(2), 63-71.

Kiliç-Çakmak, Ebru (2010). Learning strategies and motivational factors predicting information literacy self-efficacy of e-learners. *Australasian Journal of Educational Technology,* 26(2), 192-208. http://www.ascilite.org.au/ajet/ajet26/kilik-cakmak.html

Kulik, J. A.(1985). The Importance of Outcome Studies: A Reply to Clark. *Educational Communications and Technology Journal*, 42(2), 381-386. http://web.uconn.edu/myoung/Clark.pdf

Ku, Song-Min (2002). *Effects of Goal setting, Learning Time, Learning Attitude on Online Learning Performance.* Unpublished master thesis. National Kaohsiung Normal University, Kaohsiung, Taiwan.

Laura, G. M. (1999). Evaluating net evaluators. *Searcher*, *7(2)*, 57-66.

Leidner, D. R., and Jarvenpaa, S. L.(1995). The use of information technology to enhance management school education: a theoretical view, *MIS Quarterly*, 19(3), 265–291.

Lin, Chien-Ming (2003). *An Exploratory Study of Network Collaborative Learning Performance.* Unpublished master thesis, Nanhua University, Chiayi, Taiwan.

Liang, Jia-Ling (2002). *A study of Affecting Factors on Effects of Web-Based Instructional Systems.* Unpublished master thesis, National Pingtung University of Science and Technology, Pingtung, Taiwan. http://ndltd.ncl.edu.tw/cgi-bin/gs32/gsweb.cgi?o=dnclcdr&s=id=%22090NPUST396018%22.&searchmode=basic

Li, Jian-hua (2008).*The influence of creative thinking teaching on the student learning effectiveness on web design curriculum for the data-processing department in vocational high school.* Unpublished master thesis, National Taiwan Normal University, Taipei, Taiwan. http://ndltd.ncl.edu.tw/cgi-bin/gs32/gsweb.cgi?o=dnclcdr&s=id=%22096NTNU5037054%22.&searchmode=basic

Lwo, Laurence L. S. (2004). Construction of Evaluation Criteria for Educational Websites , *Journal of Instructional Technology & Media*,68: 4-22

Marki, R. H., Maki, W. S., Patterson, M. and Whittaker, P. D.(2000). Evaluation of a Web-based Introductory Psychology Course: I. Learning and Satisfaction in On-line Versus Lecture Courses, *Behavior Research Methods, Instruments and Computers*, 32(2), 230-239.

Ouyang, Yin, and Lin, Tzy-Miao (2002). The Development of an Evaluation Instrument for Children's Learning Web Sites - A Pilot Study. *Journal of National Tainan Teachers College.* **35**, 155-179 http://db1n.sinica.edu.tw/textdb/tssci/listsrchpr.php?_op=?paperID:5749

Pan, Wen-Fu (2006). *Digital Archives integrated into the textbook in the field of Science and Life Technology*. National Digital Archives Program (94-2422-H-026-003-), Hualien :National Dong Hwa University.

Peng, Samuel S. (1995). New technology and teaching innovation .*Journal of Education Resources and Research***, 2** , 58-62. http://192.192.169.230/edu_paper/data_image/g0000219/0n2/19950128/P0000058.PDF

Schutte, J. G. (1997). Virtual Teaching in Higher Education: The New Intellectual Superhighway or Just Another Traffic Jam, California State University, CA. http:// www.csun.edu/sociology/virexp.htm.

Starr, R. M. (1997). Delivering instruction on the World Wide Web: Overview and basic design principles. *Educational Technology, 37(3)*, 7-15.

Taiwan Network Information Center (2009).*The Taiwan Broadband Internet use survey reports*. January 2009, Retrieved from http://www.twnic.net.tw/download/200307/0901all.pdf

Tu, Kuo-Shou (2005). *The Evaluation and Design of an Information Technology Education Content Based on Web in Grade 1-9 Curriculum for Elementary Schools*. Unpublished master thesis, Providence University, Taichung, Taiwan.

Wahlstedt, A. (2005). *Time and the Design of Web-Based Learning Environments*. Paper presented at the meeting of the Informing Science and Information Technology, Arizona.

Wang, J. and Chuang, K. C. K. (2003). A Study of Instructional Website Guidelines. In A. Rossett (Ed.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2003* (pp. 1244-1247). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/12116.

Wang, Bao-Jin and Wang, Li-fen(1998).A Study on the Accreditation System of NCATE and Its Implication for Our Nation's Teacher Education Program Evaluation. *Journal of Research on Elementary and Secondary Education*, 4, 1-34. http://readopac1.ncl.edu.tw/nclJournal/search/detail.jsp?sysId=0005573133&dtdId=000040&search_type=detail&la=ch

Wang, Chin-Yu, Hwang, Wu-Yuin (2002). An Exploration of Asynchronous Learning Time Styles and the Achievements. *Chinese Journal of Science Education*, 4, 389-405. http://ejournal.stpi.narl.org.tw/NSC_INDEX/KSP/search.jsp

Wang, Shu-yi (2002). *The Construction of Teachers' Teaching Effectiveness Indicators in Elementary School* .Unpublished master thesis, Taipei Municipal University of Education, Taipei, Taiwan.

Webster, J., and Hackley, P. (1997). Teaching Effectiveness in Technology-Mediated Distance Learning, *Academy of Management Journal*.40, (6), 1282-1309.

Wu, Ming-Long (2003).*The SPSS statistical Application Learning Practice- Questionnaire Analysis and Applied Statistics*. Taipei: http://findbook.tw/book/9789867845634/basic

Wu, Ying-xiao (2004). *A Study on Effects of Web-Based Learning-A case of Trigonometric Function at Senior High School Level* . Unpublished master thesis, National Kaohsiung Normal University, Kaohsiung, Taiwan. http://ndltd.ncl.edu.tw/cgi-bin/gs32/gsweb.cgi?o=dnclcdr&s=id=%22092NKNU0479037%22.&searchmode=basic

Xie, jin-Qing (1997).The Evaluation Indicators and the Weight System of School Effectiveness in Elementary Education. *Journal of National Hsin Chu Teachers College,* 11, 449-486.

Yang, Jia-xing (2000). The vision of the course of the new century: Open educational environment on the Internet. *Distance Education*, 16, 75-84

Yu, Fu-Yun, Hsieh, Meng-Da, Chen In-Gann and Lian, Ya-Ling (2007). Educational Website Evaluation: Learning Facilitating Effect versus Functionality Comprehensiveness Perspectives. *Journal of Educational Media & Library Sciences*, **44** (4), 393-412. http://joemls.dils.tku.edu.tw/detail.php?articleId=44402&lang=zh_tw

Zhang, Wan-Xiang (2007). The teaching website evaluation indicators Preliminary Study. *Living Technology Education*,**40**(5),104-118. http://ir.lib.ntnu.edu.tw/ir/retrieve/29035/ntnulib_ja_E0201_4005_104.pdf

Zou, Jing-Png et al. (2003). *Introduction to digital learning*.Retrieved from Digital Education Institute for Information Industry lecturer group .Best digital learning guidelines (page1.2-1.23),Taipei: Institute for Information Industry. http://www.iiiedu.org.tw/webnet/bookstore/Chtdetail.aspx?sku=BW19.