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Development of Game-Based Learning Media Using Construct 2 in Informatics Subjects in Class X of SMK NU Tulungagung

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***Abstract*— This research aims to develop interactive learning media in the form of educational games using Construct 2 in Informatics class X subjects at SMK NU Tulungagung. The background of this research is that the learning process is still conventional and less motivating for students. The media is developed in the form of platformer games that can be accessed through Android devices, presenting algorithmic material in a gradual and interactive manner. The research method used is Research and Development (R&D) with the ADDIE development model which includes the stages of analysis, design, development, implementation, and evaluation. The results of the development show that the media has easy-to-understand navigation, content according to the curriculum, evaluation in the form of multiple-choice questions, and an attractive visual display that is in accordance with the characteristics of the students. Validation by two media experts and one subject matter expert obtained results of 70% (valid), 75% (valid), and 84% (very valid), respectively. The test for students resulted in scores of 88.8% (small group) and 84.4% (large group) which were categorized as very valid. Thus, this game-based learning media is very suitable for use in learning Informatics at SMK NU Tulungagung.**

Keywords*— Games Platformer, Construct 2, Learning Media Algorithms, ADDIE

I. INTRODUCTION

The independent curriculum is considered the first step in supporting the achievement of the goals of national education, which is to educate the life of the nation [1].

The development of information and communication technology today has become a vital human need, not only in social interaction, but also on a scale between institutions, regions, and countries. This development has a major impact on the world of education, where the media plays a role as a means to increase the effectiveness and efficiency of achieving educational goals [2]. Informatics is a broad field of science that includes computational theory to network technology. In the digital age, these skills are becoming essential in various sectors such as education, healthcare, business, and government. Informatics includes the management, processing, and distribution of information, as well as the development of digital systems such as educational information systems, e-commerce, and e-government [3].

Game-based learning is an approach that uses the principles of games to achieve learning objectives, by actively engaging students and supporting the natural learning process. This approach also contributes to character formation such as cooperation, honesty, and discipline, and has an impact on cognitive development by linking learning materials to everyday life situations [4].

The results of observations and interviews on June 8, 2025 at SMK NU Tulungagung show that this school has five departments, with a total of 320 students from the 2024–2025 batch. Learning is still dominated by lecture methods and minimal innovation in teaching media, especially game-based learning. Teachers have difficulties in developing learning media because there is no adequate training available. The average score of informatics learning outcomes of 82.69 indicates that there is a problem of student motivation and saturation. Seeing the high interest of students in online games, game-based teaching media innovations are needed, especially by using the Construct 2 application. In the development of this game-based learning media, it is made using construct 2 software which was developed so that it can be operated on the android operating system which has a minimum OS specification of android 5.0 lollipop, 2GB RAM, and 500 MB storage. Based on observations, the specifications of students' mobile phones support the use of this media. According to [5]. learning media plays a role in increasing motivation and learning outcomes. Media includes a variety of physical tools for conveying material, such as books, videos, and computers [6]. Therefore, the development of game-based learning media is considered relevant to be applied in the informatics subject of class X of SMK NU Tulungagung.

II. LITERATURE REVIEW

1. *Informatics Learning*

Informatics is a broad field of science, including computational theory to network technology. In the digital age, expertise in this field is essential, not only in the world of technology, but also in the education, health, business, and government sectors. Informatics not only focuses on the processing and distribution of information, but also includes the development of systems such as educational information systems, e-commerce, and other digital services [3].

The subject of Informatics encourages students to become analytical, independent, and innovative learners. In addition to learning software, students are also equipped with digital skills, critical thinking, problem-solving, as well as ethical values and responsibility in the use of technology.

A. *Game-Based Learning*

Game-based learning delivers an engaging, interactive, and challenging learning experience. In games, students play an active role as decision-makers and problem solvers, allowing for the creation of a personalized and adaptive learning process. The presentation of material through game elements not only increases motivation, but also encourages active involvement of students in the learning process [7].

Game-based learning provides an engaging, interactive, and challenging learning experience. Students are actively involved as problem solvers and decision makers, so that the learning process becomes more personal and adaptive. The game element also increases students' motivation and participation in learning.

B. *Construct 2*

Construct 2 is an HTML5-based tool developed by Scirra Ltd, designed to make it easy to create games without the need for programming skills. With a drag and drop system and a visual editor based on behavioral logic, Construct 2 is perfect for non-programmers [8].

Software Construct 2 is one of the software that can generate applications or games (game engines). The following is a view of Software Construct 2 in the image below:

Figure 2. 1 Construct 2

C. *Game Platform*

A platformer game is a genre of games that emphasizes on character movements such as jumping, running, and climbing from one platform to another. This genre is considered to be efficient in terms of time and cost compared to 3D games. Platformers can be run on a variety of devices, whether desktop, mobile, or browser. Popular examples of this genre include Super Mario Bros, Sonic the Hedgehog, and Rayman [9].

III. RESEARCH METHODOLOGY

This research uses a research and development (R&D) approach that aims to develop game-based learning media using Construct 2 in Informatics class X subjects at vocational schools. The development model used is the ADDIE model, which consists of five systematic stages, namely Analyze, Design, Develop, Implement, and Evaluate [10].

The selection of ADDIE models is based on its practical and systematic advantages and its ability to assist in the design and evaluation process of products. Each stage in this model includes an ongoing evaluation process, so as to guarantee the validity and effectiveness of the developed product.

This learning media was developed based on the needs identified at SMK NU Tulungagung, with the hope that it can be an innovative learning solution and support student involvement in the learning process. The final product is expected to be worthy of trial and make a positive contribution to teachers in the implementation of teaching and learning activities.

The ADDIE model consists of five stages, namely: Analyze, Design Planning, Development, Implementation, and Evaluation. The stages of the ADDIE model according to [11] can be seen in this image:

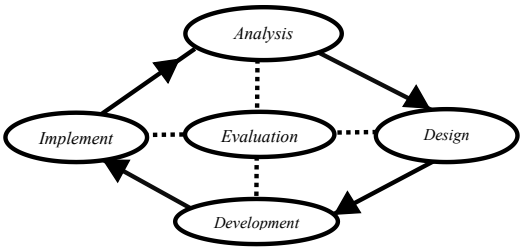

Figure 3. 1 ADDIE Model Stages

The stages of developing this learning media include five steps, namely: a) Analysis, to identify students' needs, problems, solutions, and competencies; b) Design, design structure and content of learning media; c) Development, including the creation and incorporation of media elements such as text, graphics, animation, audio, and video, based on the design that has been made, including the preparation of pre-production materials such as informatics materials, videos, icons, images, and backgrounds; d) Implementation, namely the application of media in the learning process according to the specifications that have been designed; and e) Evaluation, which is testing the learning media that has been developed [12].

A. *Product Trials*

The trial of game-based learning media products using Construct 2 was carried out by involving validators, media experts and material experts to obtain input in product improvement. The user trial was carried out offline in class X TKJ SMK NU Tulungagung, involving 30 students as respondents.

B. *Data Collection Techniques*

This study uses three data collection instruments, namely interviews, observations, and questionnaires. Interviews were conducted with homeroom teachers to identify learning problems in class X of SMK NU Tulungagung. Observation was used to directly observe learning activities and students' responses to the Construct 2 game-based learning media. Meanwhile, a questionnaire was given to a team of experts and students to assess the validity and level of attractiveness of the developed media.

IV. RESEARCH RESULTS

A. *Develop Stage*

After conducting the analysis and design stage, then conducting the development stage to create game-based learning media using construct 2 in informatics lessons. The results at this development stage in the development of game-based learning media using contruct 2 can be seen and studied in the following figure:

Figure 4. 1 Main Menu Page

In the initial menu display, there are game titles (Algorithms), Play buttons, hint buttons, audio buttons, and reset buttons. With attractive graphics display. minimum of one author is required for all conference

Figure 4. 2 Instructions Menu Display

In the instructions menu, there is a guide on how to play algorithmic game products and there is a home button to return, a developer profile button, and an audio button.

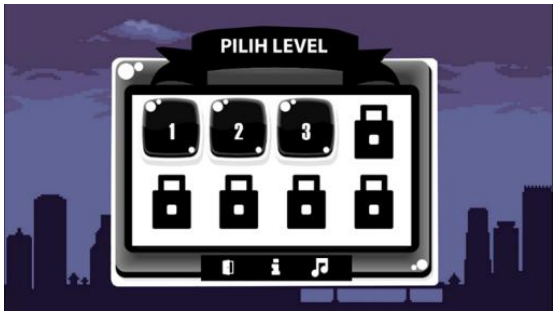

Figure 4. 3 Select Stage/Level Page

This page displays the stages that have been won or are still locked and there are several back buttons, profiles, and audio.

Figure 4. 4 Developer Profile Page

This page displays the identity information of the developer of game-based learning media, and there is a home button to return to the start menu, a stage menu button to view levels, and an audio button.

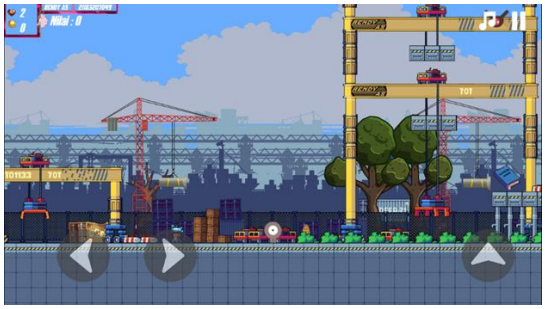

Figure 4. 5 Gameplay

The display in the game has obstacles and several book items and coins, in the book item there are informatics materials, and the coin item has evaluation questions. This game has 8 stages.

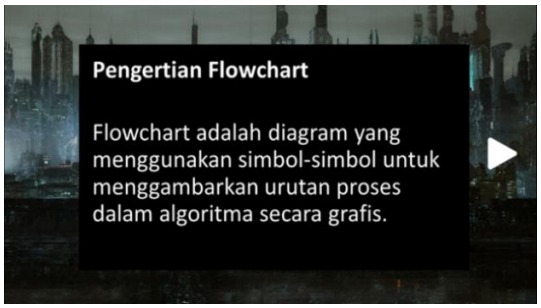

Figure 4. 6 Algorithm Material Display

In this display there is algorithm material and the next button, this is useful for providing material readings related to the given questions.

Figure 4. 7 Evaluation Question Display

In this view, there is an evaluation question if the answer is wrong, the animation feedback appears incorrectly and vice versa if it is correct.

B. *Media Expert Test Results*

The results of the media test are carried out to test whether the media has been made according to what is desired, the media expert test is carried out when the media has been created by the developer. The results of the media expert test were obtained by providing a statement that has been adjusted to the needs of the developer in making game-based learning media using construct 2. The results of this media expert test show the validity and feasibility of the media that has been made.

Table 4. 1 First Media Member Test Results

No	Indicator	Score	Category
	A. Display		
1	Attractive design	5	Very valid
2	Neat and consistent layout	4	Valid
3	Appropriate and attractive color selection	5	Very valid
	B. Navigation		
4	Easy to use navigation	4	Valid
5	Indicator buttons are easy to recognize and function	5	Very valid
	C. Interactivity		
6	There is feedback when choosing an answer	4	Valid
7	Responsive to user actions	4	Valid
	D. Content suitability		
8	Material in accordance with KI/KD Informatics Subject Class X	4	Very valid
	E. Compatibility with *Game Learning*		
9	Game Elements Support Learning Objectives	4	Very valid
10	In-Game Challenges Relevant to Learning Materials	5	Very valid
	F. Language		
11	Language Used According to Indonesian Spelling (EBI)	4	Valid
12	In accordance with Indonesian rules	4	Valid
	TOTAL SCORE	52	Valid

The results of the first media expert test after the revision of the Construct 2 game-based learning media for Informatics class X subjects of SMK NU Tulungagung showed a total score of 52 out of 60, with a validity percentage of 86%. This value indicates that the media is in the valid category.

Table 4. 2 Results of the second media member test

No	Indicator	Score	Category
	A. Display		
1	Attractive design	4	Valid
2	Neat and consistent layout	4	Valid
3	Appropriate and attractive color selection	4	Valid
	B. Navigation		
4	Easy to use navigation	3	Quite Valid
5	Indicator buttons are easy to recognize and function	3	Quite Valid
	C. Interactivity		
6	There is feedback when choosing an answer	3	Quite Valid
7	Responsive to user actions	4	Valid
	D. Content suitability		
8	Material in accordance with KI/KD Informatics Subject Class X	4	Valid
	E. Compatibility with *Game Learning*		
9	Game Elements Support Learning Objectives	4	Valid
10	In-Game Challenges Relevant to Learning Materials	4	Valid
	F. Language		
11	Language Used According to Indonesian Spelling (EBI)	4	Valid
12	In accordance with Indonesian rules	4	Valid
	TOTAL SCORE	45	Valid

The results of the second media expert test on the Construct 2 game-based learning media for Informatics class X subjects of SMK NU Tulungagung showed a total score of 45 out of 60 or 75%, which was included in the category of quite valid. The shortcomings of this media include animation aspects, evaluation features, inconsistencies in sound volume, and inconsistent background displays, so that the presentation only reaches 60% of what is expected.

C. *Material Expert Test Results*

This material expert test was carried out on teachers who were able to learn informatics lessons at SMK NU Tulungagung. In the material expert test, the aim is to adjust the material that will be made in adjusting the material that will be used for the development of game-based learning media using construct 2. By conducting an expert test, this material provides accuracy in adjusting the material to be included in the learning media that is in accordance with what is learned by tenth grade TKJ students at SMK NU Tulungagung.

Table 4. 3 Media Expert Test Results

No	Indicator	Score	Category
	A. Curriculum Fit		
1	The material is in accordance with KI (Core Competencies) and KD (Basic Competencies) Informatics Class X SMK	5	Very valid
2	The material is in accordance with the set learning objectives	4	Valid
	B. Material Completeness		
3	The material covers all the important aspects of the topic covered	4	Valid
4	The material is quite in-depth according to the cognitive level of vocational school students	3	Quite valid
5	Compatibility of Game-Based Learning Media components	3	Quite valid
	C. Language and Delivery		
6	Communicative language	5	Very valid
7	Sentences are clear, and easy to understand	4	Valid
	D. Relevance of In-Game Training Questions		
8	Questions can measure students' understanding and ability	5	Very valid
9	In-game questions/tasks according to the material	4	valid
10	Improve students' insights and skills	5	Very valid
	TOTAL SCORE	42	Highly Valid

The results of the material expert test showed that the Construct 2 game-based learning media obtained an average score of 42 out of 50 or 84%, which was categorized as very valid. This means that the material in the media is in accordance with the needs of students in the Informatics class X subject of SMK NU Tulungagung. However, there is still a shortfall of 16% of the maximum score due to the existence of several materials that are considered less varied.

D. *Product Trials*

The assessment was carried out through a questionnaire filled out by respondents as media users. The test subjects consisted of two groups, namely a small group of 5 students and a large group of 25 students.

Table 4. 4 Small Group Test Results

No	Indicator	Score	Category
1	Students' interest in learning	48	Highly Worth It
2	Students' understanding of Game-Based Learning Media	42	Highly Worth It
3	Selection of attractive images and colors.	42	Highly Worth It
4	Evaluation suitability	43	Highly Worth It
5	Learner insights	47	Highly Worth It
	TOTAL	222	Highly Worth It

The results of the small group test on Construct 2 game media in the Informatics class X subject of SMK NU Tulungagung with a total score of 222 out of 250, resulted in a feasibility percentage of 88.8% which is classified as very feasible.

Table 4. 5 Large Group Test Results

No	Indicator	Score	Category
1	Students' interest in learning	4	Highly Worth It
2	Students' understanding of Game-Based Learning Media	4	Highly Worth It
3	Selection of attractive images and colors	5	Highly Worth It
4	Evaluation suitability	4	Highly Worth It
5	Learner insights	4	Proper
	TOTAL SCORE	21	Highly Worth It

The results of the large group test on the Construct 2 game media in the Informatics class X subject of SMK NU Tulungagung with a score of 21 out of 25 out of a total of 1055 out of 1250 maximum scores, resulted in a feasibility percentage of 84.4%, which is included in the very feasible category. However, some obstacles in the game are considered too difficult, so the percentage value is still 15.6% less than the maximum.

CONCLUSION

The development of game-based learning media using Construct 2 through the ADDIE model which includes the analysis, design, development, implementation, and evaluation stages showed positive results. The first media expert validation test obtained a score of 70% (valid), the second media expert 75% (valid), material expert 84% (very valid), small group test 88.8% (very valid), and large group 84.4% (very valid). Based on these results, this learning media is very suitable for use in Informatics class X subjects at SMK NU Tulungagung.

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