



Using Multimedia Interactive Learning Informatics Materials in Junior High Schools on Increasing Students' Cognitive Abilities

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ABSTRAK

Proses pembelajaran informatika selama ini belum sepenuhnya efektif. Hal ini menyebabkan kemampuan dan hasil belajar siswa yang rendah. Tujuan penelitian ini yaitu untuk mengembangkan menghasilkan produk multimedia pembelajaran interaktif di SMP Terhadap Peningkatan Kemampuan Kognitif Siswa. Jenis penelitian ini yaitu penelitian pengembangan. Model yang digunakan untuk mengembangkan produk yaitu Alessi and Trollip yang terdiri dari: 1) perencanaan, 2) desain, dan 3) pengembangan. Pengujian produk terdiri atas uji alfa dan uji beta yang digunakan untuk mengetahui tingkat kelayakan produk dan uji efektivitas yang digunakan untuk mengetahui tingkat efektivitas produk pada capaian hasil belajar kognitif siswa. Uji alfa produk, uji beta produk dan uji efektivitas melibatkan 30 orang siswa. Untuk pengumpulan data menggunakan wawancara, observasi, angket dan tes. Data yang telah terkumpul selanjutnya di analisis dengan cara deskriptif kualitatif. Hasil penelitian yaitu hasil dari pengujian produk pada uji alfa menilai multimedia ini dalam kategori sangat layak dengan rerata skor 3,75 oleh ahli media, dan 3,50 oleh ahli materi. Hasil uji beta juga menilai multimedia ini dalam kategori sangat layak dengan rerata skor 3,68 dengan Gain score 0,725 yang termasuk pada kriteria Tinggi. Disimpulkan bahwa multimedia pembelajaran interaktif layak digunakan dalam pembelajaran. Disimpulkan penggunaan multimedia pembelajaran interaktif materi informatika secara signifikan dapat meningkatkan motivasi belajar dan capaian belajar kognitif siswa.

ABSTRACT

The informatics learning process so far has yet to be completely effective. causing students' abilities and learning outcomes to be low. This research aims to develop interactive learning multimedia products in junior high schools to improve students' cognitive abilities. This type of research is development research. The model used to create products is Alessi and Trollip, which consists of 1) planning, 2) design, and 3) development. Product testing consists of alpha and beta tests, used to determine the level of product feasibility, and effectiveness tests, used to determine the level of product effectiveness on students' cognitive learning outcomes. The product alpha test, product beta test and effectiveness test involved 30 students. To collect data using interviews, observations, questionnaires and tests. The data that has been collected is then analyzed using qualitative descriptive methods. The research results, namely the results of product testing in the alpha test, rated this multimedia in the very feasible category with an average score of 3.75 by media experts and 3.50 by material experts. The beta test results also placed this multimedia in the very doable category with an average score of 3.68 and a Gain score of 0.725, included in the High criteria. It was concluded that interactive learning multimedia is suitable for use in learning. The use of interactive multimedia learning information materials can significantly increase students' learning motivation and cognitive learning achievements.

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1. INTRODUCTION

The development and progress of information and communication technology have a very important role in all fields, one of which is the field of education. In line with technological developments, the quality of education must always be improved so that it is not far behind (Lahitani & Sulistyarningsih, 2020; Machmud et al., 2021). Indonesia is entering a new industrial era which is marked by the era of digitalization in various fields, especially in the field of education. This era is called the era of industrial revolution 4.0 experts. The automation of digitalization of technology in education has changed the curriculum and implementation of learning (Devi et al., 2020; Halili, 2019; Sadikin & Hakim, 2019; Sudana et al., 2019). In addition, the informatics-based curriculum is prepared taking into account the learning resources and learning media that are needed and already available so as to enable students to gain real, meaningful, broad, and in-depth learning experiences (Ardini et al., 2020; Khasanah et al., 2021; Sumarsono & Sianturi, 2019).

Information technology, such as using computers or gadgets that connect one to another, is expected to be able to become a new learning in utilizing technology anywhere and anytime (Istiningsih et al., 2020; Makarova & Makarova, 2018). The world of education in the digital era allows students to get knowledge and information quickly and easily. To meet this need, the use of interactive learning multimedia is a good alternative choice for memorable teaching and learning for students (Heo & Toomey, 2020; Kurniawan & Soenarto, 2022; Sagita et al., 2021). As we know, most teachers only use conventional teaching in class; using interactive learning media will certainly attract more students' attention to be more focused and increase interest in learning effectively in the teaching and learning process (Mantasiah et al., 2018; Yusri et al., 2018; Kartikasari, 2016). By utilizing technology, teachers can better face the challenges in the digital era. Therefore, the use of technology in teaching teachers is very important to improve the quality of education and student learning outcomes (Ayu et al., 2015; Darmawan et al., 2017; Putri & Rakhmawati, 2018).

The application of Informatics subjects can affect children's knowledge of technology which is continuously developing; in this case, of course, the application of Informatics subjects is important in the implementation of the current independent curriculum (Hikmah, 2019; Wibawa, 2017). It is very unusual if there is informatics learning without the availability of computers in schools. The independent learning curriculum should provide students with convenience in carrying out a more flexible learning process and is realized with case studies and projects to support students' understanding of informatics subjects which are used as compulsory junior high school subjects in the independent learning curriculum (Bunga et al., 2023; Gusrianto & Rahmi, 2022).

There are still many students who have never used a computer. Selection and supporting components such as learning resources and media used must be adapted to the characteristics of students and learning materials that make learning more effective, efficient, and on target. However, in reality, the informatics learning process has not been fully effective so far. Learning Multimedia is learning media that utilizes the help of computers or other electronic devices to present learning information in the format of text, sound, images, animation, video, and so on (Aruan et al., 2019; Sandang et al., 2022; Siregar & Kurniati, 2022). Learning media can make the learning process more effective and efficient and can overcome student boredom in the learning process using learning media to increase student active participation. Students who were previously passive because they did not understand the material presented can change to become active in the learning process (Lindasari et al., 2019; Saifudin et al., 2020; Wulandari et al., 2017). This material will teach students about computer systems which are parts of computer equipment that are interrelated and interact with each other to carry out a data processing process so that it can produce information that its users need.

Students learning interests influence the enthusiasm and activeness of students in the learning process. But the reality on the ground, students' interest in learning is still very low (Anggraeni et al., 2021; Rohaeti et al., 2019). One of the factors that support the learning process is the media. The function of interactive learning media is also adapted to the needs of students who are inseparable from technology. The use of technology is very influential in the learning process (Abdillah et al., 2021; Sahronih et al., 2020). Multimedia comprises digitally manipulated text, images, graphic art, animation, and video element (Heo & Toomey, 2020; Sagita et al., 2021). Multimedia is also an alternative to the various media used in learning and functions as a link in the delivery of material. While the supporting factors for achieving quality learning outcomes are that educators must manage the learning experiences of students and learning activities that are appropriate and interesting (Asmara et al., 2020).

Based on the considerations of the authors conducting research at Junior High School State 1 SMP Negeri 1 Patuk, Gunung Kidul. Interactive learning multimedia is made to assist students in learning computer system material so that later it will make it easier for students to improve the learning process based on empirical factual knowledge and the presence of practical skills in students. The results of this study were able to reduce obstacles in the implementation of practicum that occurred during the informatics learning process, both for teachers as educators and students as learners, who were truly able to improve students' cognitive learning outcomes. Cognitive learning outcomes are learning outcomes that combine mental training or brain activity related to memory, thinking skills, and argumentation. Changes in thinking and intelligence that help children remember, think creatively, and solve problems are known as cognitive learning outcomes (Mayub et al., 2020; Retnaningrum, 2016). Children's interests and motivation are vital for the success of the learning process. There is a positive correlation between children's achievement and their interest in and motivation to learn in their activities (Frahasini et al., 2018; Wardhani et al., 2020).

Apart from having strengths and weaknesses, online teaching and learning also have many negative and positive impacts on students. The positive impacts of online teaching and learning for students include students being able to add value to independence (Corry & Stella, 2018; Nugroho et al., 2021; Sari, 2020). Furthermore, the results of interviews conducted with the teacher explained that the characteristics of students in the border areas were very different from students in urban areas because students who lived in the borders tended to be passive. Therefore, awareness to focus on participating in KBM still needs to be improved. In addition, students tend to get bored easily and are not enthusiastic about participating in teaching and learning activities, and become unfocused when learning takes place. It was also explained that the use of interactive multimedia in the teaching

process for informatics subject matter would help students to be motivated and make it easier for students to understand the material compared to teaching and learning with conventional methods. From the results of small-scale user tests conducted consisting of 1 teacher and six students, from the seven respondents, the overall score was obtained with an average of 3.68. Thus multimedia can be used to test the effectiveness of students to assess students' cognitive learning outcomes both before and after using interactive learning multimedia.

Based on the problems, it is necessary to do multimedia learning using a learning model to motivate students and understand informatics lessons with more interactive learning. The author tries to find solutions in solving problems by using learning models that can encourage students to play an active role in the learning process so that they can test student learning outcomes. In line with that, other research explained in his research on the development of multimedia-based interactive learning media in informatics subjects where research on the development of interactive multimedia learning media facilitates learning and motivates students to engage more specifically with computer thinking material (Sah & Saprudin, 2023). In addition, the subject matter implemented in the media is relevant for use in informatics learning (Fathoni & Surjono, 2022; Lia et al., 2021; Wardhani et al., 2020). Based on the results of the research described above, research was carried out using a model Alessi & Trollip. This Informatics material is also relatively new, so there are still few who conduct this research; so there is an opportunity for researchers to conduct more in-depth research related to the effectiveness of using Informatics interactive learning multimedia on computer systems material to improve the cognitive abilities of class VII students of junior high school. The aim of this research is to develop interactive learning multimedia products.

2. METHOD

This research is a type of research and development developed using the Alessi & Trollip model (Alessi & Trollip, 2001). Development style Alessi & Trollip it consists of three stages, including the planning stage, the design stage, and the development stage (Alessi & Trollip, 2001). This study involved subjects, namely two instrument experts, two subject matter experts, two media experts, one teacher, and seven students for user trials on a small group scale and thirty students for pre-tests and post-tests. Furthermore, data collection in this study used a questionnaire (questionnaire) and test methods. The collection of questionnaires is used as data from the review of student needs analysis, media experts, material experts, user trials on a small scale, and pre-tests and post-tests. Furthermore, tests carried out objectively were carried out to collect data testing the effectiveness of student learning outcomes to get scores on learning outcomes in the pre-test and post-test activities. The lattice of the instruments in this study is presented in Table 1, Table 2, Tabel 3, and Table 4.

Table 1. Analysis of Student Needs

No.	Indicator	Question	Item Number	Total
1	Material	a) Opinions of students about the difficulties of learning informatics	1	3
		b) The most challenging material to understand	2	
		c) The reason why the material is difficult to understand	3	
2	Media Learning	a) How important is learning media in the learning process	4	5
		b) How often do students use learning media in class	5	
		c) Do students like the use of media in learning	6	
		d) Students' Perceptions of informatics learning media	7	
		e) Students' perceptions of ideal learning media for learning	8	
3	Learning Contextual	a) The need to link the material studied with everyday life situations	9	2
		b) If informatics lessons are associated with real life, it can motivate learning	10	
Total				10

Table 2. Media Expert Rating

No.	Aspect	Indicator	Item Number
1	Appearance	Home screen	1
		Text Selection	2,3
		Menu Display	4
		Multimedia Elements Layout	5,6,7
		Clarity of Multimedia Elements	8,9,10

No.	Aspect	Indicator	Item Number
		Integration of Multimedia Elements	11, 12
		Color Selection	13,14
2	Navigation	Navigation Button	15,16,17,18
3	Programmign	Performance Program	19
		Accessibility	20,21,22
Total			22

Table 3. Material Expert Assessment

No.	Aspect	Indicator	Item Number
1	Material	Content Material	1,2,3,4
		Material Accuracy with learning objectives	5
		Language	6,7
		Summary	8
		Evaluation	9,10,11
2	Motivation	Motivation to learn	12
3	Learning	Coherence of presentation of the material	13,14,15
		Duration	16
Total			16

Table 4. User Response

No.	Aspect	Indicator	Item Number
1	Media	Text readability	1
		Image clarity and animation	2
		video clarity	3
		Music/sound clarity	4
		Color match	5
		View attractiveness	6
		Ease of understanding menus in the program	7
		Ease of selecting menus in the program	8
		Ease of choosing material in the program	9
2	Material	Interesting material in motivating learning	10
		Clarity of language used	11
Total			11

Data collection technique for testing the feasibility of the product at the alpha test and beta test stages of learning multimedia products developed is to use quantitative data obtained from questionnaires converted into a Likert scale. In this case, the Linkert scale can be used to see and know the attitudes and opinions of media experts, material experts, and users regarding the product being developed. To calculate the score of the resulting multimedia product criteria can be determined through interval distances using the highest (ideal) and lowest (ideal) basis, along with the number of classes. With the following details, the highest score (ideal) is 4 (very feasible), the lowest score (ideal) = 1 (not feasible), the number of classes = 4 (very feasible-not feasible) with the highest score interval of 4 minus the lowest score of 1 divided by the total class 4 with the acquisition of 0.75. From the results of the interval distance above, a classification table can be made for the average score or multimedia product value x_i = average score for each item.

Table 5. Classification of Average Scores

Average Score	Classification
$3,25 \leq x_i \leq 4,00$	Very Worth it
$2,50 \leq x_i \leq 3,24$	Worthy
$1,75 \leq x_i \leq 2,49$	Less Eligible
$1 \leq x_i \leq 1,74$	Not feasible

3. RESULT AND DISCUSSION

Result

The research and development results are in the form of products and the validity of the results of interactive learning multimedia. In the process of developing this interactive learning multimedia using the development model procedure which consists of three stages, namely planning, design, and development (Alessi & Trollip, 2001). The first stage is planning, which consists of determining the study's scope, identifying the learner's characteristics, determining and gathering resources, and gathering initial opinions. In this early stage, based on the results of interviews, analysis of student needs in the form of questionnaires and observations. Based on the data collected in the planning stage, information was obtained regarding students' needs in the form of interactive learning multimedia and the results of students' lack of interest and lack of focus in informatics lessons, especially among class VII students of Junior High School State 1 Patuk, Gunung Kidul.

The second stage is design. In this second stage, production begins in the form of initial content development, flowchart designs, and multimedia storyboards for interactive learning in informatics learning, as presented in Figure 1.

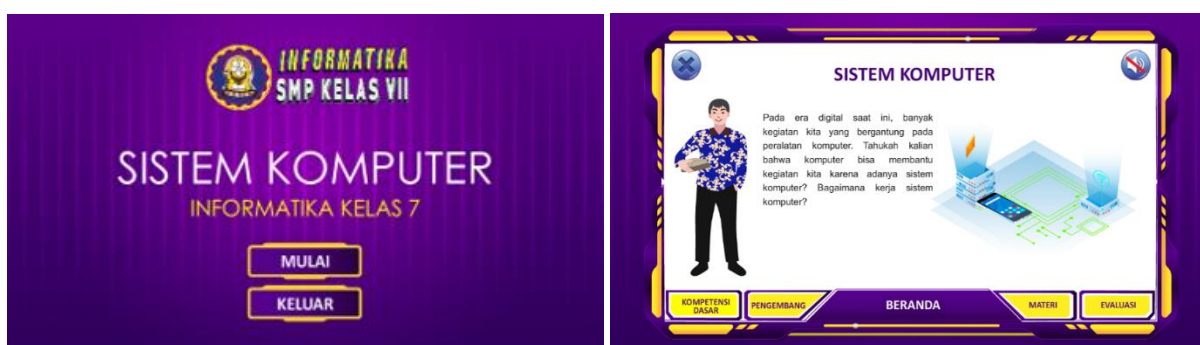


Figure 1. Interactive Multimedia Development Design Process

The third stage is development; in the development stage, prepare text, create graphics, produce audio, integrate program components, prepare additional material, conduct alpha tests, revise, conduct beta tests, final revision, and validate the program. Conducting validity tests is measured by product trials in the form of material expert tests, learning media experts, user trials on a small scale, and finally, trials in the form of initial tests and post-tests.

The results of the validity of developing interactive learning multimedia were determined based on reviews from material experts, learning media experts, and product trials on a small scale. Based on the results of the product validity test conducted by the first media expert, a percentage of 3.64% was obtained, and the second media expert obtained a percentage of 3.73% with an overall average score of 3.75% with the qualification "Very Eligible." Based on the results of the material validity test conducted by the first material expert, a percentage of 3.06% was obtained, and the second material expert obtained a percentage of 3.75% with an overall average score of 3.50% with the qualification "Very Eligible." User trials on a small scale of one teacher and six students obtained an overall average score of 3.68 with the qualification "Very Eligible." Furthermore, for the initial test with an average qualifying score of 48.22 and the final test with an average qualification of 85.78. The results of the pre-test and post-test calculations in the Table 6.

Table 6. Calculation of the Effectiveness Test with the N-Gain Formula

No.	Variable	Score	
		Pre Test	Post Test
1	Lowest Value	33.00	73.00
2	The highest score	73.00	100.00
3	Average	48.22	85.78
Score Gain		0.275	
Criteria Gain		High	

Discussion

First, the results of this study regarding the effectiveness of interactive multimedia in informatics lessons in improving students' cognitive abilities contribute to students' learning motivation in learning. Previous research findings also state that interactive multimedia can improve student learning outcomes (Amirudin & Setuju, 2018; Leszczyński et al., 2018; Sandang et al., 2022). Second, the development of interactive learning multimedia is feasible to be applied in the learning process because students can easily understand informatics learning material, both from the content of the relevant material and the presentation of language that has been adjusted to the characteristics of students' relevance, correctness of the material, and choice of language in overall delivery. The relevance of the material presented in multimedia makes it easier for students to learn (Illahi et al., 2018; Lindasari et al., 2019; Saifudin et al., 2020). The advantage of this interactive multimedia from the material aspect lies in the suitability of the content and the way the teaching materials are presented according to the characteristics of the students. Adjustment of interactive learning multimedia that is developed according to student characteristics that effectively increase knowledge in learning outcomes for the information obtained (Amirudin & Setuju, 2018; Sandang et al., 2022; Siamy et al., 2018).

Third, the role of multimedia in learning presents the cognitive theory of multimedia learning and summarizes research programs that have produced seven principles of using multimedia learning, namely the principle of multimedia (students can learn better than just words), the principle of spatial proximity (students can learn more both related to being displayed on the page or layer), the principle of time proximity (students can learn better simultaneously than alternately), the principle of coherence (students can learn better if extra material is set aside rather than included), modality principle (students can learn better when words are in multimedia messages than print), the principle of redundancy (students can learn better from animation), the principle of individual differences (The effect of the design is stronger for students with low knowledge than for students with high knowledge and students with high spatial ability than low spatial) (Amirudin & Setuju, 2018; Diyana et al., 2020; Sandang et al., 2022; Siamy et al., 2018).

Based on the results of this study, it is essential to motivate and stimulate students' enthusiasm for learning. In addition, by involving students in the learning process, students can be expected to quickly find, understand and analyze what they have learned. The results of testing the effectiveness of this multimedia product are only tested based on the motivation of learning outcomes that affect cognitive outcomes only. While the testing of the level of effectiveness based on affective and psychomotor aspects was not carried out due to the limited time the researcher had. Thus, suggestions for further product development are carried out at the testing stage of the effectiveness of learning outcomes for both effectively and psychomotor students. Teachers can use the developed multimedia to enhance a pleasant learning atmosphere.

4. CONCLUSION

The conclusion from the results of the data analysis obtained that interactive learning multimedia is at a "High" and "Very Eligible" qualification value based on the results of the validity test of the experts. The use of interactive learning multimedia can be feasible for use in the learning process. Learning will also be maximized to improve learning outcomes that are more effective and interesting in the learning process. This interactive learning multimedia also has a "high" level of effectiveness which is assessed based on students' cognitive learning outcomes in Informatics learning in Computer Systems material for class VII students of Junior High School State 1 Patuk, Gunung Kidul.

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