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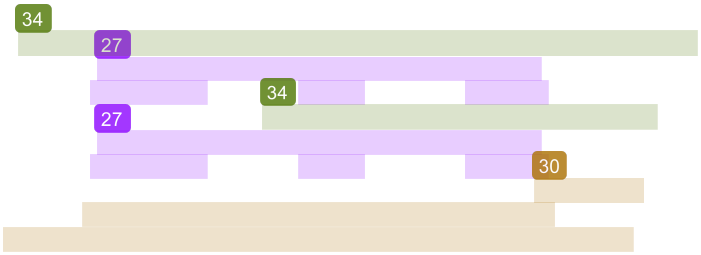
TOLSYASUPI-EduMed: Development of Educational Media Using the Problem-Posing Learning Model for Basic Programming Subjects



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Abstract. The importance of expertise in making programs in the current era, makes Vocational High Schools include curriculum that can learn programming, which is further called basic programming subjects. Basic programming is one of the mandatory productive subjects that must be programmed by all tenth-grade students in the first and second semesters of Vocational High School in the fields of Information, Communication and Technology (ICT) expertise throughout Indonesia. These subjects are the initial foundation, to study other productive subjects. However, students tend to dislike these subjects, because they tend to be difficult to understand and learn. Therefore, we try to present a solution to overcome these problems by developing basic programming education media, especially in branching control structure material. This educational media is called TOLSYASUPI-EduMed, desktop based. The research and development method (R & D) was used as the main method in this study. The model for system development uses ADDIE by adapting to the R & D method. The A/B testing method is used to validate the selection of the initial educational media design. The form of the design until the development stage must be validated by media experts and the material carried out in 3 iterations, to ensure that the educational media can seek effects on the effectiveness of learning. A total of 36 students were involved in the use of this educational media. Evaluation of the use of educational media to determine aspects of satisfaction and usability using the Computer System Usability Questionnaire (CSUQ) method. The results of the study stated that 90.9% of experts agreed that Strongly agreed to choose design B to be continued in the stages of advanced design, development, and implementation. The results of the validation of media and material experts strongly stated that it was feasible to use. Based on the functional requirements specifications all features are functioning properly, and non-functionally 93.96% Strongly Agree that end users (students) are satisfied and feel the usefulness of this TOLSYASUPI-EduMed educational media.

Keywords: educational media, learning media, basic programming, branch control structure, problem-posing, research and development, ADDIE model, design process, usability satisfaction

1 Introduction

The urgency of programming in the present era is very important to support the automation of the movement of a machine, system and or application that can be controlled by a program, this progress is in line with the era of industrial revolution 4.0 and 5.0. Where before becoming a good program, it must go through stages called program coding and programming. So the knowledge and ability for the field of programming have a great opportunity, experts who are skilled in programming skills have a huge opportunity to work, and this supports the Vocational High School students in the ICT field of expertise to be taught earlier materials about programming, which in this is called basic programming.

Basic programming is one of the compulsory productive subjects with section C2 which is for basic expertise in Vocational High Schools throughout Indonesia, in the ICT field of expertise. Taught only for the tenth grade in the first and second semester with a standard time allocation of one meeting, namely 3 hours of study (JP), where every 1 JP is equivalent to 45 minutes [1]. According to [2] basic programming subjects have a function as the initial foundation for students to practice mindset (logic), sharpen creativity, and understand programming languages and as a basis for other related lessons. According to [3] basic programming as a subject that aims to build a basic understanding for students and as an initial introduction to understanding programming languages.

However, in reality on the ground, basic programming learning still has many obstacles and problems faced by the school. One is that students tend to still find it difficult to understand the material in basic programming, lack of programming practices, and the class feels boring because the teacher tends to apply monotonous/conventional methods and does not use assistive media that can support the learning process.

This was proven by the researchers themselves who had made observations and interviews directly to several schools, the findings produced were very suitable with the facts that had been previously stated. The result of observation is by distributing questionnaires to students who have learned and who are still learning basic programming, they tend to dislike basic programming subjects, learning tends to be boring, they tend to have difficulty learning branching control structures as the most difficult material for students, compared to other material. Then the results of interviews with some of their basic programming teachers tend to convey that they are aware when applying basic programming learning is still done in a conventional way and the practice also tends to be rarely done, this makes students difficult to get to the next material, repetition of the material continues to provide understanding to students, then the teacher does not use other assistive media in basic programming learning, does not apply learning models that have potential so that learning is not monotonous and looks more active and enthusiastic, consequently student learning motivation is also low and the end effect is low student learning outcomes with a large number of students doing remedial. Other constraints and problems still tend to haunt the basic programming learning process.

According to [4] to be an expert and reliable programmer, at least keep learning and honing skills for at least 10 years. This means that to support programming skills

and understand the material in programming tend to be not easy.

Furthermore, the researchers have equated perceptions and agreed that basic programming learning tends to have problems and problems faced. Especially the most vital problem is the difficulty of students understanding basic programming materials, even though this programming ability is needed by industry/companies. This has been proven and revealed by several studies, namely from [5][6][7][8][9][10].

From these constraints and problems, researchers have provided solutions in the form of design recommendations for development in the form of educational media, educational games, interactive learning media, other assistive media, and even proposing instruments to design the effectiveness of basic programming learning processes. Educational media and/or the like that take advantage of the development of computer technology, tend to have great opportunities to make learning better, can increase student motivation, and have a very good effect. Especially in developing an educational media with content and interaction flow that is built in such a way, in order to strive to help students in the learning process. However, the educational media that has been proposed by researchers tends to be minimal in instilling the use of syntax of learning models in the flow of educational media interaction.

Based on this background, we propose and contribute to the development of basic programming education media in the material of branching control structures, where the flow of interaction in the educational media is instilled using the problem-posing learning model. The problem-posing learning model itself is very suitable for use because it can hone students' abilities to create and solve problems in programming.

2 Related Work

Related to relevant research, there are several studies that have developed educational media for basic programming subjects, but do not use the syntax of learning models as the flow of interaction embedded in the educational media. The research included [11] who developed an Android-based basic programming education media, but the educational media they proposed was limited to replacing and even moving material in books into digital content, with material descriptions, animated videos for making algorithms, and practice MCQs. Furthermore, research from [12] that carried out the development of educational media, but also tended to be seen to only move existing material in the book into multimedia-based learning digital content.

Furthermore, we also explore some scientific articles that have relevance where proposing educational media and/or the like that have collaborated learning models in the interaction flow/gameplay to help basic programming learning, namely research from [13] proposes developing online systems with digital game-based learning (DGBL), where the problem-based learning model is applied to the reverse flow in the game flow. Then the research conducted by [14] is to develop game-based learning (GBL) with a three-dimensional (3D) approach, where the flow of interaction from the game is embedded in a computational problem-solving learning model.

Several studies have proposed collaboration between educational media by applying the problem-posing learning syntax, namely research from [15] which proposes an interactive learning environment by designing to the stage of developing a computer-based environment to help learn mathematics by disguising it as integrating sentences for material story matter, the name of the application is MONSAKUN System with a problem-posing approach that has been embedded in it.

Along with the rapid development and advancement of technology and artificial intelligence in educational media technology, the research conducted by [16] extends

the performance domain of the MONSAKUN application, by analyzing learner thinking when experiencing problems when interacting to solve problems in the integration settings provided by the MONSAKUN system. Furthermore [17] further broadens the performance of the MONSAKUN system by recommending a scaffold system design that aims to overcome obstacles when learners are faced with the problem of completing arithmetic words. Then continue to expand the performance of the MONSAKUN system carried out by [18] by analyzing and investigating what actions are carried out by the learner when faced with arithmetic word problem solving. The latest development of the MONSAKUN system performance has been carried out by [19] which uses log data to explore patterns and data relationships to understand learning experiences and identify learners after using the MONSAKUN system.

In a study conducted by [20] who proposed the use of problem-posing methods to develop problem solving skills in basic programming learning and to develop educational media that supported the application of problem-posing methods to actual classroom learning, for the scope of material using C language programming the obstacle they face is in the form of a lack of students' understanding of the flow of problem-posing methods in educational media, it is likely that a preliminary study is needed to ensure that students can understand the problem-posing method as little as possible.

Research from [21] has proven that there are 75 scientific articles that have collaborated learning models into educational media, educational games, interactive learning media, or the same name. Where the application varies greatly in terms of subjects, education level, effects, and population or sample used. This means that the discovery of a small number of scientific articles provides an opportunity to collaborate between educational and syntactic media in the learning model.

Research from [22] who conducted a preliminary study in the process of applying the problem-posing learning model manually to the basic programming class on algorithmic material and flow diagrams as a means to validate and determine the extent to which the problem-posing learning model can be applied in class, can be understood by students, and give effe The results of the study show that by applying the problem-posing learning model there is an increase in student activity, student learning outcomes, and also students tend to be good at understanding what is done in the syntax of problem-posing learning models, this research is the basis and continuation of research [23] and research proposed at this time.

Based on some of the relevant studies, for the research area that we are proposing is to develop a basic programming education media in the branching control structure material using the problem-posing learning model, the programming language learned by students is Basic Visa with programming software using Visual Basic 6.0. Educational media aimed at end users, namely tenth-grade students in ICT Vocational High School multimedia expertise. Validate media and material experts to determine the design and development that can seek effects on effectiveness in learning. Also evaluated is the use of educational media in the form of functional and non-functional requirements.

3 Educational Media

According to [24] educational media can be defined as all communication tools such as prints, graphics, animation, audio, and audiovisuals. Educational media technology combines all print quality, graphics, animation, audio, and audiovisual and technology is defined as objects or processes that come from humans that can be used to convey

media and multimedia. In this case, technology covers various phenomena such as books, films, television, and the internet. In education, media is a symbol system that is used by teachers and learners to represent knowledge and technology is a tool that allows them to share representations of knowledge with others.

According to [25] that educational media can include media designed either intentionally or unintentionally with the aim of educating or providing enlightenment to knowledge and knowledge.

Then from theory [26] educational media is a tool that refers to communication channels that carry messages with instructional objectives. In this domain it is usually used for learning and teaching purposes. Furthermore, it is explained that educational media technology is a channel for transmitting information to learners (used tools such as computers, gadgets, machines, etc.) as a means to transmit information to learners. Educational media technology has a variety of types that are currently used in teaching and learning, including: computer systems, microphones, cellular devices, interactive whiteboards, digital-video-on-demand, online media streams, digital games, pod-casts and so on . The relevance of the computer system in the classroom allows the teacher to show new lessons, liven up the learning atmosphere, present new material, describe how to use the new program, and show new websites. For example in noisy classrooms or large classes, learners will be able to hear their instructors' instructions clearly and in the learning process it is better to use a microphone.

The following is a classification chart of various types of educational media presented in Figure 1.

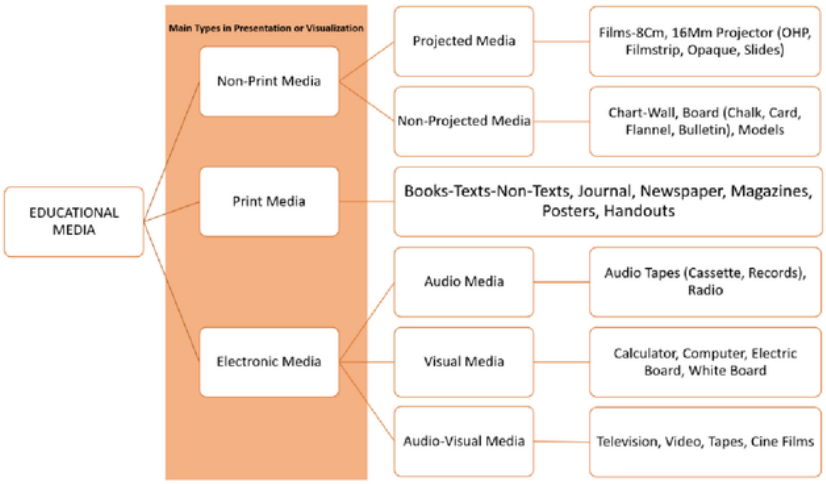

Fig. 1. Educational media classification
(Adapted from: [27])

Figure 1 explains that educational media has 3 main types in presenting visualization, namely in the form of Non-Print Media, Print Media, and Electronic Media.

In terms of interaction in obtaining information and even effects between educational media and learners, according to [28] it is said that the process of obtaining new information from an educational media is a process that tends to be complex, where the need to involve more attention and understanding of the stimuli generated When

learners interact with educational media, they integrate various kinds of stimuli into units of bits of information that have meaning and can be understood by paying attention to important or interesting aspects of stimulation.

4 Problem-Posing Learning Model

According to [29] an action in building new problems and questions that have the purpose of exploring certain conditions or reformulating problems based on the problem given is the definition of the problem-posing learning model.

The theory presented by [30] the problem-posing learning model is very useful in providing opportunities for learners to raise problems from themselves, can provide the effect of growing critical thinking, more diverse, and flexible, in order to improve problem solving skills, broaden perceptions learners about the material being studied and enriching and consolidating fundamental concepts.

In the study [15] defining the core in the application of problem-posing is that learners can make various problems and submit them, some learners may be able to repeatedly make the same problem, or make simple problems that are useful for learning.

Furthermore, from [31] argues that one of the suitable learning models to be able to improve student learning activities is by applying the problem-posing learning model. This learning model can be used to lure students to find knowledge gained through efforts to find relationships in the information learned, so as to improve student learning activities in the classroom.

The problem-posing learning model has great potential to create a completely new orientation to the problem, then who is responsible, and what they must learn. Therefore, a situation is given in which the learner is asked to produce a problem or in other words to ask questions, even given the freedom to modify it to make it look more diverse [32].

In theory, [33] explains that the submission of independent questions in the application of problem-posing learning models can be applied in 3 main forms of cognitive activity, namely as follows:

1. Pre Solution Posing, that is if a student asks a question from an existing situation. So students are expected to be able to make questions related to questions made previously by the teacher.
2. Within Solution Posing, that is if a student is able to reformulate the question into a new sub-question in the order of completion as previously completed. So, students are expected to be able to make new sub-questions from a question in the question in question.
3. Post Solution Posing, that is if a student modifies the purpose or condition of the problem that has been resolved to make a new question that is similar.

According to [16] which divides the type of problem-posing learning model into 2 types that have been applied and the interaction, flow is embedded in the MONSAKUN system, namely:

1. Open problem submission (Open-Posing) is that learners are required to make their own problem statements first, then submit them to the system.
2. Submission of problems in a closed manner (Close-Posing) is that learners do not make their own problem statements, but recommendations for problem statements have been provided by the system.

The syntax in applying the problem-posing learning model according to [34] is as follows:

1. The teacher explains the subject matter to students. The use of props to clarify concepts is highly recommended.
2. The teacher gives examples of sufficient questions.
3. Students are asked to send 1 or 2 challenging questions, and the students concerned must be able to solve them. This task can also be done in groups.
4. At the next meeting, randomly, the teacher tells students to present their findings in front of the class. In this case, the teacher can determine students selectively based on the weight of the questions posed by students.
5. The teacher gives home assignments individually.

5 Research Methodology

Research and development methods (R & D) according to Richey and Klein in [35] which focus on analysis from beginning to end, which includes design, production, and evaluation. A design which means the activity of making a product plan that will be made with a specific purpose, which begins with a needs analysis carried out through research and literature studies. Producing means the activity of making a product based on the design made in the previous stage. Evaluation is the activity of testing and assessing how high the product meets the specified specifications.

Methodologically, according to Richey and Klein in [35] research and development methods have four levels of difficulty, namely: (1) Level 1 - Researching without testing; (2) Level 2 - Not researching but testing; (3) Level 3 - Research and testing to develop existing products; (4) Level 4 - Research and testing to make products that do not yet exist.

In this study, we adopted a research and development method with a level 4 type that researched and tested to make products that did not yet exist. Then adapted to the system development model using the ADDIE model. ADDIE which stands for analysis, design, develop, implement, and evaluate. According to [36] the ADDIE model is a development concept for making a product with predetermined instructional procedures. Figure 2 is a research and development method that we have combined between Level 4 R & D research methods and the ADDIE development model.

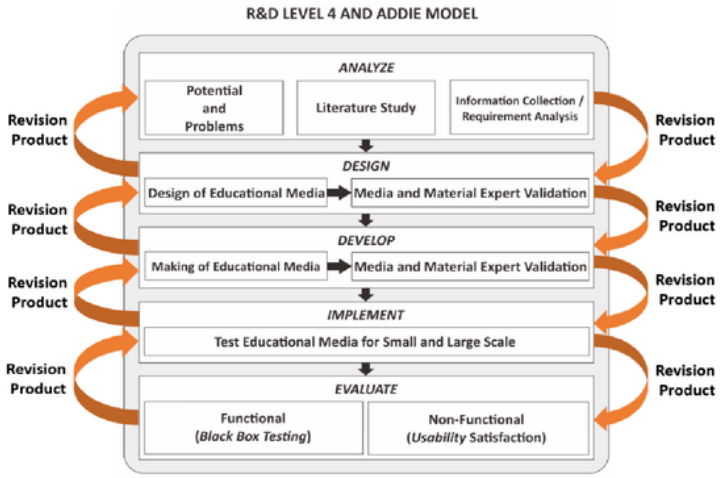

Fig. 2. Research Methodology

From Figure 2, the collaboration between R & D level 4 and the ADDIE model is carried out for the process of developing educational media that we named TOLSYASUPI-EduMed, where each product will be revised, and if it is ready and validated, proceed to the next stage. To explain the more detailed stages in Figure 2, they are presented in sub-sections 5.1 to 5.5.

5.1 Analyze

The analyze phase relates to the activity of analysis of the work situation and environment so that it can be found what products need to be developed.

The stages of analysis consist of 3 ways to support the continuity of this stage:

1. Potential and Problems, intended to explore all the potential that exists. Potential is everything if empowered will have benefits so that it has added value. While the problem is a deviation between what is expected and what happens.
2. Literature Study, intended to find and collect all forms of scientific research that have relevance to the topic of the development of educational media especially for basic programming.
3. Information Collection/Requirement Analysis, intended to collect information through observation or interview (related to the adoption of user experience methods) to the field by reviewing conditions and stakeholders as material to explore everything needed.

5.2 Design

Design is an activity for designing products according to what is needed based on the results of the analysis that has been done before.

In this case, the design is to design the appropriate educational media. The initial design is made first, it is recommended to make at least 2 different designs. Furthermore, the initial design of educational media is validated by people who are considered experts who are in accordance with their fields. Validation can be done through focus group discussions if possible, and also online (via Skype, social media, etc.) where experts are asked to provide assessments and suggestions for improving educational media design.

The A/B testing method is used to select one of the initial educational media designs. Where experts validate some of the initial designs submitted, give suggestions and comments, and make choices with scores/percentages. Educational media design that has a minimum score of 75%, then the initial design is agreed upon by experts to continue the next phase.

Furthermore, after the initial design of the educational media was selected, the researchers made improvements to the design of educational media in accordance with the results of the validation from the experts. After the design of educational media is improved, the design of educational media is tested internally, until it is expected to mature. Then proceed to the development stage.

5.3 Develop

Develop is the activity of making products and testing internally. In this case, make an educational media based on an agreed and validated design. Making educational media tailored to human resources, software, and hardware. Then after the production is thought to be mature and finished, then do the testing by doing expert validation and

internal testing. Expert validation continues to be repeated (iteration validation process). If you still need to revise each feature, it must be repaired first, according to the advice of experts. If the decisions of the experts agree that the education media is feasible to use for research, then it can proceed to the implementation stage.

5.4 Implement

The implement is an activity to use products to end users. In this case the use of educational media for Vocational students of class X in the field of ICT multimedia expertise.

The implementation of this study was carried out 2 trials. The first small-scale trial, which was attended by 5-10 prospective end users, was intended to provide an initial understanding of how to use the product, the interactions that were carried out, and to know the initial feedback. Then at a different meeting, a large-scale trial was conducted involving 20-40 end users in the actual class, this was an implementation of research in terms of the use of educational media. In this large-scale trial, all assessments are carried out in accordance with what was formulated, in order to have resulted in research needs.

5.5 Evaluate

Evaluate is the activity of assessing whether each step of the activity and also the products produced are in accordance with the specifications of the needs or not.

In this study, the main evaluation consisted of 2 types of assessments of software requirements specifications, namely:

1. Functional, namely the needs that contain any processes or services that must be provided by the education media, including how the education media must react and take action on certain inputs and how the educational media behaves in certain situations. This functional requirement is very dependent on the type of software, educational media users, and types of educational media where the software is used. Functional requirements can be found from the question: What should the education media do? Because basically, the functional requirements must be able to describe the services that can be provided by the education media to end users in detail. In this study using the black box testing method.
2. Non-Functional, namely the need that focuses on the behavioral property possessed by the educational media and determines how the system works as it should. Non-functional needs place limits on the educational media being developed, the development process, and determine external constraints that must be met by the educational media. In this study using the usability satisfaction method by adopting the Computer System Usability Questionnaire (CSUQ), to determine the quality of satisfaction and the use of educational media for end users.

6 Results and Discussion

6.1 Analyze

The results obtained from the stages of analysis are as follows:

1. Potential and problems

The first stage is exploring potential and problems, based on the background that the problem that occurs with the highest value of the problem is the difficulty of

students in learning basic programming subjects, especially in the material of branching control structures. Potential is to help students understand the material, make students more active, make students able to think, make diverse problems, solve problems, and motivate studen 43 y proposing design and development of educational media that 46 aborate with the problem-posing learning model as the highest potential value. The problem-posing learning model with the type of open-posing is embedded in the flow of educational media interaction, because it has characteristics that are in accordance with the basic programming knowledge that requires play in thinking and practicing logic.

2. Literature Study

The literature study that we did was looking for all the topics of related research so that it could support problem-solving in this study. Literature studies were obtained through research results and other scientific sources on the same topic, namely relating to educational media using the problem-posing learning model that had been done before. The study of literature conducted can be used as a theoretical basis in conducting this research, as well as obtaining an overview of educational media such as what has been developed by previous researchers.

3. Information Collection/Requirement Analysis

Observation techniques from a user experience (UX) point of view and when used to design products are exploration, generally carried out to obtain a better understanding of the user's willingness, user duties, and environment that is declared comfortable by the user. This is what is used to explain all the requirements and ideas that can inspire design. Observation techniques in this domain have benefits if researchers cannot interact directly with end users. When observing, researchers make objective and careful notes. In this research we mix observation activities with questions to get a better understanding of what is needed by end users, we immediately interact with potential end users. Prospective end users here are tenth grade vocational high school students in the field of multimedia expertise who take basic programming subjects and will use educational media. Collection of information by means of this observation is conducted for prospective end users and also experts who have developed and have conducted research in the field of educational media. The results obtained broadly from the collection of information is that the educational media designed can be used easily, simply, not complicate the user, can be a solution to problems that have been found, can have a good effect on learning, adjust material in the curriculum, and media education must adhere to the syntax of the problem-posing learning model with the type of open-posing that has been proposed, namely interaction in raising problems openly and solving problems.

6.2 Design

We have made a proposal for two TOLSYASUPI-EduMed educational media designs that have been planted with problem-posing learning models with the type of open-posing adapted from [16], submitted to 11 media and material experts, then the selection is done using A/B testing which has several ways adapted from [37][38] with a voting system, scoring, and comments/suggestions. Examples of initial design recommendations for educational media are presented in Figure 4.

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Fig. 4. Design recommendation

Figure 5 is a voting form submitted to experts, to determine the choice.

Fig. 5. Educational media design voting form with the A/B testing method

One design that is recommended with the highest value is designed B with a value of 91.9% Very Strong experts approve it. This design B educational media adheres to the strength of the problem-posing learning model, which most experts agree with the type of open-posing, which is giving students the opportunity to openly open their own

questions into the system through educational media, thus encouraging, sharpening knowledge and students' way of thinking, then recommending other students to solve questions in the quiz section, where the questions raised in the quiz section are questions that have been asked by the other students in the past. The questions presented in the quiz section are in the form of lines of program code arranged randomly. The students will first understand what problems they have to solve based on questions, then answer them by arranging the lines of program code by drag-and-drop so that they are structured and appropriate according to the rules of Visual Basic programming.

The A/B testing process is done once, because the final value reaches> = 75% and experts have no doubts to agree on the design that has been chosen.

The design of the system architecture from the TOLSYASUPI-EduMed educational media is shown in Figure 6, which has also been discussed with experts.

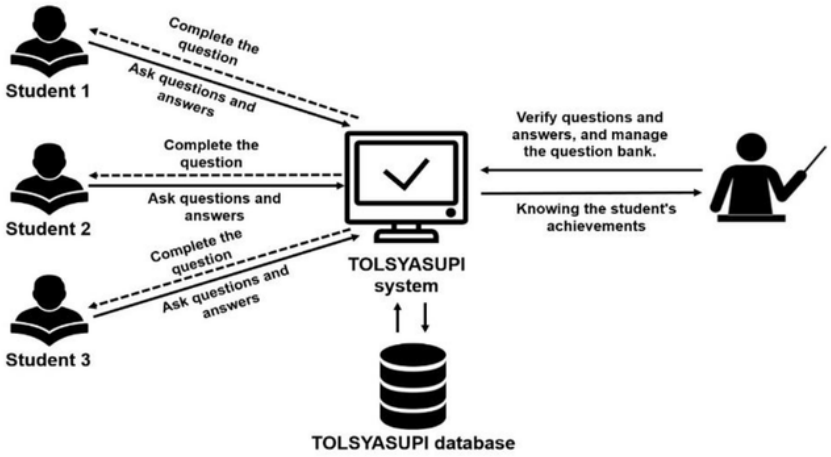

Fig. 5. Design of TOLSYASUPI-EduMed educational media system architecture

Figure 5 is a form of educational media architecture design TOLSYASUPI-EduMed, which explains that students submit questions and answers to the TOLSYASUPI-EduMed system, then accommodated in the database, the teacher will immediately verify the recommendations of questions and answers, if student questions are valid and the answers continue the question and if it is still invalid, it must be revised (see Figure 6), then the teacher determines the questions submitted in the quiz, then all students complete the questions provided based on the quiz provided, then when students have completed the quiz, they will get information about the acquisition value, statement of success or failure, and also feedback in the form of right and wrong questions.

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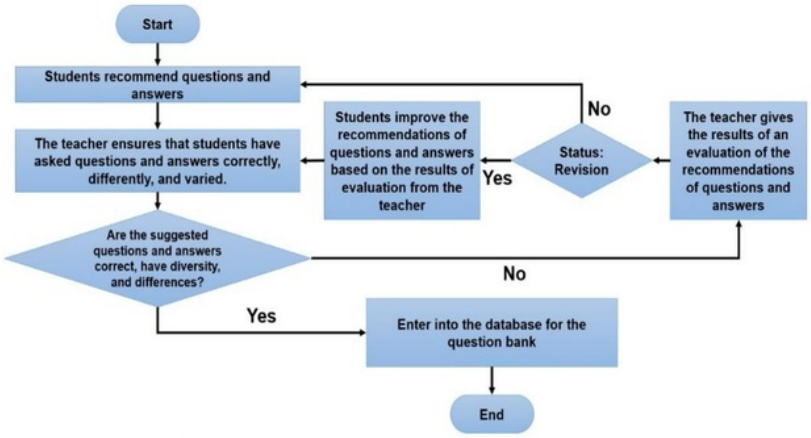

Fig. 6. Design of TOLSYASUPI-EduMed educational media system architecture

From the flow diagram in Figure 6, for the protocol to verify the recommendations of questions and answers, students must first go through a process to recommend questions and answers, so the teacher must ensure whether the questions and answers for recommendations by students are correct, different, and have diversity. If it meets the protocol, it is directly entered into the database for the question bank. If it does not meet, the teacher will give the results of the evaluation in what form is corrected by the students from the recommendations for questions and answers. Then the teacher states his status, whether revised or not. If revised, students correct according to the instructions that have been delivered by the teacher, and re-enter the recommendations of questions and answers into the system, until it is certain that they have successfully entered the question bank. If not revised, students must make (new) recommendations for questions and answers that are certainly correct, have differences and diversity.

Experts in terms of anticipating that each question and answer recommended by students can have the opportunity to be valid and correct, give advice so that students are guided by basic programming handbooks and students are required to make and code the program code first in the software. Visual Basic 6.0. This allows students to learn and find the truth, sharpen skills, increase activity and productivity and can save time (in this case reducing the risk of revision).

Next to determine the description of user interaction with the system, the use case diagram of the TOLSYASUPI-EduMed system is designed in Figure 7.

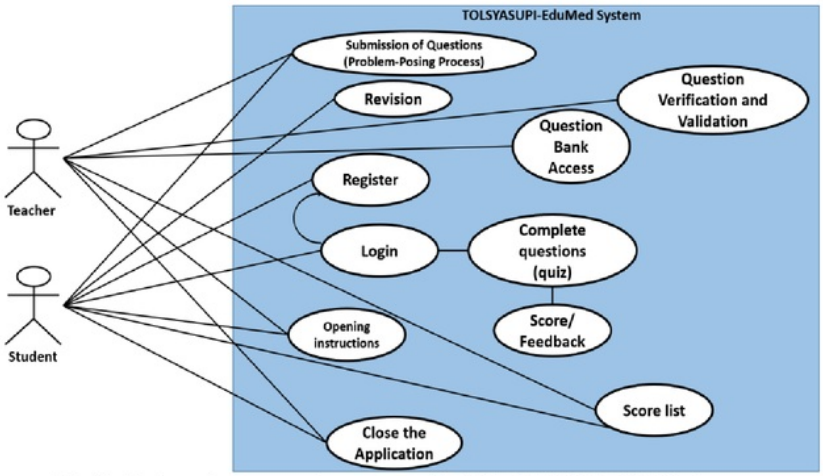

Fig. 7. Design of use case diagrams on the TOLSYASUPI-EduMed system

Figure 7 illustrates the interactions that occur between end users and the TOLSYASUPI-EduMed system, which consists of 2 main actors namely the teacher and students and several use cases involved.

6.3 Develop

Before the development stage begins, expert validation is carried out again (1st iteration), to ensure design improvement after A / B testing.

Media experts number 5 people and material experts totaling 6 people with fields relevant to the topic of research. The results of the media expert validation and the material carried out each iteration are in the form of:

1. To find out the results of media expert validation in determining the feasibility of educational media in terms of the assessment of aspects and criteria of educational media as learning media, for the validation instrument adapted from [39]. In this study, we gave the code Validation-01. For example instruments, a validation sheet for Validation-01 is presented in Figure 8 and can be accessed at the following link: http://bit.ly/itaration03validation-01.

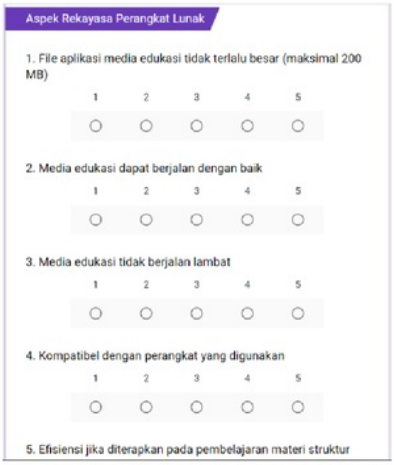

Fig. 8. Instrument expert validation sheet for Validation-01

The instrument in Figure 8 consists of 3 main aspects, namely in terms of software engineering, visual communication, and media design with a total number of questions as many as 36, then filling in the types of errors, improvement suggestions, comments, and decisions. The scale u is a type of Likert scale [41] with a form of positive statement value, namely 5: Strongly Agree; 4: Agree; 3: Neutral; 2: Disagree; 1: Strongly Disagree.

2. To find out the results of media expert validation in determining the feasibility of educational media in terms of assessment of aspects of satisfaction and usefulness of educational media, for the validation instrument adapted from [40] with access: https://garyperlman.com/quest/quest.cgi. In this study, we gave the code Validation-02. For example instruments, the validation sheet for Validation-02 is presented in Figure 9 and can be accessed at the following link: http://bit.ly/itaration03validation-02.

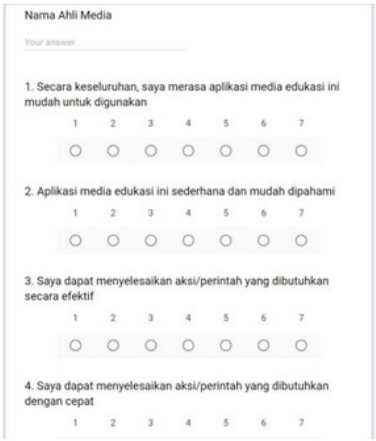

Fig. 9. Instrument expert validation sheet for Validation-02

The instruments in Figure 9 consist of 19 questions, then fill in the bad things from the education media, things that are good from the media of education, comments and decisions. The scale used is a type of Likert scale [41] with the form of a positive statement value, namely 7: Strongly Agree; 6: Very Agree; 5: Agree; 4: Neutral; 3: Disagree; 2: Strongly Disagree; 1: Very Strong Disagree.

3. To find out the results of the material expert validation in determining the feasibility of educational media in terms of evaluating the design aspects of evaluation questions that existed on the quiz, for the validation instrument adapted from [39]. In this study, we gave the code Validation-03. For example instruments, a validation sheet for Validation-03 is presented in Figure 10 and can be accessed at the following link: http://bit.ly/itaration03validation-03.

Fig. 10. Instrument expert validation sheet for Validation-03

Figure 10 is an instrument for assessing Validation-03 which consists of 19 questions, then filling in the types of errors, improvement suggestions, comments, and decisions. The scale used is a type of Likert scale [41] with a form of positive statement value, namely 5: Strongly Agree; 4: Agree; 3: Neutral; 2: Disagree; 1: Strongly Disagree.

For the interpretation criteria the score adapts from theory [41] by producing a percentage number (%), which is the number 0% - 20%: Very Weak; number 21% - 40%: Weak; number 41% - 60%: Enough; number 61% - 80%: Strong; figure 81% - 100%: Very strong.

Figure 11 through Figure 13 is an example of a wireframe from the design that was submitted to the first iteration and was agreed to go to the development process.

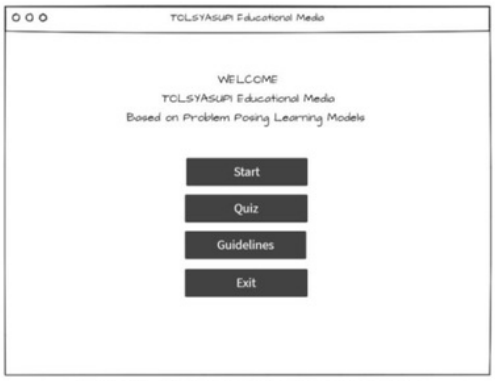

Fig. 11. Design of main menu page

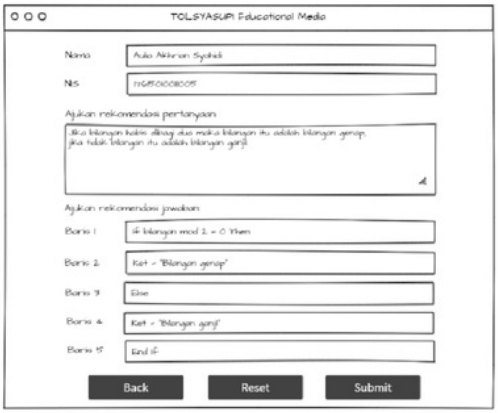

Fig. 12. Design of question submission page (problem-posing process)

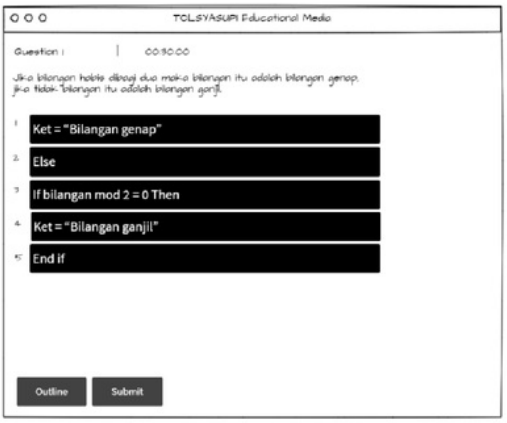

Fig. 13. Design of quiz page (problem-posing and solving process)

Furthermore, the process of developing educational media is done using web programming and flash programming. Where at this stage of development is making a product in the form of desktop-based TOLSYASUPI-EduMed. After the education media was developed, the second iteration expert and internal trials were validated. Table 1 is a comparison of the overall results of the overall assessment, in each validation iteration.

Table 1. The results of the 1st to 3rd iteration expert validation

Type of Validation	Overall Average Value					
	1st Iteration		2nd Iteration		3rd Iteration	
Validation-01	15.17	60.67%	20.14	80.56%	22.61	90.44%
Validation-02	20.32	58.05%	26.58	75.94%	32.21	92.03%
Validation-03	15.79	52.63%	22	73.33%	27.68	92.28%

From Table 1, there is a significant increase in assessment in each type of validation in each iteration. For the average value of the overall final results in the third iteration for Validation-01 at the value of 22.61 predicate Strongly Agree with a percentage of 90.44% the media experts agreed Very Strongly to declare that this educational media is worthy of being used as learning media with average comments their average is that this media is very unique and has a contribution to make it easier for students to understand the code and make the program. In Validation-01 aspects and criteria this consists of 3 aspects, the average value of which can be translated, namely for aspects of Software Engineering with an average value of 24.58 predicated Very Agree with the percentage of 98.33% Very Strong, for aspects of Visual Communication namely the average value of 21.36 has a Strongly Agree predicate with a percentage of 85.45% Very Strong, for the aspect of Media Design, the average value is 21.85 predicated Strongly Agree with the percentage of 87.38 with a Very Strong predicate.

Assessment for Validation-02 is with an overall average value of 32.21 predicated Strongly Agree with a percentage of 92.03%, media experts agree that Very Agree for this educational media has satisfaction and usefulness and is worthy of use, in terms of the average expert comments stating that this media is very easy to use and very simple in its usage flow.

Furthermore, for Validation-03, the overall average value of 27.68 is strongly agreed with the percentage of 92.28% of the material experts stated that Strong educational media is feasible to use. The average comments of material experts state that the educational media is very good and very unique in its presentation because it can collaborate with the syntax of the problem-posing learning model.

Based on the assessment and decision from the validation of media experts and material experts on the results of the 3rd iteration improvement, which is the last validation iteration. Media and material experts have also given a decision in the form of agreeing on this educational media that is worthy of being used for research purposes. Then the results of the development of the final educational media used to be implemented for research are presented in Figure 14 through Figure 20 which is an example of the TOLSYASUPI-EduMed interface that was built and was approved and validated at the 3rd iteration improvement.

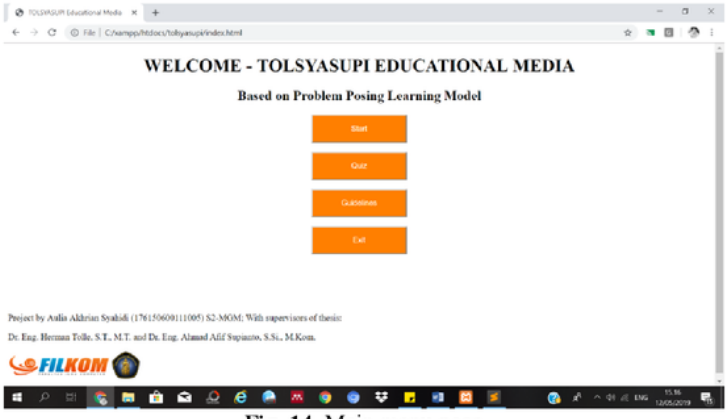

Fig. 14. Main menu page

Figure 14 shows the page when the user opens the application, the start page that appears is the main menu page that contains 4 menu buttons, namely Start, Quiz, Guidelines, and Exit. The Start menu button works to go to the page asking questions and answers. The Quiz menu button functions to go to the question completion page. Menu Guidelines button to open instructions for using educational media (manual book). Exit the menu button to exit in full from the educational media application.

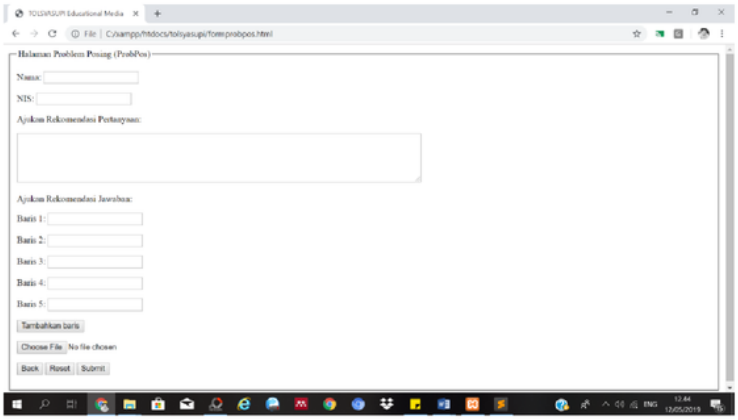

Fig. 15. Question submission page (problem-posing process)

Figure 15 is a page for submitting questions and recommendations for answers, consisting of several forms that must be filled in by the user. Form Name and NIS need to be filled by users, namely students, which serves to accommodate the identity of anyone who has asked questions and answers. Request Form Recommendation The function of the question is to fill in questions about the material for branching control structures that can be solved by programming (in the form of story problems, algorithms, etc. that refer to the answer flow). Request Form Recommendation The function is to fill in a line of structured program code. The Add Line button works if the program code exceeds 5 lines. The Choose File button serves to attach the output in

the form of visualization of the program screens generated from the program code, by experts intended to help users check and think about what outputs are generated from the questions and program code. Then the Back button, to return to the main menu page, the Reset button to clear all filled forms (repeating the form), and the Submit button to submit it to the Temporary Bank to be validated by the teacher.

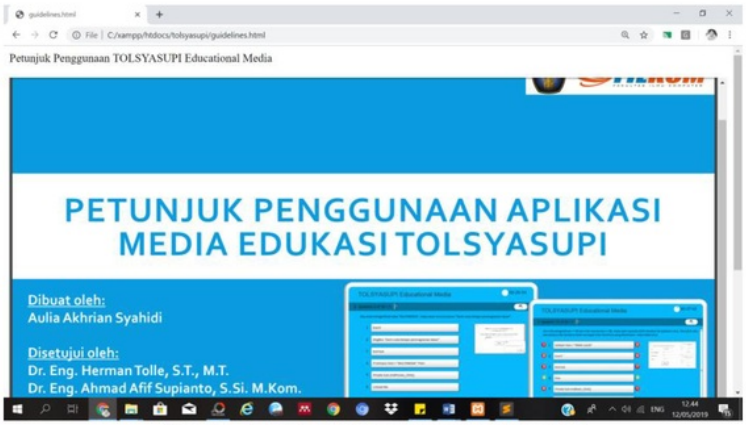

Fig. 16. Application usage instructions page

Figure 16 is a page for use instructions from an educational media application, in the form of file attachments with extension. PDF., Which serves to direct and help users / lay people to read in advance about the use of the application.

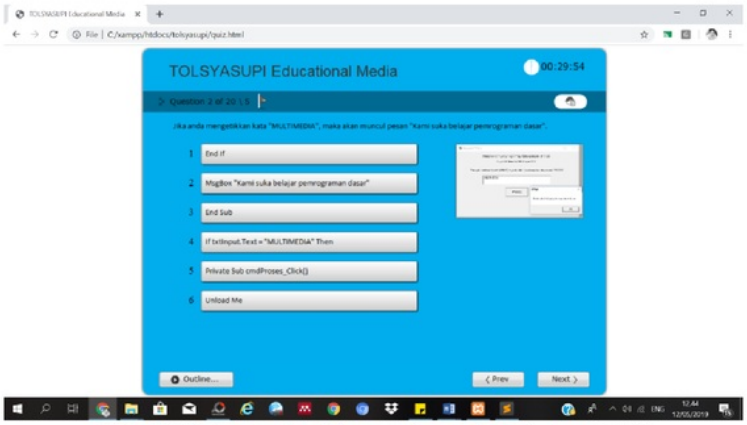

Fig. 17. Quiz page (problem-posing and solving process)

Figure 17 is a Quiz Page, where this process must be completed by students, by interacting in the form of drag and drop in terms of compiling the program code appropriately and structured according to questions and also attaching images in the form of output visualization programs produced. Information is also available in the form of quizzes, quiz position, and timers. The Outline button functions to display a list of available questions. Prev button to return to the previous question. The Next button

works to go to the next question. This quiz system allows users to go back to the previous question, to ensure their answers if they are still in doubt, until the time provided has ended, which is 30 minutes.

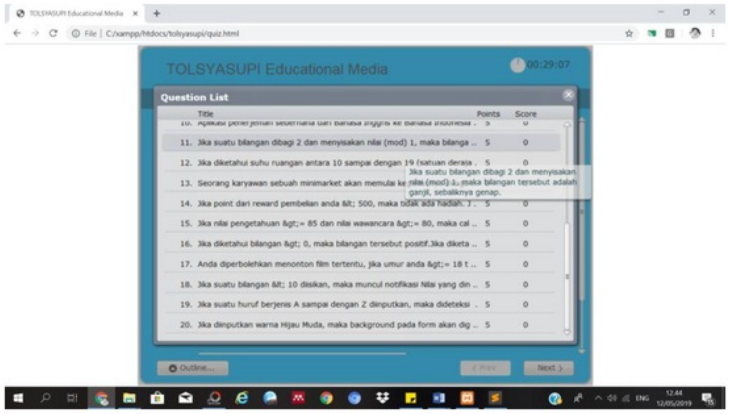

Fig. 18. Question outline page (in the quiz page)

Figure 18 is a list of questions provided by this quiz, with 20 varied questions accompanied by information on the points they will get each correct question. At the end of the quiz (normal conditions), when the user arrives at question number 20, there will be a Submit button, to send all their answers to the system and then match the answer key and the user's answer. If they run out of time (abnormal conditions), the submit button does not exist and the system directly closes their quiz processing access and goes directly to the score acquisition information page (See Figure 19).

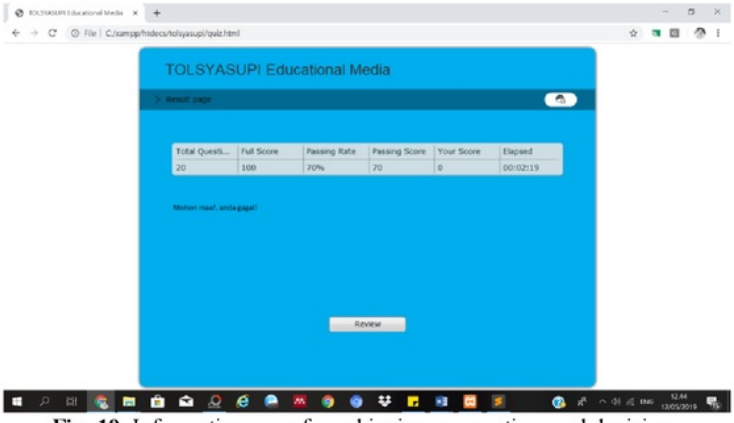

Fig. 19. Information page for achieving scores, time and decisions

Figure 19 is an information page on score achievement, time needed, and decision. Full score if their answer is correct, all are 100. To determine the decision that they succeed or fail, a passing rate of 70% is equivalent to a minimum value of 70 (passing rate), this 70 value is the minimum completeness criteria (KKM) basic programming subjects adjusted to the school curriculum rules. They also informed the score obtained

by students, to determine the scope of acquisition, the system automatically calculates the number of correct answers * 5 (the correct point of each answer), where the process is done by matching the answer key and the user's answer. The processing time required by students is also attached. The Review button serves to generate feedback, which is the number of questions that are right and wrong, and the comparison of the arrangement of program code between the user and the answer key from the system, this is in the form of a line numbering label, if the green label means program code is correct according to the answer key, and if the color of the red label means that the program code is misplaced (See Figure 20).

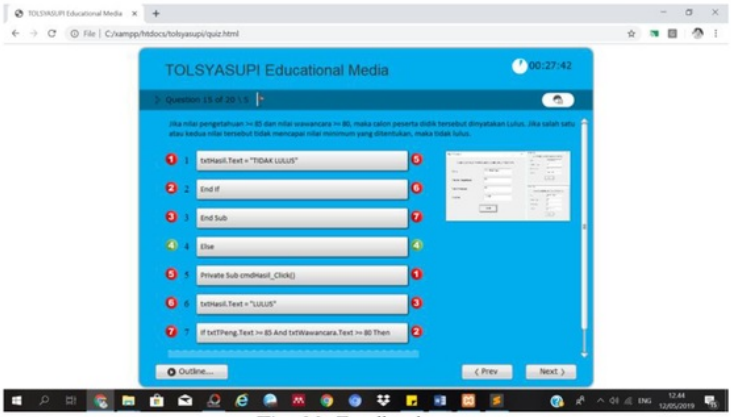

Fig. 20. Feedback page

6.4 Implement

The stages of implementation are carried out with two types of activities. The first is a small-scale trial that involves 10 end-users, this small-scale trial activity in the theory of [35] is limited field testing (preliminary field testing), this activity is needed to provide the first experience for users to interact with educational media, knowing the weaknesses of educational media, as well as constraints and problems faced by users. Figure 21 is a small-scale trial activity for end users.

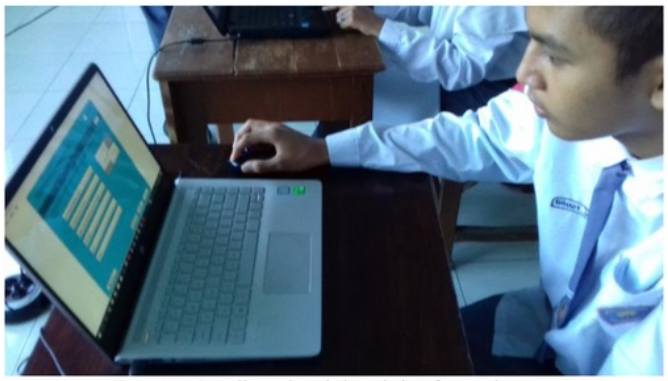

Fig. 21. Small-scale trial activity for end users

The results of this activity are input for evaluating both short and long term improvements if time permits. However, in the needs of this study, we tend to opt for temporary evaluations and are of a mild nature, because time is not possible.

Furthermore, when evaluating small-scale results has been improved, then a large-scale trial is carried out which in theory [35] is called the main field testing (main field testing), involving the target end users, which are all ten grade students of multimedia expertise 36 people. Figure 22 is a large-scale trial activity.

Fig. 22. Large-scale trial activity for end users

This activity lasts for 2 cycles, each of which consists of 2 meetings, the first meeting with an allocation of 135 minutes or 3 lesson hours, the students are devoted to the process of submitting recommendations to questions and answers on educational media. Before they submit these recommendations, it is necessary to read theories that have a basic programming handbook on the branch control structure material, then determine the questions both the story, algorithm and so on relating to the material and can be done by the programming process, after which the students make the program code in Visual Basic 6.0, if the program has been completed and running, students are allowed to ask questions, submit answer recommendations in the form of program line codes (See Figure 23), and attach images in the form of visualizing the output produced by the program code created. This is to maximize the validity of questions and answers, so as to save time in terms of the process of revision and validation by the teacher, before being included in the main question bank.

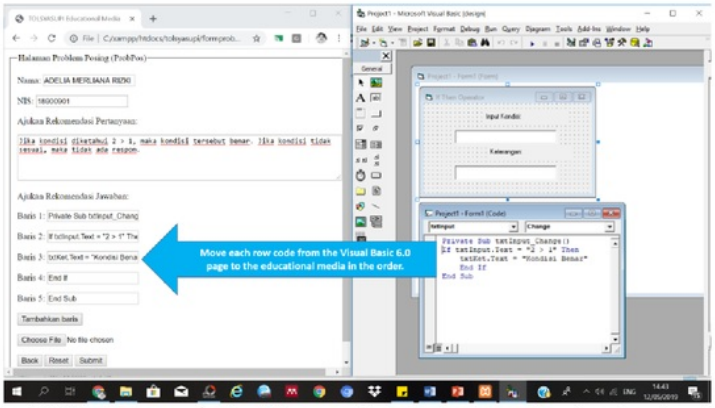

Fig. 23. The process of submitting questions and answers to educational media

On average, all students tend to be active, but still, feel confused because they first use this educational media. Then the second meeting was conducted specifically to solve all the questions in the quiz, as many as 20 questions that had been validated by the teacher were raised. The students were quite enthusiastic. In the second cycle, the first and second stages are exactly the same, the difference is seen in the interaction of students with educational media, which tend to all of them do not feel confused anymore and more active and eager to follow the basic programming learning process using this educational media.

6.5 Evaluate

Many stages have been passed in developing this educational media (including validation and revision must be considered), then is to conduct an evaluation. For the purposes of this study, 2 evaluation forms were used, namely:

1. Functional Requirements Specifications with Black Box Testing

Black box testing carried out in this study refers to the theory [42][43] the selection of black box test is based on the requirements or design specifications of the tested software entity. Functional testing mainly focuses on the external behavior of software entities. Black box testing plays an important role in software testing, this helps to validate overall system functions. Black box testing is based on customer requirements, so incomplete or unpredictable requirements can be easily identified and can be addressed later. Black box testing is done based on the perspective of the end user. The importance of this black box test handles input that is valid and invalid from the perspective of the end user. The final results of black box testing performed on the TOLSYASUPI-EduMed system are presented in Table 2.

Table 2. Black box testing results

No.	ID	Components	Expected Result	Status
1	SB	Start Button	Users can access the start button to go to the page asking questions and answers	OK
2	QB	Quiz Button	Users can access the quiz button to go to the question completion page	OK
3	GB	Guidelines Button	Users can access the guidelines button to display information on how to use the application	OK
4	ExB	Exit Button	Users can access the exit button to exit completely from the application	PK
5	NF	Name Form	Users can access and fill in the name form	OK
6	NsF	NIS Form	Users can access and fill out NIS forms	OK
7	AFQ	Ask Form Questions	Users can access and fill out forms to ask questions	OK
8	SFA	Submit Form Answers	Users can access and fill out forms to submit answers	OK
9	ALB	Add Line Button	Users can access and the system adds the program code line form	OK
10	CFB	Choose File Button	Users can access to attach image files to the system	OK
11	BB	Back Button	Users can access the back button to return to the main page	OK

12	RB	Reset Button	Users can access the reset button to delete all data entries on all forms	OK
13	SB1	Submit Button 1	Users can access the submit button to send questions and answers to the system	OK
14	PN1	Popup Notification 1	The system sends a notification that the question was submitted successfully, the user can find out	OK
15	CBatPN	Close Button at PN	Users can access the close button in notification popup 1 to exit the notification	OK
16	FNF	First Name Form	Users can access and fill in the first name form	OK
17	LNF	Last Name Form	Users can access and fill in the last name form	
18	CB	Continue Button	Users can access the continue button to proceed to the problem solving page	OK
19	OB	Outline Button	Users can access the outline button to see a list of questions	OK
20	SB1	Submit Button 2	Users can access the submit button to send answers to the system	OK
21	QN	Question Notification	The system can bring up notifications of questions to what users can see	OK
22	TN	Timer Notification	The system can bring up a timer system to provide workmanship quota to users, users can see it	OK
23	DDB	Drag and Drop Button	Users can access the buttons that can be carried out drag and drop action to properly arrange the program code line	OK
24	PN2	Popup Notification 2	The system sends a notification that your answer is incorrect / correct, the user can see it	OK
25	RPN	Result Page Notification	The system can bring up information about the results obtained by the user when they have completed all the questions on the quiz, the user can see the score and processing time	OK
26	PB	Preview Button	Users can access the preview button to check information about feedback in the form of any questions whose answers are right or wrong	OK

The results obtained from testing with the black box testing method from Table 2, that all the features in the educational media TOLSYASUPI-EduMed have worked very well according to what was expected with an OK status or equivalent to 100%.

2. Specifications of Non-Functional Needs with Usability Satisfaction

Evaluation of this type is used to determine the extent of TOLSYASUPI-EduMed's satisfaction and usefulness of educational media towards end users. For example, CSUQ sheet instruments adapted from [40] used in this study are presented in Figure 24 and can be accessed at the following link: http://bit.ly/usabilitysatisfactionsiswa.

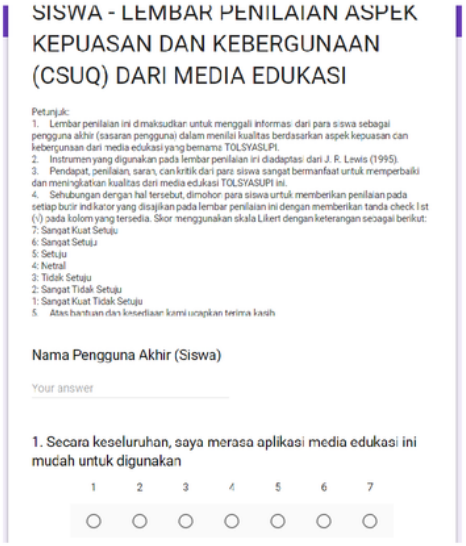

Fig. 24. Instrument CSUQ questionnaire sheet

Usability satisfaction evaluation is carried out after the implementation of a large-scale trial has been completed and in the sense that all end users have conducted interactions with the TOLSYASUPI-EduMed education media as a whole. A total of 36 students were involved in filling out the CSUQ questionnaire by accessing the link provided. The list of questions submitted in the CSUQ [40] questionnaire is presented in Table 3.

Table 3. List of CSUQ questions

ID	Questions
Q1	Overall, I feel this educational media application is easy to use
Q2	This educational media application is simple and easy to understand
Q3	I can complete the actions/commands needed effectively
Q4	I can complete the actions/commands needed quickly
Q5	I can complete the actions/commands needed efficiently
Q6	I feel this educational media application is convenient to use
Q7	I feel this educational media application is easy to learn
Q8	I feel I will feel productive quickly by using this educational media application
Q9	This educational media application clearly shows my mistakes when I make a mistake
Q10	When I make a mistake, I can easily identify and mitigate it
Q11	Information in this educational media application is clearly shown
Q12	The information I need is easy to find in this educational media application
Q13	Information in this educational media application is easy for me to understand

Q14	Information in this educational media application helps me to complete the action/command
Q15	Information in this educational media application is arranged neatly and clearly
Q16	The interface of this educational media application is pleasing to the eye
Q17	I am happy with the educational media application interface
Q18	This educational media application has the function and ability as I expected
Q19	Overall, I am satisfied with this educational media application

The results of the usability satisfaction questionnaire using CSUQ adapted from [40], are presented in Table 4.

Table 4. Usability satisfaction assessment results

ID	Score	Predicate	Percentage	Predicate
Q1	252	Strongly Agree	100%	Very Strong
Q2	252	Strongly Agree	100%	Very Strong
Q3	219	Strongly Agree	86.9%	Very Strong
Q4	216	Very Agree	85.7%	Strong
Q5	215	Very Agree	85.3%	Strong
Q6	252	Strongly Agree	100%	Very Strong
Q7	252	Strongly Agree	100%	Very Strong
Q8	252	Strongly Agree	100%	Very Strong
Q9	224	Strongly Agree	88.9%	Very Strong
Q10	219	Strongly Agree	86.9%	Very Strong
Q11	229	Strongly Agree	90.9%	Very Strong
Q12	201	Very Agree	79.8%	Strong
Q13	250	Strongly Agree	99.2%	Very Strong
Q14	221	Strongly Agree	87.7%	Very Strong
Q15	243	Strongly Agree	96.4%	Very Strong
Q16	251	Strongly Agree	99.6%	Very Strong
Q17	252	Strongly Agree	100%	Very Strong
Q18	247	Strongly Agree	98	Very Strong
Q19	252	Strongly Agree	100%	Very Strong
Overall Average Value	236.79	Strongly Agree	93.96%	Very Strong

Based on Table 4, it can be concluded that the results of the evaluation of non-functional requirements, namely all users state that the educational media has usefulness and they are satisfied with the overall average value of 236.79 predicates Very Strongly Agree and with a percentage of 93.96% predicated Very Strong. The highest scores are in the statement numbers 1, 2, 6, 7, 8, 17, and 19 with a full score of 252 with a percentage of 100% Strongly Agree that the TOLSYASUPI-EduMed educational media is very easy to use, very simple, very easy to understand, very comfortable used, very easy to learn, very much made me more productive, really enjoyed the application interface, and overall very satisfied with the performance of educational media that has its own uniqueness. From the results obtained, it is very suitable and in accordance with the comments from the validation of the experts who

have carried out the Validation-02 process which on average states that educational media is very easy to use and simple and unique. The condition of the class when learning took place at the time of the large-scale trial also felt that on average all students were very serious in learning basic programming using the TOLSYASUPI-EduMed educational media, although initially they were confused because they first used it, after the next meeting tended to be more familiar and they must do to interact with educational media, they are very enthusiastic, happy, more active class activities, and they are very enthusiastic.

7 Conclusion and Future Work

Based on the research and development that we have done, it can be concluded that:

1. The form of educational media design chosen by media experts and material experts is designed B with a percentage of 90.9% Very Strong to agree that this design will be used for advanced design, development, and implementation processes, so as to seek effect on effectiv ss in learning.
2. Design and develop of educational media based on the assessment of media experts and material experts consisting of:
   a. Assessment for aspects and criteria of educational media as learning media was done three times iterations with the final results in the form of iterations in the 3rd validation, namely for aspects of Software Engineering with an average value of 24.58 predicated Strongly Agree with a percentage of 98.33% Very Strong , for the aspect of Visual Communication, that is, the average value of 21.36 with a Strongly Agree predicate with a percentage of 85.45% Very Strong, for the aspect of Media Design, the average value is 21.85 predicated to Strongly Agree with a percentage of 87.38 with a Strong predicate For the overall average value at the value of 22.61 predicate Strongly Agree with a percentage of 90.44% the media experts agreed Very Strongly to state that this educational media is worthy of being used as a learning medium with their average comments that this media is very unique and has contributions to make it easier for students to understand the code and program making.
   b. Assessment for aspects of satisfaction and use of educational media was carried out 3 times iterations with the final results of validation in the 3rd iteration, with an overall average score of 32.21 predicated Strongly Agree with 92.03%, media experts agreed that Strong for this educational media has satisfaction and usability and is feasible to use, in terms of the results of an average expert comment stating that this media is very easy to use and very simple in the flow of its use.
   c. The evaluation for the design aspects of the evaluation questions that were on the quiz was carried out 3 times validation iterations, the final results were obtained in the 3rd iteration, namely the overall average value of 27.68 with the Strongly Agree percentage of 92.28%. educational media is feasible to use. The average comments of material experts state that the educational media is very good and very unique in its presentation because it can collaborate with the syntax of the problem-posing learning model.
3. Evaluation results from the implementation of educational media based on requirements specifications consisting of:
   a. Functionally, all educational media features are functioning properly and in accordance with what is expected with an OK status or equivalent to 100%.

b. Non-Functional, that is, all users state that the educational media is very useful and they feel very satisfied with the overall average value of 236.79 predicated Strongly Agree and with a percentage of 93.96% predicated Very Strong.

The future work that we recommend is knowing the effects of using TOLSYASUPI-EduMed educational media on the next basic programming class, making further improvements and developments, improving performance, and making it mobile-based.

References

1. KEMDIKBUD RI, Struktur Kurikulum SMK Perdirjen Nomor 07 Tahun 2018, Direktorat Jenderal Pendidikan Dasar dan Menengah. Jakarta: Kementerian Pendidikan dan Kebudayaan Republik Indonesia, Direktorat Jenderal Pendidikan Dasar dan Menengah (2018)
2. Syahidi, A. A., Asyikin, A. N., Asy'ari.: Applying Student Team Achievement Divisions (STAD) Model on Material of Basic Programme Branch Control Structure to Increase Activity and Student Result. Proceedings of the 2nd International Conference on Vocational Education and Electrical Engineering (ICVEE) - IOP Conference Series: Materials Science and Engineering, vol. 336, issue 1, pp. 1-8 (2018)
3. Likmalatri, L.: Pemrograman Dasar untuk SMK/MAK Kelas X Semester 1 dan 2 Bidang Keahlian Teknologi, Informasi, dan Komunikasi. Putra Nugraha, Surakarta (2018)
4. Soloway, E., Spohrer, J.: Studying the novice programmer 1st edition. L. Erlbaum, Hillsdale (1989)
5. Malliarakis, C., Satratzemi, M., Xinogalos, S.: Designing educational games for computer programming: A holistic framework. Electronic Journal of E-Learning, vol. 12, issue 3, pp. 281–298 (2014)
6. Yang, T.-C., Hwang, G.-J., Yang, S. J. H., Hwang, G.-H.: A Two-Tier Test-based Approach to Improving Students' Computer-Programming Skills in a Web-Based Learning Environment. Journal of Educational Technology & Society, vol. 18, November, pp. 198–210 (2015)
7. Kunkle, W. M.: The Impact of Different Teaching Approaches and Languages on Student Learning of Introductory Programming Concepts. ProQuest Dissertations and Theses, vol. 16, September, 175 (2016)
8. Dwinanto, A.: Pengembangan dan Analisis Kualitas Game Edukasi Menggunakan Metode Pembelajaran Kooperatif Tipe TGT pada Materi Pemrograman Dasar Siswa SMK Kelas X. Thesis Document, UNY (2017)
9. Rozali, N. F., Zaid, N. M.: Code Puzzle : ActionScript 2 . 0 Learning Application Based on Problem Based Learning Approach. Proceedings of the 6th ICT International Student Project Conference, pp. 2–5 (2017)
10. Topalli, D., Cagiltay, N. E.: Improving programming skills in engineering education through problem-based game projects with Scratch. Computers and Education, vol. 120, pp. 64–74 (2018)
11. Kusumadewi, W. A. P.: Pengembangan Media Pembelajaran Berbasis Android pada Mata Pelajaran Pemrograman Dasar Kelas X di SMK Negeri 3 Surabaya. Jurnal ITE-Edu (Information Technology and Education) UNESA, vol. 1, no. 1, pp. 103-110 (2016)
12. Hidayah, N., Surjono, H. D.: Pengembangan Multimedia Pembelajaran Pemrograman Dasar untuk Kelas X SMK. Thesis Document, UNY (2015)
13. Hsu, W. C., Lin, H. C. K.: Impact of Applying WebGL Technology to Develop a Web Digital Game-Based Learning System for Computer Programming Course in Flipped

Classroom. Proceedings of the 5th International Conference on Educational Innovation through Technology, pp. 66–69 (2017)

14. Hong, T., Chu, HC.: Effects of a Situated 3D Computational Problem-Solving and Programming Game-Based Learning Model on Students' Learning Perception and Cognitive Loads. Proceedings of the 6th International Congress on Advanced Applied Informatics, pp. 596–600 (2017)
15. Hirashima, T., Yokoyama, T., Okamoto, M., Takeuchi, A.: An Experimental Use of Learning Environment for Problem-Posing as Sentence-Integration in Arithmetical Word Problems. Proceedings of the International Conference on Intelligent Tutoring Systems, pp. 687-689 (2008)
16. Supianto, A. A., Hayashi, Y., Hirashima, T.: Model-Based Analysis of Thinking in Problem Posing as Sentence Integration Focused on Violation of The Constraints. Research and Practice in Technology Enhanced Learning, vol. 12, no. 1, pp. 1-21 (2017)
17. Supianto, A. A., Hayashi, Y., Hirashima, T.: Designing Scaffolding System in a Problem-Posing Learning Environment. Proceedings of the 3rd International Conference on Science in Information Technology: Theory and Application of IT for Education, Industry and Society in Big Data Era, ICSITech 2017, pp. 20-551 (2018)
18. Supianto, A. A., Hayashi, Y., Hirashima, T.: Analysis of Steps in Posing Arithmetic Word Problem as Sentence-Integration on Interactive Learning Environment. Proceedings of the 24th International Conference on Computers in Education (ICCE), Think Global Act Local - Main Conference Proceedings, vol. 1, no. 11, pp. 242-251 (2016)
19. Supianto, A. A., Hafis, M.: GTLAS: Graphical Tracking Activity System for Problem-Posing Learning Process Insights. Proceedings of the International Conference on Advanced Computer Science and Information Systems (ICACSIS), pp. 231-235 (2018)
20. Kunimune, H., Niimura, M.: Preliminary Evaluation of a Problem-Posing Method in Programming Classes. Procedia Computer Science, vol. 35, pp. 794-802 (2014)
21. Syahidi, A. A., Supianto, A. A., Tolle, H., Hirashima, T.: Application of Learning Models in Educational Games: A Systematic Literature Review," Publication process at Jurnal Ilmu Pendidikan (JIP), Universitas Negeri Malang, Malang (2019)
22. Syahidi, A. A., Tolle, H., Supianto, A. A.: A Preliminary Study: Applying Problem-Posing Learning Models on Algorithm and Flow Chart Materials to Know Activities and Student Learning Outcomes in Basic Programming Class. Publication process at International Journal of Education (IJE), Universitas Pendidikan Indonesia, Bandung (2019)
23. Syahidi, A. A., Tolle, H., Supianto, A. A.: Educational Media Design for Learning Basic Programming in Branching Control Structure Material Using Problem Posing Learning Model. Publication process at KINETIK (Game Technology, Information System, Computer Network, Computing, Electronics and Control) Journal for Informatics and Electrical Engineering, Universitas Muhammadiyah Malang, Malang (2019)
24. Thomas, C. R.: The Impact of Media and Technology in Schools. Research Report, Georgia (1998)
25. Kirkorian, H. L., Anderson, D. R.: Learning from Educational Media. In: Calvert, S. L., Wilson, B. J., (Eds.), The Blackwell Handbook of Children, Media, and Development. Blackwell, Boston, MA, pp. 319-360 (2008)
26. Webcrawler, C.: Definition of Educational Media. California (2013)
27. Omodara, O. D., Adu, E. I.: Relevance of Educational Media and Multimedia Technology for Effective Service Delivery in Teaching and Learning Processes. IOSR Journal of Research and Method in Education (JRME), vol. 4, issue 2, ver. 1, pp. 48-51 (2014)
28. Huston, A. C., Wright, J. C.: The Forms of Television and the Child Viewer. Vol. 2, Academic Press, New York (1989)
29. Silver, E. A.: On Mathematical Problem-Posing. For the Learning of Mathematics. FLM Publishing Association, Vancouver British Columbia, Canada, vol. 14, issue 1, pp. 19-28 (1994)
30. Brown, S. I., Walter, M. I.: Problem Posing in Mathematics Education. In Stephen I. Brown & Marion I. Walter (Eds.), Problem Posing: Reflection and Applications, Hillsdale, Lawrence Erlbaum Associates, New Jersey, pp. 16-27 (1993)

31. Suryosubroto.: Proses Belajar Mengajar di Sekolah Wawasan Baru, Beberapa Metode Pendukung, dan Beberapa Komponen Layanan Khusus. Rineka Cipta, Jakarta (2009)
32. Brown, S. I., Walter, M. I.: Third Edition - The Art of Problem Posing. Lawrence Erlbaum Associates Publieshers, New Jersey (2005)
33. Silver, E. A., Cai, J.: An Analysis of Arithmetic Problem-posing by Middle School Students. Journal for Research in Mathematics Education, vol. 27, pp. 521-539 (1996)
34. Suyitno, A.: Dasar-Dasar dan Proses Pembelajaran Matematika I. Penerbit Universitas Negeri Semarang, Semarang (2004)
35. Sugiyono.: Metode Penelitian dan Pengembangan – Research and Development untuk Bidang: Pendidikan, Manajemen, Sosial, dan Teknik. CV. Alfabeta, Bandung (2016)
36. Branch, R. M.: Instructional Design: The ADDIE Approach. Springer (2010)
37. Kohavi, R., Longbotham, R.: Online Controlled Experiments and A/B Testing. In: Sammut C., Webb G. I. (Eds.) Encyclopedia of Machine Learning and Data Mining, Springer, Boston, MA (2017)
38. Siroker, D., Koomen, P.: A/B Testing: The Most Powerful Way to Turn Chicks Into Consumers 1st Edition. Wiley (2015)
39. Wahono, R. S.: Aspek dan Kriteria Penilaian Media Pembelajaran. address: http://romisatriawahono.net/2006/06/21/aspek-dan-kriteria-peningkat-media-pembelajaran/ accessed on 27 November 2018 at 23:08 WIB (2006)
40. Lewis, J. R.: IBM Computer Usability Satisfaction Questionnaires: Psychometric Evaluation and Instruction for Use. International Journal of Human-Computer Interaction, vol. 7, issue 1, pp. 57-78 (1995)
41. Riduwan.: Metode dan Teknik Menyusun Tesis. Cetakan ke-11, pp. 86-89, Penerbit Alfabeta, Bandung (2018)
42. Nidhra, S. Dondeti, J.: Black Box and White Box Testing Techniques - A Literature Review. International Journal of Embedded Systems and Applications (IJESA), vol. 2, no.2 (2012)
43. Murnane, T., Reed, K.: On the Effectiveness of Mutation Analysis as a Black Box Testing Technique. Proceedings of the Australian Software Engineering Conference, pp. 12–20 (2001)

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