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Implementing an Interactive Powerpoint into a Self-Controlled Learning Environment

Yuh-Tyng Chen
Department of Information Management, Tainan University of Technology,
Yung-Kang District, Tainan 710, Taiwan

Abstract: PowerPoint is the widespread multimedia presentation tool, but the traditional slide show presentation simply enlarges the passive nature of the instruction. This study integrated the modularity concept and annotation into interactive PowerPoint presentation based on the cognitive theory of multimedia learning and investigated the participant's reflection and learning performance through post-test, motivation survey and the experimental teaching activities. An exploratory test was conducted with 76 students in a university of technology. The results showed that under the self-controlled learning environment, instructor/students could easily hyperlink the particular segment they need so as to reduce student's extraneous cognitive load. Also, the interactive PowerPoint presented the related bullet points and annotation simultaneously which could benefit to reinforce their learning. Accordingly, the findings of this study revealed that the interactive PowerPoint presentation could promote students more engaged and acquired more information and remembered more ideas. Furthermore, the students in the experimental group could get the higher posttest scores and learning motivation than those of the control group.

Key words: Annotation, hyperlink, interactive PowerPoint presentation, modularity concept, self-controlled learning environment

INTRODUCTION

Today, training and learning are now regarded as competitive advantages to cope with the rapid changes in the world. An integrated learning approach is the best solution to this market demand. Without question, PowerPoint is the right choice for this task and has some appealing features as well. Users can easily integrate multimedia into a presentation and even for a beginner user to create conspicuous and easy-to-read slides. The multimedia representation which includes text, audio, graphs, photographs, animation, or video is readily and effectively communicated between teachers and learners (Bartsch and Cobern, 2003). Many college teachers facilitate their lectures with PowerPoint presentations so that their lectures will effectively affect their students' attitude and belief of self-efficacy (Rankin and Hoaas, 2001; Susskind, 2008). And students also have confirmed that the lectures were more organized, clear and interesting. However, PowerPoint has its critics. According to the researches (Tufte, 2003; Elizabeth, 2009; Chen *et al*., 2011), the worst presentations by PowerPoint users are concluded: too many or too few words per slide, backgrounds that are inappropriate and distract from the content, too much animation, sound effects, or video, too many slides for presentation length, overcomplicated graphics or charts and lack of presentation structure and content relationships.

Since PowerPoint is everywhere, using it efficiently for learning purposes needs a focused approach. The solutions to overcome the above problems are to break away from its static and linear presentation and incorporated the annotation into the bullet points. Hence, considering the drawbacks of traditional PowerPoint presentation and multimedia learning load, this study adapted the modularity concept and annotation with pop-up window to construct an interactive PowerPoint presentation. The research question is: what are the perceptions of students that find themselves in the interactive PowerPoint presentation? An exploratory study was conducted with 76 students of a university of technology in southern Taiwan to figure out the impact of interactive PowerPoint.

METHODOLOGY

Construct the interactive PowerPoint:

Using the modularity concept to build the interactive menu: The traditional PowerPoint presentation is linear presentation way which includes a succession of screens

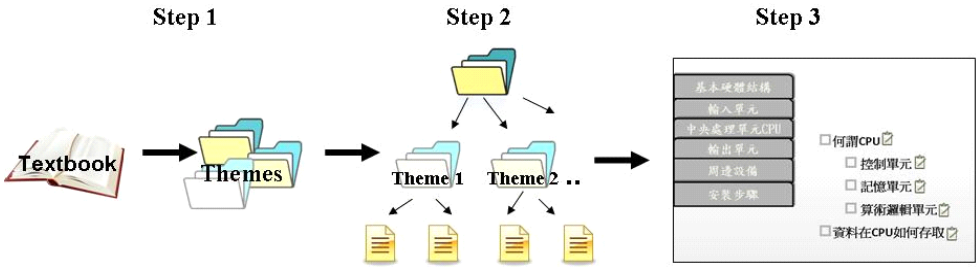

Fig. 1: Using the modularity concept to build the interactive menu,
Step1: To break away form the static and liner presentation and catalog the contents with the same themes into modules form the textbook
Step2 : To adapt the concepts of modularity for building the hierarchically organized structures called presentation network
Step3: To borrow the navigation technology in the presentation network to provide instructors or learners with the ability to rapidly find and display whatever contents they needed and whatever they needed it

presented one after another. It is known that traditional way of teaching discourages active learning and the slide show presentation simply enlarges the passive nature of the instruction. With slide show presentation, the order of the presentation is preset; the instructors can not alter around the material to help with student questions because they need to flip through page after page of the presentation. The presenter may lose chances to make important links between more distantly related topics by showing material in a set order. Based on this defect, this study integrated the modularity concept into the design procedure of PowerPoint. Modularity can be described as modules of a complex object to simpler objects. The modules are simplified either by the structure or function of the object and its subparts (Schmidt and Bandar, 1988). A module represents a set of related concerns which include a collection of related components, such as features, views, or business logic and pieces of infrastructure, as well as services for logging or authenticating users. Modules are independent of one another but can communicate with each other in a loosely coupled fashion. Besides, according to cognitive load theory (Aggarwal *et al*., 2001), human working memory capacity is limited and overloading working memory prevents learning. In order to inspirit learning and transfer, the solution process of a complex task may be divided into small, purposeful building blocks (Erhel and Jamet, 2006).

Hence, we broke away from the static and linear presentation and cataloged the contents with the same themes into modules from the textbook. Then, we adapted the concepts of modularity for building the hierarchically organized structures called presentation networks; each module acted as a set of related concerns which included an acquisition of related units. Modules were individual of one another but could interact with each other in a relatively coupled way. Finally, we borrowed the navigation technology in the presentation networks to provide instructors or learners with the ability to rapidly find and display whatever contents they needed and whenever they needed it. This interactive menu not only worked as an outline of the contents, but also allowed users instantly link to the desired part with self-control (Fig. 1).

Using annotation to facilitate the bullet points learning: Adapting the bullet points to list the main points of discussion and serve as a headline for talking about can effectively avoid the information load and presentation holding (Mayer and Moreno, 2007) because they can emphasize the key points of the teaching material. However, some researchers found that students may have difficulty understanding every slide because there are only some simple contents and some key information (Lai *et al*., 2011b). Moreover, some teachers display the teaching materials without adopting the spatial or temporal contiguity principles of multimedia learning (Reed, 2006). This phenomenon often leaded to splitting the attention of the students. Hence, we used the annotation with various formats such as texts, tables, pictures, video clips and so on by means of pop-up window in the same slide to supplement information in teaching/learning process. This capacity is helpful for the students to reduce the extraneous cognitive load because all learning contents will not show up at once; students can choose what they want to learn. Furthermore, it also reduces the splitting attention because the bullet points and related annotations which were appeared in the same slides. Also, this function is benefited for teachers to diminish tension for the students and make the instruction flowing, because the teachers can use the supplementary descriptions or notes as hits (Lai *et al*., 2011b) (Fig. 2).

Participant: The respondents of this study were 76 university of technology students enrolling in Computer

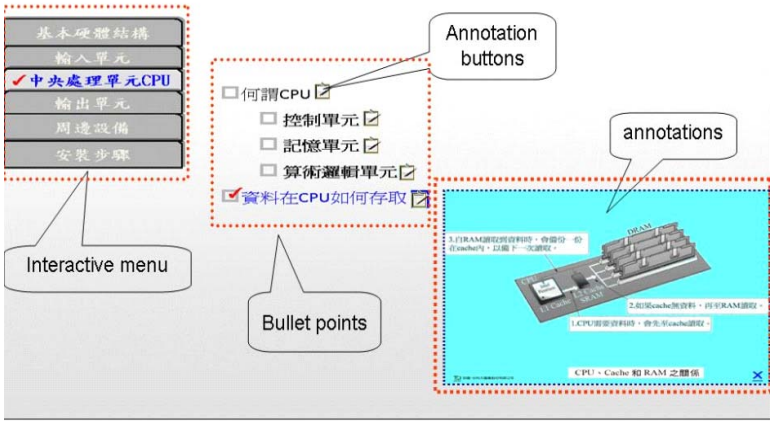

Fig. 2 : The presentation of interactive power point,

Interactive menu: Using the modularity concepts to catalog the contents into modules and borrowing the navigation to allow learners random "on demand" access to any particular part

Bullet points: Listing the main points and serving as a headline for discussion

Annotations: Using annotations buttons to supplement descriptions or notes with pop-up windows

fundamentals class. Thirty students participated in the pilot study and they were not included in the actual study. The researcher selected a university of technology in Taiwan and a total of 82 students participated in this study. Exclude the unusable surveys which were either incomplete tests or questionnaire or not followed instructions which were identified and discarded. As a result, 76 respondents (93% out of 82 cases) were used as the basis for data analysis. Of the 76 subjects, 37 are males and 43 are females with a mean age of 18.9.

Instruments: The research instrument consisted of one questionnaire and three tests. All the items in the instrument were carefully constructed so as to be in line with the purpose of the study. The questionnaire, through the use of a survey instrument--the Instructional Materials Motivation Survey (IMMS)-overall motivation to learn

was evaluated. The IMMS was developed around Keller's ARCS model (Keller, 1983) of motivational design. The four constructs in this model include attention, relevance, confidence and satisfaction, they describe the motivational procedure: while keeping the learners' attention is critical, instructors will provide an interactive and participative environment to gain and maintain learners' attention; learners will feel relevant that the course content, activities and assignments must be related to their personal and professional goals, confident that they can achieve the expected outcomes of the course and satisfaction which derive from the instruction (Johnson and Aragon, 2003). The IMMS was designed to evaluate how instructional materials affect motivation to learn. It contains a 36 5-point Likert scale statements. Each statement measures an individual ARCS component. In order to minimize possible error because of students' varying levels of English comprehension, a Chinese version of the questionnaire was used, with the Chinese version of IMMS administered by ESL/EFL and translation experts to prevent any translation mistakes. The reliability of the IMMS, as assessed by Cronbach alpha for internal consistency, was 0.891. For the four components (attention, relevance, confidence and satisfaction) of IMMS, Cronbach alpha was between 0.818~0.885.

And the three tests were included: pre-test, learning performance test and learning retention test. To exclude the factor of digital divide, the participated students were required to take pre-tests in the first week of the school to understand their initial cognitive ability (Computer fundamentals) for the experimental course. Researcher compiled the learning performance test based on students' learning progress and how well students absorb the materials. The learning retention test used the same questions, but the numbering and the ordering were different to prevent the answers from being influenced due to repeated exercises. The tests were validated by three university instructors (each with ten years' working experience in the related field). Reliability testing was also conducted. There were 20 questions in the learning performance test and the Cronbach's coefficient alpha (α) was 0.841. That means the learning performance test is an appropriate instrument for learning performance measurement. The learning performance test, learning retention test and IMMS were conducted after the experimental teaching.

Research design: To minimize errors of the teaching experiments and enhance the internal validity of this study, the control variables for the two groups were the same during the research period. The control variables are included the same instructor, course scope, assignments and evaluation tools.

Pilot study: In this phase, the 30 students who participated in the pilot study were administered a similar experimental teaching and tests. Following the pilot study, a few items in the instructional content and test were modified.

Actual study: Since this experiment required class coordination, willingness of instructors, time constraints and other appropriate conditions, this study selected students from the school where the researchers taught the subjects of this study. There are two classes (total of 76 university of technology students) participated in a workshop. Total workshop duration was 20 h and lectures were spread over ten weeks at a 2 h rate. One class (37 students) was assigned to control group and the other (39 students) was assigned to experimental group. In the experimental teaching activity design, instructor presented the static slides to introduce the instructional content for the control group, but for the experimental group, the instructor integrated the interactive PowerPoint to introduce and summary the literature. The instructor also used a series of small group techniques for two groups that enable students to exercise creative problem solving methods. Students are asked to perform and give oral presentations for their term project. It helps students to practice their communication skills. After the experimental teaching, the learning performance test and learning motivation survey (Instructional Material Motivational Survey, IMMS) have been conducted. One month later, without informing the students to have reviews in advance, the two groups of students had the test to compare the students' performance in the learning retention tests.

Data analysis: After testing and distributing the questionnaires, the researcher gathered the responses and used Statistical Package for the Social Sciences (SPSS) for Windows, a statistical program, for data analysis. The data collected was coded and entered into a computer by optical scoring and analyzed using SPSS. Descriptive statistics, including frequencies, means and standard deviations, were reported in order to understand the learners' performance. T-test were used to determine the effects of experimental course. The standard for significance in this study was $p<0.05$.

Table 1: The summary of two group's pretest scores, posttest and retention test

	Exp. (n = 39)		Ctrl. (n = 37)			
Groups	M	SD	M	SD	t-value (2-tailed)	Sig.
Pretest	42.38	13.36	41.92	15.48	0.132	0.896
Posttest	60.83	16.08	50.78	14.89	2.89	0.006**
Retention test	54.75	14.48	45.70	13.40	2.60	0.005**

*: Significant at $p<0.05$; **: Significant at $p<0.01$; ***: Significant at $p<0.001$

Table 2: Two groups' learning motivation

	Exp. (n = 39)		Ctrl. (n = 37)			
Categories	M	SD	M	SD	t- value	p (sig.)
Attention	4.06	1.16	3.78	1.28	3.38	0.000***
Relevance	3.85	1.00	3.81	1.01	3.45	0.000***
Confidence	3.89	1.08	3.68	1.26	2.10	0.000***
Satisfaction	3.93	1.16	3.78	1.24	3.34	0.000***

*: Significant at $p<0.05$; **: Significant at $p<0.01$; ***: Significant at $p<0.001$

RESULTS AND DISCUSSION

This section presents the difference of learning performance, learning retention and motivation for the two groups after the experimental curriculum was implemented. It includes the descriptive statistics and significance test of the empirical study.

Students' initial cognitive abilities (pretest) of experimental course: Before the teaching experiment, this research used the independent samples t-test to compare the pretest which is the initial cognitive abilities of experimental curriculum of the two groups. In Table 1 showed that the t value and the significance level ($t = 0.132$, $p = 0.896>0.05$) did not reach a significant level, indicating that before the training session, the two groups' initial cognitive abilities were the same. It could be the results of Taiwan's government successfully rooted its own National Information Infrastructure (NII) project since June 1994 (Chen *et al*., 2001).

Analysis of the learning performance test and retention test: In Table 1, excluding the effect of covariance (pretest) on dependent variables, the results revealed significant difference between the two groups on the posttest ($t = 2.98$, $p = 0.006<0.05$) and retention test ($t = 2.60$, $p = 0.005<0.05$). They have reached the statistically significant level which indicates that due to different teaching materials, the two groups of students have obvious differences in their learning performances. This could be due to the self-controlled learning environment which instructor or learners could rapidly select to find and display whatever contents they needed and whenever they needed it. Under this situation, according to schema acquisition and the borrowing and reorganizing principles of cognitive load theory (Schär

and Zimmermann, 2007; Roszanadia and Norazmir, 2011), the recorded materials could effectively help students to recall learning activities in the class situation. This is to learners' benefit to transform the knowledge of the teacher's problem-solving skills to the students (Lai *et al*., 2011a; Chen, 2012b).

Analysis of the IMMS: Table 2 showed that after both groups of students received the experimental teaching, the t values and significances level of four components indicate that the testing results reached the level of significance, which means that after the two groups had the experimental teaching; their learning motivations were significantly different. And the mean of each curriculum in IMMS of the experimental group was clearly higher than that of the control group. This could be due to the interactive menu not only works only as the outline of the contents but also provides the self-control instruction/learning environment. So, the students felt that the presentation helped them pay attention in class. And the lectures were effective and quick in solving students' questions which could facilitate the cognitive process in the understanding of the content being taught. Based on the spatial and temporal contiguity principles of multimedia learning, the students well accepted the relevant verbal and visual annotations with contiguous and simultaneous presentation in slides (Astleitner and Wiesner, 2004; Reed, 2006; Mayer and Moreno, 2007). The annotation display might benefit to make meaning and thereby promote their understanding of the learning contents and clearly recall the classroom experience. Accordingly, they felt confident and satisfied.

CONCLUSION

A good presentation meant being coherent, explicit and a clear structure (Chen, 2012a). This study stranded on the cognitive theory of multimedia learning to integrate the modularity concept and annotation into PowerPoint presentation to promote the positive effects in learning. The experimental results showed that under the network presentation design, the content was hierarchically arranged and navigable, the teachers could simultaneously show what they taught, by any means of where the interaction leaded; their message would take greater meaning. An superb presentation requires the right amount of text overlap and slides with consistent annotations that excite the students' active inference (Lai *et al*., 2011a). The active reconstruction of documents through a 'drag and drop' process enables to improve the quality of the mental representations in the learning process (Bodemer and Faust, 2006; Erhel and Jamet, 2006). Namely, the interactive PowerPoint presentation allows students to create more cognitive paths to assist the construction of referential links and mutual references between visual and verbal information channel displays. Accordingly, the proposed learning environment can support learners to build up coherent mental representations. That is to say the experimental results revealed that based on cognitive theory and the congruity principle of multimedia learning, the interactive PowerPoint presentation can effectively help students to reach a better learning performance.

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