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 the field of programming today makes Vocational High Schools as early as possible incorporate curriculum that can learn skills in programming, which is then called basic programming subjects. These subjects are the initial foundation, to study other productive subjects that must be studied by students in the field of ICT expertise. However, in reality, students tend to dislike these subjects because they feel difficulties in understanding and learning them. Therefore, we try to present a solution to overcome this problem by developing basic programming educational media, especially in the material of branching control structures by embedding the syntax of problem-posing learning models in the type of open-posing into the interaction flow. This educational media is called TOLSYASUPI-EduMed. 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 the R&D method. A/B testing methods are used to validate the initial selection of educational media design. The form of design until the development stage is validated by media and material experts as much as 3 iterations, to ensure that the educational media can look for 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 Very Strong to choose design B to continue at the advanced design, development, and implementation stages. The results of the validation of media and material experts state that it is feasible to use. Based on functional requirements specifications, all features function properly, and non-functionally 94.49% with predicates Very Strong that end-users (students) are satisfied and feel the usefulness of this TOLSYASUPI-EduMed.

Keywords: educational media, problem-posing, research and development
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 expressed by several studies, namely from [5] stating that computer
programming is very difficult. Subsequent research from [6] stated programming
subjects were difficult. Furthermore [7] said that students had difficulty in learning
object-oriented programming. Research by [8] who presented his findings that the
material contained in basic programming is very difficult for students to understand.
[9] found a very difficult condition for beginners who did not have a background in
programming skills. Finally from [10] which also describes the conditions
experienced when carrying out the research process, namely students have difficulty
learning programming.

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
do 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. This research included [11]
[12] who developed basic programming education media, but the educational media
they proposed was limited to replacing and even moving material in books into 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 technological advances and artificial intelligence in educational media technology, research conducted by [16] extends the domain of MONSAKUN system performance, by analyzing learner thinking when experiencing problems when interacting to solve problems in the regulation of integration of sentences that have been provided. Furthermore [17] recommends a scaffold system design in MONSAKUN which aims to overcome obstacles when students are faced with the problem of completing arithmetic words. From [18] analyze and investigate what actions are carried out by students when faced with problem-solving arithmetic words. 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 students after using the MONSAKUN system. Furthermore, from [20] who developed a web-based application to visualize the activity patterns of student actions in arithmetic learning with a problem-posing approach, then the form of visualization was used to provide information to teachers to analyze improvements in the future learning process.

In a study conducted by [21] 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 [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 effect. Research [23] is one part of the current research proposed.

Based on some of the relevant studies, for the research area that we are proposing is to develop a basic programming education media on branching control structure material by embedding the syntax of problem-posing learning models with the type of open-posing into their interaction paths, programming languages learned by students is Visual Basic 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 up to the development stage which can seek effects on learning effectiveness. 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 print, graphics, animation, audio, and audiovisual. According to [25] that educational media can include media designed either intentionally or unintentionally with the aim of educating or providing enlightenment to 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, digital games, and so on. The following is a classification chart of various types of educational media presented in Figure 1.

![Educational media classification chart](image)

**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 students, according to [28] it is said that the process of acquiring new information from educational media is a complex process, where it needs to involve more attention and understanding of stimuli produced when students interact with educational media.

### 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; 2) Within Solution
Posing; 3) Post Solution Posing.

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 core syntax in applying the problem-posing learning model according to [34] is that students are asked to send 1 or 2 challenging questions, and the students concerned must be able to solve them.

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. R & D 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. The reason researchers combine this method is to complement the shortcomings in the R & D method, where the flow of improvement only flows downward, while the ADDIE model is flexible.

![Fig. 2. Research methodology](image)

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. The analysis phase consists of 1) Potential and Problems; 2) Literature Study; 3) Information Collection/Requirement Analysis. The design phase is the activity of designing products according to what is needed based on the results of the analysis that has been done before. The initial design was submitted and assessed using the A/B testing method which was validated by experts to be able to proceed to the development stage. In [35] experts are people who have expertise. Researchers in this case also stated the criteria of these experts, namely people who have a track record of expertise and wrestle in a field of research/project creation as minimum as 5 years. The development phase is the activity of making products and testing internally. Expert validation is needed over and over to declare feasibility. The implement phase is the activity of using products for end-users, consisting of two activities, namely small (preliminary field testing) and large scale trials (main field testing). The evaluate phase 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.

6 Results and Discussion

6.1 Analyze

The results obtained from the stages of analysis are excavating the problem, namely 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 by proposing the design and development of educational media that is embedded in the problem-posing learning model in the flow of interaction. The literature study was obtained through the results of research and other scientific sources on the same topic, namely relating to the development of educational media using the problem-posing learning model that had been carried out by previous researchers. The results obtained in general from the collection of information/requirement analysis with end-users is that educational media designed can be used easily, simply, not complicate users, can be a solution to problems that have been found, can have good effects 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 the 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. The results of the A/B method testing process are experts agreeing to choose design B with a value of 90.9% Very Strong predicate approving it. The A/B method is tested once because the final score reaches \( \geq 75\% \) and they are not hesitant to approve the chosen design. According to experts, design B has simplicity, tends to be easy to use, has a uniqueness, and brings strength to the problem-posing process.

The design of the system architecture from the TOLSYASUPI-EduMed is shown in Figure 3, which has also been discussed with experts.
Figure 3 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 4), 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.

![Fig. 3. TOLSYASUPI-EduMed system architecture](image)

Figure 4 is a question and answer verification protocol where the protocol is to verify the recommendations of questions and answers from students, the process is accepted to be included in the question bank, and the revision process. 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).

![Fig. 4. Question and answer verification protocol](image)
Next to determine the description of user interaction with the system, the use case diagram of the TOLSYASUPI-EduMed system is designed in Figure 5.

Figure 5 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 began, checks were carried out again by experts, to ensure improved design after A/B testing. Figure 6 is a wireframe example of an approved design to go to the development process.

Furthermore, the process of developing educational media is carried out using web programming and flash programming. Where at this stage of development is making products in the form of EduMed-based desktop TOLSYASUPI. After the education
media was developed, then expert validation was carried out for the first iteration and internal trials.

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 in 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, the instrument validation sheet for Validation-01 can be accessed at the following link: http://bit.ly/iteration03validation-01. The instrument in Validation-01 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 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.

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, the instrument validation sheet for Validation-02 can be accessed at the following link: http://bit.ly/iteration03validation-02. The instruments in Validation-02 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, the instrument validation sheet for Validation-03 can be accessed at the following link: http://bit.ly/iteration03validation-03. The 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.

Table 1 is a comparison of the overall results of the overall assessment, in each validation iteration.

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<tr>
<th>Type of Validation</th>
<th>Overall Average Value</th>
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<tr>
<td></td>
<td>1st Iteration</td>
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<tr>
<td>Validation-01</td>
<td>15.17</td>
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<tr>
<td>Validation-02</td>
<td>20.32</td>
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<tr>
<td>Validation-03</td>
<td>15.79</td>
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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 Very Agree with a percentage of 90.44% the media experts agreed Very Strong 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 predicted Very Agree with the percentage of 98.33% Very Strong, for aspects of Visual Communication namely the average value of 21.36 has a Very Agree predicate with a percentage of 85.45% Very Strong, for the aspect of Media Design, the average value is 21.85 predicted Very 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 predicted Strongly Agree with a percentage of 92.03%, media experts agree that Very Strong 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 Very Agree with the percentage of 92.28% of the material experts stated that Very 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 7 through Figure 13 which is an example of the TOLSAYASUPI EduMed interface that was built and was approved and validated at the 3rd iteration improvement.

![Welcome page](image)

**Fig. 7. Main menu page**

Figure 7 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. 8. Question submission page (problem-posing process)**

Figure 8 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. 9. Application usage instructions page**

Figure 9 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.
Figure 10 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.

Figure 11 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 12).
Figure 12 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.

Based on Figure 13, the feedback contains information on the number of correct and wrong questions, and a comparison of program code settings between the user and the answer key of the system, this is in the form of a line numbering label, if the green label means the correct code matches the answer key, and if the color red label means the program code is incorrect.

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.
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 14 is a large-scale trial activity.

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 15), 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.

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] with the results obtained that all the features of the TOLSYASUPI-EduMed educational media 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, the CSUQ sheet instrument adapted from [40] can be accessed at the following link: http://bit.ly/usabilitysatisfactionsiswa. The 19 questions asked in the CSUQ questionnaire consisted of 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. 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 results of the usability satisfaction questionnaire using CSUQ adapted from [40], are presented in Table 2.

<table>
<thead>
<tr>
<th>ID</th>
<th>Score</th>
<th>Predicate</th>
<th>Percentage</th>
<th>Predicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>252</td>
<td>Strongly Agree</td>
<td>100%</td>
<td>Very Strong</td>
</tr>
<tr>
<td>Q2</td>
<td>252</td>
<td>Strongly Agree</td>
<td>100%</td>
<td>Very Strong</td>
</tr>
<tr>
<td>Q3</td>
<td>219</td>
<td>Strongly Agree</td>
<td>86.9%</td>
<td>Very Strong</td>
</tr>
<tr>
<td>Q4</td>
<td>216</td>
<td>Very Agree</td>
<td>85.7%</td>
<td>Strong</td>
</tr>
</tbody>
</table>

Table 2. Usability satisfaction assessment results
Based on Table 2, 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 238.11 predicates Very Strongly Agree and with a percentage of 94.49% 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 in accordance with the comments of 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. Class conditions when learning takes place during large-scale trials also feel that students are very serious about learning basic programming using TOLSYASUPI-EduMed educational media, although at first, they were confused after the next meeting tended to be more familiar in interacting with educational media, they looked very enthusiastic, happy, and more active class activities.

### 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 effectiveness in learning.

2. Design and develop of educational media based on the assessment of media experts and material experts consisting of:
   a. Evaluation for Validation-01 has done three iterations with the final results of the 3rd validation, namely for aspects of Software Engineering: the average value of 24.58 is predicated Very Agree with a percentage of 98.33% (Very Strong), for aspects of Visual Communication: the average value of 21.36 predicated Very Agree with the percentage of 85.45% (Very Strong), for the
aspect of Media Design: the average value of 21.85 predicated Very Agree with a percentage of 87.38% (Very Strong). For the overall average value at the value of 22.61 predicates Very Agree with a percentage of 90.44% media experts stated Very Strong agree that the media of education is appropriate to be used for basic programming learning.

b. The assessment for Validation-02 has done 3 iterations with the final results of the validation in the 3rd iteration, with an overall average score of 32.21 predicates Strongly Agree with 92.03%, media experts agree that this very Strong agree educational media has used and satisfaction for the end-user.

c. Evaluation for Validation-03 was done 3 times iteration validation, the final results were obtained in the 3rd iteration, namely the overall average value of 27.68 with the title Very Agree with a percentage of 92.28% that Very Strong agree design quizzes on educational media are feasible to use.

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 238.11 predicated Strongly Agree and with a percentage of 94.49% predicated Very Strong.

The future work is to find out the effects of using TOLSYASUPI-EduMed on the next basic programming class, make further improvements and development, improve performance, and make it mobile-based.

References


