MATHE*dunesa*
Jurnal Ilmiah Pendidikan Matematika *Volume 8 No. 2 Tahun 2019*
ISSN :2301-9085

DEVELOPMENT PROCEDURE OF RPG GAME TO SUPPORT STUDENT'S SELF-STUDY ABOUT SIMULTANEOUS LINEAR EQUATIONS FOR SENIOR HIGH SCHOOL STUDENTS

Nila Rosita Dewi
Mathematics Education, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya
email : nilarosita0597@gmail.com

Atik Wintarti
Mathematics Education, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya
email : atikwintarti@unesa.ac.id

Abstract

Mathematics is a subject which contribute to technology development and have a big role in almost every subject in school. Mathematics itself help human to solve their daily problems in life. One of the most commonly encountered problem is simultaneous linear equation. In fact, students still have trouble to solve the problem of simultaneous linear equation moreover if it is a word problem because of their perspectives toward mathematics. It had impacted the students' motivation to learn. So, it is a need to create a new idea to support student self-study such as developing an RPG game. The aim of the study was to describe the development procedure of RPG game to support student self-study. This study belonged to development research that used ADDIE as the models. ADDIE stands for Analyze, Design, Development, Implementation, and Evaluation. Data of this study were collected from field note, validity observation sheet, response questioner sheet, and game level completeness. The result of the study showed that the RPG game was developed in five phases in ADDIE. Analysis was carried out by analyzed student needs, curriculum, and literature review. Design was obtained by design flowchart, presented problem, and instrument of the study. Development was held by realized the design and validated the game to mathematical content and media instructional experts. Implementation was done by test the game to the experimental subjects. Evaluation was carried out by analyzed the data of the study.
Keyword: Development, ADDIE, RPG game, self-study.

INTRODUCTION

The documents of Indonesia's 2013 curriculum declared that mathematics is one of the subjects that is learned and developed since primary level. Mathematics is also a subject which contribute to the technology development and have a big role in almost every subject in school (Kemendikbud, 2017). It means, mathematics is not only perfect knowledge by itself, but also help human to solve another problem fields such as social, economy, and nature (Subekti, 2012). The definitions of mathematics indicate that mathematics is one of the subjects that have important roles in human daily life, science, and technology development. The statement above is contrary with the result of Programme for International Student Assessment (PISA) evaluation, that Indonesia gets 386 for mathematics while Organisation for Economic Co-operation and Development (OECD) countries that followed the program get 490 as average score (Wurinanda, 2016). It can be stated that Indonesian students have low motivation in mathematics. One of the chapters in mathematics that is faced in daily life is solving simultaneous linear equations. But, many students struggle to solve the problem. Moreover, if it is a word problem, many students hard to understand the problems and solve the algebraic equations (Makkulawu, 2015).

Data of a study showed that from 176 students, 55.56% have wrong interpretation and 83.70% have encoding trouble in word problem for solving simultaneous two variables linear equations (Islamiyah , Prayitno, & Amirullah, 2018). There are a lot of factors which influence the student's adversity of understanding the narrative problem such perspective, negative or positive (Syah, 2011). From 6 students, 3 of them have negative perspective through mathematics, they said that mathematics was hard lesson because of the complicated formula (Puspitasari, Yusmin, & Nursangaji, 2012). That perspective can decrease students' motivation in mathematics (Suryanih, 2011). Motivation can affect to reach wanted aims, it can develop by interest from outside or inside (Dalyono, 2009). Interest can be enhanced by something that being their likes. In this case, a game is being one of the children mostly like, as a research showed that from 79 respondents, 49 students agreed to choose playing game online over going to school (Angela, 2013). Another data from a survey organization, Steampy at 2013, there are ± 3.814.976 Indonesians play online game with 32% of them are less than 18 years old and 56% of them play game with RPG (Role Playing Game) basis. An RPG game is one of the game where the user can control the main character in the story (Aditya, 2014).

A survey from Agate Studio said that 89% game developer from Indonesia chose PC as their platform.

Game Developers Conference 2016 showed that 52% of game developers choose PC rather than others to develop their games. Another data showed in 2016 that a user can play in average 4 Android mobile games per month and 2 games on a daily basis, some genre of games were downloaded over 60 million times in the U.S. and the calculation predicted increased into 63.7% in 2020 over worldwide (Fuller, 2018). Meaning to say, Android is quite popular these days, but less developer to develop their games in Android mobile. Therefore developing android mobile games have a big chance in this millennium.

METHODS

The development procedure was carried out based on the ADDIE models. ADDIE stands for Analysis, Design, Development, Implementation, and Evaluation. There are five phases in ADDIE which will be described below

1. Analysis

   Analysis phase was conducted to investigate neither the research is necessary or not. Curriculum analysis, student need analysis, and literature review included in this phase. Curriculum analysis was conducted by analyzing what material and chapter that students accepted in the classroom. Students needs analysis was carried out to recognize the problem that student faced and to analyze will the prototype suitable to the students or not. The literature review was carried out to review the materials of the chapter and how to develop a good prototype.

2. Design

   Designing the flowchart of the game, designing the problems, designing the characters, even preparing the needed instruments was included in this phase before developed the prototype. The flowchart of the game contained of how the game works, lose and win condition, and the story that built during the playtime. The game was designed as RPG game characteristic, where the game provided the user to choose the actor in the first place. After chose the player and changed the name of actor, user would be transferred in the play area. The actor would get mission to save the world from a monster. The problems in the game contained narrative problems in simultaneous linear problem which had difficulties respectively, first and second stage contained two variables narrative problem, while third and fourth stage contained three variables narrative problem in simultaneous linear equations. The problems provided with multiple choice and short answer in each dialogues while the actor collecting hint to defeat the monster. When the actor could answer the problem, the score would be added in the actor's score history. Otherwise, if the actor cannot answer the quest then he could not receive any hint. The student's score would be analyzed in the evaluation phase. The game provided safe mode so the user could continue the latest position. The prototype would be developed to encourage the student to exercise and examine their knowledge about simultaneous linear equation. So, the problem designed form the easiest to the more complicate.

3. Develop

   After the design was ready, the prototype was developed. The prototype was developed based on the literature review. It was developed with advisor help and advice. The development process used two software, RPG Maker MV and Android Studio. In the development step, the prototype consulted and validated by the experts. There were two validations, content validation and construct validation. The content validation conducted by validating the prototype in the material experts. The expert who validated the content validation must be a mathematics lecture who expert in designing contextual word problem. The construct validation conducted by validating the prototype in the media experts. Media expert is the one who already developed a game prototype. The prototype revised based on the result of the validity test score and the comments. If the result of the validation is moderately valid, valid, or highly valid, the prototype do not need a revision or need a minor revision without revalidation. If otherwise, the prototype revised based on the experts suggestion and will be validated again until the result is valid. The validation will be conducted minimally three times, if after three times the prototype the score still under the valid criteria, the prototype will keep to be tested and will be discussed in the discussion section.

4. Implementation

   Implementation conducted by testing the prototype to the senior high school students. This study was carried out by test the prototype to the limited subject in the limited area. The prototype was given to the 14 chosen subjects. After subjects play the prototype, subjects received the user response questioner sheet and game level completeness test sheet.

5. Evaluation

   Evaluation carried out by analyzing the received data from the user that already played the game. The data was processed to analyze the effectiveness and practicality of the prototype. The evaluation process also analyzed all the tests that already carried before.

RESULT

1. Analysis
   a. Student needs analysis. As the result student data analysis, it could be said that student need a new idea to help them maximize their performance in simultaneous linear equation. Student also gained their excitement if they face the problem through the game. It means that it is needed to develop a game that could make student motivated to study about simultaneous linear equation.
   b. Curriculum analysis. Student in Indonesia study about simultaneous linear equation in two periods, divided into two variables and three variables. Even though simultaneous linear equation for three variables is given to senior high school, two variables problem is also given as the preliminary knowledge. Beside the number of variables that appear in the problem, the difference between junior high school and senior high school material in simultaneous linear equation is, the methods was extended into cramer's rule and Gauss Jordan elimination. All the methods to solve simultaneous linear equation was given, it depends on student's choice to use the methods which they prefer to use (Fauzi, 2016).
   c. Literature review. Based on literature review, it is said that game was being children trend for these days, especially the RPG base. The android user also increased year by year, so it is found a solution to solve problem above by develop a game in android device which can support student study about simultaneous linear.
2. Design

   In this study the design of the game based on the ten elements by Hitchens (Hitchens & Drachen, 2008), the design is described below:

   a. Rules. The rules in the RPG game is to travel the world to save the world from the monster. The regulation to move the character was described in the beginning of the game by touch the button controller in the left corner of the screen. To click an option or enter a room, the user can click touch button in the corner right of the screen.
   b. Victory and Lose condition. RPG game was designed to help student self-study, so the condition was set to educate the user. Every level has minimum problem which student need to answer. If user cannot answer the minimum question so the character will come to a game over. So, they cannot move to another level. The user can defeat the monster if the user can guest the unique weapon for each monster in the each level. The hint was spread in the all supported actors, the user can get the hint if only if the user can answer the question beforehand. The victory condition was set if user can answer the quests, such as get coins, hint, or another item which can help the user during the war in the end of the level section.
   c. Setting. The RPG game has setting mode to help user disable or enable the music background and sound effect. The setting also provide user to ability of the character to always run or not.
   d. Interaction model. Every character in the game was design to have interaction if the main character touch them. The dialogues was set to carry the problem about simultaneous linear equation as well.
   e. Perspective. RPG game has different perspective for each user who plays the game. The user may thought the main mission was to safe the princess when another can think it as to save the world.
   f. Role. Every character has own role, when main character as the warrior. The supported character also has the role such as guardian, seller, king, queen, grandfather, and the ship owner. The role was set based on the problem which the character was carried on.
   g. Mode. The mode of the game could be accessed by clicked the return button beside touch button. The mode contained of equipment, items, and armor which character used, setting, safe, and go to title to end the game without safe the current position.
   h. Structure. The structure in the game was set the main character with the highest role to save the world from the monster and rescue the princess. The mission was clear if the user could answer the problems during the playtime.
   i. Realism. All the character was designed as real as possible, such as how to illustrate a monster, an angel, a king, a flower field, a palace, a sea shore and another components. The problem which appear during the dialogue also was designed as real as possible based on the basic competence which was set earlier.
   j. Story. The story in the game developed during the game, for first level, the main actor only knew to save the world, but as the times flies, the main actor would find that the princess was missing and the user need to rescue her.
3. Development

   Development was carried out to realize the "Hello Counselor". The procedure was carried by four steps, the information will be described in the Table 1

Procedure	Steps in the develop phase
Mapping	Create map and scenery
Database using	Create character, set the database, and set the music

Eventing	Set the dialogues, set the transition of the main actor, and create the title screen
Extracting	Deploy the RPG game and extract the game into .apk extension.

Table 1. Procedure of game development

As the Table 1, the development procedure was carried out. The prototype was validated to experts, both mathematical content aspect and media instructional aspect. The validation process was carried out in two process, the construct and content. The result shows that the developed RPG game was valid. The RPG game need a minor revision based on the suggestion without revalidation process, some revision was carried, as follows:

a. Give further explanation about the introduction and instruction.
b. Make a new menu for author.
c. Correct all the error typing
d. Change the NPC that carried out the information into more than one events
e. Change the icon for selecting actor to be bigger
f. Give more information in weapon shop
g. Give instruction to safe the game
h. Script the monster event to disappear if the actor back to the previous map.

The suggestion from first experts to list all the actors was not carried out because RPG maker do no provide the developer to list the NPC actor as well, the permission only for the main actor. From the second experts, there are three suggestions which was not carried out, such as type the name of each NPC, Monster could appears if the user answer the problem wrong, and The attack for Orc was too low. The NPC name was not listed because the RPG game characteristic itself was stated that the importance was to know the name of main actor only, so the suggestion no need to be conducted. The second suggestion about the monster which appears if the user answer the problem wrong because the punishment was given by user did not getting score and coins, if the monster appears during the problem, it might decrease user motivation to keep playing. The last suggestion about the aggression of Orc need to set higher. The monster, Orc, is the monster in the first level. It was designed to prepare the user for the next higher level, so the monster was set low so the user could be win if the user with only minimum requirements. The next question about riddle in the level 2 was the box could be open if the user could answer the riddle. The character who carried out the riddle was the King, but the user need to found it out by themselves.

4. Implementation

The implementation was carried out by test the game to 14 students. The subjects divided into two groups. First group was tested with English version. While other group was tested with Bahasa Indonesia version. The test was conducted in two days. First day for the girls and the second days was for the boys. Except one device, the RPG game could be installed in all the android devices, it caused the devices was not carried the authentic android version. There are no difficulties during the test. The groups which was tested in Bahasa Indonesia is faster to catch the problems. While the group which was tested in English was more expedite to execute the problems.

5. Evaluation

After clarified and analyzed collected data, it was obtained as below:

a. The RPG game was valid based on validation paper result from experts.
b. It is known:
   i. The RPG game is valid based on validation paper result from experts.
   ii. The subjects response data shows that the game is easy to used and interesting

   So the developed RPG game is practice
c. The number of students who passed the passing grade for final score shows that the developed RPG game is effective.

CONCLUSIONS AND SUGGESTIONS

Conclusions

There are 5 steps of development of RPG game to support student self-study about simultaneous linear equation for senior high school student as follows: analysis, design, develop, implementation, evaluation. Analysis was conducted by analyzing student needs, curriculum, and literature review. The analysis result showed that it was needed to develop a game in android that could help student self-study about simultaneous linear equation.. The next phase was design, it is carried out by design the flowchart of the game, the instrument of the study, and the provided problem in the game. In develop phase, the game was realized and validated to the experts. After through minor revision, the game was tested to subject in implementation phase. Evaluation was carried out by clarifying and analyzing about the practicality and effectiveness from the collected data.

Suggestions

Based on the experiment and result of the study, the suggestion for further research is as listed below:

1. The game preference of the game still too small, moreover if the devices is under 5 inches, so it is suggested to make the game have the ability to be zoomed in or zoomed out.
2. The problem can only appears once, and it only provide the same problem for each devices, it is suggested to make it more dynamic by randomize the number in the provided problems.

DAFTAR PUSTAKA

Aditya, R. 2014. *Kinerja Otak.* Jakarta: Kompas.

Advent, J. 2015. "Dua Jam , waktu rata - rata bermain game". Retrieved from *MNC Media*. California

Akker, J. V., Gravemeijer, K., McKenney, S., & Nieven Nienke. 2006. *Educational design research.* London: Routledge.

Angela. 2013. "Pengaruh Game Online Terhadap Motivasi Belajar Siswa SDN 015 Kelurahan Sidomulyo Kecamatan Samarinda Ilir". *Ejournal Ilmu Komunikasi.*

Arsyad, A. 2009. *Media Pembelajaran.* Jakarta: Rajawali Press.

Fauzi, A. 2016. *Melatih Peserta Didik Memilih Caranya Sendiri Untuk Ditest*, (Online), https://sejutaguru.com, Retrieved on October 18.

Fuller, S. 2018. *Mobile Gaming: Mobile Gaming Industry-Statistic & Facts*, (Online), http://www.statista.com/topics/1906/mobile-gaming, Retreived on October 2018.

Hitchens, M., & Drachen, A. 2008. "The Many Faces of Role-Playing Games". *International Journal of Role-Playing*. Page: 1-20.

Islamiyah , A. C., Prayitno, S., & Amirullah. 2018. "Analisis Kesalahan Siswa SMP pada Penyelesaian Masalah Sistem Persamaan Linear Dua Variabel". *Jurnal Didaktik Matematika*. Page: 66-76.

Kemendikbud. 2017. *Buku SMP kelas VII.* Jakarta: Balitbang.

Jenvey, V., & Jenvey, H. 2001. "Criteria used to categorize children's play: Preliminary". *Social Behavior and Personality: An International Journal* 30(8). Page: 733-740.

Kulik , J. A., Rangert, R. L., & William, G. W. 1983. "Effect of computer-based teaching on secondary school student". *Journal of Educational Psychology*. Page: 19-26.

Maker, R. 2015. *Products of RPG Maker: RPG Maker,* (Online), www.RPGMaker.com, Retrieved on October 20, 2017.

Miller, H., & Kuhaneck, H. 2008. Children's perceptions of play experiences and the development of play preferences: a qualitative study. *American Journal of Occupational Therapy.* Vol 64 (4): Page 407-415.

Nugroho, D. S. 2016. "Pengembangan Media Belajar Mandiri "Samudra Edukasi Aritmatika.apk (S.E.A)" Berbasis Android untuk Siswa Tingkat SMP Kelas 8 pada Materi Lingkaran". *Prosiding Seminar Nasional Matematika dan Pembelajarannya*. Page 224.

PISA. 2019. PISA Programme for International Student Assessment: What is PISA, (Online), http://oecd.org, Retrieved on October 20, 2018.

Puspitasari, E., Y, E., & N, A. 2012. "Analisis Kesulitan Siswa Menyelesaikan Soal Cerita Materi Sistem Persamaan Linear Dua Variabel Di Smp". Pontianak: FKIP UNTAN.

Salen, K., & Zimmerman, E. 2003. *Rules of Play : Game Design Fundamentals.* The MIT Press.

Septiyaningsih, S. 2017. "Pengaruh Aktivitas Belajar dan Kemandirian Belajar Terhadap Prestasi Belajar Mahasiswa". *Jurnal Pendidikan dan Ekonom*. page 272.

Somakim. 2010. *peningkatan kemampuan berpikir kritis and self-efficiiency matematik sekolah menengah pertama dengan menggunakan pendekatan matematika realistik.* UPI.

Subekti, A. 2012. *Ensiklopedi Matematika.* Jakarta: PT. Mandiri Abadi.

Wurinanda, I. 2016. *Skor PISA Indonesia Masih di Bawah Rata-Rata.* Retreived Okezone : Jakarta.