

The Analysis of Determinant Factors In Software Design For Computer Assisted Instruction

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Abstract—The purpose of this study is to identify the determinant factors in the formulation of human and computer interaction in software design for Computer Assisted Instruction (CAI). The methodology used is descriptive analysis toward determination of the determinant factors in the formulation of human and computer interaction in software design for CAI through Focus Group Discussion, and then weighting each aspect in the interaction of human and computer through the respondent perceptions and questionnaire by using utilities weighting model on the Analytic Hierarchy Process. The result showed that the determinant factors in the determinant factors and the formulation of human and computer interaction in software design for CAI, which are respectively based on the value of their interests, are functionality, productivity, interaction model, and security.

Index Terms—Human and Computer Interaction, Software, Computer Assisted Instruction.

1 INTRODUCTION

Development and advancement of information and communication technology (ICT) in education opens new horizons for the opening of the access and the changing patterns of learning, which leads to an increase in the quality of education (Munir, 2010). Technological advances have provided new concentration for humans. A lot of activities previously carried out manually (non-computer) are then facilitated by the computer facilities due to efficiency and modernization. This generates the big interest for people to use computers in all fields, including in education. These advances are an enticement for education experts to take advantage of learning resources designed as a learning resource integrated into the Computer Assisted Instruction (CAI). An emerging problem at this moment, according to researchers is the need to make analysis of determinants aspects for the design of computer-based learning systems, so that this learning model can run effectively and efficiently. Based on the background of research, the purpose of this study is to identify the quality of determinant factors in the form of human and computer interaction in software designing for CAI, which can then be used as a main material in designing computer-based learning systems.

2 LITERATURE REVIEW

Technology is one key to successful implementation of learning process and has an inevitable role. Wong (2005), states that technological support to the learning process can be developed widely so that it can be applied and integrated into an organization technology platform. Information technology is the infrastructure (hardware, software, brainware) systems and methods to acquire, transmit process, interpret, store, organize, and use the data significantly.

Therefore, the use of technology provides much convenience in managing information that means storing, retrieving, and updating information (Warsita, 2008). Technological support often becomes a prerequisite of the success of learning, technology functions to facilitate communication between people without boundaries of time and distance, supporting the flow of knowledge that can be accessed quickly and easily, and to facilitate cooperation among organization members. Chong et. al., (2005) identified the learning process to improve skills and expertise supported by information technology. According to Brink (2003), the condition of an organization technology contributes to the development of knowledge-sharing activities. Technological conditions in the context of learning process can be defined as the technological ability to facilitate knowledge-sharing activities. The support of technological facilities toward organization has an important role in encouraging knowledge-sharing activities in the organization. Technological developments currently allow the availability of a convenient facility for the storage, retrieval and knowledge communication. For example, the support of organization technological facilities through providing groupware, database on-line, internet and virtual communities. Furthermore, Warsita (2008) states the functions of information technology in education can be divided into seven functions as: (a) a knowledge repository, (b) a learning tool; (c) an educational facility, (d) a standard of competence; (e) an administrative support, (f) a tool of school management, and (g) an educational infrastructure. The main purpose of technology in education, which is often called as learning or education technology, is to solve problems or facilitate learning activities. Learning technology as software of technology in the form of systematic ways to solve learning problems is more sophisticated and has widely position in education (Warsita, 2008). Thus, the practice of learning technology application in solving learning problems has a concrete form in the presence of learning resources that facilitate learners to learn. To make CAI effective and efficient in the learning process, it is necessary to bridge human and computer interaction design well. Human and Computer Interaction (HCI) is a subject matter that studies the relationship between humans and computers that covers designing, evaluation, and implementation of face to face computer users in easy way. Science seeks to discover the most efficient way to design an electronic message, while the human and computer interaction

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itself is a series of processes, dialogues and activities done by humans to interact with computer in order that the two sides provide input and feedback each other through gathering to obtain the expected final results. System must be in accordance with human needs and is designed human-oriented as users (Subakti, 2006).

3 METHODOLOGY

Systematic problem solving starts from the basic idea of the software design development, followed by weighting to the general multi-criteria approach of weighting models. This analysis is then linked to the problems associated with quality determination of the determinant aspects in designing computer-based learning systems. The main procedure used in this research is the study of literature, Focus Group Discussion (FGD), and weighting the utility model with AHP. AHP model application is the task of assigning weight to various criteria and the construction of pairwise comparison matrices. It starts as the top level of the hierarchy, and proceeds to the other level until the lowest level of the tree is reached (Ramdhani and Santosa, 2012). Scheme of the procedure can be seen in Fig.1.

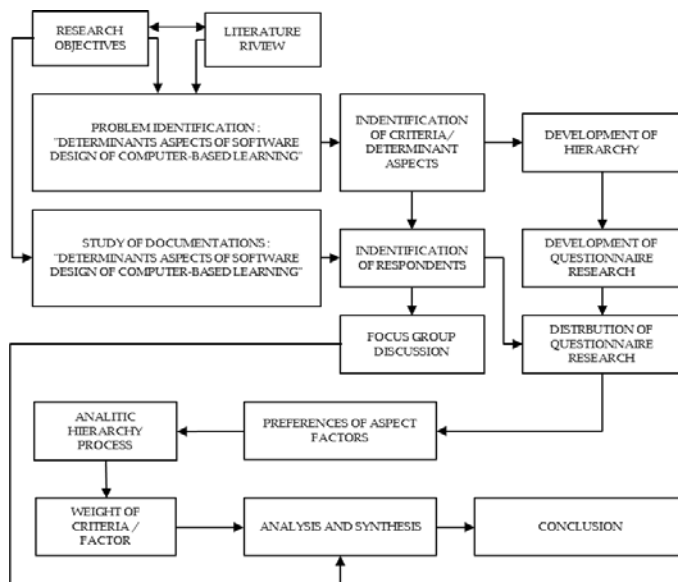


Fig.1. Research procedure

4. RESULT AND DISCUSSION

4.1 Design of Computer Assisted Instruction

4.1.1 Analysis System

The basic principle as the reference system analysis in designing of CAI is that each system is tied together by information exchange. Basic idea of systems analysis design of CAI is the relationship among data, models, models of dialogue, communication networks, as well as the information generated. The starting point of the approach is objective, and the focus is on the design of CAI as distinguished from the design of components or subsystems. CAI system design takes advantage of the development and management analysis of information systems within the learning system. A framework for the design of CAI technology component is approached through a synergy between the elements of dialogue management, data management, component model,

and network communications in a system, this approach is based on efficiency principles and effectiveness of each system element, so that each element in the system is fully identical and related to the system.

4.1.2 Dialogue Management

Dialog component in the CAI uses hardware and software that provide a means of interface between the user and the system. Dialog component presents output for the user and gathers input into the system. CAI uses a dialog component that supports the input commands and output to communicate with the user. Designing the dialogue component is aimed at supporting effective communication between decision makers and system, design begins with decision analysis and decision-making process. This analysis focuses on the representation (output) used, and control mechanisms (input) used for operations involving such representation. Dialog component is designed to use multiple (combined) model of dialogue.

4.1.3 Database Management

Database management is a topic that is relevant to the majority of computer applications. Database management in CAI was applied for these purposes:

1. Simplifying the collection and maintenance of used data;
2. Limiting the management functions required;
3. Simplifying the system design;
4. Eliminating unnecessary performance and security support;
5. Improving the ability to use the data collectively

Data Base Management System is also an important prerequisite for CAI flexibility, because the DBMS handles database maintenance and control, as well as simplifying program interface with database systems. Database management is an important component of the CAI because of differences in data requirements. The database is an integration mechanism of various types of internal and external data. It is possible this data should be manipulated or modified in its use.

4.1.4 Model Management

Modeling component provides ability to the learners to analyze their competence in learning process of a material. Modeling component is the main tool to support learning evaluation. Designing modeling component allows decision makers to support activities directly. Some of the required modeling capabilities in the CAI are as follows:

1. Interface

- a. user can work in solving the problem without any distraction unnecessary
- b. control parameter is expressed in a form that is easily recognizable by the user

2. Control

- a. User is given a spectrum of control. Manual Supporting operation systems that enables the user to select the appropriate level of learning
- b. Control mechanism enables the users to understand problem solving directly.

3. Flexibility

Manual Operations and algorithmic can be used interchangeably, so that the user can develop a partial solution through manual methods and then proceed with the algorithm method, or vice versa.

4. Feedback

- a. System provides feedback so the user knows the full status of solution at any time.
- b. Designing uses a feedback system.

4.1.5 Communication Network

The design of proposed pattern of CAI in this study uses communication network components that support the commands to send and receive data to communicate between individuals (among learners themselves and between learners and educators). The design of communication network components is intended to support effective communication among them. Communication network components in the CAI need to be fully integrated into software program, designed to support the provision of sending and receiving data means in the form of a structured database. Technically, software and hardware utilize existing technology, the Internet network together with its devices, especially for electronic mail applications.

4.1.6 Technology Design

Design analysis performed in the CAI technology is based on identifying the type of technology required and the amount needed by the application package. For hardware technology, determining the type of technology is based on the identification of equipment used in each process in the CAI, meanwhile the software selection is based on the needs of the system compared to the reliability of the software implementation of CAI in the running target. Technology design developed in this system is used in order to receive input, run the model, store and access data, generate output, and help control the overall system.

4.1.7 Designing Application Program

Stage of designing application program is the stage of manufacturing and using the system operation. This stage also includes writing program code of producing CAI application program. The design of the application program is done by reviewing the relationship between work components and considering the selection of CAI architectural. The design of the application program is the integration of model configuration with the system architecture. To connect one component to another component, and move the control mechanism of a component system from one to another it used an integrating component module or component interface. Connecting components, in this regard, is a sub-program (subroutine) that exists in every system component, functioning to read and write parameters of the memory system. It also identifies the parameters of the system functions and memory allocation.

4.2 Weight of Aspects on Human and Computer Interaction in CAI Design

The process for obtaining data on the analysis of AHP developed by Saaty (1988, 1994) was carried out using a questionnaire developed in accordance with the requirements of data or research purposes and by direct interviews with the

parties or experts who are entitled to the information required that is corresponding to the data. The data in this study is an agreement drawn from five participants of Information Technology lecturers who have competencies with minimal educational standards are Master Degree, in the field of Information Technology. The participants were selected based on the consideration that the level of recognition and their expertise focusing on in-depth study. The data taken for this study was comparison assessment of pairs of potential data perception factors (criteria) to be the primary consideration in analyzing human and computer interaction design in software design for the learning process.

Table 1. Data from the calculation of the weight of each factor and sub-factor of human computer interaction design for CAI.

Factors	Weight	Sub-factors	Weight
Interaction models	0,1430	User-centered	0,0734
		Participatory	0,0105
		Experimental	0,0309
		Iterative	0,0281
Security	0,0723	Data	0,0362
		Health	0,0362
Productivity	0,3008	Effectiveness	0,2005
		Efficiency	0,1003
Functionality	0,4839	Search model	0,0793
		Material mapping	0,2608
		Multimedia tools	0,1438

4.2.1 Interaction Model

Interaction model has a weight of 0.1430, this indicates that the model of interaction in human and computer interaction design for CAI models is in third place, it constitutes an important aspect to consider, especially in user-centered aspect, furthermore experimental, iterative aspects, and finally participatory. Discussion for this aspect can be accounted that CAI is the individual learning pattern, because computer provides services more as a tutor for students. In CAI there is intensive two-way communication between learners and computer systems. This is regarded as an interactive CAI. In addition, the CAI allows students to ask questions, to respond and provide feedback computer systems after they respond questions. Feedback the computers give is intended for learners to always encourage and enhance their capability, in particular computer literacy. Stimulation Procedures presented via the display monitor, the response of learners through the keyboard, and feedback in the form of text, sound or image directed by the structure of a program designed by the developers of CAI.

4.2.2 Security

The aspects of security have the lowest weight, which is 0.0723; it indicates that the security is not a major aspect in designing human interaction and computer for the model of CAI. This is presumably due to the security aspect has become a major issue when designing computer hardware.

4.2.3 Productivity

Aspects of productivity have a weight of 0.3008; it indicates that the aspect of productivity is an important aspect in designing human and computer interaction for CAI models.

Sub-effectiveness factor is giving the largest contribution to the productivity aspect. This is understandable because the CAI was created to help the learning process be optimal. The result of this study is in line with Noegroho's notion (2010) which states that one of the triggers for the growth of knowledge is technological advances that integrate communication technology, information technology, and multimedia technologies (telematics). This phenomenon is often referred to as the convergence of learning technology, communications, information, and multimedia.

4.2.4 Functionality

Functionality aspect plays a major role in the design of human and computer interaction for CAI model with a weight of 0.4839. This is based on the primary function of CAI as a medium of learning resource material arranged in a systematic and easily searching for things that are relevant to the learning process. The material is one component of the anatomy curriculum. In the learning model utilizing computer technology, the material should be well structured. Material based on structure as pointed by Bruner (1977) that the achievement of material understanding can be obtained when the material is developed structurally, and in sequence structure. Various methods have been studied and developed which aim at achieving goal in order for learners to be more motivated to easily learn and understand the material presented. This is not free from the role of learning resources as a medium which is used as a means to support the simplicity of learning. Plomp and Ely (1996) stated two kinds of learning resources, namely: 1) learning resources by designed, the learning resources designed to be implemented, and 2) learning resources by utilization, the learning resources utilized, available and have a relationship with the material to be learned by the learners. Both are two aspects to be accommodated by the CAI.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

Determinant aspects in designing of human and computer interaction in software design for learning process are as follows:

1. The model of interaction, it is seen from how much benefit gained from the interaction model used, whether the system simplify or complicate the users. Four aspects of the character designs that pay attention to the utility have been identified, namely:
 - a. user-centered design: from the beginning it has been focused on the user's design and functionality of the system
 - b. Participatory design: the design involves the user as a design team.
 - c. Experimental design: there is an experimental stage performed by the user to determine whether the created system fitted the pattern of learning and the user wishes
 - d. Iterative design: an ongoing system that has been revised in accordance with predetermined specifications.
2. Security of system, which includes:
 - a. Data security, and
 - b. Security of its users (in terms of health)

3. The productivity of the system for the learning process
 - a. Effectiveness, it is seen how big the absorptive capacity of users in the learning process
 - b. Efficiency: it is seen how efficient cost and time in the process and learning outcomes
4. Functionality: the aspects related to the functions that exist in the system itself, which consists of:
 - a. Facility of information retrieval (search model);
 - b. Systematic representation (material mapping);
 - c. The completeness of multimedia tools to explain the matter;

5.2 Suggestions

Based on the analysis and synthesis of research results confirmed by the results of literature study, interviews, observations, and focus group discussions (FGD), this study further recommends technology diffusion as media of learning that consider the following factors:

1. Relative advantage, it is whether the use of technology provides a relative advantage to the learning process.
2. Harmony, it is whether the use of technology to be diffused matched with the values, systems, belief, ideas that have been first introduced, as well as alignment with the needs, tastes, cultures, customs of the people concerned.
3. Complexity, it is whether the use of complicated technology is perceived. Availability of manual books/guide books is an absolute aspect for technology diffusion process
4. Could be experimented, it is that the use of technology will be more acceptable, when it can be experimented on a small size before all people already accept it as a whole.
5. Can be observed, it is if the use of technology can be viewed directly on the alleged impact, this will lead people to consider accepting it easier.

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