Development of Coding Class Learning Media for Elementary School Children

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Abstract. This study aims to develop and explain how coding class learning media for elementary school children. Development in this study is a way or action to create something new by benefitting someone, especially children. The purpose of this research is to improve the ability of critical thinking about critical thinking. Research and Development with the 4D development model method are used in this study. This study uses observation and observation techniques for the data collection process. This study found that we need to apply effective learning media to improve critical thinking.

Keywords: Critical Thinking · Coding Class · Learning Media

1 Introduction

The learning process must contain interactive, practical, and fun aspects so that students are motivated to continue to think critically. Currently, the learning method used is less attractive, so students feel bored during the learning process and need help accepting the material presented by the teacher. Several factors strongly influence fun learning and teaching activities, one of which is the selection of learning media used [1]. Mahwah et al. [2] suggested that the selected media should attract students to learn more actively and interactively but not reduce the content of the material presented. Learning media is a component of learning [3]. The rapid development of Information Technology certainly impacts the realm of education. So it needs to be translated by education activists, especially teachers, to prioritize students so that they can start to be introduced to the latest technology that is developing rapidly. Development of Coding Class Learning Media for Elementary School Children The length of the papers should be minimum 3000 words and maximum 8000 words, excluding abstract and references.

One of the most crucial factors that the world of education can have a significant influence on the educational transformation process in creating aspects of the use of technology in education is playing in cyberspace, which communicates with each other between students, teachers, and stakeholders regarding the assistance of interactive and communicative technology facilities, namely E-Learning Learning Model as one of the Technology Trend System Methods for students and teachers [4]. Technology and

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information in the current era that impact learning are so important [5]. In addition, Tnanomporn [6] explains that the e-learning learning model is one of the most popular technologies that produce output in video, audio, and graphics today. So technology dramatically improves and develops students in learning [7].

One of the skills needed in the 21st century is Critical Thinking. Critical thinking does not mean thinking like a computer but thinking about criticality, where one is required to understand a fact in the form of a complex problem (in the form of an algorithm) or explain why a suitable solution is not found. So explain that the cognitive abilities that are the basis of Critical Thinking are the ability to think critically and rationally. Therefore, 21st-century education must be essential in facing the changing times. The learning process helps acquire behavior to think critically in solving a problem in the surrounding environment [8]. The ability to think critically, called Critical Thinking, is a part of the 21st century in the skills field.

Training or familiarizing students with Critical Thinking can be done by analyzing or analyzing problems into learning strategies. The strategy in question can be related to the packaging of the material, the learning media used, or an exciting learning model that can familiarize students with Critical Thinking. According to [9], critical thinking skills include four stages: Clarification, Assessment, Inference & Strategy/tactics. The clarification stage, namely, the stage was to clarify the existence of a problem or define the existence of a problem. Then the assessment stage connects a problem with other problems. Furthermore, the conclusion stage is the stage that concludes a problem using induction, deduction, and clarification. Moreover, the last stage of strategy and tactics is the evaluation stage of preparing ways to overcome a problem, known as action.

The characteristics of elementary school children are essential to be used as a benchmark in teaching and learning. The strategy used in learning produces a goal. The learning strategy is the goal of effective and efficient learning produced by [10]. Usually, some educators need to understand the characteristics of students because the characteristics of a student are different. Characteristics of students can be known in terms of intelligence, activity, and learning styles carried out in and outside the classroom. Therefore, learning strategies, objectives, media, and components must be prepared by educators in advance [11].

Coding needs to be taught in education, especially in the 21st century [12]. Technology in the 21st century has significantly improved. The application of coding learning in elementary schools is very influential, such as critical thinking, solving a problem, and thinking creatively in literacy [13]. The advantages of learning coding can be used in everyday life, namely solving a problem. The President of the Republic of Indonesia, Joko Widodo, made a speech about programming languages or often called coding, which is more important than English. In addition, "Language is not only English; Coding Language is even more important in the future," said Jokowi at the Presidential Briefing event to PPSA XXII Participants of the National Resilience Institute at the

State Palace, Wednesday (13/10). Informatics subjects were also included from the elementary level because the basis of coding is related to learning informatics. The stages of the 4D development model include the following:

1. Define Stage

At the Stage of defining or analyzing needs, analyze previous research and literature studies. Thiagarajan's 4D model [14] says five activities can be carried out at the define stage, including:

a) Front-end analysis

At this Stage, the researcher identified the main problems faced in the learning process so that the background of the need for development was to analyze the lesson plans and the learning media used [15].

b) Participant Analysis

At this Stage, the researcher identifies how the characteristics of students are related to academic abilities, cognitive development, motivation, and individual skills related to learning topics. The researcher found that the students lacked Critical Thinking ability [16].

c) Task Analysis

Learning media development is complemented by projects that can later make students practice programming and get used to having Critical Thinking abilities [17].

d) Concept Analysis

Researchers identify sources that support the preparation of learning materials through the lesson plan.

e) Setting Instructional Goals

The purpose of learning is to improve the ability of Critical Thinking. Fig. 1: 4D Development Model.

2 Method

This study uses a 4D model development model. This model is used to develop learning tools. The 4D development model has steps shown in Fig. 1, including Defining, Designing, Developing, and Distributing [18].

2. Design Phase (Design)

The second stage in the 4D model is designed. Four steps must be passed at this stage, including compiling criteria reference tests, media selection, format selection, and initial

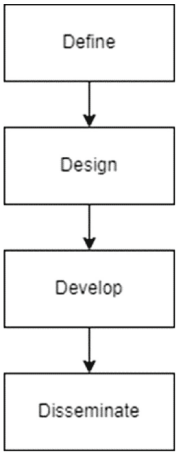


Fig. 1. 4D Development Model

design. At this stage, an overview of the learning media is produced in a low-fidelity prototype [19].

3. Development Stage (Develop)

The third stage in the development of 4D model learning tools is development. This stage consists of two steps, namely expert assessment accompanied by revisions, where there are two experts, namely material experts and media experts, and development testing.

4. Stage of Dissemination (Disseminate)

The researcher will conduct the socialization by choosing the socialization time used by the 4th, 5th, and 6th graders of SD Negeri Bogorame [20].

3 Result and Discussion

This research develops coding learning media to improve Critical Thinking for elementary school children. This media can be used by students at school (school environment) or at home (outside the school environment). The following are the results of the learning media products made by researchers:

At the stage of making learning media, it can be seen through the Use Case in Fig. 2; students will be given subjects, then students choose to learn materials to be followed, either by using modules or tutorials. After that, the project view will appear on the dashboard view. The first step to accessing or visiting the learning media is to create a website link http://codingku.epizy.com/.Then the Home Page display will appear as shown in Fig. 3.

The initial appearance of the created website can be seen in Fig. 3; several buttons are available. On the home page is a menu of programs, about us, and contacts us. The beginning of the website is the first time students visit the coding course website.

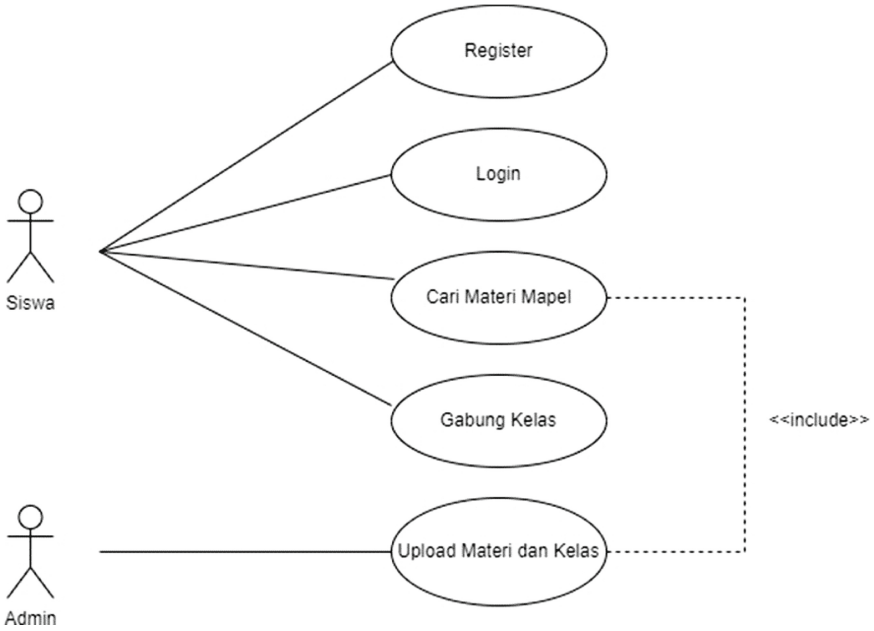


Fig. 2. Use Case

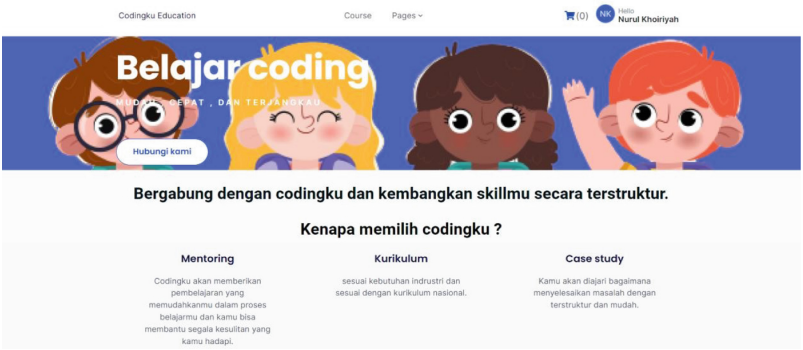


Fig. 3. Website Initial View

Pictures of some of the packages that will be selected can be seen in Fig. 4. The course packages include online, offline, and online courses. In each package, there is a difference. The package price or the course you want to take is presented as a pamphlet.

Fig. 4. Display of Course Package Options

The display of the flyer is freely chosen according to the course you want to take. The differences between the three-course pamphlets are:

1. Online Course

This pamphlet is about online coding courses, with the online registration method, and self-study, according to the curriculum, without consultation and mentoring. With payment or registration fee is free.

2. Offline Course

Coding course pamphlets are carried out offline, with online registration methods, according to the curriculum, discussion groups, consultation and mentoring, and hands-on learning. Pay the price of Rp. 100,000/Month.

3. Online Course

This pamphlet is about coding courses conducted online, with the online registration method, self-study, according to the curriculum, consultation, and mentoring, via zoom. With a registration fee of Rp. 70,000 (Fig. 5).

In this view, several materials match the selected package options. What is shown in the picture is about "Introduction to Scratch - Calculating the Area of a Triangle." In the display of the material, there are sub- chapters presented. This view can be seen in Fig. 6.

The description of some of the sub-chapters of the material presented is shown in Fig. 6. The sub-chapters of the material presented are an introduction to scratch, the purpose of scratch, the benefits of learning to scratch, and sprite scratch. In addition, there are also learning materials presented in the form of scratch, including learning about calculating flat shapes (triangle area), uniform straight motion (GLB), and simulation of back- and-forth motion on scratch.

In addition, there are several dashboards about scratch recognition, scratch goals, the benefits of learning to scratch, and scratch sprites. A dashboard that can be used to find out students' Critical Thinking. Therefore, you can choose the material according to what you want to learn.

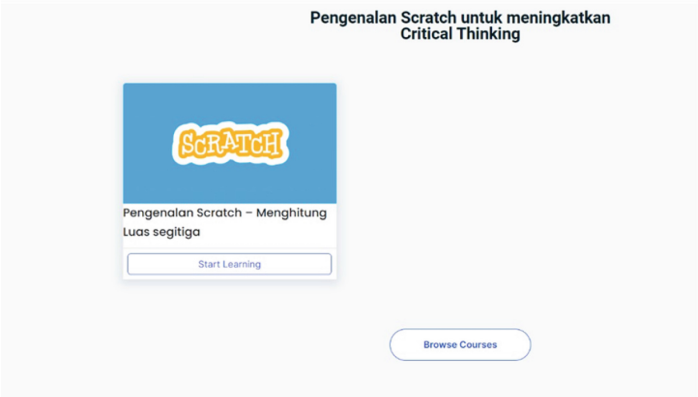


Fig. 5. Material Display

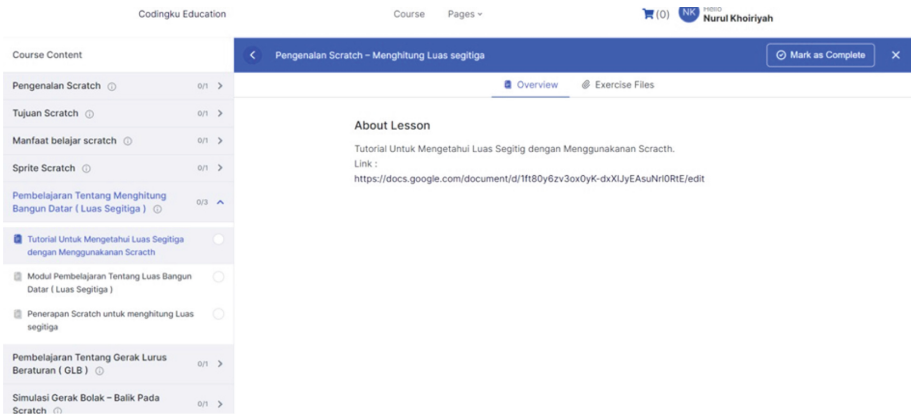


Fig. 6. Sub-Chapter Material

After selecting the subjects to be studied, Fig. 7 shows the appearance of the selected subjects. The menu contains modules, learning tutorials, and scratch learning links. When students access the following material, click on the link. They will be directed to Google Drive; when students want to access the following learning tutorial, they are directed to Google Drive. If students want to access the Scratch learning link, they will be directed directly to the Scratch that has been created.

Figure 8 shows the display after running scratch to calculate the triangle area. After the students see the learning module, the tutorial on making scratch, and the application of scratch, here students will develop a coding program from the beginning until the coding program is successful. Students will know the results of calculating the area of a triangle. This learning media is then applied to elementary school students. The purpose of this learning media is applied to be used to improve Critical Thinking.

The formula for calculating the area of a triangle entered into the scratch. The formula for the area of a triangle is:

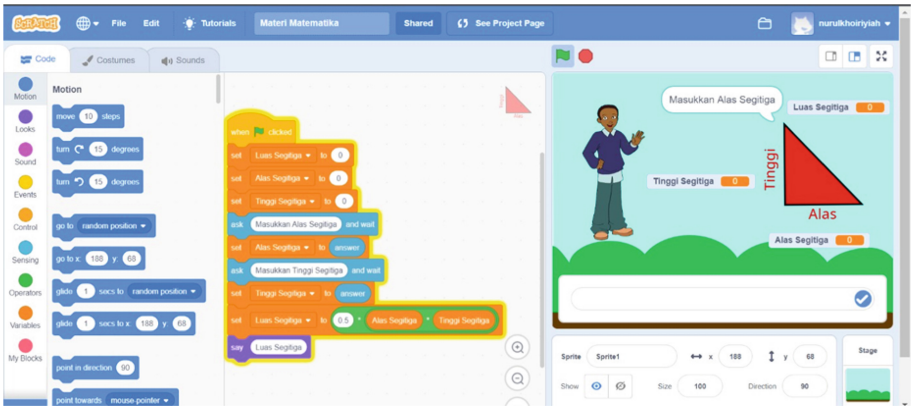


Fig. 7. Course view

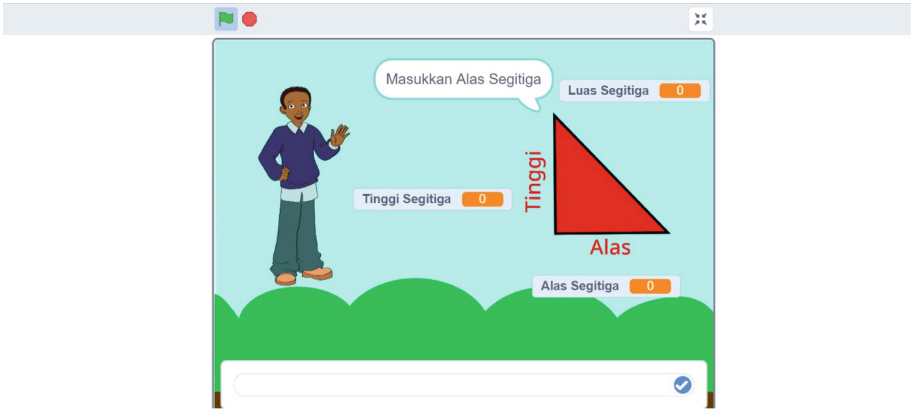
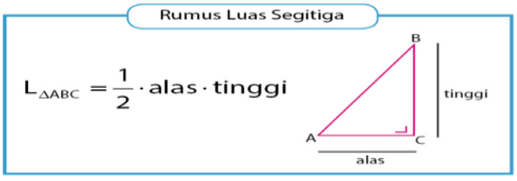


Fig. 8. Run view



In this learning media, we can quickly determine the area of a triangle without having to calculate. So solving the problems given by the teacher will be faster. In addition, by using these media, students can find out the mindset of students, namely Critical Thinking or thinking creatively.

For testing from the website, the research was carried out with several testing categories, including the medium test. Based on the results of tests conducted by two media experts, which can be seen in Table 1.

Table 1. Media Test Results

No	Examiner	Aspects of Learning Design	Visual Communication Aspect	Software Aspect	Total Score	Max. Score	Percentage
1.	Taster 1	33	23	29	85	92	92%
2.	Taster 2	35	21	31	87	94	94%

Table 2. Media Eligibility Criteria By Media Experts

Percentage	Criteria
92%	Worthy
94%	Very Worthy

The test for media expert test uses a questionnaire. On the results of the media test, it was obtained that media expert 1 with a percentage obtained was 85%, while media expert 2 with a rate of 94%. So that the results of the media testing can be concluded in category as very feasible to be applied or tested to students (Table 2).

In addition to conducting a media test, it was followed by a material test to material experts by a Lecturer of Informatics Engineering Education at the University of Muhammadiyah Surakarta, seen in Table 3.

From the material test results by material expert lecturers, it was stated that the material was feasible to be tested on students. Test the material by having a percentage of 88% and 92%. So in trying the material, it has been laid out to Based on the results of the user satisfaction questionnaire after using the coding media website, the results are shown in Table 4.

So that the user satisfaction aimed at students can be known by having the highest percentage of 100%, so the media website is very feasible to apply to elementary school students.

Based on a comparison with research that explores the results of critical thinking skills, Critical Thinking in learning media can make students more interactive. According to (Rafluddin, 2016), this research is based on the results of several instruments that develop digital- based learning media to ensure that coding learning media can improve Critical Thinking in students so that the test results of several media experts, materials, media eligibility and validation sheets for students are very feasible to apply to elementary school students.

Table 3. Material Test Results

	No	Theory	Score
Material Expert 1	1.	Content truth	5
	2.	Free from concept errors	5
	3.	Contemporary and up-to-date material	4
	4.	Coverage and depth of material	3
	5.	The reliability of the reference (reference) used	5
		Total Score	22
		Maximum Score	88
		Percentage	88%
Material Expert 2	1.	Content truth	5
	2.	Free from concept errors	5
	3.	Contemporary and up-to-date material	5
	4.	Coverage and depth of material	4
	5.	The reliability of the reference (reference) used	4
		Total Score	23
		Maximum Score	92
		Percentage	92%

Table 4. User Satisfaction Questionnaire Results (Students)

User	Value of Each Item											SUS Score (Total * 2,5)
	1	2	3	4	5	6	7	8	9	10	Total	
Student 1	4	3	4	4	5	3	3	5	3	4	38	95%
Student 2	4	3	3	5	4	3	5	4	3	4	38	95%
Student 3	5	3	3	4	5	3	3	3	4	4	37	92%
Student 4	4	4	4	4	5	3	3	5	5	3	40	100%

4 Conclusion

Based on the study's results, coding class learning media can be used. This learning Media can be run on laptops, tablets, and smartphones. Learning media development is expected to improve Critical Thinking for elementary school students. Critical Thinking is also needed in today's era because it can mend students to think critically, logically, systematically, and structured.

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