

DEVELOPMENT OF INTERACTIVE MULTIMEDIA COURSEWARE (E-CRAFT) FOR CRAFT EDUCATION

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ABSTRACT

The way of teaching and learning traditional crafts have always used traditional apprenticeship learning methods where the expert facilitates transfer of practice skill sets to novices. As a craft has been taught in conventional approach, the students and experts have been facing several problems especially when expert needs to teach a group of students.

An appropriate mapping of craft education and Information and Communication Technologies using Multimedia technology for instance, has the potential in transforming traditional craft learning into more flexible environment. This paper reports on a research project on development of an interactive multimedia courseware package for teaching and learning traditional craft called e-CRAFT.

The e-CRAFT is specially designed for songket weaving course taught to certificate and diploma students from Fakulti Seni Kraf Tenunan in their first year study at Institut Kraf Negara, Malaysia (National Craft Institute). The courseware was developed in a web-based environment and overall development process was based on the Dick and Carey's process model and conceptual Instructional Design framework. It is made up of eight learning modules: Introduction, Materials & Tools, Knowing Motifs, Learn How to Weave, Quizzes & Test, Online Discussion, Glossary and Help module. In order to test whether the courseware is suitable in terms of usability, pilot testing was done to a sample of 10 students.

The results from pilot test received positive feedback which signifies the courseware is considered acceptable for effectiveness study and help for further improve of the e-CRAFT courseware.

Keywords: Craft education, web-based courseware, traditional craft

INTRODUCTION

Practicing craft in most traditional way of learning is through apprenticeship method (Gamble, 2001; Torrey, Churchill, & McDonald, 2009; Wood, Rust, & Horne, 2009). (Collins, Holum, & Brown, 1991) stated that in traditional apprenticeship, the expert shows the apprentice how to do a task, watches them practices portions

of the task, and then turns over more and more responsibility until the apprentice is proficient enough to accomplish the task independently. Learning is mostly done through observation from expert and apprenticeship also put students on observing other peers. However Wood, et al. (2009) in their study highlighted that experts can have difficulty in articulating their knowledge and explaining to novices. Experts' skills are deeply embedded in their physical movements and in their history of interaction with materials, making this knowledge hard to express. A large gap between watching and doing extremely challenging for novices to successfully learned in a short period of time (Torrey, et al., 2009).

Nowadays, craft skills were taught in formal education at several craft training centre and higher institutions. In Malaysia, the government began supporting the creation of craft centers in various regions as extensive efforts to preserve and conserve of national heritage products. Such example, National Craft Institute at Rawang, Selangor was established in year 2001 by Malaysian Handicraft Development Corporation (MHDC) under Ministry of Information, Communication and Culture to primarily engaged in the assisting craft communities and training young craftsmen, besides offering educational certificates and diploma courses related to traditional Malaysian handicrafts. Learning in craft skills is presented through combination of theory and practical and traditional apprenticeship remains the predominant method of teaching and learning crafts.

As compared to informal craft skills learning that most of experts attached with small group of apprentices (or individual) and often taught face to face or side by side, formal crafts education involves a large number of students. This is an obvious problem in the conventional approach that potentially limiting the support from expert to monitor, focus and assess student individually.

Therefore, new learning strategy utilizing apprenticeship method and ICT technology and multimedia was studied to support and enhance the learning process in craft education. This study proposed multimedia courseware which implemented based on theories related to development, and songket weaving craft was selected for this project. The second purpose of this study is to evaluate the usability of the courseware through pilot testing to determine whether the courseware can be considered for effectiveness study.

PREVIOUS STUDY

Study conducted among students and experts at National Craft Institute found that there were some weaknesses in conventional lectures and skills demonstration in traditional apprenticeship applied in teaching and learning craft (Osman et al., 2012). Traditional apprenticeship method acquire high level of dependency to experts thus reducing students' ability to solve their own problems especially at the beginning of learning as they much like referring and asking to the experts. Besides, other problems that were facing by most of students including frequent repetition of the teaching process, took a long time in memorization of learning process, difficulties in obtaining expert assistance and related course materials anytime and anywhere, communication problems occurred from verbal learning and difficulty to visualize practical teaching that is verbally delivered.

To overcome these weaknesses, new learning opportunities should be given as alternative method in enhancing apprenticeship in craft education such as exposing to digital learning in order to prepare students for operating in an information-based society. With the advances in digital revolution, most information is presented to us in a multimedia context. Besides being a powerful tool for making presentations, multimedia offers unique advantages in the field of education as independent teaching tools for students.

More education teachers incorporating courseware into their classroom in order to allow students with different learning styles to work at their own pace. Providing multimedia courseware in a web-based learning environments provide more flexible ways of learning to fulfill individual needs. Students can have more alternatives of control over their learning and pace, as well as the learning objectives and outcomes. To maximize web-based learning, it is appropriate to emphasize on constructivist learning environment which focus on student individual query or student-centered approach and also cognitive apprenticeship guided by experts or teachers (Tsai, 2008).

Web-based learning environment can effectively offer cognitive apprenticeship for students by utilizing communication technology via synchronous or asynchronous online communications medium such as email, chat and an online discussion using forums that can facilitate peer to peer and students-to-experts interactions.

In order to deliver teaching and learning of traditional craft in digital environment, a new model for courseware development for teaching and learning traditional craft was developed by Osman & Zin (2010) as a guide to developers and researchers. The model called CDTC Model consists of 12 main components obtained from extensive review of prior studies includes analyzing teaching and learning theories and pedagogy, comparing existing teaching and learning frameworks and models of courseware development and by reviewing a number of applications and multimedia technologies. The model went through several validation processes among crafts' instructors and comprises of the following components: Teaching and learning goal setting (objectives), Teaching and learning theories, Learning strategy, Course materials design, Course structure design, Delivery design, Multimedia technology and delivery medium, Interactivity design, Adaptive craft modules, Multimedia databases, Self assessment and Output & rewards.

Hence, in this study the authors adopted CDTC model in designing an interactive multimedia courseware for teaching and learning traditional craft.

DEVELOPMENT PHASES OF e-CRAFT

To develop e-CRAFT courseware, Dick and Carey's model was chosen as the flow guidelines for the whole courseware development process. This model comprised from four development phases starting from Analysis, Design, Development and Evaluation as shown in Figure: 1. The first phase involved an analysis study based on interviews, observations and questionnaire from preliminary study and also from reading on the past research related to the study in order to identify goals and requirement analysis.

Based on the analysis results and literature review, the problem statements, objectives, scopes of the research were specified.

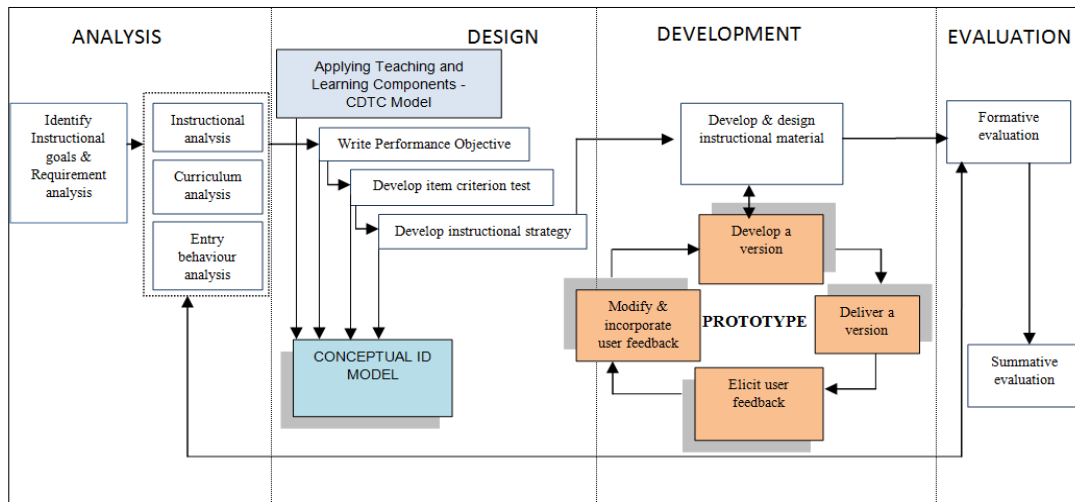


Figure: 1
Courseware development phases

The second phase focused on designing the e-CRAFT courseware by referring to the data gathered from the analysis. The process of design and development of multimedia learning environments is complex and requires careful consideration of a number of basic elements. As part of the development of a multimedia tool, it is important to design appropriate conceptual Instructional Design (ID) model in order to promote understanding in learners. The consideration was given to select courseware contents and its elements that will enhance apprenticeship learning. The next section describes the details on design of courseware contents, elements and activities in e-CRAFT based on ID framework.

The third phase is development phase which involves developing a working e-CRAFT. This phase also refers to acquire and prepare technologies for content presentation and interaction with users. Basic activities involves in this phase including development of storyboards, flowcharts and navigational maps, designing interfaces and screens, authoring and integrating contents as well as continuous evaluation to ensure that all elements work together to improve the design.

The courseware was developed using selected development tools. Multimedia authoring software used to develop the courseware is Adobe Flash CS3 Professional while others such as Adobe Illustrator, Microsoft Paint and Adobe Photoshop CS3 for creating and editing graphics as well as for creating the icon of courseware interface, Microsoft Sound Recorder and Sound Forge 8.0 for audio recording and editing, Adobe Premier Pro CS3 for video editing and Swish Max4 as an advanced Flash creation tool for 3D graphics and effects. Because of the e-CRAFT is developed in a web-based environment, the following software also had been considered:

Microsoft internet browser to launch the courseware, Adobe Dreamweaver CS3 as a tool design interface which can be linked with the programming language, Php programming language which stands for hypertext pre-processor is a server-side scripting language for creating dynamic web. The final phase involves the courseware testing and evaluation. The e-CRAFT courseware underwent several stages of formative evaluation process suggested by Mann (2006): quality review by an instructional design and a subject matter expert, pilot testing with selected students and validation among students and experts. After an alpha testing was done and it was satisfied, a pilot testing then was conducted to make sure the courseware was designed and developed according to users' requirement. Feedback and results from pilot testing will be used for final modification and improvement of courseware and for further effectiveness and usability studies.

DESIGN AND DEVELOPMENT OF E-CRAFT

In this study, the e-CRAFT courseware was designed based on relevant teaching and learning theories and various pedagogical approaches. The courseware was prepared to meet the specific needs of individual learners as part of meeting learners' demands for content. Conceptual ID framework for e-CRAFT development as depicted in Figure: 2 adapt the CDTC Model which is a well-researched courseware development model for teaching and learning traditional craft. It was tailored to learners' needs for specific content, media, and applications of technology. The courseware also address appropriate structure and delivery design while providing appropriate assessment and feedback. However, the most important component for the courseware design lies on learning strategy of cognitive apprenticeship framework that has been designed for a web-based learning environment. Appreciation of these needs guide the development and delivery of learning activities that meet learners' performance objectives. Conceptual ID framework incorporates a number of elements.

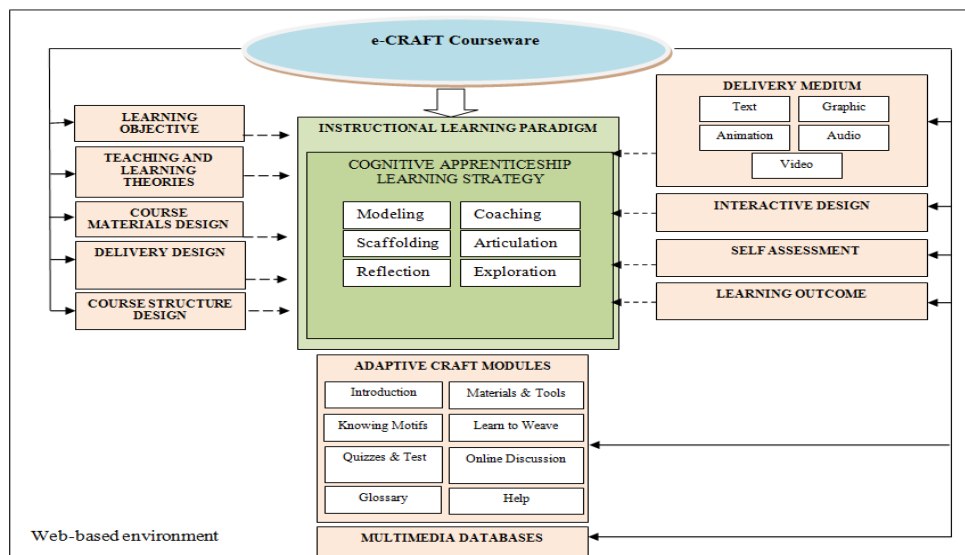


Figure: 2
Conceptual ID Framework of e-CRAFT

Performance Objective

These elements are:

Performance Objective emphasized on the teaching and learning objectives for every module and at the lesson levels in order to accomplish teaching and learning goals for selected traditional craft.

Performance objective or learning objective is a statement that tells what learners should be able to do when they have completed a segment of instruction and give much more direction as to what learners actually need to learn to do. During courseware development, objectives are valuable to all members of the learning system.

Teaching and Learning theories adaption

Adaption selected teaching and learning theories into teaching and learning traditional craft courseware enable to provide the appropriate learning environment that meet diverse learning style of students. Such theories are Social Learning Theory, Cognitive Theory, Constructivism Theory, Behaviorism Theory and Mastery Theory.

Social Learning Theory was introduced by Julian Rotter (1916) and later expanded by Albert Bandura (1925). Bandura's Social Learning Theory posits that people learn from one another, via observation, imitation, and modeling. Within Social Learning Theory, the interaction is depicted among the individual's knowledge and experiences, the environment, and the individual's behavior. In essence, most human behavior is learned observationally through modeling: from observing others, one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action.

Bandura identifies a number of component processes that will determine the outcome of observed behavior, involving four factors:

- Attention
- Retention
- Reproduction and
- Motivation or reinforcement.

It would appear that Social Learning Theory was applied in the courseware through observational learning and modeling.

Behaviorism Theory concentrates on the study of overt behaviors that can be observed and measured (Good, 1990).

Implication of behaviorism theory to promote learning in ways it can stimulate students to perform activities repeatedly to achieve mastery levels. Repeated activities are purposely to improve performance and individual understanding of the subjects.

Assessment can be done through individual tests and performances to demonstrate mastery of entities, activities, and processes.

Cognitive theorists recognize that much learning involves associations established through contiguity and repetition (Good, 1990). It is also known as Gestalt theory and emphasized higher-order cognitive processes in the midst of behaviorism. This theory claimed that students are active entities and not passive. Students not only store data (knowledge) that they have obtained, but actively processing the data and make it more meaningful for them.

One theory that incorporates cognitive features is the most widely accepted theory, Information Processing Theory (Mihalca, 2005). This theory focus on what is playing on the minds of student when learning occurs and how information is stored in memory. A control mechanism is required to oversee the encoding, transformation, processing, storage, retrieval and utilization of information. Several way to apply Information Processing Theory in the e-CRAFT courseware including develop an exercise that will provide the opportunity for learners to use interactive animation to learn a new topic. Through repetition, the learners could easily learn the new process or facts and encode it into their long term memory. Besides, an activity such as observing the video to illustrate skills encourage learners to rehearse and improve their thinking process. By using the learned skill over and over and applying it to their projects assignments will help encode the skill into their long term memory.

Constructivism Theory asserts that learners should be viewed as cognitive subjects engaged in the process of active knowledge construction. Moreover, constructivism also "concentrates on learners constructing their personal understandings during social interactions in their learning environment" (Maor, 2000). Because learners interpret new information on the basis of their existing knowledge, constructivist pedagogy is grounded on students' previous conceptions and beliefs about the topics to be studied. It emphasizes understanding instead of memorizing and reproducing information, and it relies on social interaction and collaboration in meaning making. By applying constructivism in the learning, learners are actively engage in meta cognitive and reflective activities and encourage them to generate new ideas and more creative. Besides, delivery e-CRAFT courseware in Web-based learning permit cross-referencing to other resources specifically with hyperlink and searching capabilities, fit the constructivist learning theory, where learners search out and create their own knowledge bases.

Mastery learning was introduced by Benjamin Bloom (1971) who outlined a specific instructional strategy to make use of feedback and corrective procedure. Previous study showed that Mastery learning effect on achievement and motivation (Clark, Guskey, & Benninga, 1983). Mastery learning proposed students must demonstrate mastery on unit exams, typically 80%, before moving on to new material (Guskey, 1997; Slavin, 2003).

This theory can be very important to the study which aims to enable the highest level of learning, and is opposite of the conventional method. Besides, the theory will help in determining level of student's achievement based on what they have learned. Students can do self assessment based on individual learning path.

Course Structure Design

Course structure design involves organizing and constructing the content by dividing it into small meaningful units that are linked for the presentation. This process is important for achieving the goals of the courseware and for directing the content as well as for providing better learning (Efendioglu, 2012). Therefore, to structure and partition the content into different units involves development of logical flowcharts or navigation maps or storyboards.

Course Material Design

There are various types of traditional crafts. Designing course material involves selecting contents and elements used for appropriate craft learning and according to program goals. The e-CRAFT courseware made up from eight modules which emphasis on the syllabus for the last two processes: Making of songket motif on warp - Menyongket and weaving of songket fabric - Menenun songket in songket weaving. It is also highly relies on the book of "Seni Kraf Tenunan - Motif dan Teknik", first edition published by Institut Kraf Negara (Shukor et al., 2009). During the instructional design phase, a typical instructional presentation was divided into several units in order to effectively deliver instructions as proposed by Jono, Yasin, Za'ba, Ramakrisnan, & Isa (2008) and corresponding to Gagnes' nine events of instruction as shown in Figure 3.

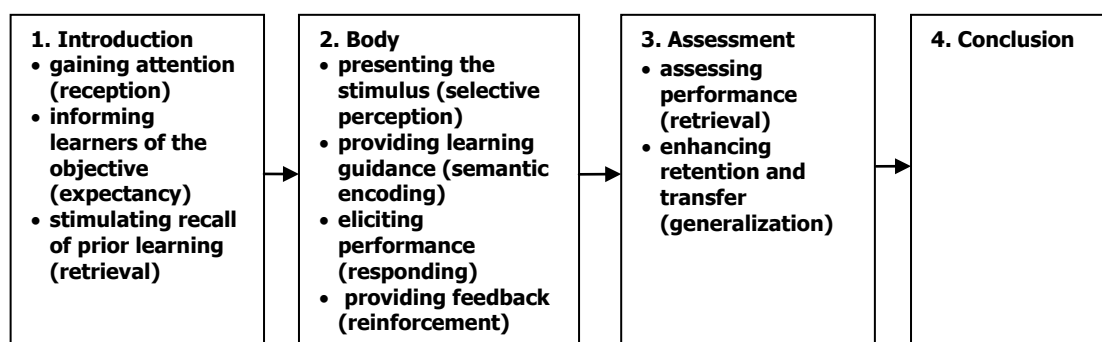


Figure 3:
Segmentation for Content Delivery

Learning Strategy

Learning strategies determine the approach for achieving the learning objectives and are included in the pre-instructional activities, information presentation, learner activities, testing, and follow-through. The strategies are usually tied to the needs and interests of students to enhance learning and are based on many types of learning styles. To deliver the contents, it requires a collaborative learning environment that has convenient access and pedagogical strategies are implemented that are appropriate for online learning. In the case of e-CRAFT courseware, it was emphasized on integrating cognitive apprenticeship method as an effective learning strategy for online teaching and learning traditional craft. As conventional learning was taught in traditional apprenticeship, utilizing the apprenticeship approach in electronic environment was a good choice to remain the importance of the "master-apprentice" relationship. In general, cognitive apprenticeship is seen as a model complementing traditional teaching (Collins, Brown, & Newman, 1989).

Cognitive apprenticeship method was highlighted through simulations, discussion, tutorials and exercises. In order to adopt cognitive apprenticeship in teaching and learning craft, all six teaching strategies were deployed through modeling, scaffolding, coaching, articulation, and reflection and exploration element.

Modeling is the process of the demonstration of expert skills to students on how to do different parts of the task. The expert makes the target processes visible, often by explicitly showing the apprentice what to do. Applying modeling within selected modules in e-CRAFT was provided with a wide selection of models created using various technology media. For example, a series of digital videos, 2D or 3D animations consisted of model of experts that explaining and showing the processes, flows and methods in teaching traditional craft. The models illustrate moving, handling skills and thinking process while completing each task. Some of models was designed purposely included some common mistakes and problems while showing the process or steps to allowed the model correcting the mistake and showing the strategies for problem solving. The modeling component involves the student observing the models. By watching, listening and following along with the videos and animations, student will have the opportunity to grab learning. Because the material is delivered in web-based environment at any time, place and pace that suits students best, they can repeat many times to master the learning. Repeated activities are purposely to improve performance and individual understanding of the subjects to achieve mastery levels as proposed by behaviorist theory.

Coaching is the process of monitoring of students' activities and providing students with opportunities to attempt problems relevant to everyday life, observing them in practice and providing feedback on their performance (Oriol, Tumulty, & Snyder, 2010). The goal is to help the student develop their thinking that is more closely aligned with that of an expert. Through courseware, the expert coaches the apprentice through a wide range of activities. Coaching was done by answering question and helps student during the process of learning through collaborative learning either using an email, instant messaging or forum. It takes some trial and error before students can perform the tasks that they have seen through observing the model. Expert can coach them how to correct the error and timely assistance will comfort student in early learning. Web-based learning provides experts to check the ability or progress of each student based on their achievements. Each student is required to test their skills and knowledge by completing a module test for each level to identify their mastery level. By doing this, expert can monitor the performance of students and know the level of each student. High attention will be given to slow learner. In brief, coaching is the process of overseeing the student's learning.

Scaffolding is temporary support provided to students so that they can cope with the task situation and extending competencies. Dickey (2008) categorized types of scaffolding by functions into conceptual, meta-cognitive, procedural and strategic. In conceptual scaffolding, it is includes elements such as hints and recommendations. Meta-cognitive scaffolding includes elements which help students to plan, organize, reflect and regulate during activity. Procedural scaffolding provides support on how to perform tasks, actions or processes and strategic scaffolding includes support on how to apply knowledge, principles and experience to various and new situations.

Applying scaffolding into web-based teaching and learning traditional craft can be done through several ways. Additional support can be provided by organizing the processes of making traditional craft in sequence order, making them easy to understand the whole process. In early stage of learning, students will be assisted through combination of hints and recommendation. Another form of scaffolding can be applied is through creating of a forum. With forum, students can offer each other support and share their understanding. Such forum can help students articulate and reflect what they have learned, and provide better understanding of what they are learning. Another type of assistance to scaffold students is through other communication technologies such as email and instant messenger. Even though students are scaffolded, it will design to foster independence among students. In early course progress, students' email for assistance will be responded in short time. However, as the course progressed, students were encouraged to seek for trial and error and delay time is given to response. This allows students to aid in problem solving and aimed to gradually remove the direct support as students' ability improves. This reduction is called fading where giving the apprentice more and more responsibility.

Reflection involves the students assesses and analyses their performance and enabling students to compare their own problem-solving processes with those of an experts and other student. Reflection can be applied in web-based teaching and learning traditional craft at the end of learning in each module. Students will be asked to reflect upon their learning experiences and assess their performance. For teaching and learning traditional craft, methods to encourage reflection might consist of physically creating appropriate traditional craft and then compare with the experts and other students.

Articulation involves the results of reflection are put into verbal form using any method to assist the learner to articulate their knowledge, reasoning, or problem-solving processes. This element will encourage students to self monitor, explore and develop strategies for actions employed. Several different methods of articulation can be done by student in a web-based teaching and learning traditional craft. Through forum discussion with peers enable students to construct their personal understandings during social interactions in their learning environment.

Other than that, a strategy of questioning students to lead them to articulate and refine their understanding of concepts taught. For example, in designing quizzes or test, students will be asked with different pattern of craft that they have learnt from modeled. Students need to construct their own understanding and able to give reasons.

Exploration involves encouraging the students to form a problem solving on their own, to test them, and to find new ideas and viewpoints. Exploration is critical if they are to learn how to solve problems. As discussed, after certain period of learning, the expert gradually reduces the scaffolding and coaching, ultimately leaving the students to perform the tasks on their own. This situation led student to explore another solution. Web-based learning provides students a chance to search the web that related to their problem to find immediate answers or solutions.

Delivery Design

Delivery design involves designing layout of the elements in the presentation. The elements such as visual, verbal, animation and chunking of information will be drawn on as the way of information is placed on the screen. In developing e-CRAFT courseware, set of guidelines for layout and interface design as suggested by Dastbaz (2003) were considered consisting of choosing the appropriate metaphor, carrying out simple and ease of use of user interface, consistency in design and providing informative help and feedback. According to Sutcliffe, Kurniawan, & Shin (2006), interface guidelines on graphical, visual and interaction design need to be interpreted in the context of the application and user audience. The using of dynamic media to attract attention: video, animation, speech and audio all have an arousing effect and increase attention and improve the attractiveness of presentations. The screen layout also must match mood to audience.

For the purpose of e-CRAFT courseware, a lecture presentation metaphor was chosen where the user could select various lectures and go through them on their own pace. The contents were provided with enhancements to the textual information by inclusion of audio, video and series of animated examples, which could help the users to better understand the issues presented to them. In accordance with integration of cognitive apprenticeship method as learning strategy, the use of videos and animations were extensively prepared to allow users learn from the observed and modeled objects.

Delivery Medium

Multimedia presentation contains selective multimedia elements such as text, audio, video, graphics and animation. Integration among multimedia elements needs to consider the continuity between interactive sequences, and three issues was highlighted by Sutcliffe, et. al (2006) that concern multimedia specifically;

- Matching the media to the message by selecting and integrating appropriate media to make sure the user comprehends the information and the contents effectively.
- Managing users' attention to make sure the key items in the content are noticed and understood, and the user follows the message thread across several media.
- Provide proper navigation and interaction so the user can access, play and interact with media in an engaging and predictable manner.

In order to deliver multimedia presentation and contents, designers must determine an appropriate delivery medium to use that will provide the required information or achieve the desired knowledge and skills.

To present the contents of e-CRAFT, instructional environments that are organized for self-paced, individualized instruction are efficiently deliver through computer-based instruction (web-based learning), video delivered lessons and audio source material in concern with interactivity. Web-based learning offered technical advantages including universal accessibility, ease in updating content, and hyperlink functions that permit cross-referencing to other resources. A reasonable media selection such as video is used to introduce the instruction and to provide information and practice situations.

Adaptive Craft Modules

Basically, the e-CRAFT courseware is consisted of eight modules; Introduction, Materials & Tools, Knowing Motifs, Learn to Weave, Quizzes & Test, Online Discussion, Glossary and Help. These modules were divided into four instructional components as shown in Figure: 4.

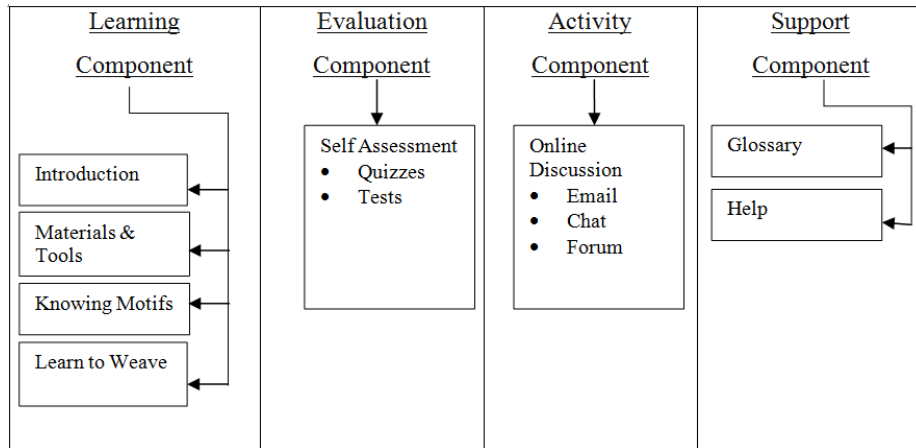


Figure 4:
e-CRAFT Modules

Introduction module introduce the learners with the definition of songket craft, the documentation of history with dedicated to the story and the origin of songket and aesthetic arts of songket accompanied by images of rare and precious pieces from Malaysia and around the region.

Second module, Materials & Tools presents the sources of raw materials, the equipments, the spinning and wrapping of the threads as well as the warp-weighted looms used. Module of Knowing Motifs details the traditional and contemporary motifs of embroideries created by the weavers.

The module Learn to Weave describes the weaving and embroidery techniques and understanding the concepts of weaving method or process step by step from Dyeing-Mencelup benang, Winding into spools or bobbins-Menerai benang, Warping-Menganing benang, Winding of warps onto a warping board-Menggulung benang, Making of shafts - Mengarak benang, Reeding of warps-Menyapuk benang, Making of songket motif on warp-Menyongket and Weaving of songket fabric-Menenun songket. The process of Menyongket and Menenun songket were given in details as this study focus on both processes.

In Quizzes & Test module, three quizzes and three tests were adopted in order to test the level of understanding among learners. Learners can take part for each quiz and they can monitor their achievement and performance based on the feedback acquired from the quiz. Learners were also allowed to repeat the quiz if they have not reached the level of mastery. Tests were provided in online form which can be easily administered by experts or instructors. However, the different between quiz and test is student cannot repeat the quiz unless the expert allows them to do so.

The benefit of online test applied in the e-CRAFT courseware is that the system automatically grades the tests and this ensures fair grading and immediate result feedbacks. Furthermore results are stored in a database and student or expert can access full record of units taken and grades obtained. In accordance to cognitive apprenticeship method, expert can gradually reduces or fade the support (coaching) to student those achieve a good performance.

Online Discussion module is among the most important feature in e-CRAFT courseware. It allows collaboration among students and immediate teacher-student communication. Online discussion was prepared with three options; email, chat and forum.

Glossary and Help module are additional module where glossary contains specialized terms related to songket weaving with definitions help learners understand terms which may be unfamiliar, meanwhile the Help module purposely to guide learners easily understand learning material provided.

Multimedia Database

In a general multimedia environment, databases would contain various types of information such as text, voice, images, and full-motion video. Multimedia database allow accessibility of data and enable more flexible learning and provides more options in hosting one or more primary media file types.

Interactive Design

Interactivity is important as intermediary between learners and contents. User is allowed to control what elements are to be delivered and when they are to be delivered. Interactivity is frequently considered to be beneficial in the context of computer-based learning. Several studies found evidence of an interactivity effect student understanding and assist the acquisition of knowledge (Evans & Gibbons, 2007; Mayer & Chandler, 2001; Schwan, 2004). Interactivity within the e-CRAFT courseware includes an interactions of three sequence actions; initiation, response, and feedback as following to three-stage model suggested by Evans, & Sabry (2002) of computer-initiated interactions. Each action involves an exchange of information between two agents.

Initiation involves the first agent inviting input from the second. Response involves the second agent providing that input. Feedback involves the first agent passing back information as a consequence of the response. From a cognitive perspective, the utility of incorporating interactivity in computer-based systems is that it allows the learner to influence the flow of information in terms of timing or content. In e-CRAFT courseware for example, button-clicking can be used to allow the learner to indicate when they want the next portion of text to be displayed; and interactive multiple-choice questions can be used to provide meaningful feedback for self-assessment.

Self Assessment/Criterion Test

Through quizzes and online test, learners can track their personal development and deepen their learning experience. They take more responsibility for their own learning and become more aware of their own knowledge gaps too. Learners can evaluate their performance based on level of difficulties.

EVALUATION OF e-CRAFT THROUGH PILOT TESTING FOR USABILITY

In order to measure the usability e-CRAFT courseware before it is used for further effectiveness study, pilot test was conducted after the development phase of e-CRAFT courseware. According to (Mann, 2006), the purpose of a pilot test is to debug the prototype (courseware) and documentation, and correct any obvious problems.

An exemplary pilot test is conducted with representatives of the target audience using a seven-steps procedure from selecting participants, explaining the procedure to them, determining their prior knowledge, observing participants how they are using the program, interview, assess their learning and take notes on how it could be revised. In a study of (Zin, 2009) stated that sampling of 4 to 5 students are sufficient in identifying 80% usability problems.

According to that, there were ten participants (all female) in the pilot testing. All of respondents were second year students from Diploma Seni Kraf Tenun, Fakulti Seni Kraf Tenun, National Craft Institute.

The students tested the e-CRAFT courseware to assess the usability based on the these constructs: memorability, learnability and ease of use, content delivery, feedback, interface and screen design, media integration and satisfaction using a set of questionnaires. All constructs were extracted from several reliable sources (Hollins, 2008; Nielsen, 1993; Zaharias & Poylymenakou, 2009). The students rate the questionnaire using a five-point Likert Scale ranging from "1=Strongly disagree" to "5=Strongly agree". The result obtained was analyzed using SPSS 17.0. The usability questionnaire instruments used in pilot test was validated by four experts. Two of them were instructors at National Craft Institute with minimum two years' practice in craft weaving field and others were lecturers possessed with five years' working experience in the design and implementation of instructional multimedia applications.

Reliability testing was also conducted. According to the analysis, overall alpha for usability questionnaire instruments demonstrated high reliability ($\alpha = 0.985$). The internal consistency for the seven constructs ranged from 0.821 to 0.966 which exceed the recommended level. Refer to Fraenkel & Wallen (2003), reliability coefficients of 0.70 and higher are viewed as acceptable. Construct of memorability consisted of two items and the Cronbach's coefficient alpha (α) was 0.899. Learnability and ease of use consisted of nine items and the Cronbach's coefficient alpha (α) was 0.821. There were 15 items in content delivery and the Cronbach's coefficient alpha (α) was 0.957. The construct of feedback consisted of four items and the Cronbach's coefficient alpha (α) was 0.950. Construct related to interface and screen design of the e-CRAFT courseware consisted of six items with the Cronbach's coefficient alpha (α) at 0.964. Construct of media integration consisted of six items showed a very high consistency with Cronbach's coefficient alpha (α) was 0.966. Lastly, students' satisfaction toward the use of e-CRAFT courseware consisted of five items with the Cronbach's coefficient alpha (α) at 0.923.

Table: 1 shows the results yielded from the usability analysis in pilot testing.

Summary of usability constructs in pilot testing

Usability Construct	Mean	Std. Deviation
Memorability		
Learnability and ease of use	4.55	0.4972
Content delivery	4.37	0.4159
Feedback	4.41	0.4846
Interface and screen design	4.40	0.5279
Media integration	4.40	0.5340
Satisfaction	4.22	0.5558
	4.48	0.5594

All constructs received an average mean score of 4.40 which signify that the e-CRAFT courseware is considered acceptable to use for real usability and effectiveness evaluation. Construct of "Memorability" measured how easy it is for users to remember how to use the courseware. Scores from the memorability subscale produced a mean score of 4.55. The second construct "Learnability and ease of use" measured how well the courseware helped user to learn from it and whether the interface helped learners use the courseware easily, received a mean rating of 4.37. "Content delivery" measured the effectiveness of the design of the courseware content and messages. The scores from content delivery subscale was resulted a mean score of 4.41. Construct of "Feedback" measured how well the courseware presents messages and provide feedback to users. According to instructional design guidelines, the interface should provide informative and immediate feedback to learner's responses (Hollins, 2008).

The scores from feedback subscale received a mean rating of 4.40. "Interface and screen design" measured whether the user interface is organized effectively and consistent. It was also rated at a mean score of 4.40. "Media integration" was used to measure the combination of multimedia elements and how they were integrated in the courseware.

The scores from media integration received a mean score of 4.22. Construct of "Overall User Satisfaction" measured the user preference with the courseware and this construct represent the user's overall perception of the courseware. Scores from the overall user satisfaction subscale yielded a mean score of 4.48. Results from pilot testing will be used to further improve and refine the e-CRAFT for effectiveness and usability study. Besides, improvement of the courseware will be made based on user feedbacks such as image and video enhancement, contents and quizzes questions. Following the pilot test, a few items in the questionnaire also were changed.

CONCLUSION AND FUTURE WORK

This study focus on designing a multimedia courseware that can effectively enhance apprenticeship learning of craft education through web-based environment. Guided by instructional design framework created, the e-CRAFT courseware was successfully developed. Pilot testing was carried among selected students in order to assess the usability of the courseware.

The result has shown that e-CRAFT courseware receive positive acceptance from the students, however, there are still need for improvement before it can be used for effectiveness evaluation. Future design research will focus on assessing the effectiveness of the e-CRAFT courseware through appropriate case study among students from National Craft Institute, Malaysia.

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