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Research Artikel

THE DEVELOPMENT OF CROSSWORD GAME MEDIA ON VIRUS MATERIAL

PENGEMBANGAN MEDIA GAME CROSSWORD PADA VIRUS MATERIAL

Mardiana Nata Ruron, Risya Pramana Situmorang*, Susanti Pudji Hastuti
Fakultas Biologi, Universitas Kristen Satya Wacana, Indonesia
*risya.situmorang@uksw.edu

Abstract

Crossword game media was a learning tool that serves features to understand the concept and solve a problem. The media provides many features that facilitate students to learn enjoyably. This study aims to develop a viable and effective product to improve students' problem-solving skills and conceptual understanding. The ADDIE model is used as a type of research and development. The subjects were students of X-grade senior high school in Salatiga. Data collection was carried out through observation, questionnaires, and tests. Media experts and material experts carried out the validation of products. Teachers were involved in giving feedback about the practicality of the media. The validation concluded that the product was feasibly based on the media aspect= 85,5% (feasible) and the material aspect = 81,25% (feasible). The product's development has improved problem-solving skills and conceptual understanding effectively that the t-test showed a significant value with acquisition sig. 2 tailed < 0,05. The results indicate that the crossword game was feasible and effective in improving problem-solving skills and conceptual understanding.

Keywords: crossword game; problem-solving; conceptual understanding

Abstrak

Media crossword game merupakan salah satu media belajar siswa, menyediakan fitur untuk menjadikan siswa dapat memahami konsep dan memecahkan masalah. Crossword game menyediakan banyak fitur yang memudahkan siswa untuk belajar dengan menyenangkan. Penelitian ini bertujuan untuk mengembangkan produk yang layak dan efektif untuk meningkatkan keterampilan pemecahan masalah dan pemahaman konseptual siswa. Model ADDIE digunakan sebagai penelitian dan pengembangan. Subjek penelitian adalah siswa SMA kelas X di Salatiga. Pengumpulan data dilakukan melalui observasi, kuesioner, dan tes. Validasi produk melibatkan ahli media dan materi. Guru dilibatkan untuk memberikan umpan balik tentang kepraktisan media. Berdasarkan validasi, disimpulkan bahwa produk layak berdasarkan aspek media = 85,5% (layak) dan aspek material = 81,25% (layak). Pengembangan dari produk telah meningkatkan keterampilan pemecahan masalah dan pemahaman konseptual secara efektif sehingga berdasarkan uji-t menunjukkan nilai yang signifikan dengan perolehan sig. 2 tailed <0,05. Hasil menunjukkan bahwa media crossword game layak dan efektif dalam meningkatkan keterampilan pemecahan masalah dan pemahaman konseptual.

***Kata Kunci**: crossword game; pemecahan masalah; pemahaman konsep*

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*Corresponding author

INTRODUCTION

Students often perceive biology as more oriented to memorization so that biology is only understood as a knowledge that focuses on theory. Meanwhile, modern learning patterns currently require student learning activities carried out through exciting and fun learning to use their knowledge through observation and analysis of natural phenomena based on biological concepts (Amalina et al., 2018).

Biology can be used as a place to prepare students' futures to have creativity, compete, and solve problems. Competition in the 21st century demands a different perspective through intellectual abilities, attitudes, and skills. Therefore a complete understanding is needed so that students gain knowledge comprehensively (Sulistiono, 2014).

Recognition of natural phenomena and the interaction of living things with their environment is one way to study biology. This condition could be used to stimulate students to be curious about natural phenomena, starting from simple cases. Natural phenomena can be started from problems and involve students' analytical skills in solving these problems. The correlation with the learning challenges of the 21st century shows that students are required not only to complete the concepts but also able to develop their skills, especially problem-solving skills (Bahri dkk., 2018).

Problem-solving skills become a basic need in learning science at schools. This is inseparable from the correlation between biology concepts and applications in daily life (Sulistiono, 2014). Learning activities that guide students to the problem-solving process allow students to think first and then try to solve problems based on relevant theories, laws, and propositions. Problem-solving skills consist of several interrelated skills: reasoning, ability to plan, and decisions (Ulya, 2016). In line with that, students who have problem-solving skills can make the right decisions carefully, logically, and systematically and consider various points of view (Bahri et al., 2018).

Problem-solving skills become a way to practice students in connecting their knowledge to solve problems and find specific solutions. Although it needs comprehensive knowledge through a structured understanding of problem-solving, through this process, students will get an understanding. Their ability to construct knowledge can make the right decisions. The successful way of finding solutions came from an understanding of the problem. Furthermore, students' efforts to interpret problems into simple concepts become one of the strategies that can be used to describe the problem.

Linking concepts about scientific phenomena are very important to provide a holistic understanding (Priyambodo & Situmorang, 2017). It can show the level of ability and provide an interpretation of information without changing the meaning. Gaining conceptual understanding can be done by combining prior knowledge with students' experiences because collaboration between prior knowledge is an attempt to develop the concept. In the learning process, mastery of the concepts provides a significant role because students can solve their intellectual abilities problems. Even, they can find meaningful learning that is useful for their lives. Therefore, biology learning as a science should be to drill students' knowledge and skills based on daily life problems (Purwati et al., 2015).

One of the subjects of biology that can practice problem-solving skills is a virus topic. The virus is very close to human life; for example, students who have ever experienced influenza and chickenpox, when asked to explain the disease's main problem, felt it challenging to explain the phenomenon scientifically. The virus is impressed abstract because it can be felt but hard to seen. The small size of the virus is a challenge for teachers in explaining the virus's structure and life cycle because students' understanding of the virus is very needed today.

The strategy in mastering concepts talks about students can answer correctly and systematically and emphasizes understanding of the problem. The fact shows that learning is still focused on normative things about the topic of the virus, for example, the presentation of the virus' structure and the life cycle of the virus. This condition causes students who fall into poor understanding to solve problems (Hasibuan &

Djulia, 2017). Therefore, it is essential to conduct a study to improve students' problem-solving skills and concepts understanding through interactive animation media development.

Conceptual understanding will be difficult to achieve if only relying on traditional methods (Roesler, 2016) because media is needed to drill understanding and problem-solving skills. Through this study, the proposed solution is the development of an interactive crossword game. Animation can be enriched by the crossword games that are expected to improve conceptual understanding. In the end, students are provided with instructions through the game challenge so students can also interact with peers.

Students need to be accustomed to understanding and problem-solving skills to improve conceptual understanding (Andresen, 2015). Through this study, the proposed solution is "the development of crossword game media to improve conceptual understanding and problem-solving skills. Crossword games were expected to improve conceptual understanding and problem-solving skills by enriched with animation. The proposed solution is "the development of crossword game media by enriched with animation" through this study. This strategy aims to give interesting references to students to do activities through pictures, animation, and the game. The interactive media can be accommodated by using Android smartphones to use them independently, not only in the classroom but also outside (Sezer & Sezer, 2019). Therefore, it is essential to conduct research entitled "Development of Crossword Game Interactive Animation Media on Virus Material".

This study aims to develop a crossword game interactive animation media, test the effectiveness, and test an interactive crossword game's feasibility to improve students' conceptual understanding and problem-solving skills.

METHODS

The research method used was Research and Development by using the ADDIE model. ADDIE model has had an acronym that consist of 5 phase: (1) Analyze, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation (Branch, 2009). At this stage, the researchers focused on the analysis phase of product design, development, and media effect. The ADDIE is implemented here to construct media-based learning as a Crossword game to develop a student-centered method so the student can be more innovative and skillful.

This research was conducted at a Private Senior High School in Salatiga, with the subjects of the research was the 10th-grade students of Natural Sciences, first semester 2019/2020. Data collection techniques in this research used interviews, tests, direct observation, and questionnaires.

The test instrument was arranged based on the indicators available in standard basic competence in materials. Problem-solving indicators included: (1) carry out the identification process; (2) formulating problem; (3) find alternative solutions; (4) choosing the best solution; (5) fluency in solving the problem; and (6) grade of the problem-solving result (Xu et al., 2013). For problem-solving skills, each aspect was converted into a scale of 4 categories and counted its N-gain score.

The observation sheet was used as supporting the data of students' problem-solving skills. The observation sheets using a Likert scale 1 to 4 score, and the resulting was counted with its average in each aspect, and then the scale converted into four categories (Sugiyono, 2010). Questionnaire of media validation used to get data about product reviews from content experts, media experts, and biology teachers related to the developed learning material. This questionnaire for each respondent included: material (The suitability of the material with the specified competencies, the accuracy, and Learning support material) and media (feasibility of presentment, technic of presentment, the feasibility of graphic.

The normality and homogeneity test should be accepted, so it's used as data analysis to obtain a difference in value. The differences in value test between the control and experimental classes were decisions based on parametric statistical tests. The data analysis technique used the SPSS software version 16 based on the value difference test

analyzed by the one-sample t-test from the experimental class (treatment class). On this stage, an independent sample t-test would be tested using the hypothesis Ho and Ha, whether Ho was accepted or Ha was rejected.

RESULTS AND DISCUSSION

Based on an analysis of the needs assessment of interactive media implemented in one of the Private High Schools in Salatiga, teachers rarely use interactive media to teach biology subjects in the classroom. The conventional teaching model here is that biology teachers only use one media as a learning tool, such as PowerPoint or whiteboard. The other problem is, teachers are not too literate about how to create or develop media-based digital because of digital technology understanding. Moreover, the teacher considered these conditions complicated to learn from basic because it needs more time to follow step by step. Generally, students need different media to support their problem-solving (Ilhan & Adnan, 2013; Jain Neera et al., 2018; Van Niekerk & Mentz, 2015). This crossword games media be something interesting for students as a supporting tool in learning.

Table 1. Need assessment about learning tools needed and available tools/devices

Learning Tools Needed	Available tools/ devices
Software	Adobe flash
Hardware	Smartphone, LCD Projector, Computer
Media for learning	Lesson plan,

Based on table 1, it can be seen that some indicators must exist before applying a crossword game in the class. So, the process of develop and implement the crossword game can be supported by the schools. So, the existence of learning tools neeeded can assist the process of applying crossword media. Based on this condition, the researchers took the initiative to develop crossword media which are expected to be able to improve the delivery process of biology material effectively.

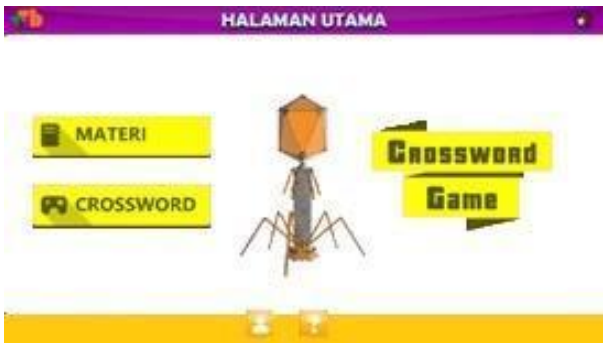

Figure 1. Initial Design of Crossword Game

The media needs an analysis phase used as a basic implementation to make a prototype of media. The next stage is to develop crossword game media and assess the media through the validation of media and material experts. The results of validation calculate and interpret based on a formula.

Table 2. Summary of Edugame Media Validation by Media Experts

Validated aspects	Percentage (%)	Criteria
The suitability of the material with the specified competencies	81,25%	Feasible
The accuracy and correctness of the material	87,5%	Feasible
Learning support material	83,3%	Feasible
Average	85,5%	Feasible with a little bit revision

Table 3. Summary of Edugame Media Validation by Media Experts

Validated aspects	Percentage (%)	Criteria
Presentation technique	81,25%	Feasible
Feasibility of presentation	83,33%	Feasible
Feasibility of media graphics	79,16%	Feasible
Average	81,25%	Feasible with slight revisions

From the media validation stage, there were some suggestions from two experts, and it was necessary to revise the media and material. This is important to be followed up because media experts suggest that media needs to be improved in terms of feature and by giving sound. Furthermore, based on a note from a material expert, crossword game media need to be revised, especially media

graphics' feasibility. We have to rearrange the display of media to be neatly arranged so readers can understand easily.

Table 4. Comments and suggestions from the teacher

Aspect	Suggestions
Material	1) the questions in the evaluation slide need delivering with specific so students will understand easily 2) it's necessary to relate about problems in life and alternative solutions that can be provided through concept analysis.
Media	1) The sound of video in the cycle of viral reproduction was heard double so that the explanation of the material becomes less clear.

The teacher also comments on the media about evaluation forms and needs to relate material about problems' life and useful features in the video. Adjusting the topic to life's problems is seen as essential to be included because it facilitates students to have a deepening of the material, at the same time, to practice problem-solving skills.

Figure 2. Design Revision and Final Results of Crossword game

The crossword game product that has been validated by a content expert, media expert, and senior high school teacher was revised according to suggestions. Then the media tested in the field to determine the product's effectiveness to increase students' problem-solving.

The difference in the improvement of problem-solving in the two classes was using the independent samples t-test. Independent samples t-test can be used depending on the normality and homogeneity test results as prerequisite tests. In the following table 3 were shown the normality test and homogeneity test results:

Table 4. Resume of Normality and Homogeneity data

Normality	**Kolmogorov-Smirnov**			**α**	**Decision**
	Variable	df	Sig.		
	Conceptual understanding	42	0,200	0,05	Normally distributed
	Problem solving	42	0,061		
Homogeneity	**One way Anova**			α	**Decision**
	Variable	df	Sig.		
	Conceptual understanding+ Problem solving	43	0,640 (Asymp. Sig (2-tailed)	0,05	Homogeneous data

Analysis of normality and homogeneity test was assisted by SPSS 16.0 and using α= 0,05. Criteria of normality: if significant value > 0.05, Ho is accepted and it showed the data normally distributed. Based on the table, the treatment and control class showed a significant value where 0,200>0,05 (conceptual understanding) and 0,06>0,05 (problem-solving). Because Ho was accepted, so the decision was normally distributed. The hypothesis formulation in the homogeneity test is Ho = data from homogeneous population Ha = data from an inhomogeneous population. A homogeneity test was conducted with a significant level of 0,05 which is 0,640 > 0,05. This matter means that the data is homogeneous.

Table 5. One Sample t-test

	One Sampel t-test			**α**	**Desicion**
	Variabel	df	Sig.		
t test	Conceptual understanding+Problem solving	42	0,000 Sig. (2-tailed)	0,000	Ha accepted

The results of the one samples t-test showed that there was a significant value with acquisition Sig. 2 tailed < 0,05. Based on this result, Ha was accepted, but Ho was rejected. It can be interpreted that there was a significant effect on improving problem-solving skills and conceptual understanding of the X-grade class in senior high school.

Table 6. Resume of problem solving skill

Indicator	Average	Category
carry out the identification process	3,14	Good
formulating problem	2,57	Good
find alternative solutions	3,40	Very Good
choosing the best solution	3,14	Good
fluency in solving the problem	3	Good
grade of the problem-solving result	3,07	Good

Based on table 6. showed that problem-solving skills could improve by implementing crossword game media. The media could train a high ability to think of many strategies to solve the problem, including finding. Understanding what kind of biological problems and ability to construct may allow students to get further opportunities to improve performance in biological problem-solving. Problem-solving facilitated students to know which strategy is useful, and if not, a transition to another suitable strategy (Lisesi, 2017). This indicates that the effect of crossword game media when learning a virus topic could exercise problem-solving and happened mainly.

Education game was focused on solving problems that can trigger the student to analyze situations through their competencies (Di Meo & Martí-Ballester, 2020; Huang, 2019). Grimes & Fields (2015) said that education games, as a unique way, could be used as a channel for students to comprehend their competence in making and sharing.

The implementation of crossword games would accompany pedagogy to enable students to become active learners and work in pairs in the lesson (Grimes & Fields, 2015). In these activities, students have increased the autonomy of their learning to solve a problem and discover scientific knowledge.

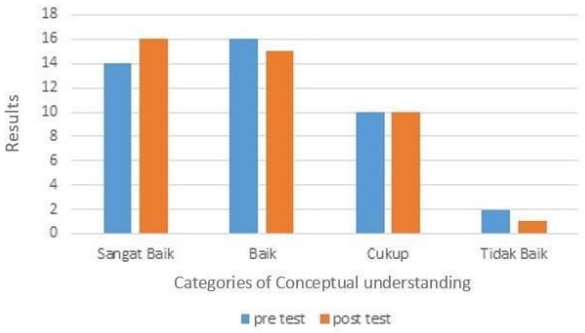

Figure 3. Resume of Conceptual understanding

The practice of the media influences the improvement of the students' conceptual understanding by using crossword game media. It also can be used as an individual, so students as a user have a position as independent learning. The findings in this trial showed that the learning process was presented with interesting animation and how to implement the material into the game. It was able to attract the attention of students to learn the content of the crossword game. It was presented with material instructions, test exercises and help students learn independently to explore their thinking ability. Conceptual understanding is also related to problem-solving that requires students to use upper-level thinking skills intensely (Mabilangan, R. A et al., 2011).

Visual media can make a generated material structure that would allow students to understand the form of material to be interpreted and potential misconceptions a student may have. So, teachers could then consider and resolve the problem with the misinterpretations that might have happened to the students (Stoen et al., 2020).

CONCLUSION

Several research findings can be concluded, namely: (1) crossword game media can be used as one of the learning media, especially on virus topics, (2) Crossword game media can be used as an alternative to interesting teaching media that use animation, (3) crossword game media can be used as one of the teaching materials to improve problem-solving skills and conceptual understanding.

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