

The Study of E-Learning for Geographic Information Curriculum in Higher Education

TING-SHENG WENG¹, HUNG CHIEH LIN²

¹Department of Management Information Systems
National Chiayi University
580 Sinmin Rd., Chiayi City 600
TAIWAN

²Department of Information Management
National Formosa University
No.64, Wunhua Rd., Huwei Township, Yunlin County 632
TAIWAN

Abstract: The e-Learning has the main characteristics of learning anywhere and anytime. It can construct an independent and individualized learning environment and break through the restrictions of the conventional learning. Geographic information e-Learning Website has been built for high school with open source Course Management System. Based on the standard of SCORM, courses have been designed with collaborative learning, Critical Thinking Instruction and Activity theories and multimedia applications through built-in modules of Course Management System. By using the SCORM-compliant environment in Course Management System, the SCORM-compliant materials can operate smoothly. Learning packages manufactured for restrictive specifications can also input to implement and use with other SCORM compliant environment. It is a cost-effective and quickly teaching pattern for sharing and reusing educational resource and proceeding e-Learning with integrating SCORM standard and open source software. The purpose of study is constructing Geographic information e-Learning Website to assist geographic information education and promote students' learning achievement with interactive environment and attractive multimedia learning materials.

Key-Words: e-Learning, SCORM, Course Management System, Geographic information Education

1 Introduction

The rapid development of internet network has already deeply influenced the life styles of people and the methods of handling affairs in e-era. The Information technology becomes closely linked with activities of daily livings. People acquire different network information and diversity and multiplicity e-Living with the rapidly advance of information and communication technology. According the report of Taiwan Network Information Center, the number of people access the Internet in Taiwan has risen 864 million in 2001 to 1537 million on July 31, 2006 [1]. Fig.1 shows the population of using broadband network in Taiwan. It reveals that people rely on Internet to get information. Besides, people use multimedia widely causes knowledge to store forward multiplicity and learning mode also to change gradually. Student can learn through surfing on the Internet. E-Learning is an innovative, and convenient learning mode and students can acquire their suitable learning courses through Internet.

Under the circumstances, e-Learning not only brings conventional education quite change to the novel education form, but lets students cross the obstacles of space-time to break through the hedge between school and realistic society. In the information explosion century, e-Learning is an education mode which indeed put into practice worthily.

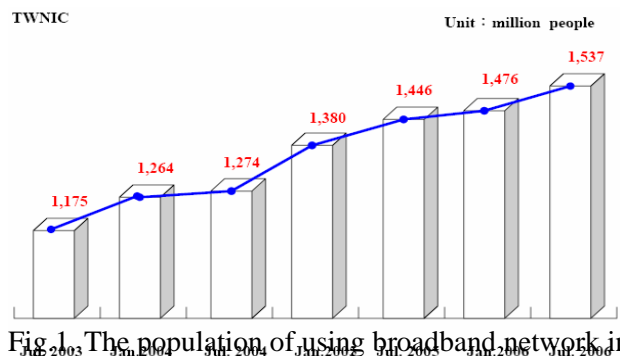


Fig 1. The population of using broadband network in Taiwan [1].

The study focuses on Geographic information in higher education and implements e-Learning website

which integrates Geographic information system (GIS) and other technologies to assist teaching. By using open software Course Management System (CMS), Moodle, the study expects to achieve the target of collaborative learning and the effect of e-Learning. GIS is an auxiliary tool which is able to storing, processing, applying, displaying the numerical Geographic information. It has been widespread applied. The study considers that students must understand the basic concept of GIS in depth before GIS applying. Therefore, the study pays attention to instruct the basic concept of GIS and make use of the technologies to transform boring textbook into interesting learning materials. The triad of this research is following. First, implementing geographic information e-Learning Website to proceed e-Learning and designing courses and learning materials with SCORM standard. Second, introducing collaboration learning mode with virtual communities and increasing the interaction among teacher, students and e-Learning Website. Finally, analyzing the student's learning path and offering suitable feedback by teacher.

2 Literature review

In this chapter, we will focus on the literature about the study. First, discuss on the development of GIS and education. Second, compare e-Learning with conventional learning. Third, illustrate the related study about open source e-Learning platform. Final, introduce the purpose and contents of SCORM standard.

2.1 GIS and GIS education

With science and technology developing, people get unheard tools and methods to solve the questions which chiefly relate to position and distribution of space. GIS will become valuable to apply. GIS combines traditional map with abundant information and computer with powerful processing ability. It can be applied to activities of daily livings and works of space decision-making. The technology and architecture of GIS have great change recently. It combines Global Positioning System, Remote Sensing, 3D, mobile equipment, Web and other information technologies to promote government organizations, educational institution and enterprise building GIS Website themselves. It also applies to personal electronic guiding system with PDA and GPS, indeed, to Location Based Service with livable, instantaneous and mobile. Undeniably, the application of GIS is closely linked our living. U.S.

Department of Labor aims industry development and manpower between 2002 and 2012 to forecast and point out that three new and developing specialized fields are Biotechnology, Nanometer and Geographic information technology [2]. It shows the significance and value of GIS in the future exceedingly.

On the other hand, the use of GIS for education has become more and more widespread. GIS is a tool that has been applied to different subjects which include natural science, social science, literature and other knowledge fields. It helps students easily discover with different subjects knowledge and mutual relations by spatial viewpoint. In addition, ACADEMIA Sinica Computing Centre integrated humanities, history, natural resources, cultural background and other aspects to apply on the Web GIS, it not only reserves enormous and valuable cultural heritage but offers scholar related information to retrieve and search.

The e-Learning Website adopted GIS to assist in teaching and learning activities becomes more and important. The famous e-Learning Website, GLOBE, in America is a successful case. GLOBE collects the environmental data all over the world and builds up a completed globe environmental database. It displays the results in form of maps. In Taiwan, National Science Council proposes the National Digital Archives Program (NDAP) which builds nation digitalize archives by digitizing important cultural relics of country sponsored. The division of NDAP, Digital Museum Plan, makes use of GIS to combine the enormous data about cultural and Geographic information. For example, The World of Xuanzang and Silk Road, Taiwan Memory Digital Photo Museum, and other Digital Museum [2].

The common characteristics of these e-Learning Websites are displaying the data with location and offering learner to enquire related attributive data with spatial location. For example, we can select a location on the topic map and click the button first. The topic map will show the picture, snack information, hotel information and other about the location chosen by your click. The planning document of nature ecological e-Learning Website and history and culture e-Learning Website among six e-Learning Websites of the Ministry of Education also brought GIS into e-Learning Website specifically in droves. It reveals that GIS plays an important role in education.

2.2 Conventional learning and e-Learning

With the rapidly advance of information and communication technology, e-Learning provides online learning environment which allows to everyone with mobile equipments anytime and

anywhere. It brings conventional learning into a novel status, breaks through the restrictions of the conventional learning and constructs an independent and individualized learning environment [3]. Teachers may be replaced for time or space. Students can carry out interactive learning activities with self-discipline through CMS. In accordance with the relation between e-Learning and conventional learning, conventional learning is a teacher-centered mode. Teacher and students must teach and learn at the same time and place. Students obtain knowledge passive. On the contrary, e-Learning is a student-centered mode. Teacher guides students to learn, emphasis group action, virtual and collaboration community. Students must learn active. Although e-Learning have been implemented for a period of time in internal educational institutions, it is not all perfect. It lacks a sense of reality and interaction among teacher, classmates and dynamical learning environment. E-Learning is a high threshold, which must be implemented with stable learning platform and abundant multimedia digital learning materials. It is an encumbrance for teacher. Nevertheless, the development of e-Learning is proceeding rapidly by information technology and Internet. The e-Learning standard, SCORM, will be noticed and e-Learning CMS can be used popularly. It improves above mentioned drawbacks by degrees. Undeniably, the development of e-Learning is getting more and more important at present.

2.3 Open source software and e-Learning platform

Open Source Software extends from free software. In middle 1980, Richard M. Stallman established Free Software Foundation and considered free software should be property for whole earth. There were three characters for free software, including using, altering and transmitting source codes permissively.

There are greater than half of Information technology manager in America high school consider that open source were getting more and more important in their school in term of the report investigated by Campus Computing Project in 2004 [3]. Abel, R. J. (2006) indicated that there were 57% high schools in America using open source software such as Apache, Linux, MySQL, Firefox and others. It reveals educational institution attach great importance to open source software [4].

CMS offers educators an environment to set up a course online and provides interactive functions. The significant part in CMS is educators can collect the opinions, suggestions, learning paths and other data made by learners. It is beneficial for educators to

understand the learners' learning condition. Before implementing the CMS, the study consults many open source CMSs and thinks over many requirements such as more activity modules, multinational language and other essential functions. Finally, the study uses Moodle CMS. Moodle is the abbreviation of Modular Object Oriented Dynamic Learning Environment. The latest Moodle is 1.7 version released on November in 2006. The reasons which the research adopted Moodle CMS are following:

- The rate of utilization of Moodle CMS is the first over the world. There are 169 countries and 19533 Websites adopted to practice e-Learning. In Taiwan, there are 345 Moodle e-Learning Websites [5].
- The learning concept is composing of collaborative learning, Critical Thinking Instruction and Activity theory. It is well suited to learners proceeded independent learning or collaborative learning.
- It can operate SCORM-compliant learning package.
- It can provide the capability of analyzing the learning paths data or files of learners.

In the study, we consider that open source software is easy modifying and lower cost to implement Moodle CMS. Moodle can do what conventional learning cannot do like educators can control the valid date to deliver data and information automatically for students, store up every record with time or content of course discussion and learning paths. Moodle can satisfy your requirements through using different module and authoring tool. In a word, source software CMS have already been unavoidable trend in the e-Learning domain.

2.4 The SCORM specification

The Department of Defense (DoD) and the White House Office of Science and Technology Policy (OSTP) proposes the Sharable Content Object Reference Model (SCORM) in the Advanced Distributed Learning (ADL) Initiative. The SCORM specifications are a composite of several specification developed by international standards organizations, including the IEEE, IMS, AICC and ARIADNE. The mission of the ADL Initiative is to provide access to the highest quality education and tailored to individual needs, delivered cost-effectively anytime and anywhere. The ADL Initiative aims to accelerate large-scale development of dynamic and cost-effective learning software and systems. As a foundation for accomplishing those goals, ADL's SCORM aims to foster creation of reusable learning content and sharable framework.

The SCORM-compliant courses had the main characters of accessibility, adaptability, affordability, durability, interoperability, reusability [6].

3 The purposes of study

This study aims to integrate information technology into Geographic information teaching and learning, construct Geographic information learning Website with Moodle CMS. The study hopes to attract students' attention to devote much time for learning tasks in Geographic Information Curriculum. With applying information technology and diverse learning modules, the study develops SCORM-compliant learning resources to use and reuse on any SCORM-compliant CMS. The study hopes students can control and adjust him learning steps autonomic, teacher can trace the students' learning status with learning path to analyze students' mistakes and learning style and give feedback in accordance with individual learning requirements to promote students' learning achievement significant.

4 Implementing CMS and designing learning materials

4.1 The functions of CMS

CMS is an e-Learning platform in charge of integrating learners and learning resources. The study adopts Moodle CMS to construct Geographic information Website. Fig.2 shows system administrator, teachers and students use Moodle through Web Browser to access user data, course content or learning recording data stored by MySQL Database with their limits of authority.

The system functions include system management module, learning management module and activity module. Teacher can assign the course contents and upload learning materials to be used by students. Teacher can divide students into groups and students can talk each other in forum. On the part of learning achievement, teachers can control students' learning status about learning pace, grade or the date of finishing learning activities with students' learning paths which records completely by Moodle. On the other hand, teachers can use scales to rate or grade forum, assignments, quizzes, lessons of student's works and analyze the learning style of different students. The learning styles embrace collaboration learning type, independent learning type and eclectic learning type. After learning unit, teacher can utilize quizzes to test students' learning

achievement and give learning guides in accordance with students' mistakes. In a word, quizzes can help students practice repeatedly. Teachers can understand the students' learning status and offer suitable feedback to promote students' learning achievement.

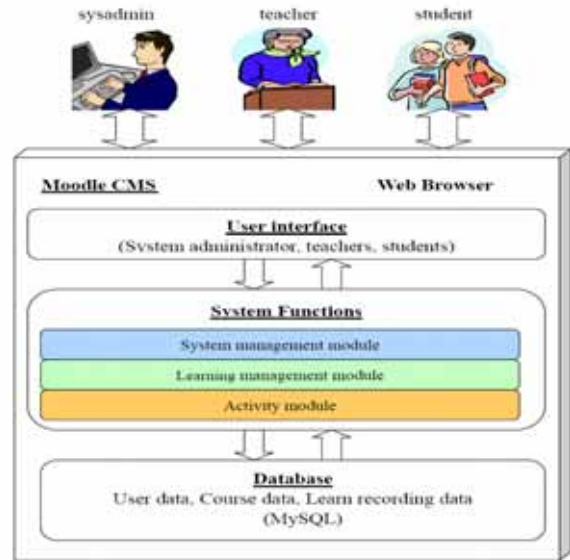


Fig.2. The model of Moodle CMS in the study.

4.2 The designing of learning materials

The study integrates information and educational technology into make learning materials, includes Macromedia Captivate, Stream Author, ESRI ArcView8 and UrMap electronic interactive map.

- Macromedia Captivate manufactures for multimedia learning materials. It will transcribe all actions on the screen automatic and set up FLASH imitation immediately. Stream Author combines image, voice and PowerPoint to transcribe learning materials with video and exactly the same in the class. After multimedia learning materials manufactured, it will be exported in package form and conformed SCORM standard. It can operate on the SCORM-compliant e-Learning platform.
- The study makes use of ESRI ArcView8 to manufacture digital map. Arc View provides the spatial information tool contained query, manage and analyze functions. The study attaches importance to integrate map, chart, form and multimedia to manufacture digital map, geographic link with attached data and render students different perception for geographic learning resources.
- The study applies UrMap API from OleMap to manufacture topical and interactive GIS map which embraced tourist spots, downtown living, local culture of Huwei in county of Yulin and

regard as local education materials in Geographic information local education.

5 Result

The study adopts Moodle CMS to construct Geographic information e-Learning Website. The teaching courses in Website displayed diversely, includes PowerPoint, streaming media, online testing, hyperlink with hidden data and other multimedia resources. In addition, the proposed Website provides forum, survey and other activities to interact with students. This chapter will show the interface of Moodle Geographic information e-Learning Website including system administrator, teacher and student.

5.1 System administrator interface

Fig.3 shows system administrator can manage Moodle Geographic information e-Learning Website with variables, site setting, theme, module management and other settings through system administrator interface.



Fig.3. System administrator interface

5.2 Teacher interface

After logging in the Website, teacher can start edited mode to design teaching courses. See in Fig.4. The form of teaching courses in the Website includes online resource and activity. Teacher can devise the content of teaching courses and interact with students through these online resources and activities.



Fig.4. Teacher interface

5.3 Student interface

Student also logs in first, and all learning resources, activities and other functions which student can exercise designated by system administrator and teacher. Student can learn automatic and proceed to learn by his steps with abundant learning resources through student interface, see in Fig.5.



Fig.5. Student interface

5.4 The presentation of learning materials

Fig.6 is a learning material example made by using Stream Author. It can integrate PowerPoint, voice and learning path into a streaming video. PowerPoint part demonstrates course content which must be prepared in advance. Teachers can explain the contents with Stream Author which can transcribe throughout the process automatically. Learning path offers students a self-determined learning environment. Students can control their learning paces and turn round to learn again that they feel confused.



Fig.6. Learning material example 1

Fig.7 is a learning material example made by using Arc view. The learning material shows the distribution of male and female populations of each Township in Yulin. We combine the map of Yulin with population of each Township to a graph through Arc view. We elect the Yulin map first and input the population data into attributive table of the map. Fig.8 is an attributive table that shows the data about the population of men and women of each Township.



Fig.7. Learning material example2

FID	Shape*	TOWNNAME	people	man	woman	英文名
0	Polygon	麥寮鄉	32666	17641	15225	Mailsao Township
1	Polygon	二崙鄉	31338	16827	14511	Edua Township
2	Polygon	崙背鄉	28478	15144	13334	Lunbei Township
3	Polygon	西螺鎮	49607	25393	24214	Siluo Township
4	Polygon	新港鎮	31402	16522	14880	Chikang Township
5	Polygon	林內鄉	20670	10824	9846	Linnai Township
6	Polygon	台西鄉	28196	15189	13007	Taihsi Township
7	Polygon	斗六市	104485	53144	51341	Douliou City
8	Polygon	土庫鎮	31477	16567	14910	Tuku Township
9	Polygon	虎尾鎮	66597	35255	33342	Hwei Township
10	Polygon	褒忠鄉	15186	8131	7055	Baohong Township
11	Polygon	東勢鄉	18222	9904	8318	Dongshih Township
12	Polygon	斗南鎮	48256	24601	23655	Dounan Township
13	Polygon	古坑鎮	35354	18719	16635	Gukang Township
14	Polygon	元長鄉	30797	16794	14063	Yuanchang Township
15	Polygon	大埤鄉	22276	11905	10371	Dabi Township
16	Polygon	口湖鄉	32113	17224	14889	Kouhu Township
17	Polygon	北港鎮	45048	23985	21063	Beigang Township
18	Polygon	水林鄉	30510	16758	13752	Shulin Township
19	Polygon	四湖鄉	28418	15742	12676	Sihu Township

Fig.8. The attributes of the population

6 Conclusion

The target of study is constructing CMS applied in Geographic information education to promote students' learning achievement by way of Website setting, programming, learning materials manufacturing. Geographic information e-Learning Website not only contains general functions owned by common e-Learning Website, but integrates electronic map which the most popular online at present. In part of learning materials, the basic concept content of GIS in textbook and geographic data will be redesigned interactive by multimedia authoring tool and ArcView. This chapter pays attention to the result and further development of the research to expect to offer related reference resources for e-Learning, Open Source applied, Geographic information education and other related research.

6.1 Leading in Open Source Software is a trend in developing system in the future.

Open Source Software can supply economical and

speedy system Implementation with extended Web community. It has more powerful supporters to cause to implement and modify rapid with customization. Based on the LAMP forming, it is not neglected for change brought for Web service.

6.2 The powerful and various functions is greatly competitive advantage in Moodle

After implementing and comparing with CMS, the study believes Moodle is the most powerful CMS at present. There are many practical and integrated teaching tools and interactive environment that commercial software not competed with. The best competitive advantages in Moodle are lower cost and open source. For high school or college wants to construct e-Learning platform is a feasible solving scheme.

6.3 Integrating information technology into geographic information education

Making use of GIS into education is a prevalent teaching pattern. It is a tendency that educators linked up with GIS to assist teaching, collected data and appeared geographic information in map and Web GIS interactive environment. The study combines theory and application in geographic information subject and performed multimedia authoring tool with streaming and screen capture to edit basic GIS concept in textbook. Beside, it provides local learning materials with geographic information of county of Yulin by UrMap.

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