

Development of Science Learning Media Using Supcath Educational Games to Improve Student Learning Outcomes

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Abstract: Technological developments have a rapid influence on the world of education so there is a need for innovation. The student's ability to solve problems is still relatively low, especially in solid pressure material. This study aims to produce educational game-based learning media that is valid, effective, and able to improve student learning outcomes. The instructional media developed by this researcher specifically focus on material related to pressure for grade 8. This research is a Research and Development study with the ADDIE research design (Analysis, Design, Development, Implementation, and Evaluation). Data was collected using expert validation sheets, student test sheets, and student response sheets. The results showed that learning media was valid and effective with an average percentage of validator ratings of 92.6% and an average N-gain value of 0.6. Referring to the results of the analysis that has been carried out, this learning media can be concluded as the learning media that are valid, effective, and able to improve student learning outcomes.

Keywords: Educational games; Learning outcomes; Supcath

Introduction

Technological developments make children play games increasingly prevalent. When children play online games, they often spend a long time so children's learning time becomes disrupted (Masya et al., 2016). Kusoy et al. (2021) state that online games make students undisciplined. Online games also make teenagers become aggressive and have trash-talking behavior (Putri et al., 2020). Based on a literature review of 61 journals conducted (Habibi, 2022), 33.3% of them discussed the negative impact of playing games on student psychology. Games have a negative impact on students' physics and psyche which in the end will be difficult to change so all parties need to cooperate to intervene and prevent them (Feng, 2022). The negative impact of playing games is that children become addicted, and the positive impact is that children will practice solving problems in games to win games (Elinda, 2019). The development of information technology has an unavoidable influence on the world of education so changes are needed, especially in the

learning process at school (Budiman, 2017). Based on some of the opinions above, it can be understood that games have a negative impact in the form of addiction but positively can train children to solve problems in games.

While students' problem-solving skills at school are still not optimal. This is supported by Saudah (2017) who said that students' problem-solving skills in solid pressure material are still not optimal and need to be improved. The students' abilities to solve problems have a positive effect on students' concept mastery (Akuba et al., 2020). Students' concept mastery related to the liquid material is still not optimal, especially the material on hydrolysis pressure and Archimedes' law. The results of Jayantini et al. (2020) regarding students' mastery of concepts in solid pressure material, 28.20% of students did not understand the concept and 3.90% of students had misconceptions and the rest understood the concept.

One of the factors that influence students' misconceptions about pressure material is learning resources that are not appropriate (Nisa et al., 2022). In

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physics learning at junior high school, 28 students or 60.75% said that the media used at school was still not helping students in understanding the material so it made students have difficulty learning (Lintang & Mayasari, 2018). Oktavia et al. (2015) argued students' problems in learning physics could be overcome by modifying the learning media used so that learning becomes more enjoyable and student learning outcomes increase. Hamid et al. (2020) Learning media provides new experiences for students and is able to train teacher creativity in designing learning.

Learning media that are suitable to be developed for junior high school students are printed modules, learning videos, educational games, pocketbooks, and e-modules that can be opened on laptops or school personal computers (PCs), due to the limited use of existing gadgets in junior high school (Ichsana et al., 2018). Khanmurzina et al. (2020) computer games have a positive impact on players. Educational games are a type of unique and interesting media that can be used in the learning process (Sa'ad, 2020). Educational games are very possible to use in learning considering that technology has penetrated various regions (Pratama et al., 2019). According to Udeozor et al. (2023) digital games can be used in education because there are hedonic motivational factors from students that encourage them to use games, where students will feel happy when using games. To increase efficiency in implementing educational games in education, games must be appropriate to the level of student motivation (Reyssier et al., 2020).

Educational games have the advantage of being able to visualize real-life problems (Ridoi, 2018). 3D animation is able to produce a real form even though it is not real (Mariana, 2017). One modification of learning media that can increase student mobility is media that present text, images, video, audio, and animation (Barokah et al., 2019). Based on the research results of Jamalludin et al. (2021) said that 3D animation learning media from the traditional "patil lele" game can be used in learning. Referring to some of the facts and needs above, a study was conducted entitled "development of science learning media based on the Supcath educational games to improve student learning outcomes".

Method

This research uses Research and Development with the ADDIE research design (Saputro, 2017). The ADDIE development model is divided into several stages, namely needs analysis (analyzing gaps, identifying students, identifying resources, and formulating goals), design (identifying tasks, and developing test strategies), development (making media and limited trials so that the media is ready for field trials),

implementation and evaluation (conducting field trials and conducting evaluations). The flow of this research can be seen in Figure 1.

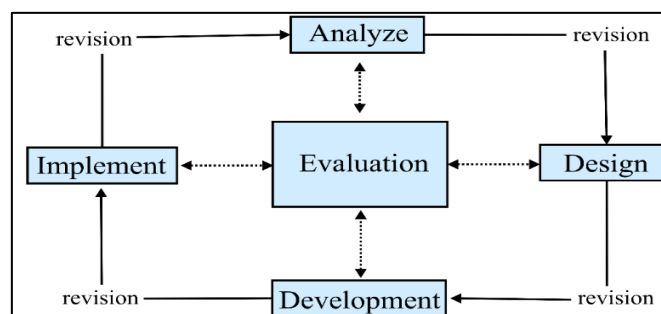


Figure 1. ADDIE development model flow (Drljača et al., 2017)

The stages of needs analysis, designing products, and making products are carried out in the Jember University FKIP laboratory, in the development stage testing is carried out by experts and practitioners, and limited trials were carried out in grade 8 of SMP Bustanul Makmur. After the media was validated and found to be practical, the next stage was field trials in three schools, namely grade 8 SMPN 3 Jember, SMPN 1 Kalibaru Banyuwangi, and MTSN 11 Banyuwangi. The method used to collect data were questionnaires, direct observation, and tests. To find out the effectiveness of the resulting product, a study was carried out using the one-group pretest-posttest design (Sugiyono, 2015).

Result and Discussion

Product Display

In this study, the researchers created an application that can be run on a computer. The animation in this educational game was made using Blender 3D software, while the researchers used Adobe Animate software to make computer applications. The resulting product display is as follows:

Instructions for Using the Game

At the start of entering the game, the user will be directed to follow a guide in the form of a hand pointing at a certain button accompanied by a description and this applies to all menus so that the user understands all the features in the game. The instructions are displayed as shown in Figure 2.

The developer profile is displayed on the developed media product to find out the biodata of the game maker. The basic competency menu is also presented so that users can find out which material is the focus of the developed product. This game is also equipped with material and practice questions to increase student literacy in accordance with the basic competencies previously described. The practice questions are made

like interactive quizzes where if the answer is wrong or right, the game will provide a unique response so that students become interested in continuing to work on the questions provided. Profile display, kd, material, and practice questions are presented in Figure 3.



Figure 2. Instructions for using the game



Figure 3. Profile menu display, KD, material, and practice questions

Game Menus

This game trains students to solve complex problems given in the game, where the characters in the game are asked to complete an obstacle through several fields to cross the island. At each level, a small window will appear before the students choose a solution from the existing problem, this is useful for knowing the predictions that students have written.

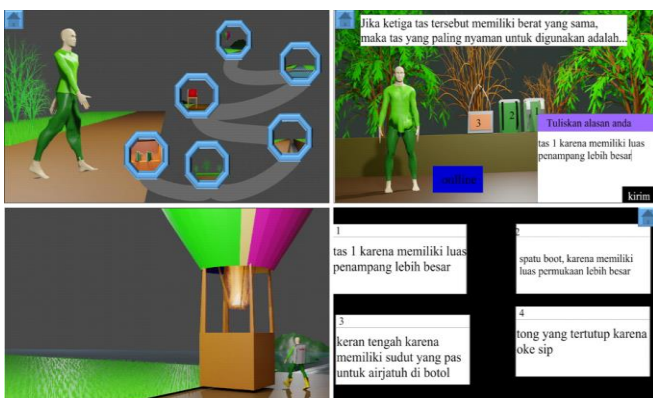


Figure 4. Game menu

Validation Results

To determine the validity of the media developed, the researcher validates the results to expert validators and users (Ummah, 2021). In this study, the results of learning media product were validated by two lecturers and one user teacher. Each validator validated the results by using a score 1-4 questionnaire. The components of content, language, presentation, and graphics were the components that were assessed in the ongoing validation process. The results of validation by experts and users were presented in table 1.

Table 1. Expert and User Validation Results

Component	Percentage (%)
Content	90.3
Language	94.4
Presentation	95.8
Graphics	90

Referring to the National Education Standards (NES), learning media are included in educational facilities which must meet the appropriate standards for content, presentation, language, and graphics. The aspects assessed from the content component were the suitability of the media with basic competencies, the suitability of the media with the students, the suitability of the media with the learning objectives, the material described being in accordance with science, and the material in contextual media. The average score for these components was 90.3%. For the language component, there were three aspects assessed, namely the suitability of the language with the rules of natural science, and the language used in communicative and informative media. For the language component, the average score obtained from expert and user validators was 94.4%.

The next component was the presentation of aspects) which were assessed on this component, namely the presentation of material written coherently, the media which triggers students' curiosity, and the developed learning media which can attract students' attention, and create a pleasant atmosphere. The average score for this component was 95.8%. The last component was the graphics where the aspects assessed namely the media is easy to install on the computer, the menu in the game is not confusing, the composition of the educational game is proportional, the memory used to run the game is small and it doesn't lag when the game is run. The average score of the three validators for this component was 90%. Overall, the average value given by the validator was 92.6% so this product is very feasible to use. This is in line with Susilana and Riyana, (2009) who say that learning media that have been asked are valid by the validator, so the media product is declared feasible to use.

Student Test Results

After the learning media product had been validated, a limited trial was then carried out. This trial was conducted on 35 grade 8 students of SMP Bustanul Makmur. Student scores before using instructional media had an average of 21 and after using instructional media became 80.3. Therefore, based on this limited trial, the media was declared effective for use. Next, after the media was declared effective, field trials were carried out in three schools, namely SMPN 1 Kalibaru Banyuwangi, MTSN 11 Banyuwangi, and SMPN 3 Jember. Brief results of this media trial were written in Figure 5.

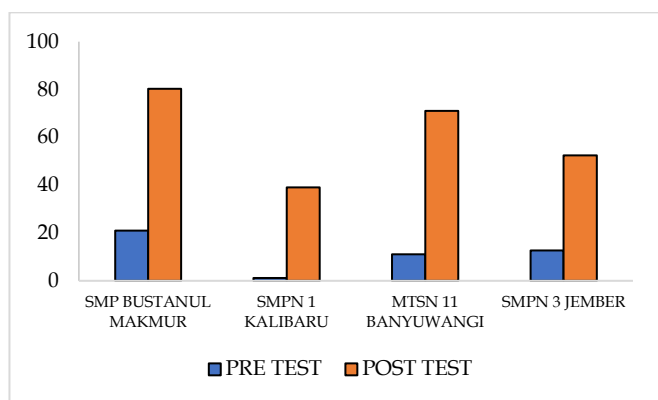


Figure 5. Students' pre-test and post-test scores

The first field trial was conducted at SMPN 1 Kalibaru. The result was that before using learning media the average student test score was 1.2 and after using learning media, the average test score was 41 so the N-gain value in this field trial was 0.4 and classified as moderate. Next, the second trial was conducted at MTSN 11 Banyuwangi. The student test score before using learning media was 11.04 and after using learning media, the student test score was 73.1 so the N-gain value obtained was 0.7 so it was classified as high. The next trial was carried out at SMPN 3 Jember. Before using the media, the average student test score was 12.7 and after using learning media earning media, the student test score was 60.5 so the N-gain value obtained was 0.55 and classified as moderate. Overall the N-gain value obtained was 0.6 so this game product has a moderate effect on improving student learning outcomes. Based on limited trials and field trials it can be concluded that the learning media developed are effective for use in school learning.

Student Response

Student response data is needed to determine the practicality of the learning media used. Student responses were given after students use the SUPCATH educational game product. Student response data was taken from a student response questionnaire consisting

of 10 statements. Brief student response data is presented in Figure 6.

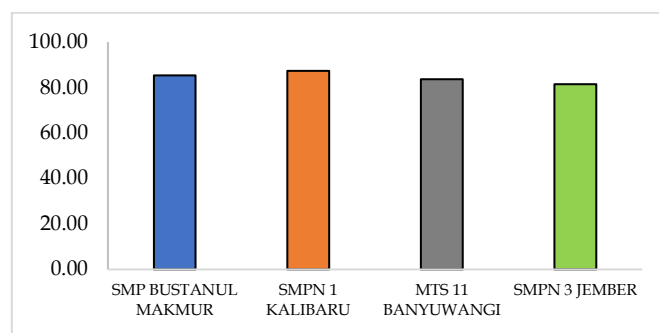


Figure 6. Student response score to the Supcath educational game

A limited trial was conducted at Bustanul Makmur Middle School and received a response of 85.36% and was classified as a very good response. Field trials and area distribution were carried out in three other schools in Figure 6 where the student response at SMPN 1 Kalibaru was 87.33%, the student response at MTSN 11 Banyuwangi was 83.65%, and the student response at SMPN 3 Jember was 81.47%. The statement that had the lowest response of 80% was a statement related to interest in the animations presented in the game, and the highest response was 90% for the statement related to how easily students could use the game product. Based on the percentages obtained in each school, the average score given by the four trial schools was 84.45%, where this statement was included in the very good response category. Therefore it can be understood that the learning media product is very practical to use in learning.

Conclusion

The results of the needs analysis carried out at the beginning related to the literature review and field observers showed that students' problem-solving skills were still not good and there were also misconceptions about natural science material, especially related substance pressure. Some researchers write that students' misconceptions can be overcome by providing fun learning media, namely educational games, while problem-solving skills can be overcome by increasing students' computational thinking skills. Based on the results of this study, it can be concluded that educational game learning media to improve students' computational thinking was successfully created with several features in it. Referring to the percentage of evaluation obtained which was 92.6%, this media is declared feasible for use, and based on the results of field trials, this learning media is effective for use in learning and can improve student learning outcomes.

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Author Contributions

This Supcath educational game product was made using blender-3d, format-factory and adobe animate software. The product is declared valid and suitable for use after being assessed by expert validators and users. After the pre-test and post-test, students who use educational games get significantly increased results.

Conflicts of Interest

The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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