Developing of TaPe Game App for interactive learning based on DGBL model for students in elementary school

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Abstract. Gaming is not only a fun activity in competing, but also an activity that can be used as a learning tool. Gaming technologies can be utilized to create a fun and interactive learning environment through game based learning. This research on developing a TaPe App, as a learning media, can be used by teachers and students in learning activities or at ice breaking time. TaPe App is built with 3 key elements: challenge, response and feedback. TaPe App is developed by using Digital Game Based Learning (DGBL) model with the stages consisting of analysis, design phase, development phase, quality assurance, implementation and evaluation. TaPe App is built with attention to the principle of a good learning media that is easy to see (visible), interesting, simple, useful, accurate, legitimate, and structured which known as the principle of VISUALS. This study shows that the TaPe App can run in many computer environment and the functionality running well based on black box testing. TaPe App has many features of a game that includes three difficulty levels, a random questionnaire in every step of game, and has a user friendly interface. The next focus on this research is to implement this app on android platform.

1. Introduction
Exam for students, is one of the activities that is routinely carried out in almost all schools. The exam itself is usually done in written format, with a tense atmosphere. The purpose of an exam is to find out a student's ability to master a lesson. However, the nature of exam is that, it is supervised by the teachers resulting in a form of pressure upon the students, this this tends to make students more stressful. For elementary school level, the pressure to face the exam must of course be minimized so that students can learn more easily and understand about the subject. Educational gaming has recently gained more attention as a technique to motivate students and enhance their learning [1].

The gaming approach was both, more effective in promoting student's knowledge of concepts and more motivational than the non-gaming approach [2]. Most teachers who actually use games in class, perceives that a student engagement with a game and cognitive learning as an outcome of the use of games in a formal teaching settings [3]. Other research show that a Game based learning (GBL) helps students to improve on problem-solving skills, and make it possible for them to interpret their society, nature and the world around them through experiences [4]. Hence, using game in education could become a potential solution for an interactive media to learn and understand something [5]. Most educational gaming is not designed to make a competition between each other students in the classroom, but also, not designed to simulate the examination conventionally.
To make an educational game with an examination in the content of the game, several researchers have suggested the following games: 3D game for a game-based learning [6], educational games based on Role Playing Game (RPG) [7]. This paper describes the design of a game development as a media to evaluate skill of students, as a learning media to students, and to make a fun situation in classrooms at Elementary School through a game. The game has a focus on Science, Technology, Education, and Mathematics (STEM) topics. This paper also describes an initial testing to see if this game prototype could be played and the scenario works with the black box method testing.

2. Methods
The main objective of this game development is to create a learning media and a competition between students, utilizing a type of snake ladder board game with the DGBL method. This application is called TaPe. In this game prototype, the game uses 3 key elements: challenge, response and feedback. The Challenge is the most important component in this game. The challenge in this game is in each question about the topic, which is must be answered by the students. The Response in this game is the answers given by the students. The Feedback in this game is the information to the students about topic questioned.

This game development with Digital Gaming Based Learning, as illustrated in figure 1, has each phase consisting of activities which need to be accomplished before moving on to the next phase [8].

![Diagam 1](image)

**Figure 1.** Digital Game Based Learning (DGBL).

2.1. A board
This game use a snake and ladder game board for a main component on this game. The design of the board displayed in Figure 2.
Referring to Figure 2, there are 3 areas in the board: the configuration area, the main area, and the question area. The Configuration area contain an action button for a player to roll the dice. The Main area is the snake and ladder board for an avatar of player that can move from one piece box to another box based on the number on the dice. The Question area is to display the questions on a topic based on location of each player.

2.2. Game scenario
This game prototype must be played with at least 2 to 4 people at the same time. The player rolls the dice in sequence, after the number of the dice is displayed, the avatar of that player will moved to the next box based on number on the dice. The question will be showed after the avatar finishes a move, and then the player will answer the question displayed. If the player answers wrongly, the player’s avatar will move back to the last box, but if the player gets a right answer, the avatar can stay on that box.

There are 2 other conditions on board for the player’s avatar, there a box of ladder or a head of a snake picture. If the player’s avatar arrived at the box of ladder, the question asked has more difficulty than the other questions. If the player can answer the question, the player’s avatar can move to the top of the ladder. The other condition is if the player moved to the head of the snake, and gets a wrong answer, the player must go down to the end of the snake.

3. Results and discussion
The game app build with the VISUALS principle for role to make a good learning media. The VISUALS principle consist of: Visible, Interesting, Simple, Useful, Accurate, Legitimate, and Structured [9].

The Visible representation the learning media is that it is easy to see. The app created in a colourful setting so that the students can be interested about the game representing the second principle of Interesting, this game also use multimedia features to enrich the graphics and contents of the game, in order to improve the learning motivations of students, and make the students interested [10]. The sound in this app can make the students interested, based on the research of sound in the game revealed that the participants who played the game with voiceovers were more engaged than participants who played without voiceovers [11].

The game just has a few button making the game simple to use, thus each student can play the game easily. This app use board format game to describe a “Simple” pattern in VISUALS principle. The board game format was readily accepted and provided an adaptable method for introducing, evaluating, and reinforcing concepts related to education [12].

The Useful principle is where the game makes a learning media with a good impact for students to increase their skill and can motivate them for learning. This app use media computer for efficiency and
make teacher and student easily communication and interaction. This app useful cause, the app can make fun situations, if the students can answer the questions very well, there is great popularity in class [13].

To be accurate, the topic of each question will be from the text books used. The game must be legitimate and structured, so this game has a different level in every questions, based on the box where the player’s avatar stands. To increase the challenge, the questions at the ladder box has more difficulty than the other boxes. The purpose is so that the students do not win easily, making the game more interesting.

After the game prototype has already been developed, a preliminary test was needed to see if this game could run according to the expected scenario. This study uses black box testing model as a reference for the test. The detail of scenario test show in Table 1.

Table 1. Black box testing result.

| Scenario Test                                                                 | Result |
|------------------------------------------------------------------------------|--------|
| Roll the dice, and avatar moved to the box                                   | OK     |
| Display question after avatar player arrive at the box                       | OK     |
| Choose a wrong answer, the avatar player will be back to the last box        | OK     |
| Choose a right answer, the avatar player is stay at the box                  | OK     |
| At the ladder box, choose a wrong answer. The avatar player will be back to  | OK     |
| the last box                                                                 |        |
| At the ladder box, choose a right answer. The avatar player will be move to  | OK     |
| the top of the ladder.                                                       |        |
| At the head of snake, choose a wrong answer. The avatar player will be move | OK     |
| to the end of the snake.                                                     |        |
| At the head of snake, choose a right answer. The avatar player is stay at   | OK     |
| the box.                                                                     |        |
| The first player rich box number 100, get the winner status                 | OK     |

As result shown in Table 1, the game has good validation scenario and good functionality.

4. Conclusion
Developing a learning media for Elementary Schools with the STEM principle is not a simple process, especially using a game as the media. This study shows that the development design with the DGBL model and the VISUALS principle as a reference makes a good learning media in a new way that can, potentially, evaluate students' skills without providing pressure like the conventional examinations. Further testing is still needed to see the usefulness of this game and how well this game can improve students' pleasure in learning and facing exams. In the end, this study also shows the potential of this game prototype as a learning tool, but further development and testing are still needed to improve the prototype of this game.

References
[1] Gallegos C, Tesar A J, Connor K and Martz K 2017 The use of a game-based learning platform to engage nursing students: A descriptive, qualitative study Nurse Education in Practice 27 101-106
[2] Papastergiou M 2009 Digital Game-Based Learning in high school Computer Science education: Impact on educational effectiveness and student motivation Computers & Education 52(1) 1-12
[3] Huizenga J C, ten Dam G T M, Voogt J M and Admiraal W F 2017 Teacher perceptions of the value of game-based learning in secondary education Computers & Education 110 105-115

[4] Ucus S 2015 Elementary School Teachers’ Views on Game-based Learning as a Teaching Method Procedia - Social and Behavioral Sciences 186 401-409

[5] Manuaba I B K 2018 The Design and Game Mechanic of Combined Game Application Prototype for Learning Social Business Procedia Computer Science 135 52-59

[6] Cheng C-H and Su C-H 2012 A Game-based learning system for improving student's learning effectiveness in system analysis course Procedia - Social and Behavioral Sciences 31 669-675

[7] Sari K W, Saputro S and Hastuti B 2014 Pengembangan Game Edukasi Kimia Berbasis Role Playing Game (RPG) Pada Materi Struktur Atom Sebagai Media Pembelajaran Mandiri Untuk Siswa Kelas X Sma Di Kabupaten Purworejo 3(2) 96-104

[8] Zin N A M, Jaafar A and Yue W S 2009 Digital Game-based learning (DGBL) model and development methodology for teaching history WSEAS TRANSACTIONS on COMPUTERS 8(2)

[9] Nurseto T 2011 Membuat Media Pembelajaran Yang Menarik Jurnal Ekonomi & Pendidikan 8(1)

[10] Cheng C, H Chung H, S, A 2012 Game-based learning system for improving student’s learning effectiveness in system analysis course Procedia - Social and Behavioral Sciences 31 669 – 675

[11] Byun J-H and Loh C S 2015 Audial engagement: Effects of game sound on learner engagement in digital game-based learning environments Computers in Human Behavior 46 129-138

[12] Schmuck H and Arvin M K 2018 Use of a board game format to promote interprofessional learning Journal of Interprofessional Education & Practice 12 51-56

[13] Taspinar B, Schmidt W and Schuhbauer H 2016 Gamification in Education: A Board Game Approach to Knowledge Acquisition Procedia Computer Science 99 101-116