

DESIGN AND NEED ANALYSIS OF COMPUTER DEVICES' EXPERT SYSTEM USING FORWARD CHAINING METHOD

Nizwardi Jalinus¹, Fahmi Rizal², Rizky Ema Wulansari^{3*}, Mahesi Agni Zaus⁴, Syaiful Islami⁵

¹Faculty of Engineering, Indonesia; ²³⁴⁵ Universitas Negeri Padang, Indonesia;

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ABSTRACT: This study aimed to: 1) Analyzing description of Core Competency and Basic Competency on Assembly of Computer Devices subject, establishing the concept of the subject and analyzing the students; 2) to know what was the obstacles that were faced by teacher during teach Assembly of Computer Devices subject 3) to know what was the instructional media that needed to be designed on Assembly of Computer Devices subject; 4) designing instructional media that was designed on Assembly of Computer Devices subject. The method in this study used SDLC (System Development Life Cycle), Waterfall. From the results of this study, it can be concluded, were follows: Assembly of Computer Devices subject was one subject that is difficult to teach through lecturing because it was practicing. So, the teacher needed instructional media that could help students so that could use it on practicing of Assembly of Computer Devices subject. That is designing instructional media based on an expert system, it could help the student to identify computer damage on Assembly of Computer Devices subject. Design of instructional media based on the expert system used UML (Unified Modelling Language) process.

Keywords: Instructional media, Expert System, Assembly of computer devices subject, Forward chaining

1. INTRODUCTION

The development of Science and Technology has brought about changes in almost every aspect of human life. The change also brings people into the era of global competition which is getting a tighter day. The era of globalization that is happening today is faced with complex challenges and increasingly tight human resources competition, so it takes superior human resources by mastering science and technology [1]. In order to play a role in global competition, then we as a nation need to develop and improve the quality of human resources. One of the efforts to produce qualified human resources and quality is through education [2].

One of the real forms of implementation of the mandated learning process in Indonesian Regulation No. 32 the Year 2013 namely the learning process in vocational/vocational education, because students are given the opportunity to develop the potential and creativity so that it is expected to have skills in accordance with their areas of expertise.

As determined that National Standard of Higher Education in Indonesian Regulation No. 32 the Year 2013 in Article 19 Paragraph 1. This article states that learning is not a one-way communication from teacher to student but must be interactive communication between students and teachers. In other words, this article emphasizes the importance of learning media in educational units, because, without the support of relevant learning media,

education will not run effectively.

Education media as one means of improving the quality of education is very important in the learning process [3]. Learning media is one tool to facilitate the transfer of knowledge from teachers to students. The use of educational media can enhance the learning process of students in teaching and learning poses which in turn can enhance the learning achievement [4]. Educational media can be models/props, flowcharts, tables, and computer-based media [5]. Learning media can help students in understanding and applying the concept of learning so that learning objectives can be achieved by students [6].

Learning media using computers or interactive media as a learning medium plays an important role in the learning process [7]. The use of this learning media can help facilitate the teacher in delivering the lesson material, can save time both preparation of teaching and in the learning process and can be used repeatedly [8].

An expert system is one of an artificial intelligence system that can be used as learning media because the expert system is information technology product which is a form of system that tries to adopt human knowledge and applied in computer, so the computer has the ability in solving the problem as done by an expert [9].

In this study, researchers develop lectures in the form of Expert System so that students have good competence, in addition to train students to study independently. The student is not only a passive recipient but also a determinant of learning for

himself. Such learning is expected to provide higher motivation because the Expert System is always associated with fun and creativity [10]. By using an expert system, students can follow the learning program according to their own speed and ability, more self-study, and can emphasize the mastery of learning materials optimally [11].

In the Assembly of Computer Devices subject, there are so many things to learn so that students can understand the learning maximally. Students must remember too many things, such as the classification of problems on the operation of the PC. However, students must have limited qualities such as forgetfulness and fatigue that enable them to result in a less than satisfactory understanding. Therefore, it takes a technology that can help overcome it.

Expert System has the ability to facilitate practical problems when the expert is absent [12]. Much is discussed on the problem classification materials on the operation of the PC so it confuses the students to be able to learn it. This expert system is very useful to help in remembering the classification of problems on the operation of the PC also to recognize its characteristics so as to minimize errors in understanding it.

Based on the background that has been described above, this research needs to be done as a preliminary study in the development of instructional media based on expert system Before developing the expert system learning media, teachers need to know what things are needed both in terms of materials and students. Teachers also need a paradigm of how they can develop instructional media that can be applied effectively in the classroom during the learning process [13].

2. METHOD

The method used in this research is the SDLC (System Development Life Cycle) Waterfall [14]. This method has a systematic approach from identification, initiation and project planning, analysis, design, implementation and maintenance, in this approach should be done sequentially from the beginning to the end.

Needs analysis is in stage one, that is identification. While the design at the fourth stage. In this identification step is the stage of data collection and determination of the needs of all elements of the system. While at the design stage of this system researchers and experts determine the concept that will be designed into the expert system. The results of the need analysis will be implemented into the form of data relations will then be applied in the system.

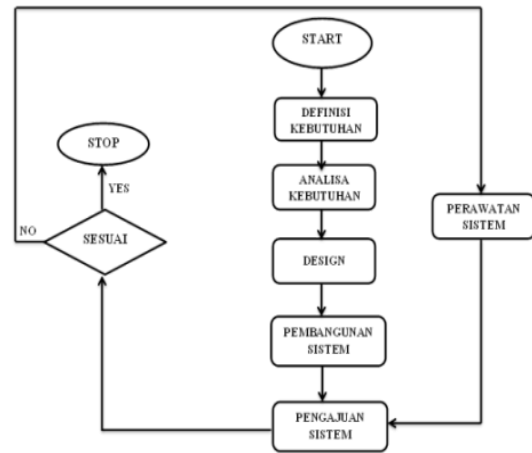


Fig. 1 Waterfall SDLC Method

Source: Modified from Al Fatta, 2007

3. RESULTS AND DISCUSSIONS

This phase of needs analysis is done so that the instructional media based on an expert system that will be developed can be in accordance with the Standard Competence and Basic Competence (SK / KD), the concepts which are contained in the curriculum, and in accordance with the characteristics of the students. This requirement analysis phase can answer the constraints faced by the teacher in delivering the material on the subject of Computer Repair Tool; know about the design to be done before conduct development of instructional media based expert system.

3.1 Analysis of Standard Competence and Basic Competence (SK/KD)

In the learning needs analysis, curriculum analysis is performed. The material developed is the classification of problems on the operation of the PC for students of class X SMK on Computer Network Engineering. In the curriculum are listed Competency Standards Diagnose problems PC operation and Peripherals and Basic Competencies Classify problems based on the group. Of the Competency Standards and Basic Competencies, the indicators used in developing this media.

3.2 Analysis of Concepts

Analysis of this concept is intended to determine the materials and concepts of Computer Repair subjects that will be used in the development of instructional media based on expert system The main concepts should be systematically arranged and the supporting concepts must be identified, be relevant and relevant to the material to be used in the expert system-based learning medium. The main concept in this material is the classification of problems on the operation of the PC.

Table 1 Formulation of SK & KD in the Assembly of Computer Devices subject

Standard Competence: Diagnose the problem of PC operation and peripheral	
Basic Competence	Indicator
Classify problem-based on the group	- The problems classify based on the group - problems are identified if there are possible problems arising from a combination of hardware, software, and or other causes, such as peripheral driver software that is not supported by the chipset of the PC main board - The student determines the initial hypothesis of whether it is a hardware or software problem if the symptoms are not specific symptoms of the problem of one group

3.3 Analysis of Students

The age of the vocational high school is in the range of 15 years to 18 years where the vocational school is entering the stage of adolescence development. According to Piaget's theory, the cognitive development of students over the age of 11 years is at the stage of formal operational growth [15]. In this period, ideally, students already have their own mindset in an attempt to solve complex and abstract problems and can imagine many alternative solutions to the problem and the possible consequences or results. At this stage students no longer receive the information as it is, but will process that information and adapt it with their own thoughts. Generally, at this operational stage, students can already think abstractly and logically. Nevertheless, the abstract thinking ability of each student is not the same. Images and animations contained in interactive learning media can help students in understanding abstract concepts to be more easily understood students [16][17].

Characteristics of students at that age have a tendency to like contrasting colors, but not conspicuous. They like music with the rhythm and harmony of soft nuances. In addition, they also like the characters or animated drawings are interesting. Integrating the color components, music, and creativity of students in learning with fun can foster students' motivation in learning. These components can also stimulate the right brain of students who can help students in the learning process and save the message in a long time because the right brain memory is long. Individuals/children at the formal operational stage are already able to think abstractly [18].

Based on observations through interview was conducted at Vocational High School in Kerinci District. Teachers experience obstacles in

developing learning media to be used in the learning process on Computer Repair subjects, but there are some obstacles faced by teachers, namely the lack of understanding of teachers in developing learning media because to develop a learning media requires precision and detail [19]. The use of existing learning media does not support teaching materials. Teachers need learning media that can help students in identifying the damage to the computer, where the media is used as a learning supplement for students.

3.4 Design of Instructional Media Based on Expert System

In this study, researchers designed expert-based learning media using Unified Modeling Language (UML).

3.4.1 Use case diagram

Figure 2 describes the obedience of instructional media based on an expert system by the user. The use of instructional media based on expert system starts from the start test, and the user must fill out the login form to create an account for each user, and the user can get the account ID and password. After that, foam users fill out the test answers on the answer question page.

After that, the system will check the user's answer with the existing knowledge base. Then the system will provide test results in the form of solutions along with explanations.

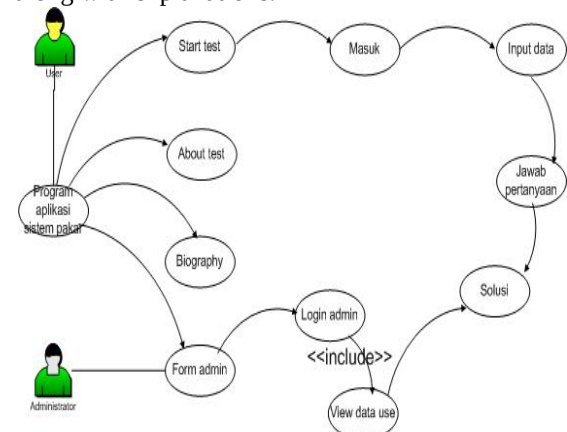


Fig. 2 Use case diagrams of instructional media based on an expert system

3.4.2 Activity diagram

Activity diagram describes the processes and activities of this instructional media based on an expert system, both in terms of user activity and in terms of admin.

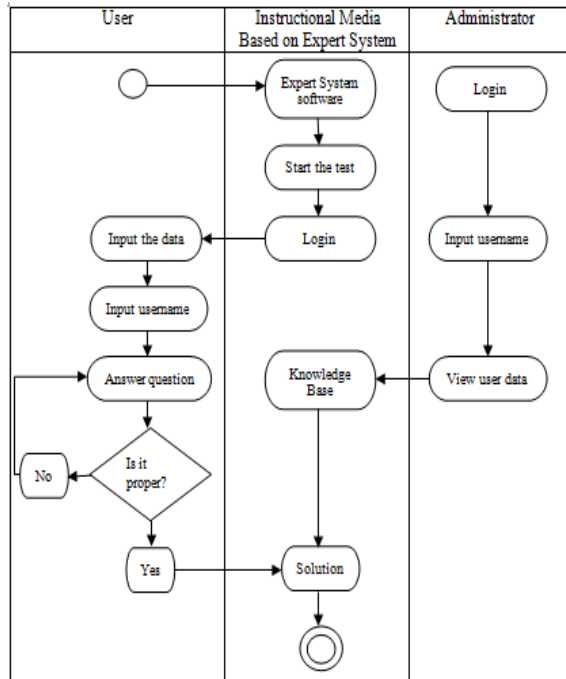


Fig. 3 Activity diagrams of instructional media based on an expert system

3.4.3 Sequence diagram

Sequence diagrams are commonly used to describe scenarios or a series of steps performed in the response to an event to produce a particular output.

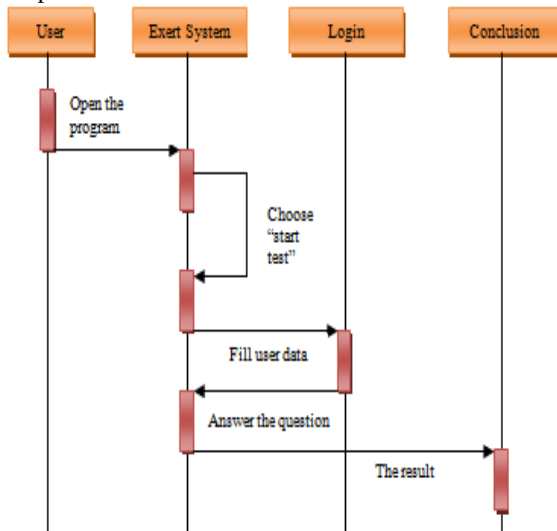


Fig. 4 Sequence diagrams of instructional media based on an expert system

3.4.4 Knowledgebase

Learning media of this expert system uses forward chaining method. This method is conducted because of the method works from a problem to the solution. If the rule data matches the situation (TRUE value), the process will state the solution. If the database sends data in accordance with the rules in the knowledge base, the knowledge base will

issue a solution in accordance with these rules.

In this study, the facts are represented by the letter of the alphabet from A to Z, the solution is denoted by figures of numbers 1-8 and the rule is denoted by R, and each rule consists of several facts.

The inference engine is part of an expert system that conducts reasoning using the contents of a list of rules based on a certain sequence of patterns. In this case how the system can take a conclusion based on the characteristics or signs that exist, provide a mechanism of function of thinking and systems reasoning patterns used by an expert. Based on the rules and facts, an inference engine is arranged as shown in the following figure:

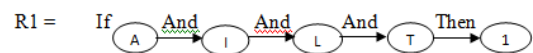


Figure 5 Inference Engine of forwarding Chaining Method

Figure 5 shows how the inference engine works for forwarding chaining. Figure 5 explains that if the situation meets the rules, consisting of facts A, I, L, T then goes into condition R1 and the system will decompose the solution that is 1.

3.4.5 Database

In this instructional media based on an expert system using a database, to store data symptoms and solutions of the material developed. The database used in instructional media based on the expert system is Microsoft Access 2010 which is then connected with Visual Basic 6.0, programming used to build instructional media based on the expert system the database created in this system is a database containing user data, admin data, symptom data, solution data and knowledge base.

4. CONCLUSIONS

The conclusions that can be drawn from the above discussion are: 1) Competence Standard of the material to be developed that is Diagnose problems of operation of PC and Peripherals, with Basic Competence Classify problem based on the group. The main concept in this material is the classification of problems on the operation of the PC. The age of the vocational high school is in the range of 15 years to 18 years where the vocational school is entering the stage of adolescence development. Characteristics of students at that age have a tendency to like contrasting colors, but not conspicuous. Blending the color components, music, and creativity of students in learning with fun can foster students' motivation in learning; 2) Teachers experience obstacles in developing learning media to be used in learning process on Computer Repair subjects, but there are some obstacles faced by

teachers, namely the lack of understanding of teachers in developing learning media; 3) The media needed to be developed on the subject of this Computer Repair Tool is an instructional media based on an expert system; 4) The design of expert-based learning media using Unified Modeling Language (UML), which consists of use case design, activity diagram, sequence diagram, knowledge base, and database of instructional media based on expert system.

5. ACKNOWLEDGMENTS

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6. REFERENCES

- [1] Ahmed, S. and Parsons, D., "Abductive science inquiry using mobile devices in the classroom," *Comput. Educ.*, vol. 63, pp. 62–72, 2013.
- [2] Ai, H., "Providing graduated corrective feedback in an intelligent computer-assisted language learning environment," *ReCALL*, vol. 29, no. 3, pp. 313–334, 2017.
- [3] Amaral, L. A. and Meurers, D., "On using intelligent computer-assisted language learning in real-life foreign language teaching and learning," *ReCALL*, vol. 23, no. 1, pp. 4–24, 2011.
- [4] Yehudit, J. and Dori, Y. J., "Object-Process Analysis of Intelligent Computer Assisted Instruction Shell : the Polymer Courseware - a Case in Point," 1994.
- [5] Jia, J. et al., "Effects of an intelligent web-based English instruction system on students' academic performance," *J. Comput. Assist. Learn.*, vol. 29, no. 6, pp. 556–568, 2013.
- [6] Wulansari, R. E., Puyada, D., Wijaya, I., and Rukun, K., "Effectiveness of instructional media based game on mathematics at vocational high school," *Int. J. Res. Sci. Manag.*, vol. 4, no. 12, pp. 125–128, 2017.
- [7] Johnson, A. M., Ozogul, G., and Reisslein, G., "Supporting multimedia learning with visual signalling and animated pedagogical agent: Moderating effects of prior knowledge," *J. Comput. Assist. Learn.*, vol. 31, no. 2, pp. 97–115, 2015.
- [8] Kablan, Z., and Erden, M., "Instructional efficiency of integrated and separated text with animated presentations in computer-based science instruction," *Comput. Educ.*, vol. 51, no. 2, pp. 660–668, 2008.
- [9] Hayadi, B. H., Rukun, K., Wulansari, R. E., and Herawan, T., "Expert System of Quail Disease Diagnosis Using Forward Chaining Method," vol. 5, no. 1, pp. 207–214, 2017.
- [10] Lin, C. C., Guo, K. H., and Lin, Y. C., "A simple and effective remedial learning system with a fuzzy expert system," *J. Comput. Assist. Learn.*, vol. 32, no. 6, pp. 647–662, 2016.
- [11] Pavlekovic, M., Zekic-Susac, M., and Djurdjevic, I., "Comparison of intelligent systems in detecting a child's mathematical gift," *Comput. Educ.*, vol. 53, no. 1, pp. 142–154, 2009.
- [12] Hung, Y. H., Lin, C. F., and Chang, R. I., "Developing a dynamic inference expert system to support individual learning at work," *Br. J. Educ. Technol.*, vol. 46, no. 6, pp. 1378–1391, 2015.
- [13] Paiva, R. C., Ferreira, M. S., and Frade, M. M., "Intelligent tutorial system based on personalized system of instruction to teach or remind mathematical concepts," *J. Comput. Assist. Learn.*, vol. 33, no. 4, pp. 370–381, 2017.
- [14] Al Fatta, H., *Analisis dan Perancangan Sistem Informasi*. Yogyakarta: Andi Offset, 2007.
- [15] Rae, A. and Samuels, P., "Web-based Personalised System of Instruction: An effective approach for diverse cohorts with virtual learning environments?," *Comput. Educ.*, vol. 57, no. 4, pp. 2423–2431, 2011.
- [16] Pernanda, D., Zaus, M. A., Wulansari, R. E., Islami, S., "Perancangan Media Pembelajaran Listrik Statis dan Dinamis Berbasis Android," vol. 1, no. 1, pp. 1–7, 2018.
- [17] Pernanda, D., Zaus, M. A., Wulansari, R. E., Islami, S., "Effectiveness of instructional media based on interactive cd learning on basic network at vocational high school : improving student cognitive ability Effectiveness of instructional media based on interactive cd learning on basic network at vocational high," *Int. Conf. Educ. Soc. Sci. Technol.*, no. February, 2018.
- [18] Steenbergen-Hu, S. and Cooper, H., "A meta-analysis of the effectiveness of intelligent tutoring systems on college students' academic learning," *J. Educ. Psychol.*, vol. 105, no. 4, pp. 970–987, 2013.
- [19] Woo, H. L., "Original article: Designing multimedia learning environments using animated pedagogical agents: Factors and issues," *J. Comput. Assist. Learn.*, vol. 25, no. 3, pp. 203–218, 2009.