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Designing Board Games: A Practical Guide for Educator to Teach Computer and Basic Network in Class

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ABSTRACT

Board Games can be a highly engaging and motivating resource to support Computer and Basic Network teaching in class. However, the development of board games to facilitate the communication of the subject may not be an easy task for those with no prior experience in designing games. For instance, the various classification of educational game features, construction of the game mechanism, and lack of scholarly guidance for designing and their efficacy in formal learning may hinder the game development process. To address this issue, this study presents a hands-on game development framework for teachers and researchers on how to design educational games. The framework is divided into five that build upon each other to create a student-centered educational resource as well as provide a means of evaluation. Learning using board games is expected to make learning more fun and help students be more active in teaching and learning activities.

Keywords: Educational Games, Game-Based Learning, Student-Centered Learning, Play, Class Activities, Computer and Basic Network, ADDIE

1. INTRODUCTION

Game based learning (GBL) has gained increased attention in formal education. In achieving learning goals and increasing student activity, educators must be able to find the right way out, one way that can be done is to use a game-based learning model. Game-based learning model by involving educational games in the learning process aims to increase learning activities(Partovi & Razavi, 2019). By using educational games, students are expected to be more active in learning process. Educational games actually refer to the content and objectives of the game that related to learning, not the actual genre of a game. Educational games are able to provide interesting and fun effects for students in the learning process, so that students are able to easily accept the subject provided by educators. There are several educational games that can be used in the learning process, one of which is educational games using a board game.

The results of observations of students at one of the State Vocational Schools in Boyolali Regency, students are not enthusiastic and experience boredom when teaching and learning activities in basic computer and network subjects. The lecture method and the use of PowerPoint media make students feel bored, being less active in class and doing other activities that have nothing to do with the learning process. As a result, these students do not understand the material provided, and learning outcomes are not optimal.

Learning using board game can help teachers to communicate the subject and can make it easier for students to understand and recall the subject that they have learned(Triastuti et al., 2016). Learning using board game can also make learning more fun and help students be more active in teaching and learning activities. The use of board games can significantly increase student motivation(Lin et al., 2021)

2. RESEARCH METHOD

Research and development method (Research and Development / R&D) is a research method that often used to research and produce new products, and then test the effectiveness of these products(Sugiyono, 2015). According to (Setyosari, 2012), development research is a systematic study to design, develop, and evaluate programs, processes and learning outcomes. This research is using ADDIE model as a framework for the board game development.

ADDIE is a stages of Instructional Systems Development (ISD) which stands for: Analysis, Design, Development, Implementation, and Evaluation(Molenda, 2003). ADDIE model is a model most often used to develop learning media products(Siemens, 2002) that allows researchers to return to the previous stage after the assessment results obtained that require improvement(Sugiyono, 2015). Stages of ADDIE model can be seen in figure 1.

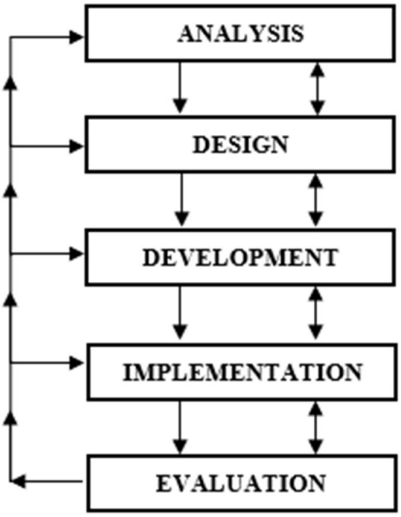

Figure 1. ADDIE stages for the development of board game

2.1. Analysis

For this initial stage, researcher would analyzes the problems and think of the solution by paying attention to the knowledge, skills, and behavior of students.

2.2. Design

At the design stage, researcher would be designing the board game and preparing the questionnaire for the data assessment.

2.3. Development

The design board game at the design stage is being developed and then tested by experts at this stage. At this stage, revisions are made according to the criticisms and suggestions given by the experts. The product results at this development stage are in the form of a board game that has been developed and that it will be implemented in computer learning and basic networking subject at the implementation stage.

2.4. Implementation

The implementation stage is the stage where the board game begin to be applied as well as being tested in the actual situation. The effectiveness of the board game will be known with certainty through observation during the playtest as well as questionnaires given to teachers and students after the playtest is carried out. In addition to effectiveness, the advantages and disadvantages of the board games can also be known from the results of questionnaires given by teachers and students.

2.5. Evaluation

The last stage for ADDIE model is evaluation. At this stage, further discussion for the results of the implementation of board game for students and revisions are made if necessary to get the perfect final results for the game that being made. For this research, the data were obtained from the results of assessments that be carried out by experts(learning media expert and subject expert) and participants that already being selected by certain criteria.

The data obtained would then be categorized according to the Likert scale measurement, after that the data would be calculated and then percentage using the following formula:

$$P = \frac{(\text{research result score})}{(\text{ideal maximum score})} \times 100\%$$

Based on the calculation above, the range and quality criteria can be categorized as in table 1 and to be analyzed descriptively for the final result.

Table 1. Category percentage for quality questionnaire

Interval	Criteria
81 – 100%	Excellent
61 – 80%	Good
41 – 60%	Fair
21 – 41%	Poor
< 20%	Very poor

3. RESULT AND ANALYSIS

3.1. RESULT

The development of the board game has followed the five stages of ADDIE model.

3.1.1. Analysis

For the starting point, analysis be carried out that resulted in 3 important things, which is: (1) the competences for the subject that must be mastered by the students, (2) the students characteristics that relate to their knowledge, attitudes, and skills, and (3) the supporting media that can help motivate the students to be more engaged at study in the classroom. And based on the analysis that has be done, it was decided that this research is being focused on the development of board games for basic computer and network subjects.

3.1.2. Design

The second stage of ADDIE model is design. In this stage the initial design for board game and the other attributes are being made. In addition to that, the selection of the matter subject that will be used is also detailed at this stage such as such as computer networks, OSI layers, topologies, and TCP/IP networks.

3.1.3. Development

At the third stage of ADDIE model, the design of the board game is being developed into a prototype. After that, the prototype of the board game and the matters subject that being chosen for the research is being tested and validated by experts. Prototype of the board game can be seen at figure 2.

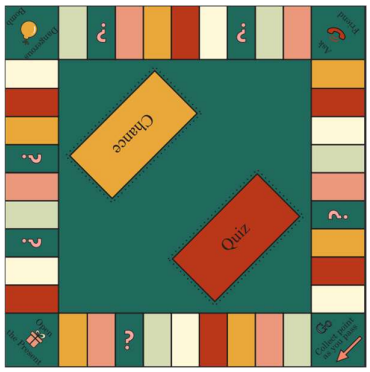

Figure 2. Prototype of the board game

Table 2. The validation results of the board game by learning media experts

No.	Aspect Evaluation	Score
I	**Media Efficiency**	
	1. Easy to used	4
	2. Easy to stored	5
	3. The usage does not need special treatment	5
	4. The attractiveness packaging design of the board game	4
II	**Media Accuracy**	
	5. Color design for the game board	3
	6. The language used for the board game is easy to understood	4
	7. Suitability usage of the type letters that being used fpr the board game	4
	8. The consistency of the usage of the letter, images, spaces on card as the game board attributes	4
III	**Aesthetics**	
	9. The harmony of the color selection for the board game	3
	10. The harmony of the color for the word on the card	5
	11. Combination color that being used for the board game design	4
	12. The accuracy color for the column on the board game	4
	13. The level of attractiveness of the card as the game board attributes	4
IV	**Media Resistance**	
	14. Board game is not easily broken or destroyed the moment it being used	5
V	**Security For Participant Educate**	
	15. Have safe material (i.e does not have sharp edges and does not have a heavy weight)	5
Total score		63
Mean score		4.2
Percentage		84%
Category		Excellent

Based on the table 2, it is known that the board game that being developed got a score of 4.2 with a percentage 84%, that can be said that the board game has an excellent quality. However, before being implemented for students, the board game have to undergo some revision according to the suggestion that being given by the learning media expert.

Table 3. The validation results of the matter subject by subject experts

No.	Aspect Evaluation	Score
I	**Relevance**	
	1. Theory relevant with competencies that must be mastered by students	4
	2. The learning media relevant with competencies that must be mastered by the students	5
	3. Completeness of the theory in accordance with the level of students knowledge	3
	4. Illustration on the theory in accordance with level of students knowledge	3
	5. Illustration on the theory relevant with competencies that being presented	3
II	**Accuracy**	
	6. Subject matter that being presented is in accordance with truth science	4
	7. Subject matter that being presented is in accordance with the up-to-date development	3
	8. Subject matter that being presented is in accordance with the daily life	4
	9. The packaging of the theory in learning media is in accordance with related science approach (scientific approach)	3
III	**Completeness of the Subject Matter**	
	10. Presented competencies that must be mastered by student	4
IV	**Draft Base Theory**	
	11. Suitability draft of the basic computer and network subjects	3
V	**Suitability of the Subject Matter With the Requirement that Centered On the Students**	
	12. Encourage curiosity on students	4
	13. Help student more engage at each other in classroom	4
	14. Help students to build it own knowledge	4
	15. Help students to study as a group	5
Total score		56
Mean score		3.7
Percentage		74.7%
Category		Good

Based on the table 3, it is known that the matter subject that being chosen got a score of 3.7 with a percentage 74.7%, that can be said that the subject that being chosen has a good quality. However, before being implemented for students, the matter subject have to undergo some revision according to the suggestion that being given by the subject expert.

3.1.4. Implementation

Table 4. Assessment by teacher

No.	Aspect Evaluation	Score
I	**Theory Learning**	
	1. Board game contains subject matter in accordance to desired indicator that has to be achieved	5
	2. Board game is suitable fo be used in learning	5
	3. Board game is making it easier for teachers to teach computer and basic network subject	4
	4. Board game already accomplised the criteria as a learning media	5
	5. Accuracy illustration with the subject matter	5
II	**Media Eligibility**	
	6. Board game is sturdy and has good durability	4

	7.	Board game is easy to be used by students	5
	8.	The board game is helping Developed media make it easy student in understand Theory on eye lesson computer and network base	4
	9.	Media loading capable material _ increase understanding student	5
	10.	Clarity regulation in learning media with game board	5
	11.	Learning media with game board very play a role in learning	5
	12.	Use illustration help understanding participant educate	5
	13.	Media facilitate student for communicate	4
	14.	Use of learning media this make student motivated in learning	5
Total score			66
Mean score			4.7
Percentage			94.2%
Category			Excellent

Table 5. Assessment by students

No.	Aspect Evaluation	Score		
		Student 1	**Student 2**	**Student 3**
1.	Appearance of the game board interesting	3	4	4
2.	Board game is easy to used	4	4	4
3.	Instruction of the game is easy to understood	5	3	4
4.	Activity study more pleasant	5	5	3
5.	Learning media could increase motivation study	5	4	3
6.	Media contains interesting material _	5	5	4
7.	Theory easy studied	5	5	3
8.	Election color on board game interesting	3	3	4
9.	Layout _ and arrangement letter appropriate	3	4	4
10.	Neatness design interesting	3	3	4
11.	Election color on board game good	3	3	4
12.	Form and attractive media color	2	4	3
13.	Language in convey easy understood	5	4	4
14.	Letters used _ simple and easy be read	5	5	4
Total score		56	56	52
Mean score		4	4	3.7
Percentage		80%	80%	74.2%
Mean percentage			78.06%	
Category			Good	

The results of the teacher's response in table 4 with a percentage of 94.2% and the results of student responses shown in table 5 with an finale percentage of 78.06% indicate that the board game that the researcher developed has a good quality and suitable to be used as learning media in class. The results that obtained from teacher and student also prove that the board game that being developed is said to be effective in increasing student engagement at study in the class.

3.1.5. Evaluation

The final stage of ADDIE model are evaluation. Because this research is limited to playtest only, then the results for the evaluation stage are obtained at the implementation stage. The evaluation results were obtained from the suggestions from the participants, in this case it is the teachers and students during the playtest, so that the final product of the board game that being developed could be perfect and have good quality in order to make students to be more engaged at study in the classroom

3.2. ANALYSIS

Based on the results of the playtest, the final score from the teacher was 4.7 with the percentage 94.2% and the median percentage from the students was 78.06%, it can be said that the board game that being developed were known to be suitable and effective to be used in teaching and learning activities for computer and basic network subject in the classroom.

4. CONCLUSION

Based on the results of research and development of board game for computer and basic networking

subjects, it can be concluded that the process of developing board game were using ADDIE model. In the analysis stage, the researcher made observations on students during teaching and learning activities. Next is the design stage, the researcher begins to design interesting learning media as an board games for basic computer and network subjects, with taking into account the results from the previous observations that have been made at the analysis stage. The third stage is the development, after the board game has been designed, then it has to be validated by the expert (media experts and subject experts), revisions are made according to the suggestion given by the expert before the board game moving on to enters the implementation stage. After passing the development stage, the board game moving on to the implementation stage. Implementation was carried out with a playtest that invited 1 teacher and 3 students, after the test was carried out the teacher and students were given a questionnaire to assess and giving suggestions for the board game as a form of assessment at the evaluation stage.

At the evaluation stage, the board game is being evaluated with considering the result from all experts involved. Learning media expert were giving score 4.2 and a percentage of 84% are in the very qualified category, while the subject expert were giving a score 3.7 and a percentage of 74.4% are in the average category, the final score indicate that the board game can be tested to participants. The board game that being developed is said to be effective because in the evaluation stage the teacher gives a score 4.7 with a percentage of 94.2% which is in the very qualified category, as well as the score from the students with an percentage of 78.06% which is in the qualified category.

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