Puzzle game development as a learning media in learning outcomes of building construction basics

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Abstract. The use of learning media in Building Construction Basics subject at SMKN 1 Sumedang were still not varied, it caused student learning outcomes to be not optimal. The researcher made alternative learning media that could encourage students' interest in the learning process. This research was aimed to design, find out, and implement learning media in the Basic Competence of Brick Installation Procedures. Learning media designed was puzzle as educational game with problem solving work technique and memory reinforcement. The research and development method were employed in developing the learning media. A purposive sampling technique was conveyed in order to collect the data with the participants of this research were 31 tenth grade students in DPIB 3 class of SMKN 1 Sumedang. This research showed that learning media were suitable to use after being validated by media experts and material experts. The students were more enthusiastic and respond positively to the use of learning media with puzzle games because it could help them to learn independently. The student learning outcomes showed the improvement both before and after using this learning media. Thus, the use of puzzle as a learning media were in the good and suitable category as an alternative media that could help the learning process and the students were able to use the puzzle well in the Basics of Building Construction subject at SMKN 1 Sumedang.

1. Introduction
The use of media in the learning process becomes inseparable. Learning media take an important role in helping and facilitating educators to deliver a material to students. Azhar Arsyad argues that a teaching and learning activity cannot be separated from a learning medium for the achievement of a learning goal [1]. While Rudi Susilana and Cepi Riyana revealed that learning media can provide stimuli and enthusiasm for learning to students so that they can learn independently. Nevertheless, what makes an educational media important in the process of teaching and learning activities is the accuracy of the media. One of the innovations made is by combining learning media with technology that is currently growing [2].

The lack of use of learning media at SMK 1 Sumedang in the teaching and learning process is one of the factors that causes boredom and saturation to students, so that students are less active during the learning process and the learning outcomes are not optimal. For the reach of an effective and efficient learning process, it should be optimized in the process of delivering material to students so that learning objectives can be achieved. Therefore, it needs an interactive learning process supported by proper media. One of them is learning using interactive learning media in the form of educational games.
Freeman and Munandar in Ismail defines the game as an activity that helps children reach complete development, from physical, intellectual, social, moral, and emotional [3].

Based on the explanation of the problem above, the researcher attempts to develop a puzzle game learning media that can be used as an alternative solution related to the problem. Since most students like a fun game, this media tries to make a game into a learning medium. The researcher takes a chance to develop an educational game as an interactive learning media on the Basic Competence for Implementing the Brick Installation Procedure by describing the use of equipment and the steps in its work.

2. Methods
The research design in developing puzzle game learning media using Contruct 2 was adapted based on research procedures and R&D development (Research and Development) Borg and Gall's R&D [4]. New learning. All of these stages can be explained in the following description in figure 1.

3. Result and discussion
3.1. Development of puzzle game learning media

3.1.1. Identification of potential and problems. The problem that was found during this research was the gap in teaching material with learning media so that researchers conducted R&D to overcome this gap and the use of conventional learning media which effected students to be bored and saturated and resulting in low learning outcomes. The potential in this research is the need for renewal of learning media by solving problems through R&D so that a media can be found to overcome these problems.

3.1.2. Data collection. After the potentials and problems can be showed factuallyy, so various data from the problems obtained in tenth grade students in DPIB 3 class and information on learning media that are still conventional make them bored and saturated, then it required an update to the learning media. Based on these data, it is used as material for planning certain products that are expected to resolve these problems.

3.1.3. Product design. The design of this learning media product was created with the Construct 2 application produced as follows in figure 2-figure 7.
3.1.4. Media expert’s validation. Media eligibility validation was carried out by media expert, Mr. Wahyudin, M.T., Lecturer in Computer Science at Universitas Pendidikan Indonesia. The criteria assessed by media expert are the presentation of the program, text, media display, media audio, and media language.

| No  | Criteria                | Score Average (%) | Category     |
|-----|-------------------------|-------------------|--------------|
| 1   | Program Presentation   | 85                | Excellent    |
| 2   | Text                    | 87,5              | Excellent    |
| 3   | Media Display           | 91,6              | Excellent    |
| 4   | Media Audio             | 62,5              | Good         |
| 5   | Media Language          | 87,5              | Excellent    |
|     | Average Total Score     | 82,82             | Very decent  |

Table 1. Valuation of media experts.
Table 2. Response, suggestion, and conclusion of media experts.

| Response | Suggestion | Conclusion |
|----------|------------|------------|
| In general, learning media for puzzle games is good, can be used for further learning and research. | Add an explanation to this puzzle game. Menu names are made consistent in terms of language. | In my opinion the learning media of this puzzle game is stated "Worth to test without revision" |

Based on table 1 and table 2, the results of validation and advice by media expert, the average percentage of assessment obtained was 82.2%. Therefore, media expert stated that the learning media of puzzle games developed is very decent to be tested.

3.1.5. Material expert’s validation. The validation of the advisability of the media was assessed by material expert, Mr. Dundun Kamal, S.T., Subject Teacher in the Basics of Building Construction at SMKN 1 Sumedang. The criteria assessed by material expert are the suitability of the material, the accuracy of the material, the updating of the material, and language.

Table 3. Valuation of material experts.

| No | Criteria                        | Score Average (%) | Category   |
|----|---------------------------------|-------------------|------------|
| 1  | The Suitability of the Material | 100               | Excellent  |
| 2  | The Accuracy of the Material    | 93,7              | Excellent  |
| 3  | The Updating of the Material   | 95,83             | Excellent  |
| 4  | Language                        | 100               | Excellent  |
|    | Average Total Score             | 97,39             | Very decent|

Table 4. Response, suggestion, and conclusion from material experts.

| Response | Suggestion | Conclusion |
|----------|------------|------------|
| In general, learning media for puzzle games is good, can be used for further learning and research. | Fixes to question number 13 that line bobbins are not yarn. | In my opinion the learning media of this puzzle game is stated "Worth to test without revision" |

Based on the results of validation by material expert the average assessment percentage obtained was 97.39%. These results show that each question made is in accordance with the subjects of the Basics of Building Construction, the material expert stated that the puzzle game learning media developed, is very feasible to be tested.

3.1.6. Design revision. The design revision is carried out when the design validation stage has been done by looking at the results of the feasibility assessment and suggestions from the media expert. Based on the results of design validation, media and material experts consider that the puzzle game learning media developed has fulfilled the rules of good interactive and innovative learning, and can be used for learning. So that the learning media of this puzzle game is feasible to be produced without revision.

3.1.7. Small-scale trial. Small-scale product trials are used to identify deficiencies of initial products that have been designed and have been assessed by experts. Product trials are conducted to determine the feasibility of the media based on respondents' responses to the puzzle game learning media developed. In small-scale trials, the ideal number of learners is between 8 and 20 [5]. This stage of product trials is conducted on 10 students of SMKN 1 Sumedang (5 students from tenth grade DPIB 1 and 5 students from tenth grade DPIB 4). Analysis of the results of the respondents' data is in Table 5.
Table 5. Results of small respondent responses.

| Indicator            | Suggestion                                      |
|----------------------|-------------------------------------------------|
| Media attraction     | Add game difficulty levels                      |
|                      | Make the animation into an original image       |
| Media Display        | Increase font size                              |
|                      | Mention the stages of achievement in each game  |
|                      | Add game resolution                             |

Based on table 5, the results of small-scale product trials, 10 respondents gave varied responses. Analysis of the small-scale product trial questionnaire of this learning media as a reference for product improvement before a large-scale usage test is conducted. The results of the analysis of respondents' responses to the learning media of puzzle games are very positive.

3.1.8. Product revision. In this research development, product revision is a product improvement from the results of small-scale product trials by considering the advice given by the respondents during product trials. These suggestions require an improvement in the appearance of the media.

Table 6. Product revision results.

| Before Revision                                      | After Revision                                      |
|------------------------------------------------------|-----------------------------------------------------|
| The size of the letters in the puzzle game is not    | The font size has been improved to be bigger than   |
| large enough                                         | before.                                             |
| The use of animation images in puzzle games          | Real picture changes in the puzzle game             |
| No material indicators are given at each level 2     | Provision of material indicators at level            |
| and letters that look childish                       | Giving real letters at level 2                      |
| No step indicator is given at level 3                | Provision of stage indicators at level 3             |
| Lack of resolution                                   | Resolution added                                    |
| Difficulty level is still easy                       | Difficulty level added                              |

3.1.9. Large-scale trials. Large-scale trials were conducted to determine the response and student learning outcomes which are samples from this study, that is tenth grade students in DPIB 3.

Table 7. Results of large-scale responses.

| Indicator                  | Suggestion                                      |
|----------------------------|-------------------------------------------------|
| Media Interest and Media   | Add game levels to be more challenging.          |
| Display                    |                                                 |

Based on table 7, the results of suggestions from respondents in the large-scale trial phase there is only one point, which is adding levels to the learning media puzzle game that was developed. This shows "very good" interpretation in media interest and media appearance for the learning media developed. It has become a positive thing to use as a learning medium at SMK 1 Sumedang.

3.2. Student responses

The response is influenced by several factors, such as experience, learning process, personal experience level, and personality values [6]. Student responses are seen in small-scale trials and large-scale trials based on experience, and assessments of respondents when using the developed media. Responses are assessed from 2 assessment indicators, media interest and media appearance. The response results shown in the small-scale product trial respondents stated "agreed" on the puzzle game learning media. The results of the response shown in the large-scale trial of the products used were "strongly agree" to the indicators of media interest assessment and media display so that learning media products are feasible to be developed [6].
3.3. Student learning outcomes

Learning outcomes are a benchmark of success for the media developed. Learning outcomes are measured by granting pretest and posttest to the sample used, which is tenth grade students in DPIB 3 class. Pretest and posttest results can be seen in Table 8.

| Statistic      | Pretest Score | Posttest Score |
|----------------|---------------|----------------|
| Total          | 1397          | 2431           |
| Highest Score  | 69            | 85             |
| Lowest Score   | 27            | 70             |
| Average        | 45            | 78.5           |
| N-Gain         | 0.6           |                |

The average score of students' achievement scores before the research was 45. Then, the average score of posttests after students used the puzzle game learning media that was developed was 78.4. The increase of 30 points was influenced by the excess of media and class activities carried out. The data was analyzed by N-Gain using the SPPS application version 24 and obtained 0.6% which is in the medium qualification range to improve student learning outcomes using the developed puzzle game learning media. Thus, the level of effectiveness of learning media puzzle games in the medium category and appropriate to be used as learning media in the daily learning process. Maharami and Irvansyah stated that the use of games as a learning medium is more effective to deepen the material [7].

This was also obtained from 3 observers during the research activities. The observers provide an assessment of aspects that have been given. The conclusions from the 3 observers stated that the puzzle game learning media were feasible to be developed and used in schools as the new and primary learning media used.

4. Conclusion

Based on the results of research conducted in tenth grade students in DPIB 3 class of SMK 1 Sumedang during the learning process Fundamentals of Building Construction in general it can be concluded that the Development of Learning Games Puzzle Media Against Learning Outcomes of the Basics of Ten Class Building Construction is Decent and Effective (Medium Effectiveness).

The use of puzzle game learning media can improve learning outcomes in competence in understanding the bricks installation procedure. The average pretest score of student results is 45 before the use of media increases in the posttest score is 78.5 after the use of puzzle game learning media. This is indicated by the use of instructional media based on the N-Gain Score of 60% which states that the level of effectiveness of this puzzle game learning media is in the medium category and is feasible to be developed and applied as a learning medium used at SMK Negeri 1 Sumedang. Improved learning outcomes show good results because it has reached the main goal of using this learning media.

Thus, the use of instructional media is expected to be an advantage for students to better understand and comprehend provided.

References

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