Effectiveness of Digital Learning in Library Use Education: A Taiwan Case Study

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The research aims to explore the viability of adopting e-learning in senior high school library use education and assess the effects of e-learning in such setting. The primary research method is qualitative analysis, with a supplementary method in quantitative analysis in evaluating students' learning, to reach the findings. Based on ADDIE Instructional System, this project designs e-learning materials and use them for the purpose of the research. The research has its subjects as 407 freshman year students from National Yuan-Li Senior High School. The data collected is used to conduct analysis comparing the learning effects between pre and post e-learning activities. Moreover, online voting results are analyzed to reach conclusions about such e-learning effectiveness.

Introduction

Senior high schools in Taiwan have been working hard in their library use education, and they each have encounters common issues relating to shortage in resources, management, information and personnel. Librarians across the board have been utilizing to the maximum the facilities available to them in hardware and software (Chih, 2002).

High-tech advancements in information processing and systems have arrived on the scene and lent themselves to help a great deal in making up the deficiencies in the traditional instructions. Connected to the Internet cyberspace, e-learning has boosted users to reach beyond their boundaries otherwise time-space restricted (Chen, 2003). E-learning not only provides instantaneousness previously unimaginable but also reduces the manpower costs in administration and other vital areas of operation. Moreover, it has the advantage of keeping track with a minimum effort the performances of the participating learners for further assessments and studies.

To enhance library use education and better manage libraries, this research aims to engage in the concepts and standards of e-learning and their adaptive materials. The following phases and objectives are undertaken to investigate the effectiveness of library use education by incorporating e-learning resources and factors into the program.

I. To select instruction units for this adapting e-learning research at high school.
II. To construct SCORM compatible e-learning materials for library use education.
III. To assess the effectiveness of such e-learning.
IV. To design learning strategies based upon the e-learning modules developed.

Design and Implementation of the Study

The locus of the study lies in the library of National Yuanli Senior High School and its users. Our main focus is to investigate the effectiveness of e-learning materials and use the findings for further adaptations and references. During the first stage of the research, two interviews are conducted. First, experts in this field are interviewed to decide the units of library use education program most appropriate for this study. Second, students are interviewed to established appropriate e-learning strategies for them.

During the second stage of the research, ADDIE systematic instruction models are used to design e-learning activities in such library use education. LMS (Learning Management System) is employed to assess the effectiveness of applying Internet in e-learning activities in library use education at high school.

Outcome and Analysis

Planned with specific goals to achieve, e-learning activities are structured for maximum effectiveness (ADL, 2004). Widely used in related professional fields, Graph I shows the process, mechanism, and flow of the systematic instruction design model this research implements for the purpose and goals intended.

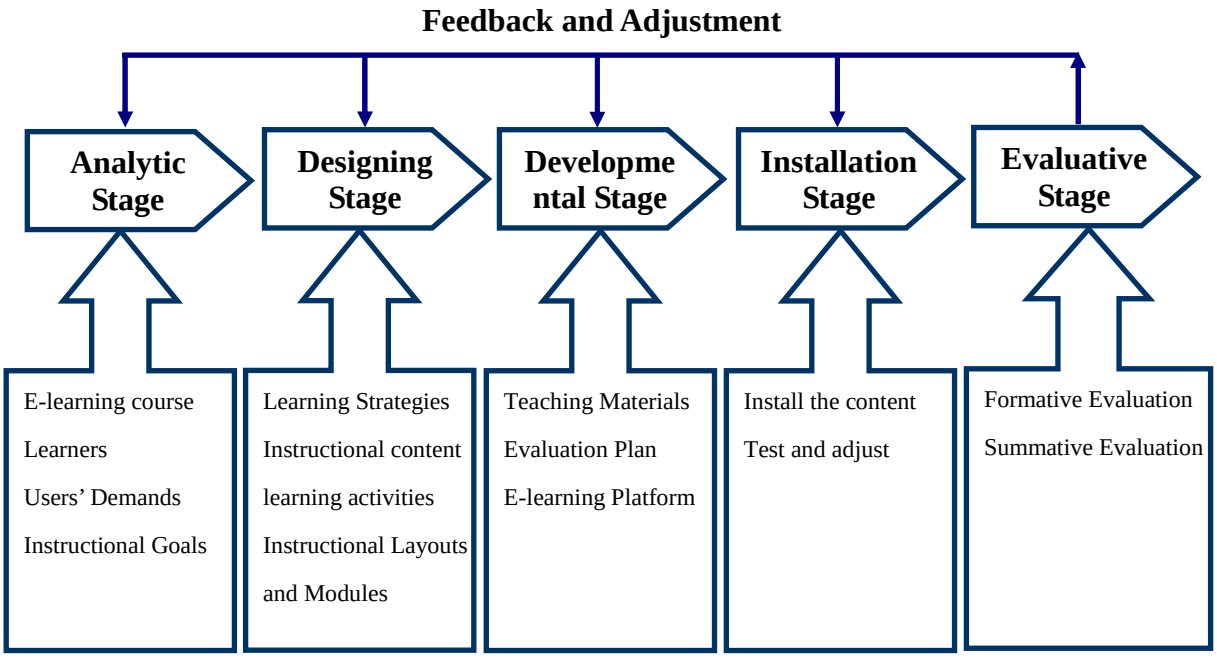


Figure1. The implemental process of the study combining systematic instruction design models

Analytic Stage

I. The Analysis of the Learners

To gather information on students' learning needs, attitudes and habits, we randomly select a student from each group of freshman year class and ask their availability for interview. A number of eight students constitute the research sample, since some students being unable to participate in the interview. Based upon the information collected regarding their backgrounds and styles, this research comes up with the learning materials and strategies most appropriate for them.

II. The Analysis of the Users' Demands

Interviews with high school freshman students result in locating the major problems they encounter in using school libraries. How to find the books they want on the open bookshelves appears to be a fundamental roadblock to their efficiency, since their previous experience school libraries, including those in junior high school, has up to the point remained rather limited. That is, library experience has not really been part of their schooling and education prior to entering senior high schools. Consequently, using senior high school libraries effectively and efficiently has now become a major challenge. This research project

comes up with a systematic instruction design unit called Seeking the World of Books, to teach them how to meet such challenge by e-learning activities.

III. The Analysis of the Instructional Goals

The following main goals have been set and incorporated into the e-learning activities of Seeking the World of Books instruction units:

1. To help students understand the history of how Chinese people collect and sort books.
2. To help students appreciate the framework Chinese apply in categorizing books.
3. To help students understand how Chinese code systematically books for shelving.
4. To help students comprehend the principles Chinese use to arrange books in order.

The Designing Stage

1. The Design of Instructional Layouts and Modules

Interface modules are crucial in making e-learning instruction units a success. Attention must be taken to meet with the characteristics and needs of the learners. Vital considerations, including web page layout and clarity of reading materials, must be given to achieve top quality visual effects for students.

Guided by interview results, this research has designed instructional web pages to meet with requirements they specified. A sample page, Graph II, illustrates the key guidelines this project uses in designing the instruction unit, such as simplicity and clarity in directions, avoiding too many and confusing colors on the same page, and using graphics and charts to enhance understanding.

Figure2. the illustration of teaching module in this study

II. Design of Learning Strategies

To enable students towards adopting best individualized learning strategies based on their characteristics and strengths, this research project designs an instruction setting to motivate students for higher interests and better effects. The following e-learning strategies are used after factoring in students' opinions, as listed in Table1.

Table1. List of e-learning strategies

Items	Contents
Cognitive strategies	1. Highlight the key words or terms. 2. Provide a glossary for important terms. 3. Send e-mails for questions and answers. 4. Establish the function of courses and procedures for surfing off line to use the materials. 5. Organize the map of knowledge and construct a tree framework showing connections and sequences in courseworks.
Meta-cognitive strategies	1. Clearly present the learning goal of the course. 2. Supply a device of repetitive learning and record the learning progress of the learners. 3. Self-pace the speed and path of learning. 4. Ongoing feedback for students to modify learning approaches.
Information management strategy	1. Customize the module of learning layout to promote students' learning interests. 2. Timing each teaching unit to last no more than 30 minutes. 3. Learning takes place during regular class sessions and, if necessary, extra sessions. 4. Provide chat room for interactions seeking support and assistance. 5. Supply guided, connected, and systematic learning types, etc. 6. Provide clear mapping functions on the learning website and clarify navigation rules for surfing. 7. Install relevant Internet resources to expand the sphere of learning.

III. Design of instructional content

This stage of research concentrates on designing instruction in a framework that would guide students step by step to advance from the simple units to the more complicated. Units are designed integrating objectives relating to cognitive domain, affective domain, and psychomotor domain, to present materials in proper learning orders.

The following teaching units have emerged after considering the content, scope, extent of coverage, and order of courses.

1. The History of Books.
2. The Structure of Books
3. The Identities of Books.
4. The Home for Books.

IV. Design of learning activities

Five steps are included in the e-learning activities, as shown inFigure3. This is to facilitate students in their learning process, to gather testing outcomes, and to collect feedback surveys.

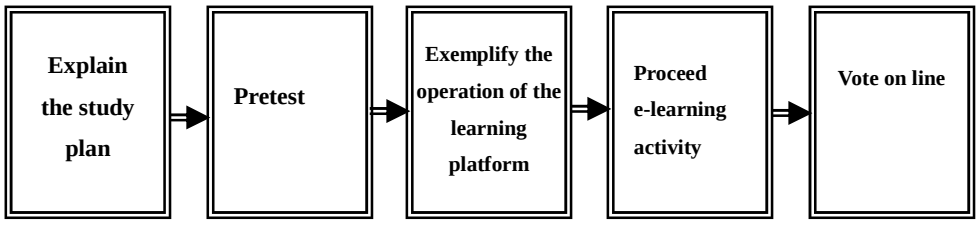


Figure3. the design of the learning activity in this study

The students are first provided with explanatory notes regarding what this e-learning project aims at and how it is conducted. Then the e-learning management platform established at school network is introduced. The e-learning course would then lead students into the library use education program. Both a pretest and a post-test are taken to assess the effectiveness of the e-learning project. Finally, the students are asked to vote online about their appreciation of this e-learning program to educate them for library use.

The Developmental Stage

I. Developing Teaching Materials

The teaching materials are designed in accordance to the characteristics of learners previously analyzed. This research project gradually sets up the entire teaching materials on the learning platform.

II. Setting Up the E-learning Platform

ATutor has been developed in the PHP language. The integrated suite of Apache + MySQL + PHP has been applied, to correspond to the Microsoft Windows platform as well as LINUX operating system. Therefore, students can pick their preferred options to use the instruction units.

Moreover, ATutor follows the protocols of WEB-BASE control devices, making it convenient to install and operate. Detailed online illustration is provided for installing software. Other features ATutor enjoys include update functions and a large virtual community for discussion and maintenance. Such tool is vital to this research project.

III. Developing the Evaluation Plan

The evaluation plan this research project has conducted includes two measurements, testing and online voting, to collect data for analysis regarding the success of this study.

A. Testing

The effect of learning activities can be assessed by the degree of correlation of pre-testa and post-test. A set of forty items of multiple choice questions is first compiled for a pretest administered to forty randomly selected students. Based upon the pretest results, corrections and re-arrangement are made on those question items. Items are retained for post-test if they meet the standard of 20-80% difficulty index or 0.2 discrimination index, while other items are excluded. After such screening, a total of 32 items is used for formal tests.

B. Online Voting

Students are asked to give their feedback by sharing their opinions about this e-learning activity. With 21 questions, the opinion survey, by way of voting, covers three major categories: students learning status, their motivations and strategies, and learning effects and interests. Table2. below lists those 21 questions used in the opinion survey.

Table2. List of questions for on-line voting

Types	Order of question	Questions
Students' Information Behavioral status	1	Do you have the information network system to connect to the Internet ?
	2	How often do you use the Internet?
	3	How much time do you usually spend on the Internet for each use?
	4	Have you had the experience of using the Internet to do e-learning before?
	5	Do you think that our information network environment nation wide is ready for e-learning?
Learning motivation and strategies	6	Do you sense a need to use resources from the school library in your senior high school years?
	7	Do the library user education courses help you to use the library resources?
	8	Does this e-learning activity help you to use the library resources?
	9	Do you think this e-learning course design use helpful wordings?
	10	Do you think this course have top quality layout?
	11	Do you think this course design have top quality graphic teaching materials?
	12	Have the teaching design of this e-learning satisfied your learning demands?
	13	Has the teaching content of this e-learning measured up to your learning demands?
	14	Is the design of this e-learning activity fitting to your learning demands?
Learning Effects and Interests	15	Has this e-learning course help you fully understand the history of Chinese books?
	16	Has this e-learning course help you understand the framework of a book?
	17	Has this e-learning course help you understand the meaning of Chinese book classification?
	18	Has this e-learning course help you understand the way of displaying books in the library?
	19	Has the course by way of the e-learning activity promoted your learning interest?
	20	Has the course by way of the e-learning activity improved the effects of your learning?
	21	If there is another e-learning program, will you be interested to participate?

The Installation Stage

After uploading the teaching materials to the host computer, we pack those SCORM 1.2 user friendly courses, expecting that those courses would be compatible with other

platforms and that learners can use the materials offline in imported formats. While ATutor has only interface to compress courses, it does not provide the metadata compiling function. Therefore, it needs to rely on other programs such as Reload, LRN, and Scormtool, to execute the e-learning compiling in conformation to the standard of LOM 1.0 as specified in IEEE PI484.12(CETIS, 2004).

The Evaluative Stage

I. Formative Evaluation

A. User Evaluation

Six sophomore students were interviewed to find out their opinions about the following content of the teaching materials used in this study: verbal statements, layout in colors, word sizes, and locations of graphs, the length of the course. Based upon the findings, the teaching materials were modified. Regarding messy computer codes, we went through a series of problem shooting and debugging glitches, to make programs running as smoothly as possible for students' use.

B. Expert Evaluation

This research study invited an advisor professor to provide evaluation regarding the e-learning course content and suggest possible further studies. Two advisory sessions have yielded constructive suggestions and consequent modifications.

The results gathered from pretests and posttests and from feedback form the basis of the summative evaluation to follow.

II. Summative Evaluation

Summative evaluation is decisive in this research project as it is used to determine the effectiveness of the e-learning courses used by comparing the answers between pretest and posttest questions. From the 32 items of multiple choice questions the data are gathered for such comparative summative evaluation. As shown in Chart IV statistical analysis, a distinctive growth has taken place in students' learning tracks and capabilities, as follows.

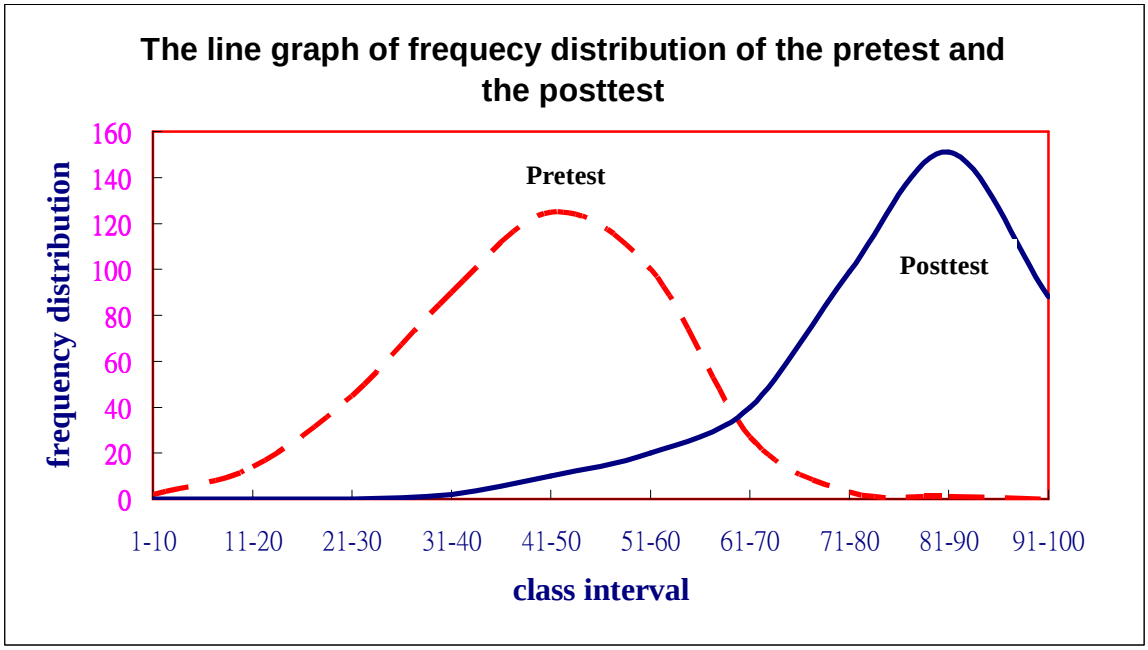
A brief list of pre-test results and posttest results

	N	Max	Min	M	SD

Analysis of pretest results	407	87	0	42.33	12.55
Analysis of posttest results	407	100	37	80.49	12.86

Statistics of equidistant frequency distribution

Class interval of results	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	*91-100*
Frequency of pretest	2	14	45	90	125	100	27	3	1	*0*
Frequency of posttest	0	0	0	0	9	20	40	99	151	88



The line graph of frequency distribution of the pretests and posttests

As shown above in the result analysis of students' improvement over pretest-posttest comparison, the increase from 42.33 to 80.49 in average is significant, an addition of 38.16, at 90% jump over the entry score. Students' knowledge, confidence level and ability to use library resources have been remarkably boosted up.

Ⅲ.Analyzing the Results of the On-line Questionnaire

To measure the research subjects' satisfaction, they were asked to participate in an online questionnaire. 334 of 407 students responded, and, after excluding incomplete data, 311 copies of valid questionnaire were obtained for analysis and evaluation.

1. Analyzing the Current Status of Information Behavior

90% of the freshman year students in the National Yuanli Senior High School indicate that they have access to the internet. And they go online more than once a week and spend at least thirty minutes online in each use. Therefore, e-learning courses, with its 30 minutes units, can be carried out with certainty that they are easily accessible to the students.

55% of the research subjects indicate that they have online e-learning experience. This shows that much room exists for e-learning to grow among them. To facilitate such growth is the sense that the e-learning environment nation wide is ready for the public to use. A joint accomplishment by the government and the industry sectors, this accessible e-learning environment puts the nation in a position to move forward with more advanced programs.

2. Learning Motivation and Strategy Analysis

More than 92% of the research subjects indicate that they need to be assisted by school libraries in their studies; 95% of them express that the library user education program is helpful to them; 80-87% are satisfied with the e-learning course regarding its content in word, art, and layout, in comparison to a relatively small percent of them dissatisfied; 93% affirm that this e-learning course makes it easier for them to use library resources.

Therefore, the learning strategies designed and implemented appear to be effective. Overall, this study has shown its positive significance and value for further advanced research to carry on.

3. Learning Effectiveness and Interests

Statistical analysis shows that the learners hold a high degree of affirmation and satisfaction towards e-learning programs this research project used. Their opinions are sorted as follows:

1. 91% of the students polled strongly or agree that this e-learning course helps them fully understand the history of how Chinese people collect and sort books. Only 1% of them disagree.
2. 91% of the students polled strongly agree or agree that this e-learning course helps them understand the framework of Chinese books; only 4% of them disagree.
3. 90% of them strongly agree or agree that it helps them fully understand the forms and methods library uses to classify books.
4. 91% of them strongly agree or agree that it helps them fully understand the principles used to arrange and display Chinese books.

The e-learning activities used in this research study has yielded positive and enforcing

merits in stimulating motivation, making improvement in achievement, and providing a setting for initiative learning, as supported in the statistics as follows:

1. 74% of the learners strongly agree or agree that online e-learning activities are able to promote students' learning interests, while only 13% of them disagree.
2. 83% of the learners strongly agree or agree that online e-learning activities uses in this study improve students' learning effects. Only 6% of them disagree.
3. 81% of the learners strongly agree or agree that online e-learning activities used in this study attract them and build up their interest for learning. Only 8% of them disagree of strongly disagree.

Conclusions and Suggestions

Part I: Conclusions

1. Senior high school students in Taiwan usually feel the need to use school libraries.
2, Senior high schools are to implement library user education program to meet with students' demands.
3. The information network nation wide is sufficient to carry out the e-learning activities involved with library user education.
4. The library use education program conducted in e-learning helps to building up students' learning interests and effects to higher levels.
5. The e-learning strategies designed in this research study can help answer to students' e-learning needs.
6. The library user education implemented in e-learning mode exhibits positive impacts on student's learning.

Part II: Suggestions and Recommendations

1. Senior high schools in Taiwan should continue with their e-learning courses.
2. E-learning for library user education should be upgraded to conform to international standards.
3. Senior high and vocational schools should act together to move e-learning forward.
4. E-learning activities should be extended to cover other subject matters.
5. Senior high school libraries are to be transformed into e-learning centers for local communities.

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