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Integrating Thematic Strategy and Modularity Concept into Interactive Video-based Learning System

[1]Yuh-Tyng Chen and [2]Lin-Fan Chen
[1]Department of Information Management,
[2]Department of Applied English, Tainan University of Technology, Yung-Kang District,
Tainan 710, Taiwan

Abstract: For preventing the superficial learning attitude known as "couch-potato-attitude", this study integrated the thematic instructional strategy and modularity concept into the video-based instructional material. An exploratory test was carried out with 73 college majoring in design students. Research data were collected through the questionnaire and tests. The findings of this study revealed that the interactive thematic video could promote students more engaged and acquired more information and remembered more ideas. Under the self-controlled learning environment, students could easily hyperlink the particular segment they need so as to reduce students' extraneous cognitive load. In addition, the interactive thematic video presented the related textual and pictorial learning elements simultaneously which could benefit to reinforce their learning. Accordingly, the students in the experimental group could get the higher posttest scores. Furthermore, the interactive thematic video could effectively attract and maintain the students' attention; they felt that the course contents and activities were related to their life experience. Also, they were confident to achieve the expected outcomes of the course and satisfied with the instruction.

Key words: Thematic instruction, couch-potato-attitude, interactive thematic video (ITV), the cognitive theory of multimedia learning

INTRODUCTION

As multimedia technology has become more complex and graphically demanding, practicing in computer applications becomes a daily challenge even for experienced computer users. Then, an active (i.e., dynamic and visual) presentation of the e-learning contents is needed (Ertelt *et al*., 2006). Video can present information engagingly and correspondingly since it is a powerful virtual learning medium being used in e-learning (Zhang *et al*., 2004; Adenubi *et al*., 2011). From the earlier research, we found out that many users viewed videos as an inspiring learning tool and highly accepted it (Armstrong and Curran, 2006). Although, it is easier for videos to show than to verbalize, videos, however, often cause superficial learning and limited sustainability of learning outcomes and low/no transfer that is the well known 'couch-potato-attitude' (Ertelt *et al*., 2006). Two of the problems in the instructional materials have not been well-organized and well-presented (Lee, 2001; Leung, 2009). Traditionally, teaching activities are always followed the chapters in the order of the textbook. Under this circumstance, students easily have a passive attitude of learning and can't enjoy learning and develop independent thinking. Students may not really understand what they have learned and even more unlikely to apply these knowledge in their life experience. Nevertheless, according to the previous studies, thematic instruction can increase student motivation and achievement (Shapiro *et al*., 2011; Cervetti *et al*., 2009; Hewahi, 2007). Probing the findings, thematic instruction not only organizes activities or lessons around a general idea or theme meaningful to the learner but also motivates students to engage in self-directed learning through the guide, cooperation and exploring modes of learning (Lesley and Matthews, 2009). In addition, modularity concept can effectively benefit for instructors to design a coherent, explicit and systematic presentation material (Chen *et al*., 2011; Shakiba *et al*., 2008). 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, 1998; Lin *et al*., 2007). 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

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

services for logging or authenticating users. Modules are independent of one another but can communicate with each other in a loosely coupled fashion. Modules can be developed, tested and/or shared on independent manners (Cheong *et al*., 2003; Karamouzis, 2005). Using modularity concept in lecturing/or learning can help the instructor and students because modular design offers the benefits including providing more expedited course creation for instructors, simplifying the course updates and affording the consistency for users (Badre and Cooper, 2008; MSDN, 2009; De-Qiang *et al*., 2011). Accordingly, the aim of this study was to integrate the thematic instruction strategy and modularity concept into video-based instruction for empirical study and evaluate the outcomes. And our research question is "Does the ITV really meet the users' needs when interacting with the system during lectures?" Hopefully, the results of this study can have a greater insight into the implement and delivery of quality e-learning courses and programs.

MATERIALS AND METHODS

Construct the interactive thematic video (ITV): According to cognitive load theory (Kirschnera *et al*., 2011; Aggarwal *et al*., 2001), human working memory capacity is limited and overloading working memory hinders learning. In order to foster learning and transfer, the solution process of a complex task may be divided into small, meaningful building blocks. Hence, in Fig. 1, first, we cataloged the contents with the special themes into modules from the textbook. Second, we adapted the concepts of modularity to build the hierarchically organized structures called presentation networks; each module represented a set of related concerns which included a collection of related units. Modules were independent of one another but could communicate with each other in a loosely coupled fashion. Finally, we borrowed the navigation technology in the presentation networks to provide presenters/learners with the ability to rapidly find and display whatever contents they needed and whenever they needed it. We also used the multimedia technologies such as various colorful buttons, step-by-step visual indicators, arrow prompts, zooming technology *et al*., to draw viewers' attention to specific action in the video. Concise key prompts and narration provides helpful explanation. Learners can use the control bar which is below the interface to stop, play and rewind the video (Fig. 2).

Conduct the empirical activity: For evaluating students' learning performance and satisfaction from the ITV, we conducted an empirical activity.

Participants: This experiment was motivated by the need of 87 students of a college of design in southern Taiwan to learn multimedia and animation arts. This study used an experimental teaching to develop and evaluate the instructional material. The experimental course, 36 h

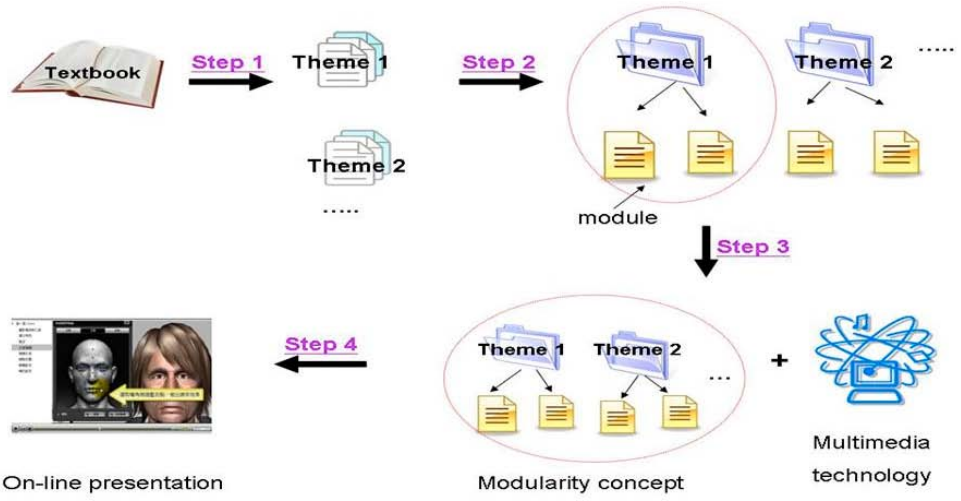

Fig. 1: The procedure of constructing the interactive thematic video is as following: Step 1: To catalog the contents with the special themes from the textbook, Step 2: To adapt the concepts of modularity to build the independent modules, Step 3: To conduct multimedia technology (ex. navigation and visual indicators) to integrate these separated modules to build a hierarchical presentation network and Step 4: To implement the presentation network to the on-line learning platform

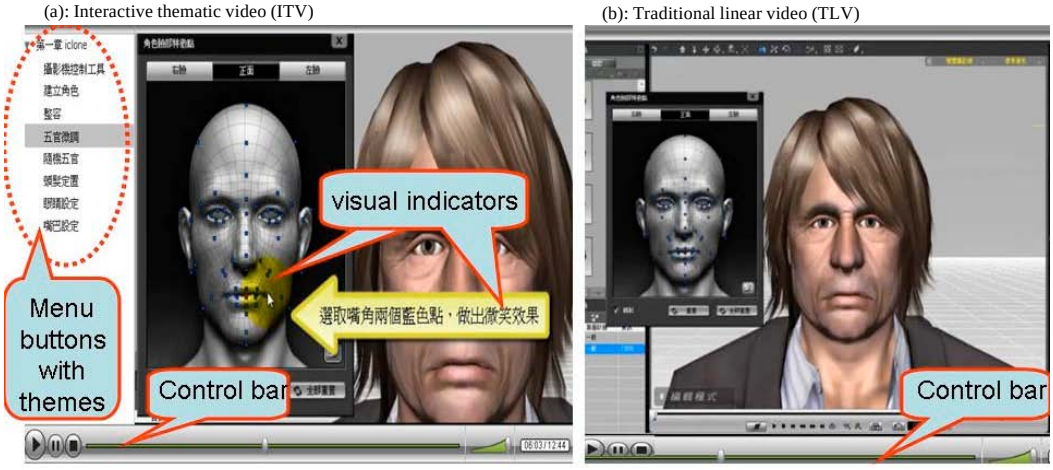

Fig. 2(a-b): The comparison of the interactive thematic video and traditional liner video, (1): The menu buttons of ITV which were cataloged by different themes, not only worked as an outline of the contents but also allowed users instantly link to the desired part with self-control; in contrast, the TLV presented with linear way and users must use the control bar to choose their desired part, (2): On ITV, the visual indicators could attract user's attention and help to enhance their comprehension and remember more ideas but those were not on TLV and (3): The narration and control bar were included on both videos

workshop, was provided for college majoring in design students. Exclude the unusable surveys which were either incomplete tests or questionnaire or not followed instructions were identified and discarded. As a result, 73 respondents (84% of 87 cases) were used as the basis for data analysis. Of these participants, 48% were males and 52% were females. Each subject participated in the study was randomly assigned to experimental group (n = 38) and control group (n = 35).

Research instrument: The research instrument consisted of two tests and one questionnaire. All the items in the instrument were carefully constructed so as to be in line with the purpose of the study.

Tests-pretest and posttest: To exclude the factor of digital divide, in the first week of the classes, the participants were required to take pretest regarding their experiences of using iClone software which is a digital video production and other video applications to check the effects of computer literacy and experience on the findings, thereby improving the internal validity of the study. And after the experimental activity, this study provided the posttest and compared the difference of two groups to determine how much the participants learned as a direct result of the learning program. Researcher compiled the posttest based on participants' learning progress and how well participants understood the materials.

Learning motivation survey: This study modified and adopted the closed-end questionnaire from the ARCS motivation model proposed by Keller (1983). 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 contents, activities and assignments must be related to their personal and professional goals, confident that they can achieve the expected outcomes of the course and satisfied which derive from the instruction (Johnson and Aragon, 2003). The questionnaire, Instructional Material Motivational Survey (IMMS)-overall motivation to learn was evaluated. IMMS that developed around Keller's ARCS model of motivational design was designed to evaluate how instructional materials affected motivation to learn (Keller, 1983). It contains a 367-point Likert scale statements, ranging from extremely dissatisfied (1) to extremely satisfied (7), as well as providing open comments on the system. Each statement measures an individual ARCS component. In order to minimize possible error because of participants' 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.

Procedure: The learning materials are distributed to the learners through TUT e-learning platform. The TUT e-learning platform which provided by Tainan University of Technology in Taiwan, is a flexible e-learning and e-working platform allowing teachers to build effective online courses and to manage learning and collaborative activities on the web. The learning environment of this research was designed and framed as a software tutorial where subjects had to learn a new computer application. In the first week, the objective and procedure of the experiment were clearly described and the participants were required to take pretest. Then, participants of the two groups received about 10 min of training during which they saw a brief live demonstration about how to watch an online lecture using the interactive video learning materials. At the next few weeks, we conducted the experimental activities. The experimental group learned with ITV and the control group learned with traditional video which has no any visual indicators and presented with the linear presentation way. The blended teaching strategy has been employed for the participants; at the beginning, the teacher explicated and demonstrated the instructional contents and then asked participants practiced the exercise by themselves. They could repeatedly watch the video-based learning materials from the platform. After the experimental activity, the posttest and questionnaire were employed to two groups.

RESULTS

This study 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. Independent samples T test was used to determine the effects of experimental course. The standard for significance in this study was <0.05. Descriptive statistics, including means and standard deviations, were reported in order to understand the participants' cognitive results of the learning activity. The computed mean rating for each item was compared with the theoretical mean rating (assuming normal distribution of responses) of 3.0 to determine whether respondents agreed with the statements. Any computed mean of an item exceeding 3.0 indicated expression of agreement with the statement while means below 3.0 indicated expression of disagreement with the statement (Donkor, 2011).

The result of pretest: This study used the Levene's test to conduct homogeneity of variance. The Levene's tests showed that before the experimental activity, regarding the pretest, the t value and the significance level (t = 1.614, = 0.086>0.05) indicated that the testing results did not reach a significant level, indicating that before the experimental activity, the two groups' initial cognitive abilities were the same.

Table 1: Means (M) and standard deviations (SD) of the posttest scores

	Ctrl (n = 35)		Exp (n = 38)	
	M	SD	M	SD
Pretest	53.1771	14.152	51.111	11.654
Posttest	74.674	20.344	79.257	20.886

*p<0.05, **p<0.01, ***p<0.001

Table 2: Descriptive statistics of learning motivation in different groups

	Ctrl. group		Exp. group		
	M.	SD	M.	SD	t-value
Attention	2.829	0.771	3.513	0.926	3.444**
Relevance	3.083	0.736	3.259	1.122	2.085*
Confidence	3.095	0.660	3.451	0.836	2.770**
Satisfaction	3.021	0.804	3.550	0.809	2.794**

*p<0.05, **p<0.01, ***p<0.001

The result of posttest: The posttest that conducted from the instructional materials was 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 posttest and the Cronbach's coefficient alpha (α) was 0.882. That means the posttest was an appropriate instrument for learning performance measurement. A one-way analysis of covariance (ANCOVA) was conducted on the posttest, with the pretest scores as prior knowledge used as a covariant to exclude the factor of prior knowledge by the students. This factor could affect the assessment of the students' learning achievement. After confirming the requirement of homogeneity of within-cell regressions, F = 1.046; p = 0.449>0.05, the t-test has been conducted. The results revealed significant difference between the two groups on the posttest, t = 2.085, p<0.05. The finding indicated that students in the experimental group had higher posttest scores than those in the control group (Table 1).

Motivation with the learning material: The reliability of the IMMS, as assessed by Cronbach alpha for internal consistency, was 0.878. For the four components (attention, relevance, confidence and satisfaction) of IMMS, Cronbach alpha was between 0.836~0.887. Considering all three experimental conditions, there were differences in motivation (ARCS model) among the different conditions: attention: t = 3.444; p<0.01, relevance: t = 2.085; p<0.01, confidence: t = 2.770; p<0.01, satisfaction: t = 2.794; p<0.01). Table 2 showed the means and standard deviations of learning motivation of participants in different experimental groups.

DISCUSSION

The results showed ITV had the positive effects on both learning outcome and learner motivation. The findings provided some insights on how to achieve higher learning effectiveness with the presentation of instructional video in an e-learning environment.

First, before the experimental activity, the results of pretest showed that 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. The goal of NII was to expand the information superhighway to every household, office, factory and school and decrease the digital divide. NII tried to provide an accessible and affordable information network for every citizen in Taiwan (Chen *et al*., 2001, 2011).

Second, the pretest scores was excluded because they could affect the assessment of the students' learning achievement, the findings of the posttest revealed that students in the experiment group gained higher scores than those in the control group. This could be due to the noticeable visual indicators and self-controlled learning environment. Under this situation, according to schema acquisition and the borrowing and reorganizing principles of cognitive load theory (Schar and Zimmermann, 2007; Roszanadia and Norazmir, 2011), the recorded materials could help students to construct the plentiful information in long-term memory (Leahy and Sweller, 2008; Onasanya *et al*., 2010). Namely, they could almost 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*., 2011).

Finally, the results of the IMMS indicated that the learning attitude of experiment group is more positive than those of the control group. Compared with the traditional linear video, the interactive thematic instructional materials with the thematic instruction fitted students' needs and preference, especially, they could randomly hyperlink to a segment with minimal search time which could enhance their engagement and so improve learning effectiveness so as to reduce student's extraneous cognitive load. Also, the video presented the related textual and pictorial learning elements simultaneously which could benefit to reinforce their learning. Under this situation, students felt confident and satisfied with the instructional activity.

CONCLUSION

As for students, a good presentation meant being coherent, explicit and a clear structure. This study stranded on the cognitive theory of multimedia learning to integrate the thematic instructional strategy into interactive video to promote the positive effects in learning. The experimental results showed that under a self-controlled and real time learning environment , the interactive thematic video not only provided the themes which related to students' daily lives but also supplied the referential connections between the visual and verbal mental representations which could built for the teaching contents by using Conceptual Association Component (Bartsch and Cobern, 2003; Cavanaugh *et al*., 2008). Accordingly, the interactive thematic video could help students to understand the learning contents and get their high satisfaction in learning.

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