國立中正大學
資訊工程研究所
博士論文

擬真遠距學習模式分析及系統設計

System Analysis and Design of Virtual Reality Model for Distance Learning

研 究 生 ：蘇明祥
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摘要

本研究旨在探討擬真遠距學習模式及系統的設計。本研究進行了三個研究實驗來研究這個課題:(1)即時課程錄影及線上同步廣播系統在遠距教學上之應用，本系統結合了 Windows Media Services 的技術和搭配 Moodle 學習管理平台應用在遠距教學上，讓學習者能透過本系統學習錄影課程或是即時觀看遠端教室的授課內容。透過錄影課程，讓學習者能反覆的觀看授課內容，增加對授課內容之理解與記憶。(2) 利用視訊會議技術於遠距互動學習，旨在利用視訊會議技術讓教導者與學習者能透過此系統，進行遠距互動輔助學習。此研究主要藉由多媒體學習，探討老師在授課中非語言成分的行為是否能增加學習效果的方法。其中非語言的行為包含了老師的眼神與肢體行為的表現。而研究的結果發現在課程錄影畫面中增加老師非語言成分的行為對於學生的學習有顯著的結果。(3) 建構線上讀書會結合社群網站系統，透過小組學習，以提高學生的閱讀能力和學習成效。學生可以在線上與小組成員立即分享閱讀的經驗，或是與其他學生透過社群網站進行知識交流。此研究透過問卷施測方式發現，利用線上讀書會結合社群網站系統不但可以增加學生閱讀的技巧，也能增進團隊合作的默契。

本研究希望藉由上述三個研究實驗去模擬真實教學環境，讓學習者可以在任何地點都能進行學習，也可透過互動視訊會議平台，去和指導者探討學習過程中之疑惑，最後利用多媒體教材設計系統，重整所學的知識，在語意的表達和內在知識的轉換中建立出一套屬於自己本身的長期記憶（long-term memory)，讓知識經過重整的活動真正吸收而達到學習目的。

System Analysis and Design of Virtual Reality Model for Distance Learning

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Abstract

The purposes of this thesis are to explore the system analysis and design of Virtual Reality Model for distance learning. The study conducted three experiments to study the issue: (a) e-Broadcasting system with application in distant learning. The system is proposed to combine the technique of Windows Media Services with Moodle in order to apply in distance learning for learners to learn pre-recorded course or watch the live teaching content of remote classroom; and further, it is increased the understanding and memory of the content in class by watching repeatedly. (b) The primary goal in this experiment was to find out a method to increasing the effect of multimedia learning in the classroom. The nonverbal components of teacher in the classroom were the instrumentality in this experiment to accompany with multimedia. The video capturing device captured the image of teacher especially in teacher's facial expression and eye-contact as the nonverbal components transformed in multimedia signal. The system integrated the signals including learning content and teachers' image and projected in the large classroom for every student in the lecture class. The outcome of this study reflected the significant progress in students' achievement as compared to lecture class with PowerPoint only. (c) The experiment proposes an online reading system that incorporates group study, called the OGS system, to enhance student reading ability and learning effectiveness. With the OGS system, a student can immediately share the experience of reading e-books with other group study students. Students can also use an online social network for the exchange of knowledge with other students. Teachers can provide guidance before students read or during the reading process.

After the conclusion of group study, teachers and students can review their portfolios during this online social network meeting to discover deficiencies in their activities. The results revealed that the OGS system is helpful to students in terms of reading skills, cooperative learning, and friendship.

This research hopes to imitate the true teaching environment with three experiments described above and enable learners to study in any place. With the platform of video conference, students and teacher probe into the doubt in the learning process. Utilized system that the multimedia teaching material is designed finally, students can restructure the knowledge they learned and achieve the purpose of studying.

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Chapter 1 Introduction

E-Learning has become more and more popular due to rapid development of Internet and multimedia. A number of studies have demonstrated how e-Learning influences today's education (Davies, J., & Graff, M. 2005) (Naeve, A., Lytras, M., Nejdl, W., Balacheff, N., & Hardin, J., 2006). Wentling et al. (Wentling, T. L., Waight, C., Gallaher, J., La Fleur, J., Wang, C., & Kanfer, A., 2000) suggested that "e-Learning is the acquisition and use of knowledge distributed and facilitated primarily by electronic means". By computer network, learners can access e-Learning content everywhere without location or time obstacle. Teachers can also design content-rich courses through various multimedia applications.

The Open Course Ware (OCW) project of Massachusetts Institute of Technology (MIT) (Richards, 2001; Carson, & Margulies, 2004; Abelson, 2008; Lerman, Miyagawa, & Margulies, 2008) has opened a new trend for asynchronous learning via the internet in recent years. The MIT OCW project aims to share knowledge and makes the educational materials to be learned by people all over the world via internet. Educators around the world may share the content design of their courses and improve them through collaboration (Freschi & Calvo, 2006). In the world, many other universities, such as University of Tokyo, Tufts, Utah State University, and National Tsing Hua University, began to focus on the promotion of open courses and made the production of various types of digital teaching material available freely with the world via the internet. The MIT OCW publishes and updates courses at a rate of about 200 courses per year to be available on line (Lerman, Miyagawa, & Margulies, 2008). From OCW's extensive, ongoing evaluation process, they have learned that about 16 percent of OCW visitors are educators, 32 percent students, and 49 percent self-learners. Some 96 percent of educators say that OCW has helped them (or will) improve their teaching or their courses. Among all visitors, 98 percent say OCW has a positive impact (Lerman, Miyagawa, & Margulies, 2008).

The advent of MIT OCW has drawn a vision of one asynchronous e-Learning type that could become popular in the future. Some studies start to explore the effectiveness and phenomenon related to the OCWs (Freschi & Calvo, 2006; Baldi, Heier, & Stanzick, 2002; Materu, 2004; Yue, Yang, Ding, & Chen, 2004). Instructional videos, one of the multimedia learning materials, are important for facilitating in-depth learning in a student (Mayer, 2001; Mayer, 2008). With the fast enhancement of technology, the influence of an OCW can be expected to be more and more significant. Recently, a variety of software can be used to create e-Learning materials, such as Adobe Presenter, Adobe Captivate, Articulate Presenter, PowerCam, Camtasia Studio, etc. However, their design procedure is tedious and takes much system resource. In addition, although an OCW provides a convenient way for people to learn materials ubiquitously, the quality of the learning materials cannot be satisfied. How to quickly create high-quality materials and increase the learning effectiveness has become a very important subject (Baldi, Heier, & Stanzick, 2002; Choudary & Liu, 2007).

Based on the fast improvement on portable vehicles such as smart phones and reading devices, we can imagine that the idea of the OCWs will play an essential role in ubiquitous learning (Jones & Jo, 2004; Chen, Chang, Shen, Wang, Chang, & Shih, 2010; Ahn & Park, 2009; Yang, Chen, Wang, & Liu, 2008) via internet in the future. Lots of the courses of the MIT OCW provide raw video stream on the internet, so the recording quality of these courses is not good enough for learners, particularly for teenagers. Therefore, it is necessary to have an easily and friendly used system to manufacture high quality courses for the ubiquitous learning in the future. In addition, the e-Learning, as we known, includes synchronous and asynchronous learning, so a system with the functions is necessary as well.

To this end, we address a directable and designable course recording system, namely Directable Signage System (DSS), which can achieve the goals. The “signage” in the manuscript means that a teacher can broadcast the teaching situation modularized by several display objects in real time or broadcast by a media server on the internet after the class. There are five modules developed in DSS, including instruction design, video/text mixing, display, recording, and broadcasting and the directable modules. There are four main advantages of the proposed DSS. First, the courses recorded through the DSS do not need enormous post-processing. In addition, the recording course can be broadcasted on the internet intermediately. Second, a variety of media such as slide, word processor and video files can be integrated into a screen. Third, to capture the teacher’s front face in a better view, the DSS allows more than two DVs and the DVs can be swapped smoothly by the hot swapping control function built in DSS. Fourth, the teacher can layout the desired screen of a course and, more importantly, the designed layout is reusable for next or another course.

Teachers act nonverbal behavior to encourage students' effective learning that implicated a positive relationship between students' performance and the teachers' effective nonverbal behavior (Chaudhry & Arif, 2012). The teachers' gesture, gaze, voice tone and the expression of enthusiasm as nonverbal behaviors during instruction that shows significant connection to pupil achievement (Klinzing & Gerada-Aloisio, 2004; White & Gardner, 2011). This study adopts the value of teacher's nonverbal behavior in the classroom to discover the effect when enhanced with multimedia mechanism support.

Teachers advance to teach with multimedia content in order to engage active learning for students in a large class, due to the extensively benefit of multimedia in the classroom (Erwin & Rieppi, 1999). However, the multimedia-enabled computer and peripherals in the classroom could promote students' multisensory experiences (Eskicioglu & Kopec, 2003). There is no significant progress in students' learning performance when learning activity underlies with the multimedia (Bartlett & Strough, 2003; Pippert & Moore, 1999). How to increasing learning achievement become a critical issue in the research field of multimedia learning. Therefore, we introduce a new perspective of multimedia application in the classroom with the emphasis of teacher's nonverbal behavior in order to discover the effectiveness of learning in lecture classes.

The most common way in the modern classroom learning is to recompose lecture material into multimedia format and project with digital presentation device. During presentation, teachers always accompany these "rich content" with learning activity. The students' achievement is still not obviously significant by presenting multimedia slides (Susskind, 2005). To solve the same problem on learning achievement, we developed a computer support system to integrate multimedia slides and teacher's nonverbal presentation on the same screen. In the system, the digital recording device captures teacher's nonverbal behavior especially on the facial expression as nonverbal cue to students. Although social cue such as teacher's image may be taken into consideration when designing multimedia material, the empirical research mentioned the on-screen image of teacher could not produce improvement on learning (RE, 2005). To discover the positive effect of teacher's image, we had built an integration system which could combine and organize the teaching material and teacher’s image. With the integration output, teacher's image as one of nonverbal behavior could be easily noticed by students in large lecture classroom. Consequently, the system is capable of multimedia integration and organization which contributes students' learning achievement.

The habit of reading is one of the primary factors affecting students’ learning. A successful reading experience can aid students in becoming active learners with positive attitudes toward learning. Therefore, providing effective reading instruction to support students promotes their reading comprehension and has always been a crucial concern for teachers and researchers (Stevens, 1995; Torgesen, 1999).

Since the rapid development of network technology, online learning has received a lot of attention (Lin, Huang, & Cheng, 2010; Lin, Lin, & Huang, 2011), in which students’ online reading behavior has increasingly become an area of empirical and theoretical exploration for researchers (O’Hara & Sellen, 1997; Liu, 2005). E-books are beginning to replace print textbooks in schools. An increasing volume of our daily reading involves reading screens or the use of some version of electronic reading tablet or mobile technology rather than textbooks (Huang, 2012; Huang, 2012; Huang, 2011).

Researchers have agreed that reading behaviors with regard to digital texts and print texts are different. Moreover, not only is screen reading distinctly different from print reading but, in general, our reading modes and habits are changing because of steadily increasing exposure to digital texts (Birkerts, 1994; Bolter, 1999; Wu, 2011).

Scholars have noted that there are four important factors that affect students’ reading motivation (Gambrell, 1996). First, the more a student approaches books, the higher his motivation to read is. Second, when a student has the right to choose his own books, he possesses higher reading motivation. Third, if a student listens to more related stories, he has more interest in reading related books. Fourth, if a student can communicate with others, exchange viewpoints and receive the affirmation of others during the reading process, he possesses higher reading motivation.

Chapter 2 Background

2.1 Streaming Media System Technology

In this section, we divide into some parts to describe streaming media system and related technologies. We introduce the streaming media system based on Windows Media technologies which e-Broadcasting system having used parts of them. Finally, we compare these systems, Windows Media-based streaming media system and e-Broadcasting system.

2.1.1 Streaming Media System Architecture

To support the streaming paradigm, servers and the network must guarantee the continuous display of the SM object without disruptions (i.e., hiccups) (Dashti, Kim, Shahabi, & Zimmermann, 2003). Figure 2.1 depicts the architecture of streaming media system.

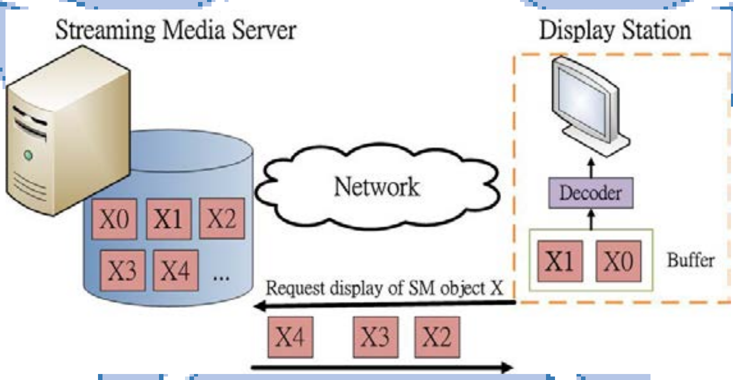


Figure 2.1 The Architecture of Streaming Media System

While a use requests to display a SM object which is stored at streaming media server, the data blocks are retrieved from the server to the client for display through network. At this moment, the data blocks are processed as soon as they are received by the client without waiting for download. Moreover, these blocks are not written to the storage at the client side and it does not reduce the problem of copyright violations.

2.1.2 Streaming Media Protocols

Streaming media protocols include TCP, UDP, HTTP and RTSP. UDP is generally favored because of its less complicated architecture and TCP loses valuable resources through steady communication between client and server (Tobias Kunkel, 2003). We use HTTP to stream content through firewalls or across networks because it is the majority of firewalls and is supported as well as recognized by all of the networks. Unfortunately, HTTP has no mechanisms to control the bit stream from server to client. Thus, another technology is used and it is the Real Time Streaming Protocol (RTSP). RTSP is quite similar to HTTP in syntax and operation, but different to HTTP in that it provides a direct control of the bit stream (Tobias Kunkel, 2003).

2.1.3 Types of Streaming Media Content

The content of streaming media is divided into two types, live and on-demand. Figure 2.2 describes the live and on-demand streaming.

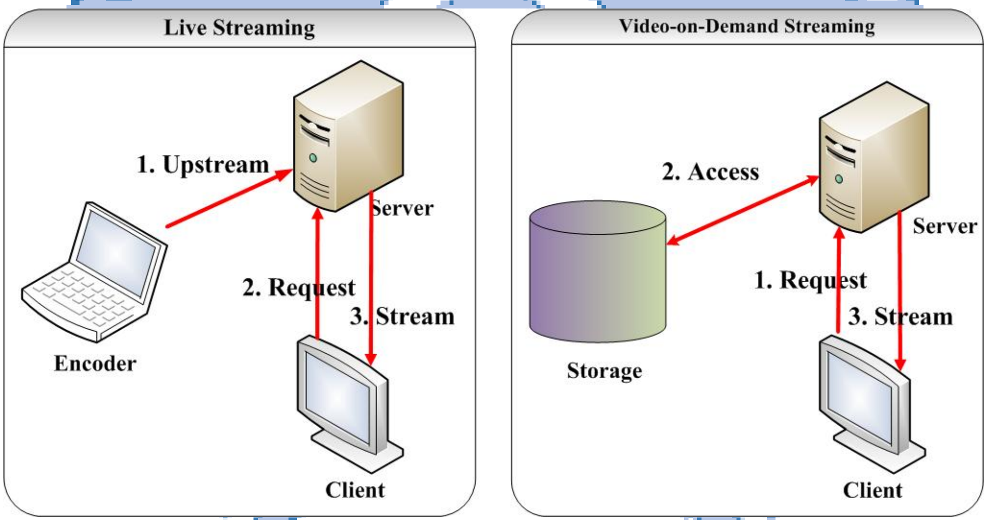


Figure 2.2 The Live and Video-on-Demand Streaming

- **Live Streaming**

  In the type of live streaming, server does not store any file. Streaming is generated by an encoder and the encoder sends the signal which belongs to audio or video to the server in real time. When the server receives the signal from an encoder, it forwards the signal to client after client's requesting.

- **Video-on-Demand Streaming**

The term Video-on-Demand (VoD) is widely used for systems that allow one to watch a certain video content at any point in time via communication systems such as cable TV, satellite or the Internet (Michael Zink, 2005). Furthermore, the user can control the streaming, like jumping to any position and operating similar to those offered by a VCR. The user can operate functions such as fast-forward, fast-rewind or pause.

2.1.4 System Based on Windows Media Technologies

In this section, we divided into three parts to make a description of streaming media system based on Windows Media technologies. First, we illustrate what additional protocol Windows Media technologies have. And then we show the differences between delivering stream in a unicast way and in a multicast way.

- **Windows Media Technologies protocols**

Figure 2.3 shows the needed protocols of Windows Media Technologies (Tobias Kunkel, 2003).

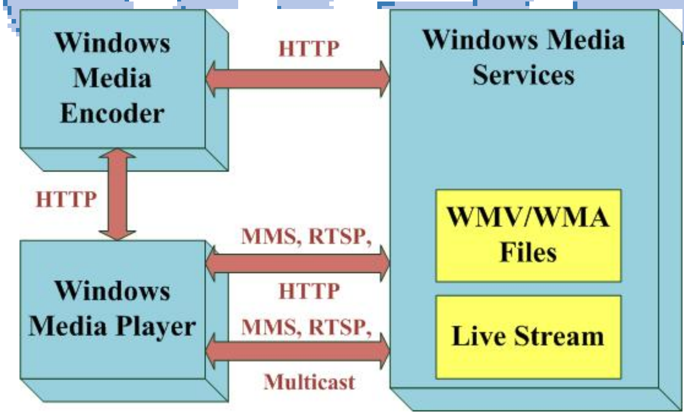


Figure 2.3 Windows Media Technologies Protocols

In addition to the protocols that are mentioned in section 2.1.2, there is an additional protocol named MMS in Windows Media technologies protocols. MMS is abbreviated from Microsoft Media Server protocol. It is just like RTSP and is used to transmit data packet and control commands from server to client. Moreover, MMS is the default method to connect from server to client in the Windows Media Unicast Service.

- **Delivering Content as a Unicast Stream**

A unicast stream is a one-to-one connection between the server and a client, which means that each client receives a distinct stream and only those clients that request the stream receive it (David Nelson, 2007). Figure 2.4 shows the scenario of delivering content as a unicast stream and using the type of video-on-demand.

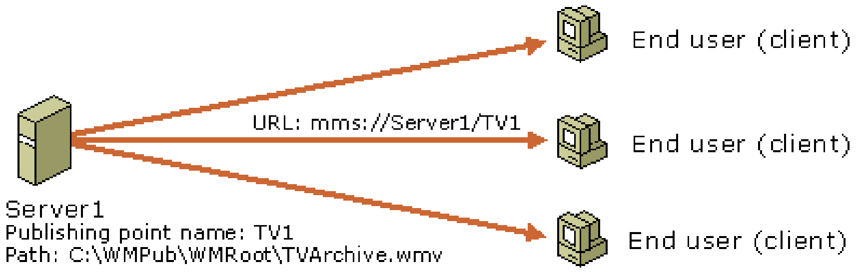


Figure 2.4 Delivering Content as a Unicast Stream (David Nelson, 2007)

From Figure 2.4 we can understand that there is a video-on-demand publishing point named TV1 which is stored in the Windows Media Server named Server1. While starting streaming, we can give users the URL to the content. Every user has a unique connection to Server1 because we deliver the content as a unicast stream.

- **Delivering Content as a Multicast Stream**

A multicast streaming is a one-to-many connection between the media server and the client. With a multicast stream, the server streams to a multicast IP address on the network, and clients receive the stream by subscribing to the IP address. No matter how many users receive the stream, there is only one stream from the server. Therefore, all users receive the same stream. It can preserve the bandwidth if using a multicast stream.

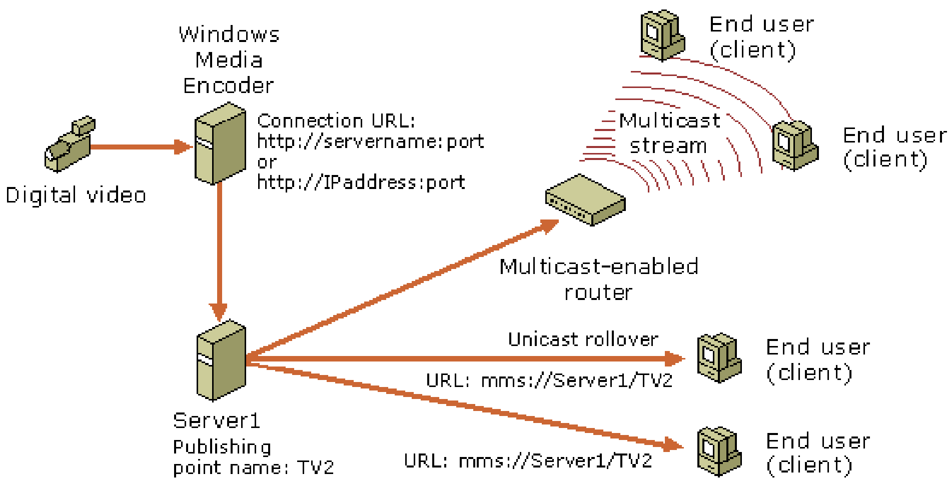


Figure 2.5 Delivering Content as a Multicast Stream (David Nelson, 2007)

First, retrieve the live image from the digital video. Second, encode the live image and forward it to the Windows Media server through HTTP. And then on the Windows Media Server named Server1 uses the Add Publishing Point Wizard to create a publishing point that source from the encoder. Subsequently, we can choose to deliver as a unicast stream or a multicast stream.

2.1.5 Comparison

Comparing to the streaming media system based on Windows Media technologies, e-Broadcasting system has a major advantage. It is that the e-Broadcasting system can retrieve an integrated signal from more than one video and audio device. In contrast with e-Broadcasting system, the Windows Media-based streaming media system has fewer applications. Thus the e-Broadcasting system can be extended to a variety of applications such as interaction mode and presentation mode in teaching.

2.2 Moodle

Moodle is an open-source learning management system (LMS). A learning management system (LMS) is a software system used to deliver on-line education (Chavan, 2004). The word Moodle is an acronym. Its full name is Modular Object-Oriented Dynamic Learning Environment. It is useful for education scholars and programmers. It is also a verb that describes the process of lazily meandering through something, doing things as it occurs to you to do them, an enjoyable tinkering that often leads to insight and creativity. The creator of Moodle is Martin Dougiamas. He is a WebCT administrator at Curtin University, Australia and has graduate degrees in Computer Science and Education.

- **Characteristics of Moodle**

According to the thought in a book (Ou, Z. C, 2006), there are some characteristics of Moodle listed below.

- Moodle stresses the security. All forms are sent after the procedures of confirmation, information verification and cookies encryption.
- Courses can be classified and searched. A Moodle website in theory can create thousands of courses as long as the computer's CPU is strong enough and memory is large enough.
- We can use Moodle to teach online fully or supply information for teaching. Moodle has a high degree of flexibility.
- Moodle has a function that is the full record of user activities. And it uses graphics to display the curve of activity reports of each student in every module. It detects the IP address which belongs to the computer student logging in last, the number of reading and the articles as well as diaries posted on the website.
- Moodle supports batch upload of students' personal information. It greatly reduced the burden on teachers.
- Moodle has functions of built-in course backup and built-in course restored. Considerate of the actual demand for teachers.
- The best of all is that there are many groups discussing related subjects about the courses of Moodle on its official website when we start using Moodle. We can find a way to solve problems or ask questions. There are often experts from various countries to help you answer questions

- **Requirements of Moodle**

Although the process of installing Moodle is straightforward and we can download several installer packages from the website, there are some requirements before the successful installation of Moodle. Moodle is written in PHP and store its data in a database. Therefore, it needs a database and a web server. MySQL is the most appropriate database for Moodle and Apache is used as the web server. Before installing Moodle users must complete the installations PHP and database to turn your computer into a functional web server platform (José M. Ferreira and António M. Cardoso, 2005). Figure 2.6 shows the successful installation of Moodle.

Figure 2.6 Moodle Website Screenshot with IE

- **Structure of Moodle Directory/File**

Table 2.1 describes the structure of Moodle directories or files. It helps developer to construct their instructional platform.

Table 2.1 The Structure of Moodle Directory/File

Directory/File	Description
admin/	Code to manage the whole server
auth/	Plugin modules to certificate website users.
blocks/	Plugin modules for managing the little blocks on webpage.
calendar/	Code to manage and show calendar..
course/	Code to display and manage courses.
doc/	Documentation for the use of Moodle.
files/	Code to display and manage upload files.
lang/	Texts with different languages and directories include every language.
lib/	Libraries of Moodle core code.
login/	Code to manage logins and produce accounts.
mod/	In here are all the main course modules.
pix/	Generate the charts of the website.
theme/	Change the look of the website. There are fourteen theme packages in advance.
user/	Code to display and manage users of the website.
config.php	Contains various basic settings. This file does not come with Moodle and you will create it in the process of installation.
install.php	This file is used to install Moodle website and create related settings of config.php.
version.php	Define current version of Moodle code.
index.php	The homepage of Moodle website.

2.3 Synchronous and Asynchronous e-Learning

Synchronous e-Learning, commonly supported by media such as video conferencing and chat, has the potential to support e-learners in the development of learning communities. Learners and teachers experience synchronous e-Learning as more social and avoid frustration by asking and answering questions in real time.

Asynchronous e-Learning is a student-centered teaching method that uses online learning resources to facilitate information sharing outside the constraints of time and place among a network of people (Mayadas, 1997). Asynchronous learning is based on constructivist theory, a student-centered approach that emphasizes the importance of peer-to-peer interactions (Wu, 2008). This approach combines self-study with asynchronous interactions to promote learning, and it can be used to facilitate learning in traditional on-campus education, distance education, and continuing education. This combined network of learners and the electronic network in which they communicate are referred to as an asynchronous learning network (Mayadas, 1997)

The online learning resources used to support asynchronous learning include email, electronic mailing lists, threaded conferencing systems, online discussion boards, wikis, and blogs. Course management systems such as Blackboard, WebCT, Moodle, and Sakai, have been developed to support online interaction, allowing users to organize discussions, post and reply to messages, and upload and access multimedia (Bourne, 1998). These asynchronous forms of communication are sometimes supplemented with synchronous components, including text and voice chat, telephone conversations, videoconferencing, and even meetings in virtual spaces such as Second Life, where discussions can be facilitated among groups of students (Bourne, 1998).

2.4 Nonverbal Factors in Classroom

Teacher's nonverbal behavior has proved to be more effective than verbal behavior in classroom learning (McCroskey, Richmond, & McCroskey, 2006; White & Gardner, 2011). The nonverbal components were more salient than verbal components in classroom communication (Keith, Tornatzky, & Pettigrew, 1974). Nonverbal behavior of teachers in the classroom could be classified into tone of voice, face expressions, eye contact, gestures and posture (Chaudhry & Arif, 2012). This study focused on the effect of eye-contact and face expression for raising students' learning performance. We capture teacher's image includes teacher's eye-contact and facial expression and broadcast around the classroom by the advantage of multimedia. White and Gardner (2011) had mentioned teacher's nonverbal behavior such as look round the classroom was originally from the "social facilitation" effect and "social loafing" effect (Harkins, 1987). Social facilitation effect implies the presence of teacher as a facilitator in influencing student's learning. Students could simply notice or observe the teacher's eye-contact and facial expression accompany with teacher presence in the classroom. Since classroom communication through eye-contact could assist the classroom management, promote students' motivation and prevent disciplinary problems (Hodge, 1971), the effect of eye-contact of the teacher is extremely difficult to be noticed for all students in the large classroom. With the limitation of large classroom, teacher's image such as eye-contact or facial expression becomes hard to recognize no matter when the teacher presence in the classroom. Therefore, visualize teacher's image to all students in the classroom had become the primary concept in this system design.

2.5 The Power of Multimedia in Classroom Learning

Multimedia learning theory, proposed by Mayer (2005), defines the principles in designing multimedia instructions to assist students construct mental representation with pictures and words so that students could result deeper learning (Mayer, 2005). The multimedia learning theory grounded on the cognitive theory which implicates the process of students to construct the mental representation with words and pictures. Three approaches to consist the cognitive theory of multimedia learning: dual channel of information processing, the limitation of memory capacity and actively processing useful information (Mayer, 2005). The cognitive load theory, a concept to use memory capacity efficiently, provided a framework in multimedia instruction design (Sweller, 2005). This study focused on the approach of cognitive load theory due to the concept to reduce cognitive load. Four major effects concerned in cognitive load theory: split-attention effect, modality effect, redundancy effect and expertise reverse effect; the influence of these effects should be taken into consideration during multimedia learning. Although the teaching and learning processes in lecture class with multimedia supported is significantly different in multimedia instruction with self-learning, the presentation of material ought to be the same. Modality effect, when presenting visual material with narration, could also analog to the classroom lecture with multimedia presentation when teacher's voice as the narration and the PowerPoint slides as the visual material. Split-Attention effect, which could be avoided in presenting text and picture simultaneously, could also occur in the classroom when the text and the picture were not strongly related in visual effect.

The major goal of multimedia instruction is to reduce cognitive load and increasing working memory with integration picture and text in one source (Koroghlanian & Klein, 2004). Animation would be a suitable solution in integration with picture and text. Therefore, we applied the concept of animation in multimedia presentation to utilize the teacher's captured image as an animation effect in the lecture class. The evidence of multimedia in supporting classroom learning outperforms traditional lecture learning (Hallett & Faria, 2006) encourages us to design image capture and presentation function as a multimedia source to enhance learning.

2.6 The Principle to Present Multimedia in Classroom

PowerPoint slides presented the learning material in the classroom so that encouraged students in active learning. The formal studies proved the benefits of PowerPoint sidles such as self-efficacy of taking note in classroom (Sugahara & Boland, 2006; Susskind, 2005), favorable impression with graphic presentation (Apperson, Laws, & Scepansky, 2006), perceived novelty of the teaching material (Burke & James, 2008) and retention in visual information (Savoy, Proctor, & Salvendy, 2009).

Teaching with PowerPoint slides had become the popular instruction method in lecture class with the advantage of which allows the instructor to present text and image in a straightforward way, especially the integration outcome in performing video and audio content during classroom learning(Hardin, 2007). The main purpose to present multimedia in the classroom is to enhance the effectiveness of classroom learning. Hence, the organized material could provide "widely" vision and structural information to students when use multimedia as lecture introduction tool to present teaching material in the classroom.

We adapted this concept in designing a computer system for classroom lecture and thought PowerPoint as one of the sources during classroom learning. The other multimedia sources to be applied in the classroom such as video or animation maybe plugged in PowerPoint slides or play independently. Different multimedia sources produced the same effect in enhancing classroom learning. The formal research proved that related video in the classroom could be a helpful introductory to novice learners and to increasing retention, comprehension, and understanding and deeper learning (Berk, 2009). The useful sources in the classroom should be well prepared in order to produce maximum effect. We adopted the ideal of "well-preparation" to design multimedia supporting system for classroom learning and propose the mechanism of "organizable" sources management in the system.

2.7 Mastery Learning

Mastery learning is an effective way to make learners reach higher learning levels under the appropriate conditions (Bloom, 1982). Its proponents argue that all students can reach high levels of mastery of instructional material with the right support. Bloom (1968) stated that well organized teaching materials and effective management of a student's learning process are two factors that help individuals achieve successful mastery. According to Bloom (1976) and others (Block & Burns, 1976; Fuchs, Fuchs, & Tindal, 1986), mastery learning can be accomplished by following specific procedures. The first step is to divide the concepts and materials into relatively small and sequential learning units. Each unit is associated with concrete learning objectives, and the structure is organized by partitioning difficult content into several smaller units that are easier to grasp. After teaching each unit, the instructor conducts a formative assessment to determine whether the learners have reached the desired level or not; the assessment also provides students with feedback on their learning (Yang & Liu, 2006). The learners who have not mastered the unit begin a process of remedial activities or corrections to assist them in achieving this goal. This learning process is shown in Figure 2.7. Mastery learning is a suitable approach to use with students due to their weak discipline in self-directed learning settings.

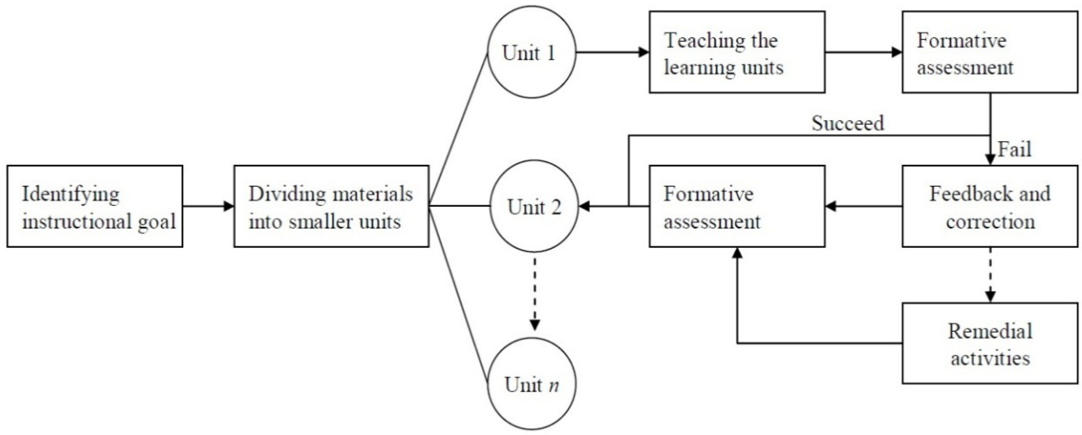


Figure 2.7 The Strategy for Mastery Learning

2.8 Group Study

One of the most important features of group study techniques is that students work for a common purpose in small groups, helping one another to learn (Açıkgöz, 1992). According to Sharan (Sharan, 1980), whether groups gather data about the topics discussed and researched by cooperating, whether studies that are conducted individually are combined to contribute to group study, and whether solutions that have been obtained are discussed and commented and then revealed as a product are in question. Currently, these questions can be answered because of developments in online social networks.

In the constructivist approach, students positively contribute to achieve sharing, discussion, promotion, expression, and questioning during group study. Learning in a group is crucial if all students are to realize cooperative and peer learning. Groups are created for students possessing different talents, necessities and learning styles, and students continue working in these groups. It is apparent that all of the members in a group have more opportunities to interact with one another in a positive manner and share materials, data and abilities. The members of a group should be responsible for something and contribute to the group with regard to the subjects of study. Teachers can act as coordinators, helpers, and supporters when necessary (Cooper, 1990; Faust, 1998). To some degree, group study and cooperative learning have many similarities.

2.9 Knowledge Sharing

Knowledge sharing is an importance aspect of groups; it can enable groups to develop skills, increase value, and sustain their competitive advantage (Grant, 1996; Kogut, 1992). The ability to share knowledge between units contributes significantly to the organizational performance of a group. Performance can be enhanced when people communicate information, best practices, lessons, experiences, and insights, as well as common and uncommon sense facts (Von Krogh, 2002). Groups are increasingly utilizing interdisciplinary organizational structures in which members share knowledge and expertise within and between groups to cope with complex tasks or studies (Cummings, 2004).

What causes individuals to effectively share knowledge with others in groups constitutes a core question (Chowdhury, 2005; Wasko, 2005; Mooradian, 2006).

Interpersonal trust is regarded as one factor in peoples' decisions to share knowledge. Prior studies have discovered that trust affects workplace attitudes, behaviors and performance (Golembiewski, 1975; Mayer, 1995; Jones, 1998; Dirks, 2001). A trusting relationship leads to greater knowledge exchange (Dirks, 2001). Interpersonal knowledge sharing and learning are more likely to occur within trusting relationships (Dodgson, 1993).

2.10 Community of Practice and Learning Communities

Henri's and Pudelko's framework, aligned with the concept of communities of practice, was chosen for use in understanding and analyzing learning activities and identity construction in online communities (Henri, 2003). Henri and Pudelko created a typology for these communities by examining discussion forums, chats, and websites as virtual social gathering spaces. They proposed that social communities depend on two variables: (a) the strength of the social bond and (b) the gathering's intentionality. The latter is defined as "the groups'" intentionality, which expresses the more or less marked will to create a strong social bond and to undertake an activity with a learning goal.

Although learning communities use participation in practice as a manner of learning (Barab, 2000), communities of practice create learning from real practice in working contexts and operate in similar conditions. According to Wenger (1998), a community of practice is created around three fundamental elements: (a) shared understanding, which is continually renegotiated by its members, (b) mutual engagement, which brings members together into a cohesive group, and (c) a shared repertoire of common resources, which is the result of a shared practice (e.g., vocabulary, artifacts, and procedures). The body of knowledge, representations, and methods used by the community in its practice aid its members in developing shared knowledge, responding to disagreement, and managing conflict (Henri, 2003; Barab, 2000; Wenger, 1998).

In summary, the literature on online education informs us that changes in pedagogical and organizational practice are required, and such changes may best be viewed as changes in interacting and nested ecologies, including those of departments, distance education graduate programs, and online courses. Furthermore, the literature recommends that online graduate education include group work involving authentic projects that relates to students' interests; group work in an online environment may be more problematic although it has the potential to increase the support for individual learners and the development of a community of practice. Finally, Henri and Pudelko have provided a useful framework for understanding activity in online communities, which are part of the evolution of the ecologies analyzed in this paper in terms of types of communities (Henri, 2003).

Chapter 3 Research Architecture

3.1 A Directable and Designable Course Recording System

3.1.1 System Architecture of DSS

The DSS aims to enhance the convenience and quality of a course recording system. We will introduce the design principles of the DSS in detail in this section. Figure 2 demonstrates the framework of the DSS. The design principles of DSS are grounded on the results of (He, 2000; Baecker, 2003; Zhang, 2008), and the authors' experimental experiences. These design principles are described below (He, 2000; Baecker, 2003; Zhang, 2008).

- The system is passive. We would like the speaker to behave normally during the talk, thus we do not impose any restrictions on him or her. The only device the speaker needs to wear is a wireless clip-on microphone.
- The system has no pre- or post-production. For instance, we do not require the speaker to give us their slides/transparencies for pre-processing. After the presentation, no post-production such as slide integration is needed. The lecture is immediately available for on-demand viewing.
- The system captures synchronized high resolution visual aids. Such synchronization is done on-the-fly during the lecture. Both the live and the on-demand viewer can watch them synchronously with the audio/video stream of the lecture.
- The system allows the remote clients to view the lecture at their own pace. Students can view the lecture at home or in any place.

The DSS allows teachers using multimedia materials to construct teaching situations as they need and recording the courses as synchronous and asynchronous learning materials via internet. The architecture and five modules of DSS are introduced in the following.

As shown in Figure 3.1, we separate the framework into local and network areas. In the local area, signals from teacher's notebook (or desktop) and the DVs are grabbed and integrated in the director's notebook (or desktop), and the signals can be transformed to the projectors or monitors in the local area, or to the media server in the network area.

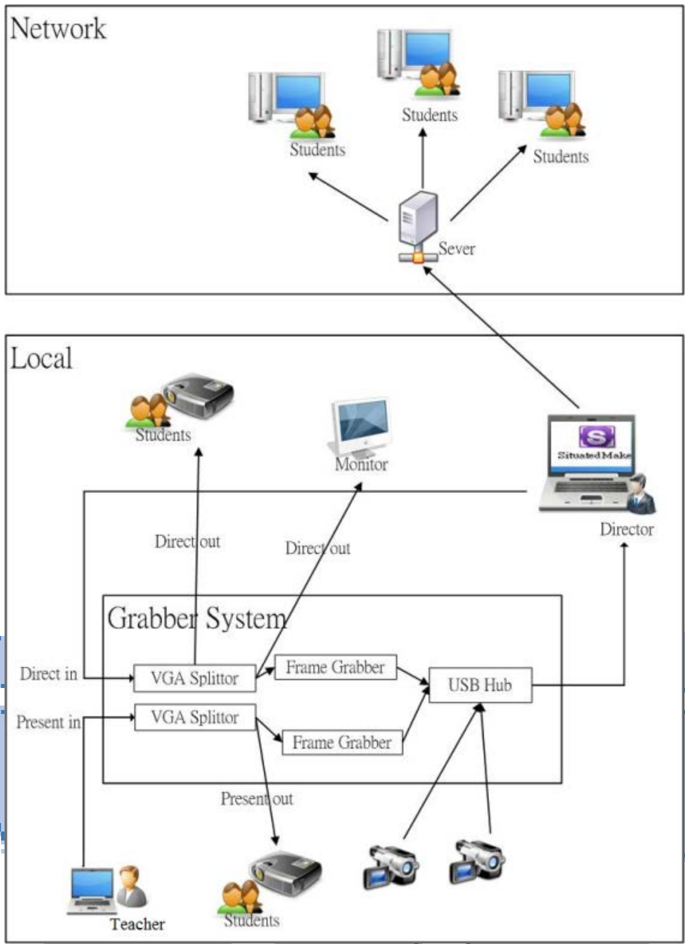


Figure 3.1 Architecture of the DSS

3.1.2 Situational Design Module

The situational design module of DSS is used for teachers to arrange a teaching situation, in which a variety of multimedia formats are supported. The variety of multimedia formats and the corresponding functions are described in Table 3.1.

Table 3.1 The Function Description of Multimedia Formats

Multimedia type	Icon	Function description
Text Box Card		This card is used to input words on edit area. It can be used as notes.
Word File Card		This card is used to load a Word document. The types of Word 2003 and Word 2007 are supported.
PowerPoint File Card		This card is used to load a PowerPoint file. The types of PowerPoint 2003 and PowerPoint 2007 are supported.
Flash File Card		This car is used to play an animation file for increasing the richness of the course content. The SWF file is supported.
Multimedia Player Card		This car is used to play motion pictures.
Internet Browser Card		This car is used to include resources on the internet for providing students with more learning materials.
DV Card		This car is used to grab the signal of a DV or a computer.
Sideshow Card		This car is used to choose images to play in sequence.
Marquee Card		This car is used to display Marquee.
Clock Card		This car is used to display the current time.

The place that these multimedia cards docked is called the tool palette, and the left and right places under the tool palette are called “Teaching situation thumbnail” and “Teaching situation layout”, respectively. Teachers can layout the components and the corresponding attribute dialog boxes directly in the Teaching situation layout area. Figure 3.2 illustrates the usage of PPT card which includes three steps: Step 1) Press the PPT card in the toolbar. Step 2) Drag and drop the PPT card on Teaching situation layout area. Step 3) Load the PowerPoint file from the hard drive. Teachers can use the cards to design various teaching situations. Figure 3.3 illustrates two different teaching situations. One situation uses a PowerPoint file as the main screen and the other uses the recording course as the main screen. Then we can activate the process of teaching situation in the Display module.

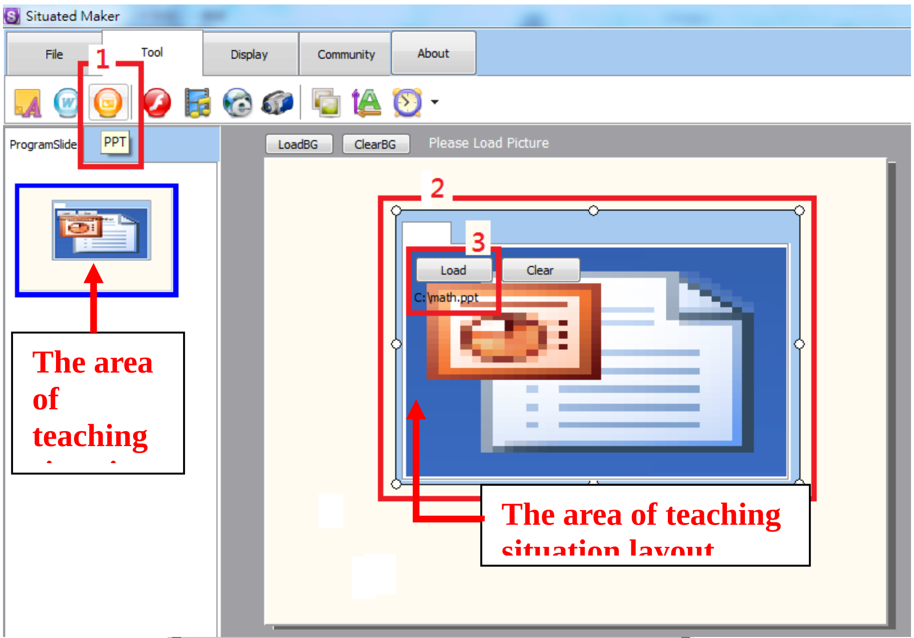


Figure 3.2 Steps to the Multimedia Format Operations

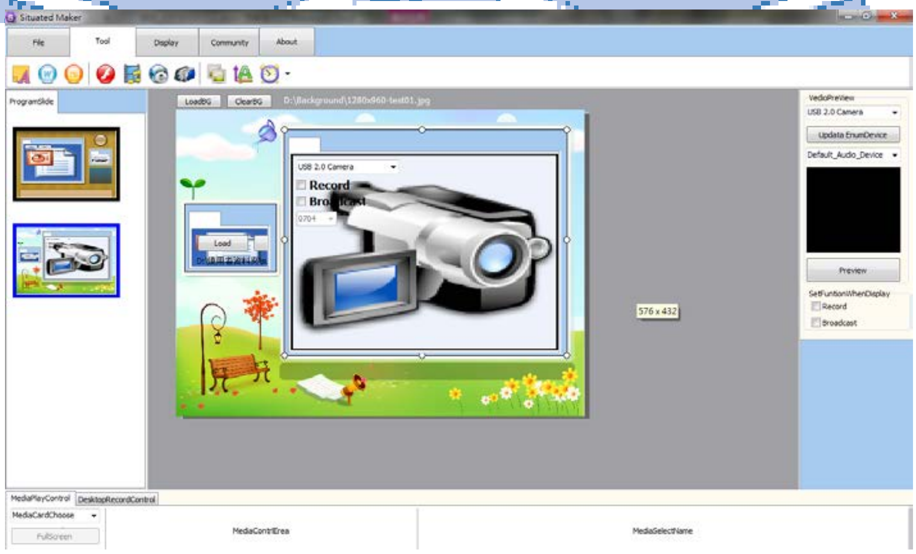


Figure 3.3 The Design of Two Different Teaching Situations

3.1.3 Display Module

The display module controls the mapping between the layout constructed in the situated design module and the screen of the recording file. In other words, one of the important features of this module is to keep the consistence between the constructed layout and the real situation while recording. The coordinates and sizes of the components on the screen of the real situation must be transformed from those components on the layout. Let xd and yd denote the X-axis and Y-axis value of the component on the display screen, respectively; Wd and Hd are the width and height of a component on the display screen, respectively. Let xl and yl represent the X-axis and Y-axis value of the component in the situation layout area, respectively; Wl and Hl are the width and height of a component in the situation layout area, respectively. Rx and Ry denote the ratio of display resolution (1024*768) to the situation layout area 576*432) in X-axis and Y-axis, respectively. The coordinate transformation between the components on the display screen and the situation layout is defined as follows.

$$
\begin{aligned}
x_d &= x_l * \mathrm{R}x \\
y_d &= y_l * \mathrm{R}y \\
\mathrm{W}_d &= \mathrm{W}_l * \mathrm{R}x \\
\mathrm{H}_d &= \mathrm{H}_l * \mathrm{R}y
\end{aligned}
$$

Based on the above transformation, we can keep the relative locations of components of the recording screen as they have on the layout. In the situational design module, we edit the attributes of all included components and do not realize the real situation until the display module. Therefore, the objects on the teaching situation layout must be visualized, meaning that the objects we see on the teaching situation layout are close to the real recording screen. Therefore, you can roughly see the presentation of objects as you edit them.

There are three function buttons available on the tool palette, as illustrated in Figure 3.4. The left button denotes the play function, the middle button is responsible for the stop function, and the right button stands for the output button and is responsible for setting the displaying instrument such as projector or TV for showing. After clicking the play button, we can see the resulting screen as shown in Figure 6; meanwhile, the DSS will automatically save the current settings to a project file. Once we stop the playing, the DSS will release the resources occupied by the layout for decreasing the utilization of memory. In addition, from Figure 3.5, we can find the resulting screen of DSS is satisfactory for learning.

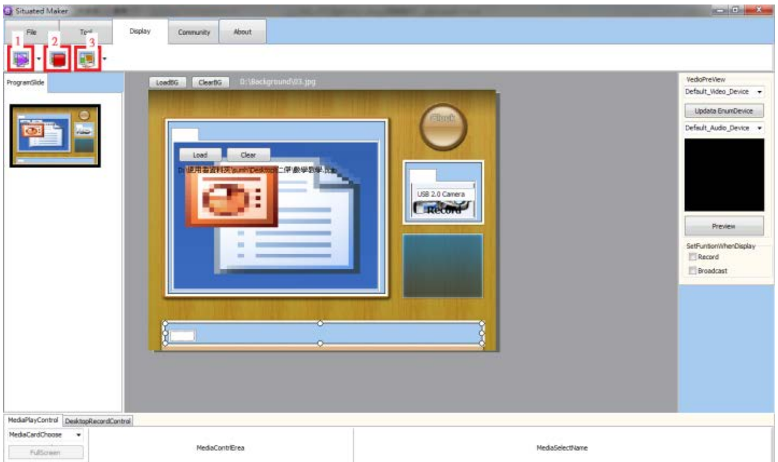


Figure 3.4 Three Function Buttons on the Tool Palette

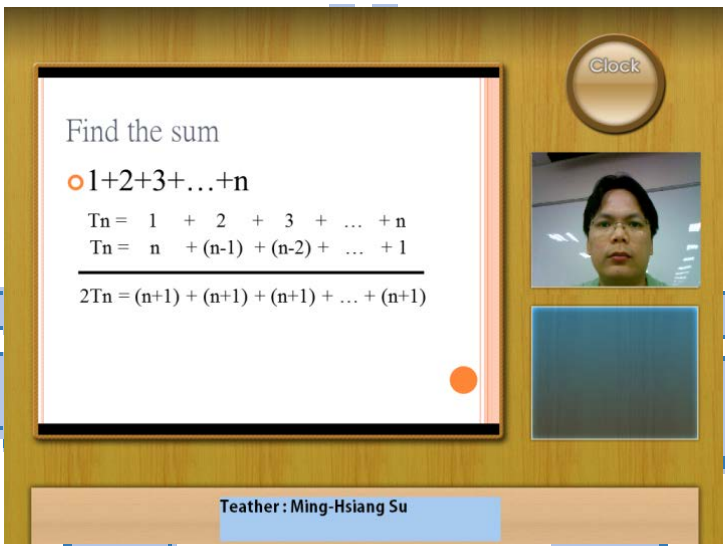


Figure 3.5 The Resulting Screen in the Display Module

3.1.4 Video Mixing Module

The video mixing module controls the mixing of the captured signals from the DVs and the notebook (VGA) into a screen. We use the Windows Media Encoder 9 SDK [28] to capture these signals simultaneously. When we capture the VGA signal (1024 * 768) to the object region we assign. One essential problem arises when directly integrating these signals together. That is, the resulting screen will become vague. Although, the “postview” technique included in SDK [28] can be used to solve this problem but another problem arises. Because the postview technique displays the stream after it has been encoded so the CPU utilization becomes very high. Therefore, a blend method is adopted to take the advantage of postview technique and to solve the high CPU utilization. In the blend method, the resolution of the captured signal from a PC or notebook is processed by the postview method and is set to 1024 * 768 and that of the other signals is set as usual. Then the screen is clear and the CPU utilization is reduced. In DSS, the layout area is divided into two regions for different signals: one is for the teacher to display the content he uses and the other is for the director to control and update the components he arranges. This strategy makes a teacher focus on his teaching and a director focus on directing the whole situation. No extra burden will be added to the teacher for creating a teaching situation. All the teacher has to do is teaching that he has done as usual.

3.1.5 Recording/Broadcasting Module

The recording/broadcasting module provides previewing the incoming screen and the way that the recording course is broadcast or not, as shown in Figure 3.6. The recording/broadcasting module offers two broadcasting types, real-time and on-demand. When using the real-time broadcasting, a media server is set to receive the live stream coming from the DSS, and then broadcasts the stream on the internet intermediately. In the on-demand broadcasting mode, the stream is sent to the media server and is stored in it. The stream is broadcasted only when a user makes a demand to the web server. Students can watch the lectures at his/her own place in the above two situations. If the director decided to record a lecture without broadcasting, the file will be recorded and saved in the local system, particularly when the recorded file needs post-produce.

Figure 3.6 Diagram for Video Preview and Options about Recording and Broadcasting

3.1.6 Directable Module

The directable module is used for a director to change the scene in a very short time without stopping the recording as we can see on the TV programs. The function is implemented in the “Update” button, as the popup menu shown in Figure 3.7. The update mechanism allows the director to change the component that he wants to update and, importantly, without stopping the recording process. That is, the function is hot-swapping. The updating process can be finished in 3 seconds. For example, if we want to switch two different DV streams, we can use the Update function to achieve the goal. If there are multiple DVs on the interactive situation, the director can use one DV to capture the teacher, the others to capture the students. When the teacher asks a student questions, the director just needs to press the Update button to change the shot of another DV to the student in a very short time and without stop the recording. When the teacher needs to use another teaching situation, the director just need to press the “Page Down” button to switch to another teaching situation.

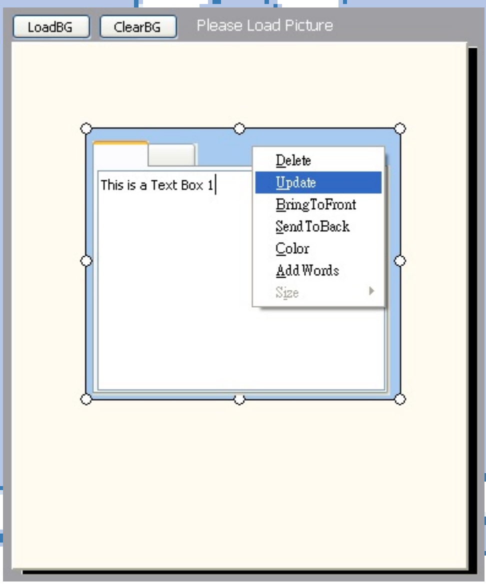


Figure 3.7 The Update Button on the Component

3.2 An Organizable Design to Enhance Teacher's Nonverbal Behavior with Multimedia in Lecture Classes

3.2.1 An overview of "organizable" multimedia system

The system adapted the advantage of multimedia in the classroom to develop an "organizable" system that could flexibly integrate different sources and smoothly in presentation and transition. The word "organizable" means in the study that a teacher can build teaching scenario as a theme in the system. The teachers or director controlled and changed the themes according to the learning situation. Figure 3.8 demonstrates the framework of the organizable multimedia system. The system integrated the multimedia signals input from teacher's notebook (or desktop) or grab from the DVs. The projectors or monitors displayed the mixed and reorganized signals from the system. The system had kept recording process seamlessly and continuously when teachers changed scenario depends on lecture situation is an outstanding characteristic of this system. We neglected the discussion of the network function in this system due to the premise on multimedia effect in the classroom. Nonverbal components of teachers in the classroom could be captured and integrated into the system through DVs. Several multimedia sources could be integrated in the scenario design as we illustrated in Table 3.1. The authoring function of this system is remarkably straightforward to users as illustrated in Figure 3.9. The system allows users to design multiple scenarios through organizing multimedia sources for instructional purpose. Figure 3.10 illustrated the example of teaching scenario design. Finally, Figure 3.11 illustrated the example of visual output.

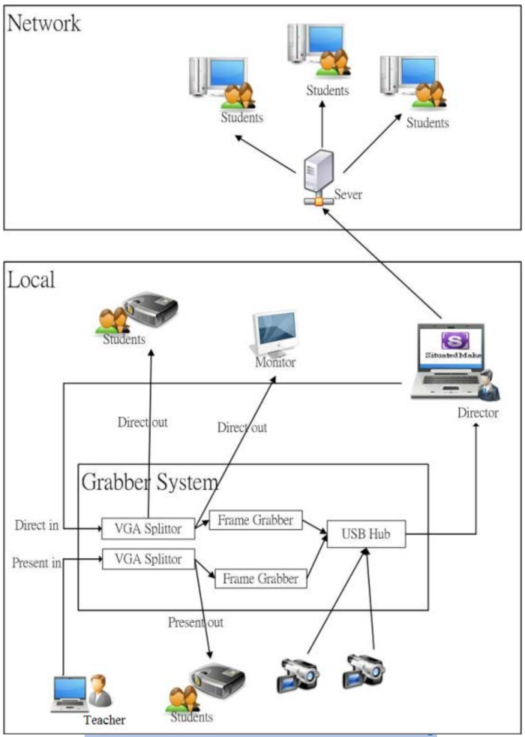


Figure 3.8 Architecture of the Organizable Multimedia System

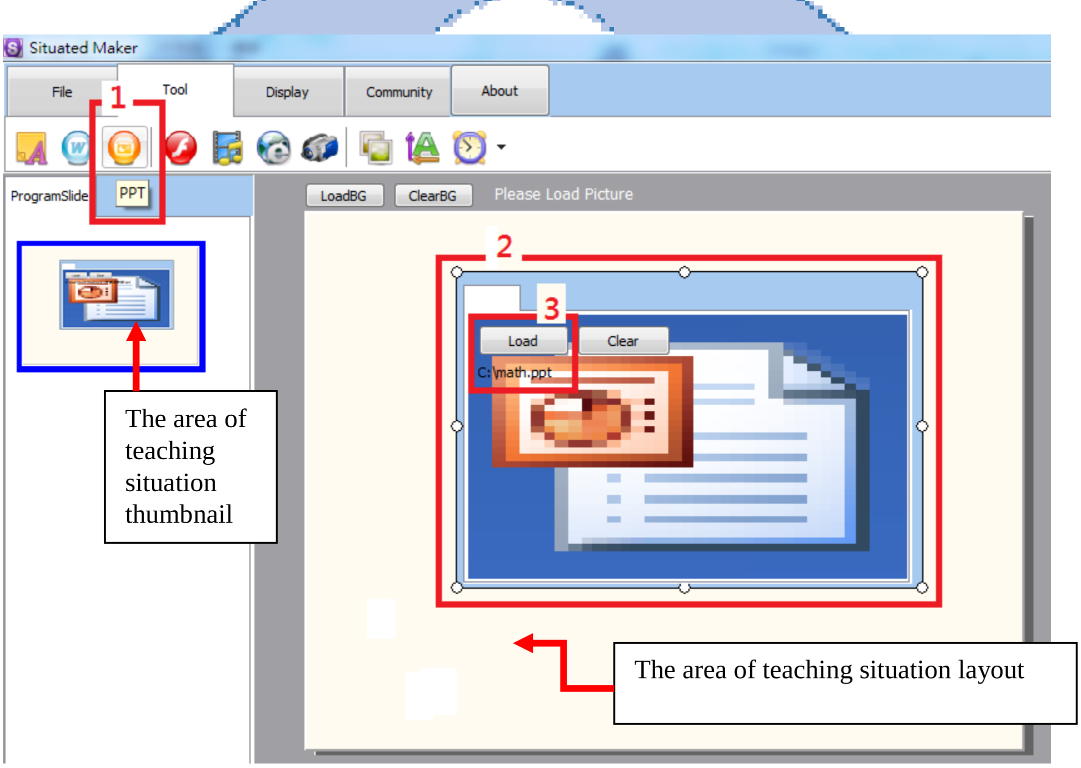


Figure 3.9 Snapshot of the Organizable Multimedia System

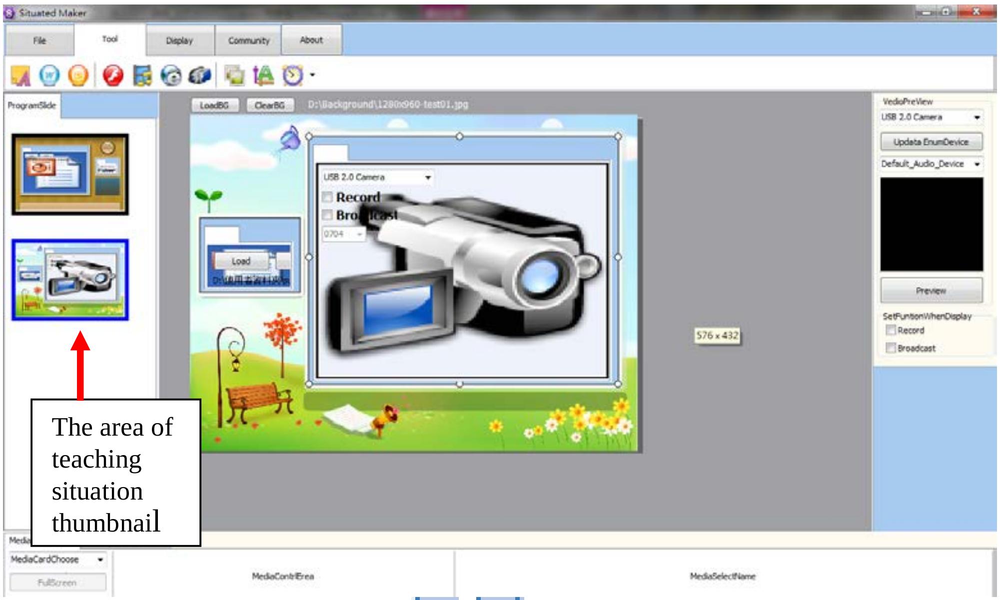


Figure 3.10 Example in Teaching Scenario Design

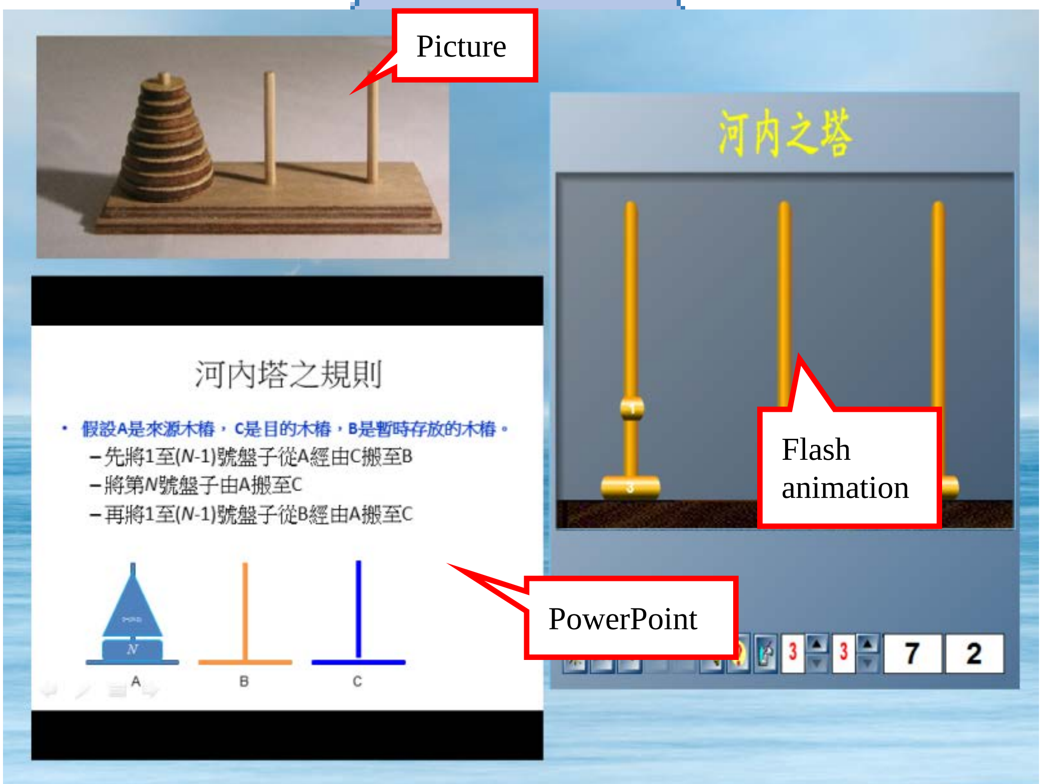


Figure 3.11 The Example of Visual Output

3.2.2 Method

3.2.2.1 Participants

We applied two-group experimental design in this study. According to the principle of two-group experiment, students from six classes in different departments as participants in this study (the department of Nursing, Cosmetology and Health Care, and Dental Laboratory Technology, Min-Hwei College of Health Care Management in Taiwan). The age of the participants distributed from 16 to 18. The students in the experimental group (three classes, 153 students) attended the lecture class using the organizable multimedia system to present PowerPoint slides, teacher's nonverbal components and the other subsidiary information in one screen. The digital video recorder captured the teacher's nonverbal components such eye-contact and facial expression into the system. The students in the conventional group (three classes, 149 students) attend the lecture class using PowerPoint presentation only. However, the experimental design in assigning experimental group and conventional group does not quite follow with the principle of randomized assignment. It is common in educational settings because the classes are often intact and already formed before the research begun (Gall, Gall, & Borg, 1999).

3.2.2.2 Experiment setting

The primary goal of the experiment design is to test the effect of broadcasting teacher's nonverbal components to all students in the classroom. To accomplish the object, we setup a lecturing environment as demonstrated in Figure 3.12. Three main components in the setting: (1)The video recorder grabs teacher's image that includes eye-contact and facial expression (2) the organizable system combines the teacher's image and the learning material (3) the projector displays the integrated images.

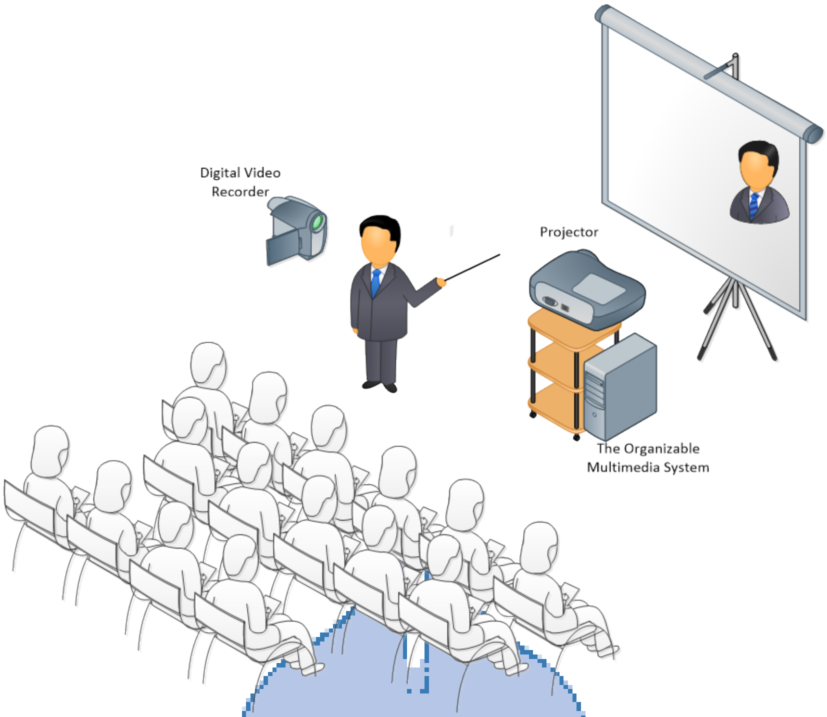


Figure 3.12 The Classroom Setting to Presenting Teacher's Nonverbal Components

3.2.2.3 Instruments

All the students in this study attended "Introduction to Computer and information science" and took the same examination. Midterm Examination and final examination were the evaluations of the students' learning performance in the experiment. The question database in Certified Computer Software Application of Techficiency Quotient Certification from Computer Skills Foundation, Taiwan provided questions for these examinations. Each test includes 50 questions, randomly selected from the database with 735 questions. The average difficulty indices with respect to these tests were 0.61 and 0.70. The scores from midterm examination and final examination in each group would be equivalent to the level of students' learning achievement hypothetically. Since, the empirical researches indicated that students' science learning outcome directly related to the mathematical ability of the students (Berlin & White, 1998; Czerniak, Weber Jr, Sandmann, & Ahern, 1999; Farenga & Joyce, 1999; Ormerod, Duckworth, England, & Wales, 1975; Science, 1989), we adopted the idea to use students' entrance mathematical scores as pre-test scores to represent the students' learning achievement in science before the experiment conducted.

3.2.2.4 Procedure

The experiment last for a semester as normal lecture class compare to the other class. During the semester, the same learning material introduced to students in different experiments groups to avoid the influence of different contents. The visual contents in experiment group organized the nonverbal components of teacher and PowerPoint slides into a single screen. The screen layout demonstrated as Figure 3.13. In those students' vision in classroom, there were four areas in one screen: (1) The area to present learning material or lecture outline usually perform in PowerPoint slides (2) The area to show teacher's nonverbal components such eye-contact and facial expression (3) The area to remain students usually in text such as the title of this lecture or the name of instructor (4) The area to show student's nonverbal components. With the organizable principle of this system, user could change the position and display size of each area depended on the necessity of lecture situation and save as the other layout. During the lecture, teacher or director could the change different layout in order to engage active learning.

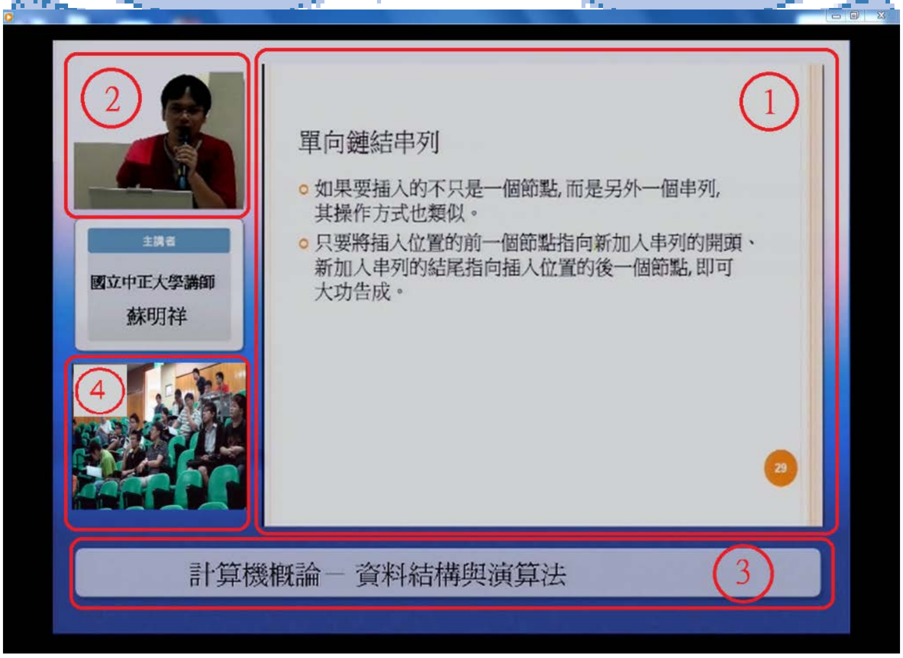
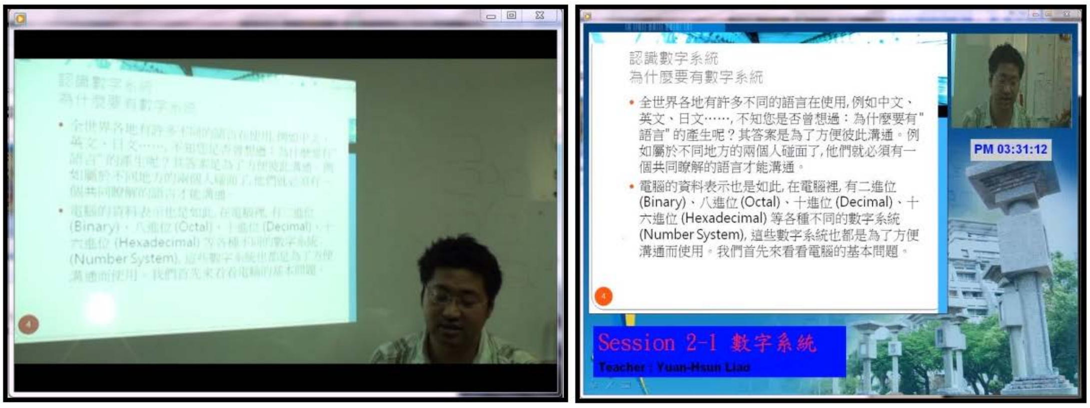


Figure 3.13 The Screen Layout of Experiment Group
(1) The area to display PowerPoint Slides (2) The area to show nonverbal components of teacher (3) Title of this lecture and the name of instructor (4) The area to show student's nonverbal components.

Teacher use PowerPoint slides as the only display source in conventional group. The snapshots of different experiment group showed in Figure 3.14 (a) and (b), respectively. Midterm exam and final exam used summative evaluation to test the performance of students in these different experiment groups.



(a) (b)

Figure 3.14 The Snapshots of Different Experiment Group
(a) The conventional group: teaching with normal PowerPoint slides and (b) The experimental group: teaching with integration of PowerPoint slides and Teacher's nonverbal components.

3.2.2.5 Measures

The measures employed in this study were the scores of examinations and the entrance score in mathematic. The scores of midterm examination implied the immediate achievement with experiment treatment. The scores of final examination implied the continuous effect in learning achievement with experiment treatment. Therefore, the outcome of midterm examination was one of the dependent variables in this study and the final examination was the other one. The comparison with covariance analysis approach between the experimental group and the conventional group emerged whether the positive influence from the experiment treatment or not. The entrance scores were the original entrance scores from all students. With the purpose in increasing experiment precision, the entrance scores represented as the pre-test scores to be the covariance variable in the experiment. Hence the analysis of covariance was the major analysis method in this study. In summary, the following list shows the measures in this study:

- The independent variable: The teaching strategy to present teacher's nonverbal components and teaching material in PowerPoint as the experimental treatment in experiment group or to present teaching material in PowerPoint as the experimental treatment in control group.
- The dependent variables: The scores from midterm examination and final examination.
- The covariate: Pre-test score acted as the covariate to make an assumption of the independence in group distribution and experiment treatment.

3.2.3 Results

In this study, ANCOVA (Analysis of Covariance) as the primary technique to analyze the students' achievement underlay on the experimental setup. The results included ANCOVA of the midterm examination and ANCOVA of the final examination. Additional ANOVA applied with midterm examination, final examination and pre-test to examine the correctness of ANCOVA.

3.2.3.1 The ANCOVA of midterm examination

The results in ANCOVA of midterm examination showed the average score in the experiment group (N=153, Mean=62.84) was better than the control group (N=149, Mean=57.31). Even the adjusted mean which excluded the effect of covariate showed the same advantage in the experiment group (Adjusted Mean Experiment =62.801>Adjusted Mean Control=57.345). To fitted the assumption of homogeneity of regression, the homogeneity test of within-group regression coefficient had to fail in the significant level ($F=0.075$, $p>.05$). This test implied that the covariate (pre-test scores) could not influence the difference between these groups in dependent variable (midterm examination scores), and built the confidence on the randomness of the experiment assignment. The between-groups test revealed the significant difference between the adjusted mean of the experiment group and the adjusted mean of the control group ($F=7.007$, $p<.05$). The effect size of the between-groups test is between small and medium size (Partial $\eta^2=0.023$), which expressed the medium relationship between independent variable (teaching strategy) and the dependent variable (midterm examination). However, the effect of enhancing teacher's nonverbal components with multimedia was significant in the result of midterm examination. The time of this treatment was short, and the reaction of students was immediate in comparison with whole semester; thus the necessity to test the effect of long term treatment caused the ANCOVA of the final examination.

Table 3.2 The Descriptive Statistic (Dependent Variable: Midterm Examination)

Group	N	Mean	Standard Deviation	Adjusted Means
Experiment Group	153	62.84	18.695	62.801[a]
Control Group	149	57.31	17.089	57.345[a]
Total	302	60.11	18.104	62.801[a]

a. Covariates appearing in the model are evaluated at the following values: Pre-test score=49.23

Table 3.3 The Summary of Homogeneity Test of Between-Groups Regression Coefficient (Dependent Variable: Midterm Examination)

Sources	SS	df	MS	F
Teaching Strategy*Pre-test Score	24.146	1	24.146	.075 n.s.
Error	95788.888	298	21.439	

n.s. p>.05

Table 3.4 The Summary of ANCOVA in Different Groups (Dependent Variable: Midterm Examination)

Sources	SS	df	MS	F	Partial η^2
Covariate(Pre-test Score)	401.413	1	401.413	1.659 n.s.	.006
Between-Subjects(Teaching Strategy)	3385.648	1	3385.648	7.007*	.023
With-in Subjects(Error)	49250.617	299	164.718		
Total	1189815.000	302			

n.s. p>.05 *p<.05

3.2.3.2 The ANCOVA of final examination

The results in ANCOVA of the final examination showed the similarity of midterm examination. The average of the experiment group (N=153, Mean=76.12) was still better than the control group (N=153, Mean=69.36). Similarly, the exclusion of covariate as the adjustment process in analyzing the significance showed the same outcome in comparing the mean of experiment group and control group (Adjusted Mean Experiment =76.087>Adjusted Mean Control=69.387). In homogeneity test, the result still remained in consistence in the non-significance level (F=1.048, p>.05). The summary in Table 3.7 illustrated the significance difference (F=20.554, p<.05) in teaching strategy and the medium effect size with partial eta squared value (Partial $\eta 2=0.064$). The results provided strong evidence to prove the teaching strategy, which enhanced teacher's nonverbal components with multimedia, could improve the learning achievement in the long term treatment.

Table 3.5 The Descriptive Statistic (Dependent Variable: Final Examination)

Group	N	Mean	Standard Deviation	Adjusted Means
Experiment Group	153	76.12	11.750	76.087[a]
Control Group	149	69.36	13.917	69.387[a]
Total	302	72.78	13.282	76.087[a]

a. Covariates appearing in the model are evaluated at the following values: Pre-test score=49.23

Table 3.6 The Summary of Homogeneity Test of Between-Groups Regression Coefficient (Dependent Variable: Final Examination)

Sources	SS	df	MS	F
Teaching Strategy*Pre-test Score	172.528	1	172.528	1.048n.s.
Error	49078.089	298	164.692	

n.s. p>.05

Table 3.7 The Summary of ANCOVA in Different Groups (Dependent Variable: Final Examination)

Sources	SS	df	MS	F	Partial η^2
Covariate(Pre-test Score)	401.413	1	401.413	2.437n.s.	.008
Between-Subjects(Teaching Strategy)	3385.648	1	3385.648	20.554*	.064
With-in Subjects(Error)	49250.617	299	164.718		
Total	1189815.000	302			

n.s. p>.05   *p<.05

3.2.3.3 The ANOVA applied with midterm examination, final examination and pre-test

In order to consolidate the reliability of ANCOVA, additional analysis of variance (ANOVA) applied to the scores of midterm examination and final examination for statistical comparison. The results of ANOVA in midterm examination (F=7.183 p<.05) and final examination (F=20.854, p<.05) appeared the significance of between groups comparison to strengthen the effectiveness of enhancing teacher's nonverbal components with multimedia still more effective than teaching with PowerPoint slides only. The pre-test in ANOVA also revealed the non-significance ($F=0.22$, $p>.05$) of between group to exclude the influence on experiment group and control group. The evidence of non-significance in pre-test showed the consistence of homogeneity test in ANCOVA.

Table 3.8 ANOVA in Different Groups and Different Examinations

		Sum of Squares	df	Mean Square	F	Sig.
Midterm	Between Groups	2306.680	1	2306.680	7.183	.008
	Within Groups	96344.714	300	321.149		
	Total	98651.394	301			
Final	Between Groups	3451.546	1	3451.546	20.854	.000
	Within Groups	49652.030	300	165.507		
	Total	53103.576	301			

Table 3.9 ANOVA of Pre-Test

		Sum of Squares	df	Mean Square	F	Sig.
Pre-test	Between Groups	36.582	1	36.582	.220	.640
	Within Groups	49944.107	300	166.480		
	Total	49980.689	301			

3.3 Utilizing an Online Group Study Environment to Enhance Student Reading Ability and Learning Effectiveness

3.3.1 Group study environment

Teachers can use the OGS system to construct a new group study environment for students to read. Figure 3.15 depicts the pictorial structure of the group study environment. The group study members include teachers and students. The environment can aid the group in reading more flexibly and sharing knowledge more conveniently, particularly when the group members are online.

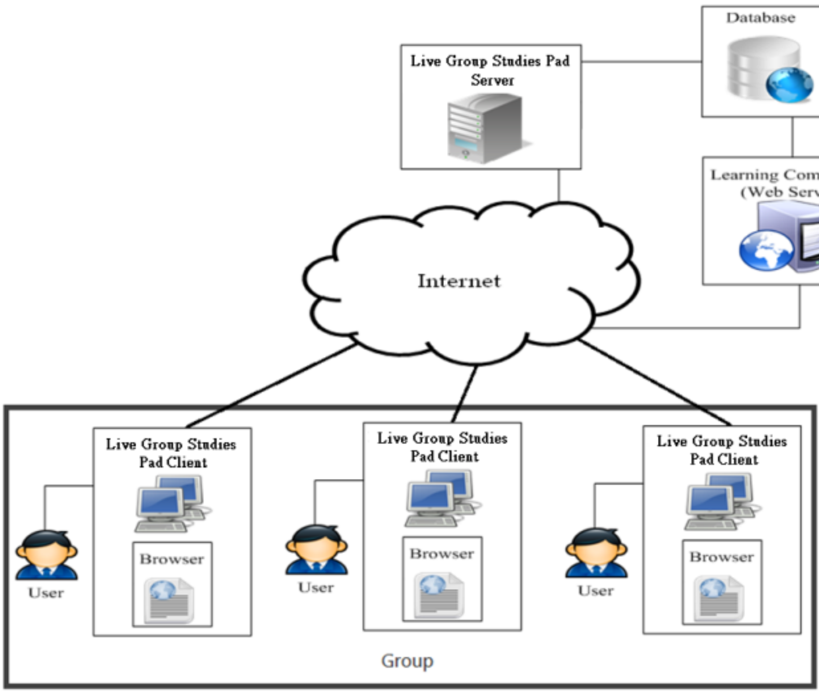


Figure 3.15 The Structure of the Instructional Environment

3.3.2 System design and structure

The OGS system is divided into two parts: the real-time group study platform and the online social network. Teachers and students can upload reading materials to the OGS system. These reading materials include e-books, slides, videos, animations, and word documents. Therefore, teachers and students can join online group study by studying the reading materials simultaneously.

The primary feature of the OGS system is the provision of a real-time online platform for group study and an online social network for asynchronous knowledge sharing. Teachers can use the real-time online platform to guide students to read. In addition to asking questions and encouraging each student to share his views, teachers also must control a variety of events and reading materials. During the reading process, teachers play a leading role. The students can read e-books in real-time with others in the group via the online platform. Students can take the initiative to read, make inferences, ask questions and absorb other students' knowledge. During the reading process, all students can benefit from others' sharing.

The structure of the OGS system consists of two parts: the real-time group study platform and the online social network, as shown in Figure 3.16. The real-time group study platform has eight principal components: video, audio, text messages, material, command, multi-media presentations, pop-discussions and internet architecture. The video/audio components provide video and audio transmission. Teachers and students can use video/audio components to immediately discuss the related contexts of materials. The text message component supports a written communication environment. Teachers can easily use text to communicate with students. The material component involves the provision of reading materials for download. The multi-media presentation component supports an environment in which multi-media file formats can be utilized. Teachers and students can use the multi-media file format for online discussion. The pop-discussion component allows students to post online discussion screens to the online social network. During the discussion, teachers and students can capture multi-media presentation component screens and post the result of the current discussion to the online social network. When other students not in the group read the posted article, they can also discuss the results of the article asynchronously.

In the OGS system, the online social network provides an asynchronous discussion feature, as shown in Figure 3.17. Students can post a theme that they want to explore on the online social network or respond to the articles that others post. Teachers can provide students with assistance through the use of articles on the online social network and guide students' thinking. Students read e-books using the real-time online platform during group study, as shown in Figure 3.18. If students cannot understand a certain concept, they can use the real-time online platform for group discussion, as shown in Figure 3.19.

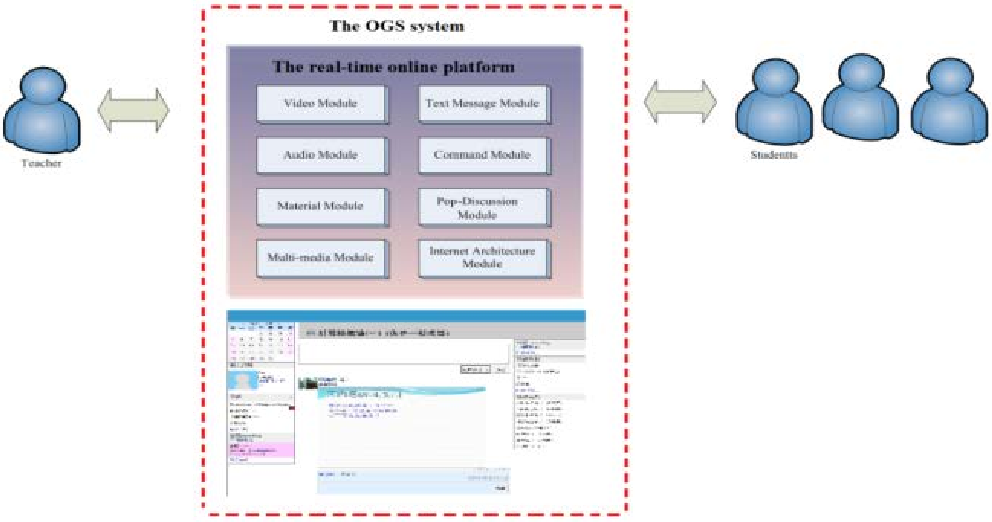


Figure 3.16 The Structure of the OGS System

Figure 3.17 The Online Group Study Social Network

Figure 3.18 Students Read e-Book Using the Real-Time Online Platform

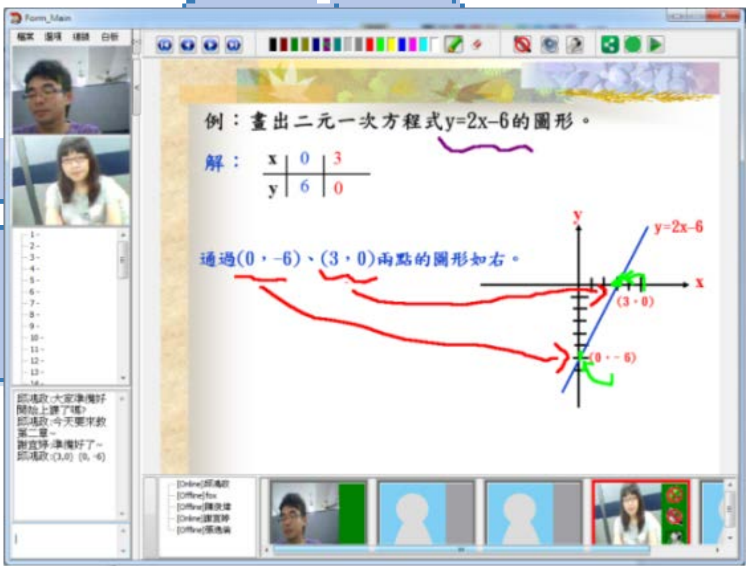


Figure 3.19 Students Discuss Themes Using the Real-Time Online Platform

3.3.3 Method

3.3.3.1Participants

The experimental design was used to investigate the effects of applying the OGS system in online group study. A total of 42 students in a college in southern Taiwan (32 men and 10 women, with a mean age of 18.7 years) who had selected the Programming course enrolled in the experiment. The experiment ran for two months. The class met two times per week for 90 minutes each session.

3.3.3.2 Instruments

We collected data using an 8-item questionnaire that students completed at the end of the experiment. The questionnaire was modified and edited by the questionnaire of DeLone and McLean's study (DeLone, 2003). The questionnaire covered perceived use and the trial experience of the OGS. Each item was assessed using a five-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's alpha reliability coefficient for the questionnaire was 0.81, and the criterion-related validity was 0.76.

3.3.3.3 Procedure

One class, which contained one teacher and 42 students, contributed to the trial of the system. The class agreed to teach using group study to support their provision of their lectures during the spring 2012 semester. The reading materials were uploaded to the online social network for students. The procedure used for the group study, as shown in Figure 3.20, was as follows.

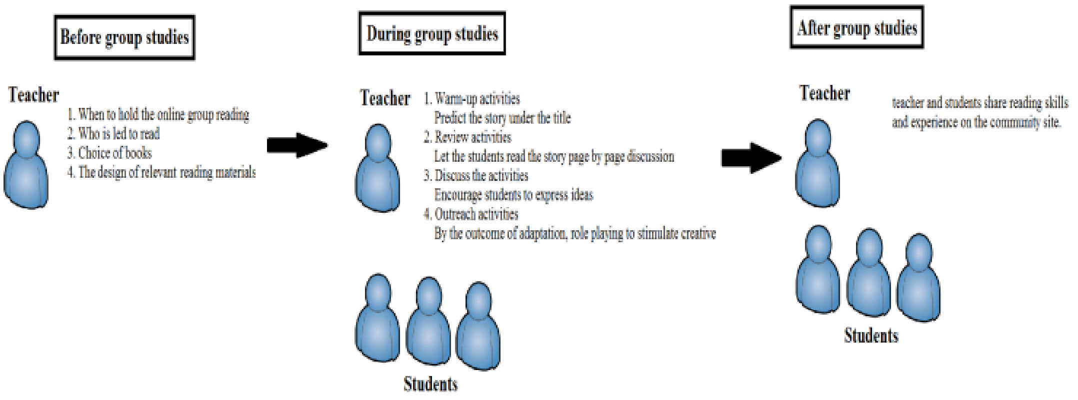


Figure 3.20 The Experimental Procedure

1. Before group study: The students themselves divide into groups of up to 5 people. In accordance with the course content, the teacher provides e-books and related reading materials. The students elect their own leaders and determine the mode of the group study operation. The group leader should be responsible for the work, including the convening of the group, discussion and knowledge sharing.
2. During group study: During the warm-up activities and in accordance with the title of the e-book, teachers can compel the students predict the story to arouse

students' reading interest. During the review activities, the group leaders must lead their own groups to read the story page by page. During the discussion activities, the teacher can encourage students to express their views. During the outreach activities, the teacher can stimulate students' creative thinking through story adaptation and role playing.

3. After group study: The teacher and the students share reading skills and experiences on the online social network.

3.3.4 Results

The aim of the investigation of student data regarding reading technology use was the establishment of the effectiveness of the OGS system for the students who used the system. Table 3.10 shows the statistical results for the questionnaire.

Over 81% of the students stated that they use the OGS system to read during group study (M = 3.93, SD = 0.71). Approximately 5% of the students disagreed with this statement, possibly because they liked in-person reading meetings. Nearly 67% of the students agreed that the OGS system was the source of their learning motivation (M = 3.64, SD = 0.69). Approximately 7% of the students disagreed with this statement, possibly because achievement pressure was the source of their learning motivation.

Nearly 79% of the students agreed that they will spend more time reading by using the OGS system (M = 3.95, SD = 0.62). They believed that they could absorb the content of e-books more quickly when they read with group members, so students were willing to spend more time reading by using the OGS system. Approximately 58% of the students agreed that they will prepare information for group members before a group meeting (M = 3.55, SD = 0.55). Some of them believed that they only needed to express their views during the reading process.

Approximately 74% of the students agreed that they enthusiastically offer their views during reading meetings (M = 3.67, SD = 0.66). Nearly 5% students disagreed with this statement, possibly because they were shy about informing others of what they believe. Approximately 79% of the students agreed that they will participate in every meeting (M = 3.86, SD = 0.61), and 65% of the students agreed that they believed that everyone's attendance at the meetings is a simple matter.

Moreover, 79% of the students agreed that the OGS system was helpful to them (M = 3.93, SD = 0.60). Based on these results, we can conclude that the OGS system is acceptable for most students.

Table 3.10 Percentage, Means (M), and Standard Deviation (SD) of the Questionnaire

Question (5 = strongly agree; 1 = strongly disagree)	SD (%)	DA (%)	N (%)	AG (%)	SG (%)	M (SD)
I use the OGS system to read e-books with others.	0	5	14	64	17	3.93 (0.71)
The OGS system is the source of my learning motivation.	0	7	26	62	5	3.64 (0.69)
I spend more time reading by using the OGS system.	0	0	21	62	17	3.95 (0.62)
Before group study, I attempt to prepare information for everyone.	0	2	40	58	0	3.55 (0.55)
During group study, I enthusiastically offer my views.	0	5	21	67	7	3.76 (0.66)
I participate in every meeting.	0	2	19	69	10	3.86 (0.61)
I believe that everyone's attendance at meetings is a simple matter.	0	4	31	60	5	3.64 (0.66)
The OGS system is helpful to me.	0	0	21	64	15	3.93 (0.60)
Strongly disagree: SD; Disagree: DA; Neural: N; Agree: AG; Strongly agree: SA						

3.3.5 Discussion

Obviously, utilization of the OGS system when reading is useful for students. Students can benefit from our experimental results during reading activities. First, the students indicated that the OGS is helpful to them (as presented in Table 1). An outstandingly useful feature of the system is that students can immediately read a variety of materials with group members online (as shown in Figure 4). Furthermore, students can discuss problems regarding the reading content and post the results of the discussion on the online social network (as shown in Figure 3 and Figure 5). Students can extend the results of the discussion by posting the outcome of the discussion.

Second, the students felt that they would enthusiastically offer their views (as noted in Table 1). With the OGS system, students have the advantage of experiencing face-to-face interaction with group members during the reading process. While reading, students can share their opinions and discuss themes of a book. Teachers abstain from being the focus of attention and attempt to encourage interaction among members (Richardson, 1967). Students positively contribute to sharing, discussion, presentation, promotion, expression, regarding, and questioning during group study (Arslan, 2004). During the group study process, a student who is highly active in group study can learn more effectively and improve friendship and cooperation abilities (Gökçe, 2011).

Chapter 4 Conclusions and Future Works

4.1 Conclusions

This study aims to present a directable and designable system for recording courses with better quality with some software techniques. The characteristics of the DSS are summarized as follows.

1) The DSS is designable. The DSS provides the teacher to layout their won teaching situation. This feature makes the teacher save lots of post-processing time on reproduction of recording files. The system does not require complicated post-processing reproduction of recording files because teachers can design the desired layout before recording. Importantly, the designed layout is reusable for other courses or people.

2) The DSS is directable. Here the DSS is called to be “directable” because we can switch the DVs in a very short time as that we can see on TV programs. This is quite an important character of DSS. Generally, if we want to record two different scenes of the classroom, we have to stop the on-going recording process and move the DV to the other scene. Then restart the recording process. The above mentioned process is a little time-consuming and inconvenient. Alternatively, we can also put two DVs in the two different corners of the classroom, and then re-edited two recorded files to be one. The DSS provides a more convenient solution for the above situation. The system allows a director to switch the shots between two DVs without the stopping recording process and to update any object included in the presentation screen in a very short time.

3) The DSS is user-friendly. Teachers do not need much additional learning the usage of DSS because the operation of DSS is similar to PowerPoint. In other words, teachers can arrange their own teaching context and teaching material page by page as they have done on the PowerPoint.

4) The DSS can be passive. Teachers need to only focus on teaching without distraction in recording if there is one director to handle the recording of the teaching process.

5) The product of DSS is high-definition. The OCWs draw the vision of an asynchronous learning in the future. Therefore, more high-definition courses will be needed. Based on the aforementioned blend method, the DSS generates courses with better quality.

DSS can give a directable design approach to catch all teaching situations around the classroom. Hence, the video caught by DSS in the classroom can reveal the details of teacher's eye contact and body language, the teaching material displayed by computer or notebook, and students' interaction. Those phenomena can form an appropriate situated learning (Brown, 1989). The situated learning was proposed by Prof. Brown, Collins and Duguid in 1989 to facilitate the learning experience of real classroom (Brown, 1989). Therefore, after we upload these videos into LMS, students can immerse the real learning experience in their classroom.

Although the DSS allows a teacher to teach and record course at the same time, the teacher will be distracted by taking video, updating display objects and directing lecture by him/herself. The best way to improve this limitation is to hire an extra person as a director to share this duty. If the budget is not a concerned issue, of course, this limitation can be neglected.

Currently, course management is built on the learning management system (LMS) and students can watch the course videos on the LMS. If we take the lecture video by DSS, we can guarantee that the quality for reading is good enough to let students learn anywhere and anytime from LMS.

In the future, we will add a campus course management system to systematically manage the recording courses and run different broadcast programs at different times. In addition, we will include the relevant SCORM principles to manage course materials to achieve the goal of sharing teaching materials.

The empirical researches of multimedia learning did not present acceptable outcome in effective learning when using student learning achievement as the determinant. In the study of Koroghlanian (2004), they found no main effect may result posttest achievement whether applied animation or static picture to illustrate in classroom (Koroghlanian & Klein, 2004). Susskind (2005) conducted the experiment to check the difference of students' grades between the classes lectured with PowerPoint and no PowerPoint which also failed in finding the significance (Susskind, 2005). Savoy (2009) used retention ability to evaluate the effect of PowerPoint which revealed no explicit improvement in students' overall scores (Savoy et al., 2009). In spite of the difficulty in employ the result of students' achievement, this study still result satisfactory outcome in the effect of enhancing teacher's nonverbal component with multimedia. The significant difference in the midterm scores manifested the immediate meaning in the positive effect of providing multiple visual cues during lecture class. More significant evidence after the final examination established solid confidence in the long term effect of enhancing nonverbal components with multimedia. We concluded this study with a successful results in evaluate student achievement as the research dependent factor. The usage of multimedia technology in improving lecture learning turned a different aspect in this study. The nonverbal components of teacher could be more effective convey to students in the classroom when enhanced with multimedia. Thus, the teacher in the large classroom may have more opportunity to communicate every student with the mechanism of multimedia projection. The facilitation of classroom learning in this study did only focus on learning content presentation, but also considered with social presence of the teacher. We integrated the learning content and the social presence of teacher with computer system to fulfill the theory of cue summation (Severin, 1967). We contrasted the imaginary principle of social cue: "The people do not necessarily learn more deeply from a multimedia presentation when speaker's image is on the screen rather than not on the screen" (RE, 2005). The contribution of this study was to suggest a solution in using multimedia during lecture which may increase students' learning achievement.

We only focused on the teacher's eye contact and facial expression as the nonverbal components which were the limitation of this study. There still were many nonverbal components of teacher in the classroom could positive in supporting learning such as gesture, posture or voice. These nonverbal components will become the main points in the future research. The body language of the teacher to enhance the learning achievement in the classroom will be a compelling issue in the further research.

In this study has proposed the OGS system. The survey and the empirical measures appear to indicate that the system is helpful to students during group study. During the online group study process, students can immediately read e-books with other students using the real-time group study platform. Students also can discuss the contents of the e-books using the platform. Teachers are responsible for guiding the students' thought process during the online reading process. Through use of the OGS system, students have more opportunities to share book content. During the knowledge sharing process, students can obtain the affirmation of others and enhance their motivation to read. In addition, discussion among students can stimulate students' possession of different ideas and, consequently, allow them to enjoy reading. The OGS system benefits students while they read e-books during group study.

4.2 Future Works

In future studies, this study will continue to explore the two study themes. First, the study will investigate whether the innovative book recommendation will affect the willingness of readers to borrow books. This study invites readers to share reading experiences and record their book recommendations by DSS system. The contents of the books recommended videos include the reader images captured by DV and the image of book captured by document camera. In this study, the innovative book recommendation combines the introduction of the books and the turning of the books to attract readers to borrow books. This study investigate whether the reader can increase the willingness of book borrowed, after they watch the books recommended videos.

Second, this study will combine the anatomy course videos which recorded by DSS system and the flipped classroom strategy to explore the effectiveness of nursing students learning. This study has recording the videos of the three units of the anatomy course by DSS system. The teacher can ask students to watch the course content via internet and discuss issues in the classroom. The course discusses activities also can be held online by OGS system. In this teaching strategies, this study can explore the effectiveness of nursing students learning.

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