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# Leveling Up Difficulty Model Based on User Experience in Education Games Mobile-based for Student Kindergartens

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***Abstract*—The purpose of this study was to identify how to build an educational game model with numerical recognition, numerical ordering and simple counting for kindergarten students with an age range of 3-6 years, where the method used is leveling up difficulty automatically based on user experience, where the level of difficulty will increase based on the success of the user completing the game, the more often the user plays the game, the difficulty level will continue to increase, so hopefully with this model education games mobile-based can develop education games model that can help students recognize numbers and improve their ability to sort and count numbers with more easy and fun way.**

***Index Terms*—Education Game Model, Game Modelling, Kindergarten, Leveling Up, Mobile-Based**

## I. INTRODUCTION

In the present era, in the life of modern society, smartphone technology cannot be separated from its users, where almost all people, from all ages use smartphones, including teenagers even early childhood also use smartphone technology, where smartphones can have an impact negative or positive in the life of modern society, where one of the positive effects that can be obtained is to use a smartphone to get information or knowledge through media information or also through applications, such as educational games. According to Ponticorvo in his research, educational digital games can be used as attractive media learning for kindergarten children [6].

This study aims to facilitate student's understanding the concept of numbers, about how the numbers shape, sequence, counting and compare numbers with building interactive and interesting learning models mobile-based, so with interactive and interesting learning is expected can develop soft-skills and competencies behaviors that affect interpersonal interactions [7].

According from De Basterrechea and Salvador, the game is a methodology where the children will learn and internalize learning concept, games for children are another experiences that can make them change, create another world, live other lives, have the role of being someone else without losing their identity , through games, children can build their own learning methods to support the knowledge that had given by their teachers at school [10]. According to Lucas, a child sees the world as a game and all his actions are imagine as a part of a game that can be enjoyed by children [1].

Based on Gabos Kiss's research, a student is more motivated to be able to complete the assignment when the assignment is in game-based form, where they will get better grades rather then when they work assignment manually [2]. According to Harvey, making education game models must be concerned with the following things, such as adjusting the game model to player target and thinking about how to keep the player's interest to still continue playing our games [9].

Also according to Esper, using games as a media learning can increase children's learning productivity, because children can get understanding from different teaching methods [8].

Based on some opinions from previous studies, with various educational game making it can be concluded, the game can provide a view of new learning methods, which are fun and easy to understand for children, to realize an interesting and interactive educational game that is easily accepted by children, in this study a education game model with leveling up difficulty based on user experience, which aims to improve children's ability to recognize and organized numbers, because according to (Moore 2000), that when a student learns something in a fun way, it can increase the enthusiasm for learning children and can also improve children's learning outcomes, in addition to having an impact on children, learning in a fun way can also have a good impact on teachers [3]. And to prove the benefits and user acceptance of this education games application, also to prove the success of the method of leveling up on user experience based on game education, a survey will be conducted using a user acceptance test.

## II. METHODOLOGY

In developing education models this game will built with colorful colors that because early childhood really likes coloful colors, because with that can improve mood, spirit and comfort for children [5].

This game model will be built using leveling up difficulty based on user experience, to maintain player interest and to reduce stress on children [5], so it is expected to have a positive impact for children.

In "Fig. 1" show a basic flowchart leveling up based on user experience diagram in this mobile-based game education game. This leveling up step will execute when player finished playing the game and gets a star.

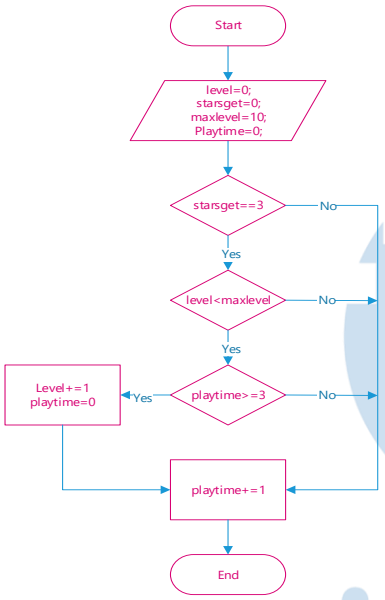


Fig. 1. Flowchart Diagram Leveling Up Method

Leveling up difficult process has 3 parameters, namely starsget parameter to accommodate the number of stars obtained by players, maxlevel to limit the maximum level and playtime to count the number of players playing. And the next step is proceed with checking, where the first check is when the player gets a star, if the player gets a three star, it will be checked for maxlevel, if it has not passed the levelmax yet, then the player need played the game at least three times, and if all conditions are met the level game will increase. Playtime parameters will always increase when player finished the games.

Main menu model in this education game develop by making several menu choices, such as starting the game, setting game options, and closing the application, as shown in "Fig. 2".

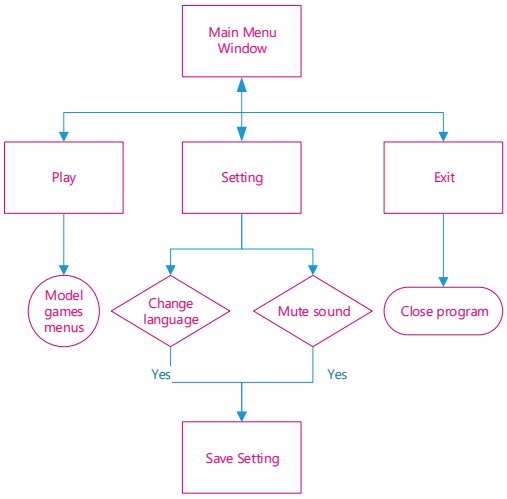


Fig. 2. Main Menu Flow

In the selection games, menus model was designed with many selection menus, where the user can choose many various types of numbers games, as shown in "Fig. 3".

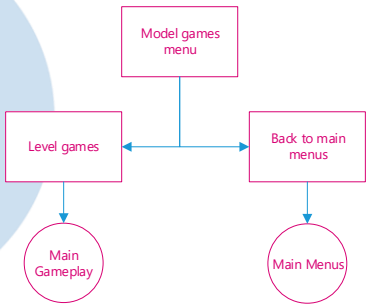


Fig. 3. Model Games Selection Menu Flow

In the gameplay menu, first step will show how to play window as a guide for user, After that the main game will show, where users will get stars based on certain criteria in each game, as shown in "Fig. 4".

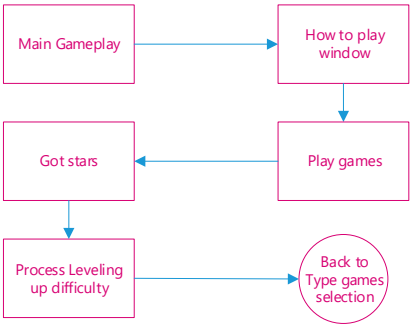


Fig. 4. Main Gameplay Flow

## III. DISCUSSION

In the development model of a mobile-based educational game, the development will be divided into three sections of development, namely the section of making the main menu model, the menu selection game model section and the gameplay menu section

which are the main scenes of this education game. This game will applied portrait display orientation, to facilitate early age users can control the games more easily [4].

In the main menu display is given a colorful color as an attraction for early age users, and in there has 3 simple buttons on the main menu that can be selected by the user, such as the start button to begin playing game, setting button or option button and exit button, as shown in "Fig. 5".


Fig. 5. Main Menu Model

The play button will be used to start the game, where after that model selection menu will be displayed as shown in **Error! Reference source not found.**. For the options menu will contain game settings, which will affect the main gameplay, the options menu will appear as shown in "Fig. 6". And for the Exit button, it will be used to exit the game.


Fig. 6. Option Menu and Selection Model Games Menu

In this learning educational game there are several types of game choices, which are made as an interactive and fun learning model, including Learn Numbers "Fig. 7", where the gameplay in this game has not been applied to the leveling up difficult method, because at this early stage the user is introduced about the shape of numbers and pronunciation. In addition there is a choice of sorting game numbers, where the leveling up method is applied in this gameplay, where when user success completing the game, it would have an impact on the level difficulty.


Fig. 7. Gameplay Learn Numbers Model

In "Fig. 8". shows changes in the level of difficulty of the gameplay, after the user successfully completes the sorting game several times and then user tries again with same game, then the level of difficulty sorting will increase, where difference lies in the random numbers that appear, if at the beginning of play, the numbers will only bring up numbers from one to ten, after a number of times the user successfully completes the game with good results, new problems will be raised which increase the difficulty level, where the numbers appear above ten.

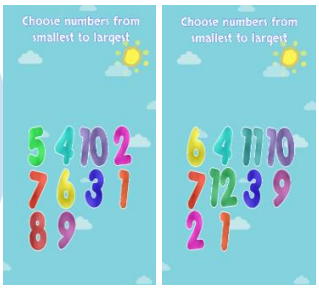


Fig. 8. Before and After Numbers Issue Model

Every time a user solves a problem, the user will get a star "Fig. 9", which will appear at the end of each game, where the number of stars indicates the user's success level in completing the game, the star is used as a trigger to increase the level of difficulty of the questions.


Fig. 9. Stars Report in The End of Games Model

The gameplay model comparing numbers is another type of game that is expected to help users understand the value of a number, where players will be asked to answer larger, smaller or equal from the 2 numbers being compared. In comparing the game

model also applied a leveling up based on user experience model, where the number level is higher, the numbers in question that will appear more diverse. In “Fig. 10” shown an increase the levels with increasingly large numbers.

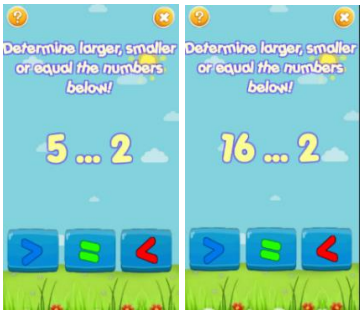


Fig. 10. Before and After Leveling Up Matching Games Model

Another type of number learning game model is counting items or objects, where multiple choices will be provided to help answer the question, in this type of game will counts the user’s speed calculating, where the more user plays, will affect higher criteria for user to getting a perfect score, at “Fig. 11” attached display of gameplay counting items or objects.


Fig. 11. Counting items model

To find out user acceptance of game education application leveling up difficult models on user experience in mobile-based educational games will be tested using the User Acceptance Test (UAT), where the target respondents who are preschool children are represented by their parents in filling out the survey this. On the User Acceptance Test form, a number of questions are presented as follows to the respondent:

1. The appearance of this mobile-based education games application is interesting.
2. Presentation of learning information recognizes numbers easily understood by children.
3. Presentation of mobile-based education training questions can help children recognize numbers?
4. With this education games application, children are more interested or happy in learning to recognize and organized numbers.
5. This education games application can run well on your mobile device.

## IV. RESULT

Testing in this application, carried out at a private school located in the location of Tangerang - Indonesia, and the following are the results of user acceptance tests conducted with respondent parents or guardians of kindergarten school students where children of parents or guardians of these students had played or experimented with education games applications.

TABLE I. USER ACCEPTANCE TEST RESULT

| No | Question | Grade | | | | | Sum | Anl | Prc |
|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 4 | 3 | 2 | 1 | | | |
| 1 | Q1 | **30** | **12** | **3** | **0** | **0** | **45** | 7,50 | 150 |
| 2 | Q2 | **10** | **32** | **0** | **0** | **0** | **42** | 7,00 | 140 |
| 3 | Q3 | **10** | **28** | **3** | **0** | **0** | **41** | 6,83 | 137 |
| 4 | Q4 | **20** | **24** | **0** | **0** | **0** | **44** | 7,33 | 147 |
| 5 | Q5 | **40** | **8** | **0** | **0** | **0** | **48** | 8,00 | 160 |

Based on the table above, it can be explained that in the Anl column (Anlysis) can be calculated from the total value (sum) / number of responded, and to get Prc (Percentage) obtained by Analysis / number of questions * 100.

By doing the above calculations, it can be concluded that there are 88% of respondents who agreed that the application of leveling up based on user experience in education games can help and can improve children's ability to recognize and organized numbers.

## V. CONCLUSION

The development model with leveling up method based on user experience has been proven that as many as 88% of respondents agree that with the leveling up based method on user experience in mobile-based educational games, can increase

children's interest in learning and increase children's ability to recognize and organized numbers.

In the next research, it is expected that more educational game models for number processing can be built, such as adding, reducing numbers and so on. In addition, it is expected that this education game can be developed to be played on various types of operating systems, which can be played not only on mobile-based but also can be played on desktop-based, and leveling up based on user experience method can be applied to many types of educational games to increase user ability.

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