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DEVELOPMENT OF AN EDUCATIONAL GAME USING CONSTRUCT 2 FOR THE SUBJECT OF BASIC COMPUTER AND TELECOMMUNICATION NETWORK ENGINEERING AT SMK TERPADU AL ANWAR DURENAN TRENGGALEK ACADEMIC YEAR 2024/2025

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***Abstract*—This study aims to develop interactive learning media in the form of a desktop-based educational game using Construct 2 software for the subject of Basic Computer and Telecommunication Network Engineering at SMK Terpadu Al Anwar Durenan Trenggalek. The background of this research stems from monotonous and less engaging learning methods, especially in Islamic boarding school environments where mobile device usage is restricted. Therefore, a desktop game was developed to be accessed via the school's computer laboratory. The game adopts the puzzle genre and presents material on Occupational Health, Safety, and Environmental Protection (K3LH) and industrial work culture in a gradual and interactive manner. The research method used is Research and Development (R&D) with the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The final product features effective navigation, curriculum-aligned content, built-in exercises for evaluation, and appealing visual design. Validation was carried out by two media experts and one content expert, followed by testing involving both small and large student groups. The validation results show that the game is categorized as "highly feasible" with a score of 83.39%. Effectiveness testing also revealed very positive student responses to the use of the game in learning activities. Therefore, this educational game is considered effective in enhancing students' motivation, understanding, and engagement in the learning process. This study is also expected to serve as a reference for the development of other contextual and technology-based learning media, particularly in educational settings with limited access to mobile devices.**

Keywords: Educational Game, Construct 2, learning media, K3LH, ADDIE.

I. INTRODUCTION

The rapid development of technology has had a significant impact on various aspects of life, including the field of education. The use of technology in the learning process has been proven to be able to increase students' interest and comfort, especially when combined with interactive media such as educational games. These media not only provide a fun learning experience, but also encourage active engagement, improve concentration, and develop students' thinking skills[1].

This research was conducted at SMK Terpadu Al Anwar Trenggalek, a school under the auspices of the Anwarul Haromain Islamic Boarding School that integrates the national curriculum with religious education. The results of initial observations show that learning at the school is still conventional and monotonous, and has not made optimal use of technology due to the ban on the use of mobile devices in the pesantren environment.

To overcome these limitations, educational game-based learning media was developed using desktop devices. This strategy aims to create a more interesting and interactive learning atmosphere that emphasizes the importance of media innovation in improving students' understanding of the subject matter[2].

The educational games used were developed with Construct 2, an HTML5-based software that allows the creation of 2D games without the need for complex programming skills. With the event sheet feature, users can visually arrange game logic, so it is very suitable to be applied in the development of interactive learning media [3].

II. RESEARCH METHODS

A. Types of research

This research is a development study (Research and Development) aimed at producing a desktop-based educational game using Construct 2 [4]. The product is developed to support the learning process of the subject Basic Computer and Telecommunications Network Engineering at SMK Terpadu Al Anwar in the form of a puzzle game. This study employs the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation [5].

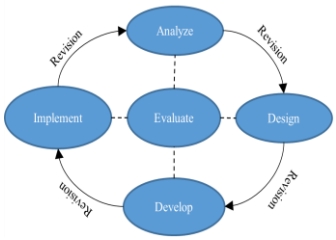


Figure I ADDIE Flow

B. instrument

The instrument used in this study was a questionnaire designed to collect data from three groups of respondents: media experts, subject matter experts, and students as users. The media expert instrument was used to assess the technical quality of the learning media, including visual appearance, navigation, and design clarity. The subject matter expert instrument focused on evaluating the content's alignment with the curriculum, conceptual accuracy, and the appropriateness of information presentation. Meanwhile, the student instrument was used to measure responses regarding the media's effectiveness in supporting the learning process, as well as the level of interest and ease of use of the developed educational game. All instruments were structured using a Likert scale and based on validation guidelines from [6].

C. Prosedur penelitian

The research procedure follows the ADDIE development model, which consists of five stages. The Analysis stage was conducted through observation, interviews, and needs analysis, including hardware and software requirements to support the development of the educational game. The Design stage involved conceptualizing the product by collecting materials, creating a storyboard, and developing a flowchart as the foundation for the application. During the Development stage, the game was created using Construct 2 and validated by subject matter and media experts to ensure content and visual quality. The Implementation stage included trials with teachers and Grade X students of SMK Terpadu Al Anwar to gather user feedback. Finally, the Evaluation stage assessed the media's effectiveness through questionnaires, interviews, and observations, which served as the basis for improvements to ensure the product is suitable for classroom use .

D. Analysis

- **Needs Analysis**

  Based on interviews with teachers of the Basic Computer and Telecommunications Network Engineering subject for Grade X and observations at SMK Terpadu Al Anwar Durenan Trenggalek, relevant information was obtained to identify the needs for learning media. The current learning process still relies on textbooks without supplementary worksheets (LKS) or evaluation tools. LCD projectors are only available in a few classrooms, while most rely solely on printed books. The school does have a computer lab with Intel Core i3 processors, 4 GB RAM, 500 GB HDD, and Windows 10, which can be used to access the educational game. Student engagement tends to be low during conventional and monotonous teaching methods. As all students are santri (Islamic boarding school students), they are not allowed to bring mobile phones. Additionally, evaluation showed that the existing school materials are incomplete, requiring adjustments to optimize the content presented in the educational game being developed.

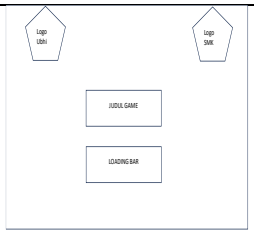
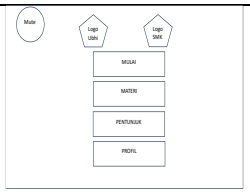
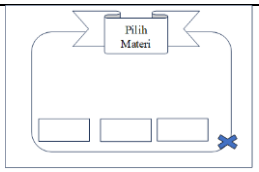
- **Curriculum Analysis**

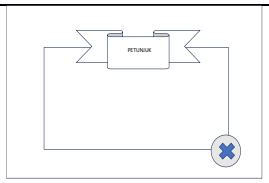
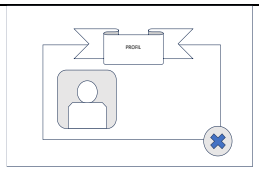
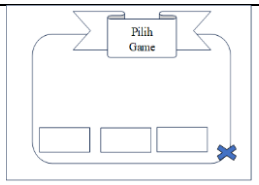
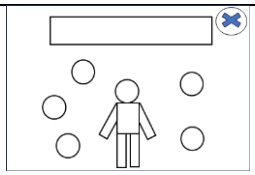
  Curriculum analysis was carried out by reviewing the curriculum used at SMK Terpadu Al Anwar, which is the Merdeka Curriculum.

E. Design stage

The design stage was carried out by the researcher by formulating the initial concept of the product, which serves as a reference for the subsequent development process. This stage involves conceptual creation that acts as the foundation for further development.

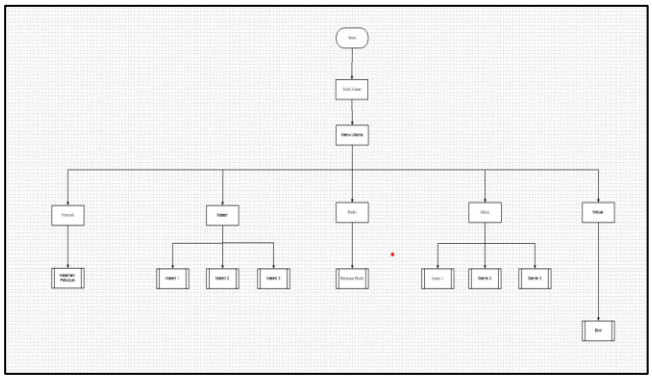
Table I Table Story board

No	Picture	Page	Keterangan
1		Loading Page	On the loading page there is the logo of Bhinneka PGRI University and the logo of SMK Al Anwar, then below it is the title of the Game and then there is a loading bar.
2		Main Menu Page	On the display of this Menu page there are several buttons, namely: • Mute • Begin • Material • Instructions • Profile
3		Select Material Page	When the Materials button is clicked by the user, the system will display a summary of the available learning materials. Students can select the material as needed, and there is a Back button to access the main menu.

No	Picture	Page	Keterangan
4		Material page	The display that appears when pressing the instructions button contains instructions in this educational game, and there is also an explanation of the procedures for playing the game in it.
5		Profile Page	The display that appears when you press the profile button contains about the profile of the researcher.
6		Choose Gane	In the Select game view, there are 3 game options that contain games with predetermined material.
7		Game Display	The Game view contains games where the player matches and can move to the correct answer.

F. Development stage

At this stage, the researcher uses Construct 2 to develop learning media in the form of educational games based on the initial design. After the development is complete, the application is reviewed by the supervisor and validated by material and media experts to assess the authenticity, feasibility, and suitability of the media and sources used, as well as collect input from experts.



Picture II Tabel flowcart

G. Implementation stage

This stage is carried out after the learning media is declared feasible by material and media experts. The trial was focused on the end user, namely subject teachers and class X students, with the aim of evaluating the feasibility of the media through questionnaires and interviews. Data from teacher and student responses were then analyzed as the basis for product evaluation.

H. Evaluation stage

The evaluation aims to measure the effectiveness of game-based learning media developed with Construct 2 on students. If deficiencies are found, the researcher will revise and retest until the product is declared feasible and effective. The evaluation is based on the results of interviews, observations, and questionnaires to assess student and teacher responses as indicators of the success of the developed media.

I. Stages of data collection

Data collection techniques are used to support the development process, including observation to observe learning activities and the use of materials to find suitable teaching material solutions for students in grade X TKJ SMK Terpadu Al Anwar Durenan Trenggalek, interviews with teachers and students to analyze the development needs of software content and systems, as well as questionnaires used at the product testing stage in the form of validation questionnaires by experts and assessments by users for evaluate the feasibility of the media, with instruments in the form of questionnaires that designed to capture responses from media experts, subject matter experts, and students to the quality and feasibility of the developed product. The instrument contains a number of statements with a choice of answers based on the Likert scale, which has a scoring range from 1 to 5 [7]

$$P=\frac{F}{N}X100$$

Information:

P= Percentage

F= Total score

N = Maximum score

After obtaining the eligibility percentage data, the final stage is carried out by converting the percentage into a feasibility predicate for users and a validity level for media and material experts. This predicate reflects the quality of the product developed, based on the rating scale or criteria listed in the following table.

Table II Table Criterion Valid [8]

No	Value	Criterion
1.	81 – 100	Highly Valid
2.	60 – 80	Valid
3.	40 -60	Quite Valid
4.	20 – 40	Less Valid
5.	0 -20	Invalid

Table III Validity Criteria [9]

No	Presentase	Criterion
1.	81%-100%	Highly Worth It
2.	61%-80%	Proper
3.	41%-60%	Quite Decent
4.	21%-40%	Proper
5.	0%-20%	Highly Worth It

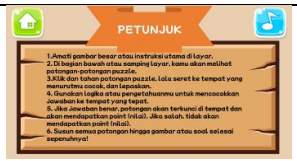
III. RESULTS AND ANALYSIS

The results of this study are in the form of an educational game based on Construct 2 to support the learning of Fundamentals of Computer Network and Telecommunication Engineering, with puzzle genres and materials that focus on K3LH and industrial work culture. The app is designed to run on a Windows-based computer or laptop, with a simple interface, intuitive navigation, and multimedia elements such as animations, sound effects, and drag and drop features. The procedures carried out are as follows.

A. Evaluasi sistem

This stage is the final stage in developing a media design, which is a system evaluation to ensure that the developed learning media is appropriate and meets quality standards. At this stage, the media is published and distributed to respondents in the form of desktop/Windows applications.

Table IV Table Education Game

Picture	Information
	On the loading page there is the logo of Universitas Bhinneka PGRI and the logo of SMK Al Anwar, then below it is the title of the game and then there is a loading bar.
	On this Menu page there are several buttons, namely: competence. • Material • Evaluation • Instructions • Profile
	When the Materials button is clicked by the user, the system will display a summary of the available learning materials. Students can select the material as needed, and there is a Back button to access the main menu.
	In the Select game view, there are 3 game options that contain games with predetermined material.
	The display that appears when pressing the instructions button contains instructions in this educational game, and there is also an explanation of the procedures for playing the game in it.
	The view that appears when you press the profile button contains about the profile of the researcher.
	The Game view contains games where the player matches and can move to the correct answer.

B. Testing

- **Media expert 1**

Table V Media expert 1

Score obtained	Maximum score
166	200
Percentage	74%
Criterion	Valid

$$\text{Achievement rate} = \frac{f}{n} X100$$

$$\text{Achievement rate} = \frac{166}{200} X100 = 83\%$$

The first media validation test conducted by the researcher obtained a score of 83%, which is included in the category of Valid Fat. This assessment was given by Mr. Fahrur Rozi, M.Kom, as the first media expert as well as a lecturer at Bhinneka University PGRI.

- **Media expert 2**

Table VI Media expert 2

Score obtained	Maximum score
149	200
Percentage	74,5%
Criterion	Valid

$$\text{Achievement rate} = \frac{f}{n} X100$$

$$\text{Achievement rate} = \frac{149}{200} X100 = 74{,}5\%$$

The first media validation test conducted by the researcher obtained a score of 74.5%, which is included in the Valid category. This assessment was given by Mr. Dr.H.Abdul Haris Indrakusuma, M.pd, as the second media expert as well as a lecturer at Bhinneka University PGRI.

- **Material Expert**

Table VII Material Expert

Score obtained	Maximum score
72	80
Percentage	90%
Criterion	Very valid

$$\text{Achievement rate} = \frac{f}{n} X100$$

$$\text{Achievement rate} = \frac{72}{80} X100 = 90\%$$

The first media validation test conducted by the researcher obtained a score of 83%, which is included in the Very Valid category. This assessment was given by Mr. Supriadi, S.pi, as a material expert as well as a teacher who teaches the Basic Basics of Network and Telecommunication Computer

Technology at the AL ANWAR Durenan Trenggalek Integrated Vocational School.

- **Product test results**

Table VIII Results of small group trials

Score obtained	Maximum score
322	400
Persentase	80,5%
Keriteria	Highly feasible

Achievement rate = $\frac{f}{n}X100$

Achievement rate = $\frac{322}{400}X100 = 80{,}5\%$

A small group trial involving 5 students yielded a percentage of 80.5%, which falls into the very feasible category.

Table IX Large Group Test Results

Score obtained	Maximum score
1001	1125
Percentage	88,97%
Criterion	Highly Worth It

Achievement rate = $\frac{f}{n}X100$

Achievement rate = $\frac{1001}{1125}X100 = 88{,}97\%$

A large group trial involving 25 students yielded a percentage of 88.97%, which falls into the very feasible category.

Table XI Table Tabulasi

NO	Aspects	Score	Maximum Score	Percentage	Information
1	Media Expert Test 1	166	200	83%	Highly Valid
3	Media Expert Test 2	149	200	74,5%,	Valid
4	Test Material Experts	72	80	90%	Highly Valid
5	Small Group Test	322	400	80,5%	Highly Worth It
6	Large Group Tests	1001	1125	88,97%	Highly Worth It
Average				83,39%	Highly Worth It

Based on these results, the development of the educational game using Construct 2 for the subject Basic Computer and Telecommunications Network Engineering for Grade X at SMK Terpadu Al Anwar Durenan Trenggalek is highly suitable for use in the learning process.

IV. CONCLUSION

This research aims to design and develop an educational game based on Construct 2 to support the learning of the Basics of Computer Network and Telecommunication Engineering subjects at the Al Anwar Durenan Trenggalek Integrated Vocational School. Development follows the ADDIE model which includes analysis, design, development, implementation, and evaluation. The final product is a desktop-based puzzle game containing K3LH material and industrial work culture, designed for Windows devices in accordance with the pesantren based school policy that restricts the use of mobile devices.

The validation results from media, materials and user test experts showed a high feasibility rate with a score of 83.39%, indicating that the game is technically and content feasible, as well as being able to increase student engagement and understanding through visual and contextual approaches. This medium is an effective solution for learning in environments with limited access to mobile technology.

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