

DEVELOPMENT OF ANDROID-BASED PUZZLE ADVENTURE GAME MEDIA IN ACCOUNTING SUBJECT TO IMPROVE STUDENTS' CRITICAL-THINKING SKILLS AT SMK NEGERI 1 JUWIRING

Sri Widi Lestari¹, Leo Agung² and Akhmad Arif Musadad³

^{1,2,3} Postgraduate Program in Educational Technology Study Program of Universitas Sebelas Maret
Universitas Sebelas Maret
Jl. Ir Sutami No. 36A, Surakarta, Central Java, Indonesia
widilestari92@student.uns.ac.id

<http://dx.doi.org/10.37500/IJESSR.2020.302262>

ABSTRACT

This research aims to produce a valid, practical and effective android-based puzzle adventure game media to improve students' critical-thinking skills in the accounting subject with the taxation subject matter. This research is a research and development using the ADDIE development model covering the stages of Analysis, Design, Development, Implementation, and Evaluation. The testing of the media, learning instruments, materials and critical-thinking skills were conducted on the eleventh grade of SMK Negeri 1 Juwiring. The trial design of this research used One-Group Pretest-Posttest Design. The results showed that the average percentage of the feasibility value of the lesson plan is 80.12%, the material 82.9%, the media 89.6% and the critical-thinking skills instrument 87.4% with the very feasible criteria. The use of an android-based puzzle adventure game media in a small-scale trial obtains an average score of 86.45% from teachers and students with the very practical criteria. The Android-based puzzle adventure game media is effective in improving critical-thinking skills, indicated by differences in students' critical-thinking test results from 78.12 to 89.68. These results demonstrate that the Android-based puzzle adventure game media developed has valid, practical and effective criteria for improving students' critical-thinking skills.

KEYWORDS: Learning Media, Puzzle Adventure Games, Android, Critical Thinking

1. INTRODUCTION

The world of education is essential in human life. The lives of educated humans always develop towards a better direction. There will always be changes that lead to the advancement of better education every era. In addition, the world of education requires various innovations. This is important for advancing the quality of education which not only emphasizes theory, but must also be directed at practical matters. Therefore, learning innovations are needed to make students excited, have motivation and interest to learn, and enthusiastic about learning at school.

21st century skills are one of the mostly-discussed topics. The development of the 21st century world is marked by the progress and demands of the times, one of which is technology. The use of information and communication technology in all aspects of life in the 21st century certainly requires

a change in the competencies needed. The use of information and communication technology in all aspects of life in the 21st century certainly requires a change in the competencies needed. 21st century learning becomes important as it invites students to think critically (critical thinking) and creatively (creative thinking), to be able to work together (collaborative) and to communicate (communication). Binkley et al. (2012) identify a set of 21st century competencies and skills, i.e. (1) creative and innovative, (2) critical thinking, (3) metacognitive, (4) communicative, (5) Collaborative, (6) Information literacy, (7) use of ICT, (8) being part of the world's citizens, (9) responsible for own career and life, and (10) having personal, social and cultural awareness.

The low development of higher-order thinking skills or HOTS can be seen from the results of the 2011 Programme for International Student Assessment (PIRLS) survey. Indonesia scored 428 along with 12 other countries with scores below 500, and from the results of the Third International Mathematics and Science Study (TIMSS) survey in the field of Mathematics and Natural Sciences in 2012, Indonesia ranked 39th out of 42 countries with the score obtained as of 406 under Palestine, Malaysia, and Thailand (Kemendikbud, 2012).

In the 21st century, critical-thinking skills have become very important to be developed in students and one of the main goals of education in Indonesia. According to Einav (2015), to improve students' critical-thinking skills, teachers must be able to understand students' mental and characteristics. In fact, the importance of these critical-thinking skills is not in line with the conditions of accounting learning in the field.

Based on the results of observations carried out at SMK Negeri 1 Juwiring, the strategies and learning media applied have not been able to facilitate students to improve critical-thinking skills. The method used is still conventional and learning is still teacher-centered. Besides, during learning, the teacher only uses the white board and PowerPoint (ppt) media. The teachers have not been able to utilize and develop more innovative learning media, especially based on contemporary technology. On one hand, the results of the observation of critical-thinking skills carried out on the eleventh grade of SMK Negeri Juwiring can be seen in Table 1.

Table 1. Results of Observation on Critical-Thinking Skills

Remark	Explanation	Interpretation	Analysis
Students fulfilling the indicators	10 students (20%)	5 students (10%)	10 students (20%)
Students not fulfilling the indicators	40 students (80%)	45 students (90%)	40 students (80%)

(Source: Processed primary data, 2018)

Based on Table 1 above, 10 out of 50 students can fulfill the explanation indicator, which means that 40 students (80%) are still unable to fulfill the thinking skills on the explanatory indicators. Only 5 students or 10% fulfill the interpretation indicator. This indicates that students have difficulty in understanding the material (interpretation) because they only accept the concept of the material without the help of the media. Then, in the analysis indicator, 10 students or 20% qualify. This can be seen when the teacher gave practice exercises, the students still had difficulty in analyzing the problems contained in the question (analysis). The problems occurring in the class indicate that the students still have low critical-thinking skills.

One indicator of a good learning process is learning that can make students actively involved in learning activities. If the students are interested and involved in interactive communication in the classroom, then their critical-thinking skills can also be increased simultaneously. Therefore, one way to make active learning is through the development of more innovative learning media. According to Kemp & Dayton (in Arsyad, 2013), the learning media is beneficial to make students more motivated and interested in participating in learning activities. One of the learning media that can be utilized now is a game. Games that can be used as educational media strategies to attract the students' attentions to be more enthusiastic about learning are puzzle adventure games. As its name, the purpose of this type of game is to solve puzzles by both arranging blocks, matching the color of the ball, solving mathematical calculations, passing the maze, and pushing the city into its place it should be. Often, this type of game is also an element of the game in adventure video games and educational games. The puzzle adventure game media has never been implemented in SMK Negeri 1 Juwiring since teachers prefer to use the blackboard, power points and lecture methods.

According to Widiara (2018), if the lecture method is the only method of learning used, the students' skills will not well trained as they are not accustomed to thinking outside the context conveyed by the teacher and become passive in choosing additional learning resources outside those provided by the teacher. Teachers are not the only source of learning, especially in the digital age, because learning resources can be easily obtained through the help of information technology. Thus, teaching or training thinking skills can help students to become critical thinkers effectively (Preisseisen, in Nurmaliah, 2009). Therefore, the development of the puzzle adventure game media is important to make the learning process more meaningful and improve students' critical-thinking skills.

II. METHOD

This research is a development research (Research and Development), a strategy that contains a process or steps to develop a new product or improve the existing, which can be accounted for (Sukmadinata, 2016). The product here is an Android-based puzzle adventure media to improve students' critical-thinking skills. The development of this Android-based puzzle adventure game media refers to the ADDIE development model, which includes analyze, design, development, implementation, and evaluation (Dick, W. Carey: 2009).

The Android-based puzzle game adventure media product developed was validated by a team of experts. The validation data from the expert team were analyzed qualitatively as an input to improve the product being developed. Then, the results of the expert response questionnaire related to the feasibility of the developed product were analyzed by transforming the average score of all observed aspects into the qualitative one with the criteria as in Table 2.

Table 2 Feasibility Criteria for Android-Based Puzzle Adventure Game Media

Score Range	Category
80-100	Very Feasible
66-79	Feasible
56-65	Quite
40-55	Feasible
30-39	Less Feasible
	Not Feasible

Source: Ernawati & Sukardiono (2017).

The analyses of the critical-thinking skill data are divided into two parts, namely the analysis of critical-thinking skills on each indicator and the analysis of critical-thinking skills as a whole. The category of the critical-thinking skill assessment is described in the following table.

Table 3. Category of Critical-Thinking Assessment

Score Range	Category
> 81.25 - ≤ 100	Very Critical
> 62.50 - ≤ 81.25	Critical
> 43.75 - ≤ 62.50	Less Critical
≤ 25.00 - ≤ 43.75	Less
> 81.25 - ≤ 100	Least Critical

Source: Klimoviene., G, Urbonienė, J., & Barzdžiukienė, R (2006)

III. RESULT AND DISCUSSION

3.1 Result of Analysis Stage

The analysis stage is the initial stage in developing the Android-based puzzle adventure media. At this stage, several activities were carried out, namely the analysis of the problems and needs of students and the analysis of the basic competence. The problem analysis was done to determine the main problems in the development of the Android-based puzzle adventure game media. In this stage, the researchers observe in general the problems that arise in the learning of accounting in the eleventh grade at SMK Negeri 1 Juwiring. The analysis of students' needs shows that the students need new innovations in accounting learning that can explain the content of the taxation material. The innovation the researcher offered is the Android-based puzzle adventure game media, where the

abstract taxation material can be explained by the components of the game, consisting of interactive media, images, animations and learning videos. The basic competency analysis determines the material developed that focuses on the basic competence of 3.5. Calculating and preparing standard income tax of article 21 and 3.6 Understanding and applying income tax calculation procedures of article 21.

3.2 Result of Design Stage

This stage is a systematic process that begins by compiling a flowchart and storyboard as a basis and an overview of the form, content, and appearance in developing an Android-based puzzle adventure media. In this stage, the supporting contents in the development of the Android-based puzzle adventure game media were collected. The following are the results of the flowchart and storyboard designs

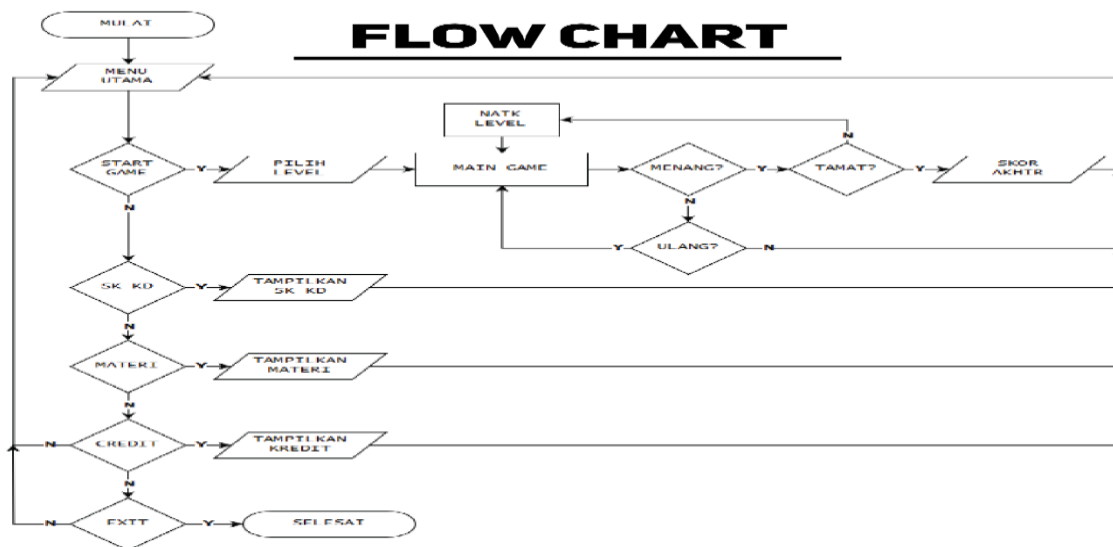


Figure 1. Flowchart

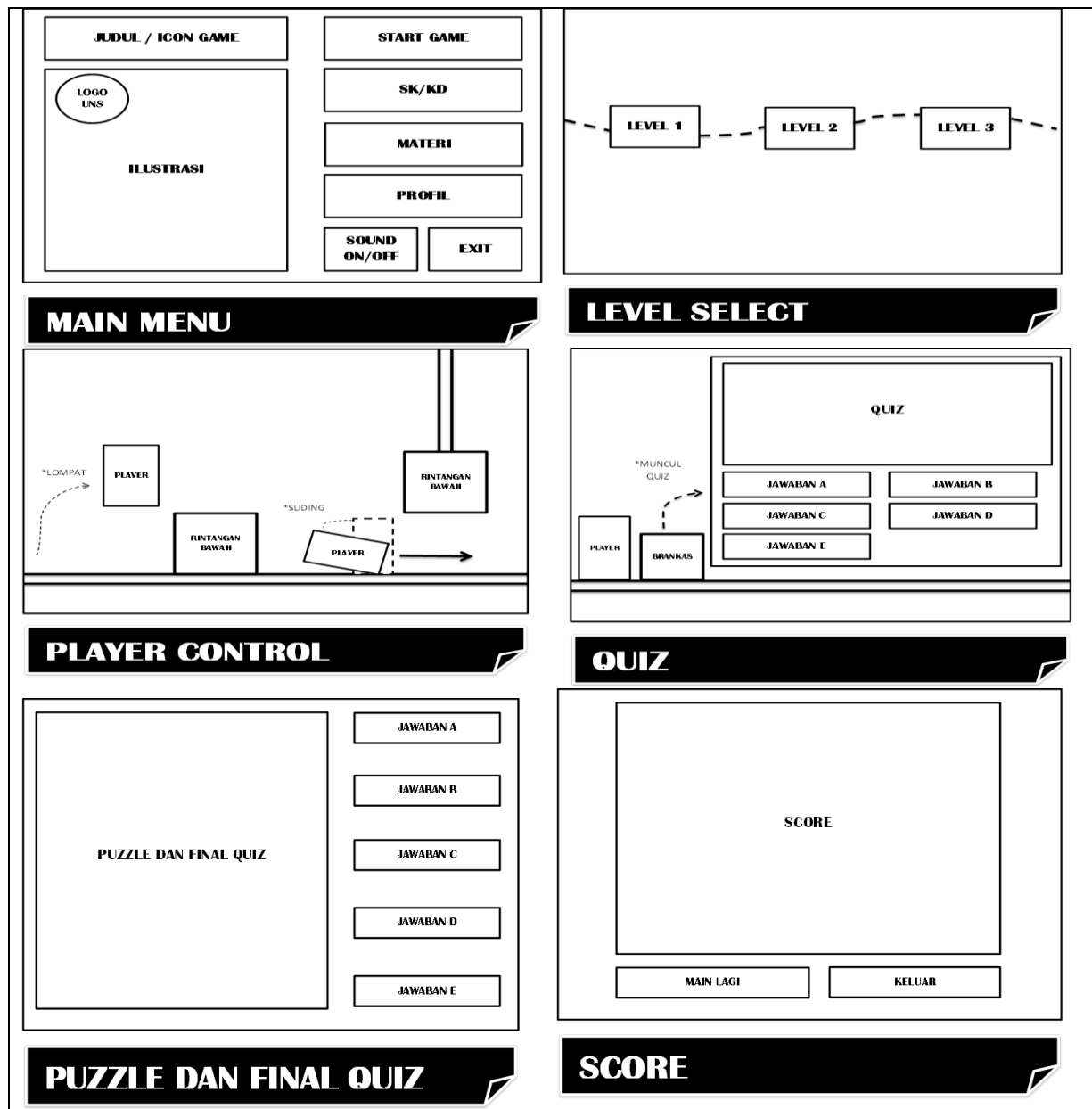


Table. 4. Result of Storyboard Design

3.3 Result of Development Stage

This is the stage of making an Android-based puzzle adventure game media, which is developed to load the opening page, BC (Basic Competency) 1 material page, Start Game page, Game Rules page, illustration of game storyline, level 1 of the game


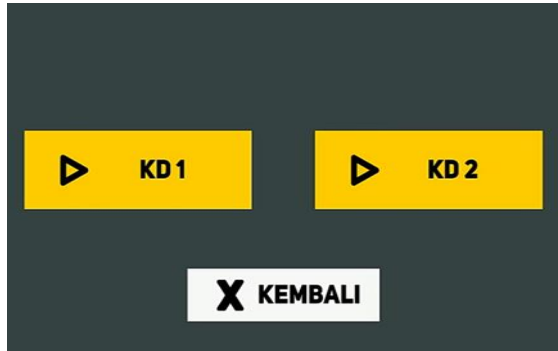
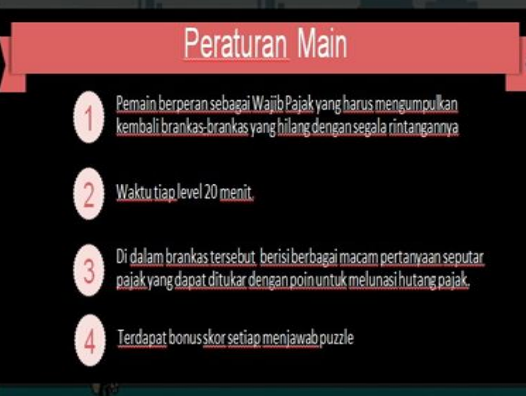
Appearance	Remark
 <p>Figure 1. Game cover, opening page containing the main menu and also a menu button that can be selected.</p>	 <p>Figure 2. Cover page of BC 1</p>
 <p>Figure 3. Start the game: containing the game with three levels. In this game, students can run adventure missions to pay off tax payable. At the end of each level, the player will also be given bonus questions in the form of puzzles.</p>	 <p>Figure 4. Game rules page</p>



Figure 5. Illustration of game storyline

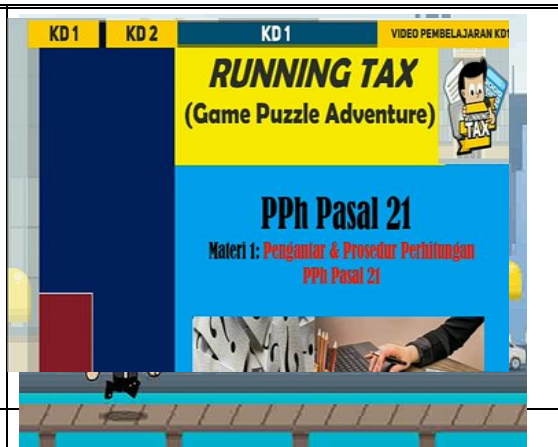


Figure 6. Game level 1



Figure 7. Quiz page



Figure 8. The screen after successfully answering the puzzle quiz

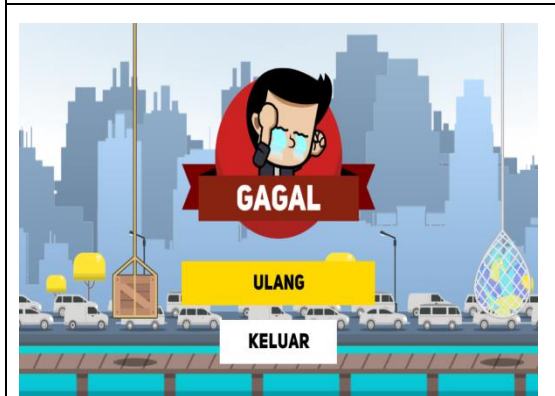


Figure 9. The screen when failed to answer the puzzle quiz



Figure 10. Tax payable status

page, and the quiz. The materials in this Android-based puzzle adventure game media have the characteristics and abstract explained with learning animations in order to train students' critical-thinking skills. The development results can be seen in the following Table 5.

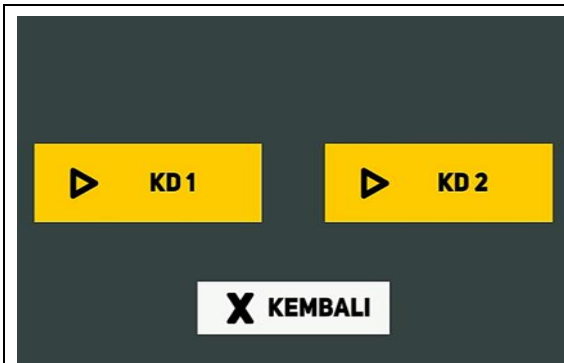


Figure 3. Start the game: containing the game with three levels. In this game, students can run adventure missions to pay off tax payable. At the end of each level, the player will also be given bonus questions in the form of puzzles.

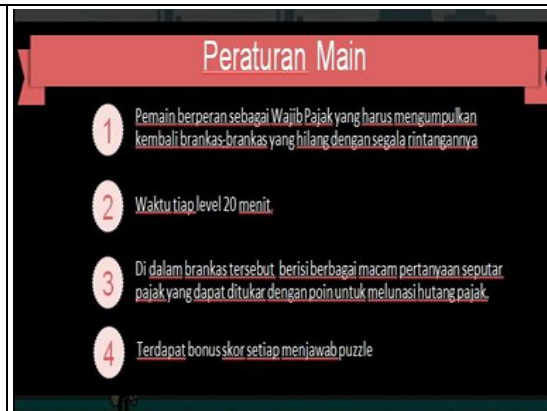


Figure 4. Game rules page



Figure 5. Illustration of game storyline



Figure 6. Game level 1

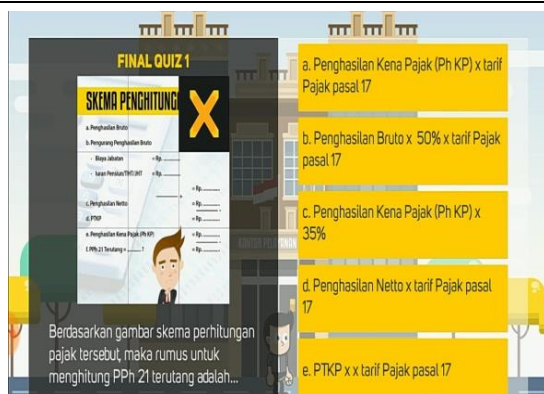


Figure 7. Quiz page



Figure 8. The screen after successfully answering the puzzle quiz

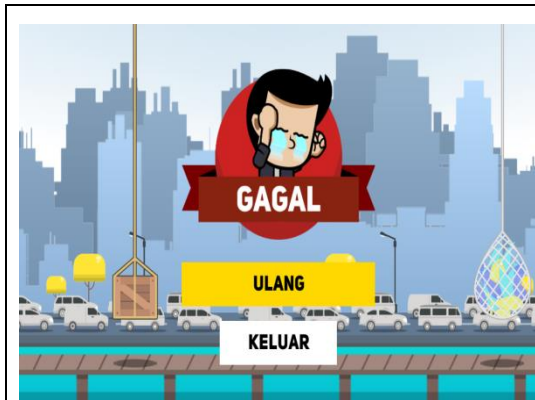


Figure 9. The screen when failed to answer the puzzle quiz



Figure 10. Tax payable status

3.3.1 Validation Result

The validation of the developed products in the form of an Android-based adventure puzzle game and critical thinking instruments is carried out by the experts who are competent in their fields. The results of expert validation obtained are listed in Table 6.

Table 6. Expert Validation Result

No.	Validator	Mean (%)	Criteria
1	Lesson Plan	80.12	Very Feasible
2	Theory	82.9	Very Feasible
3	Media	89.6	Very Feasible
4	Critical-Thinking Instrument	87.4	Very Feasible

Source: Expert validation result

Table 6 shows that the average percentage of validation/feasibility of the lesson plan is 80.12% with the very feasible criteria, the material feasibility 82.9% with the very feasible criteria, the feasibility of the media and critical-thinking instruments 89.6% and 87.4%, each, with the feasible criteria, so that the Android-based puzzle adventure media and the critical-thinking skill instrument can be implemented in learning.

3.4 Result of Implementation Stage

This is the stage of the implementation of the Android-based puzzle adventure game media on the eleventh-grade students of SMK Negeri 1 Juwiring with small-scale and large-scale trials.

3.4.1 Result of Small-Scale Trial

The small-scale trial of small and large groups was carried out to find out the practicality and readability of the developed product. This test was conducted by the teacher and students because both of them are the users of the Android-based puzzle adventure game developed. The results of the practicality test of the game media on the students and the teacher are listed in Table 7.

Table 7. Small-Scale Trial Result

Respondent	Mean (%)	Criteria
Teacher	84.2 %	Very Practical
Student	88.7%	Very Practical
Mean	86.45%	Very Practical

Source: the results of the questionnaire of the small-scale trial

3.4.2 Result of Large-Scale Trial

Based on data obtained from the posttest, it is known that the critical-thinking skills of students before and after being taught with the Android-based puzzle adventure game media are significantly different. The comparison of the pretest and posttest of the students' critical-thinking skills can be seen in Figure 2.

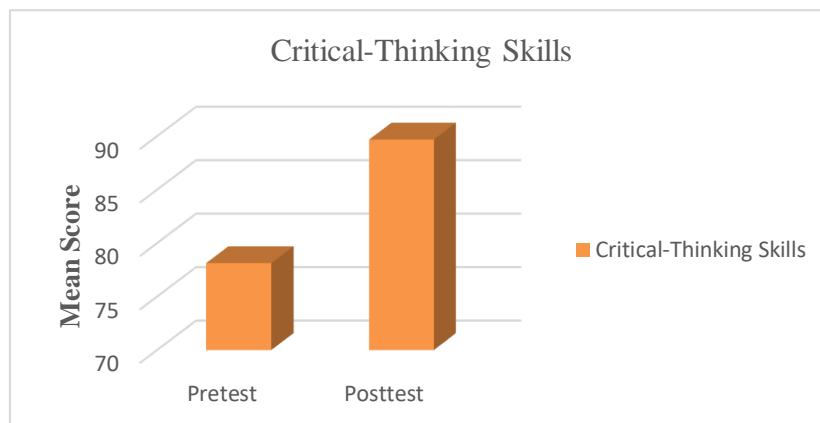


Figure 2. Average Scores of Pretest and Posttest

Based on Figure 1 above, it can be explained that learning with the puzzle-based adventure game media android has a positive effect on students with the acquisition of a posttest score of 89.68 higher than that of the pretest, 78.12. Thus, it can be concluded that the Android-based puzzle adventure game media has a very significant effect on improving students' critical-thinking skills. The students' critical-thinking skills after the implementation of the game are better than those before the implementation.

This is in line with the results of Chung & Ching's research (2013), which found that by combining mobile technology (smartphones) with games, we can improve academic abilities in students. In addition, the research conducted by Monkey Survey Intelligence on the users of mobile (Android) in the United States in July 2016 revealed that the game genres, puzzles and adventure, are included in the top 5 most popular game rankings. Thus, the adventure puzzle game is very suitable for use by teenage users because it matches them who like the game that is challenging and full of adventures. The results of this study research prove that games with puzzle and adventure genres are favored by game users, especially teenage users like school students.

3.5. Result of Evaluation Stage

After going through the previous stages, the development of this Android-based adventure puzzle game learning media gets some improvements. The evaluation of the Android-based puzzle adventure game media is based on the assessment sheet, inputs and suggestions from expert validators and test subjects as users. The evaluation was carried out in two parts, namely formative and summative evaluations. The formative evaluation was carried out at each stage of the development of ADDIE. For the summative evaluation, it consists of the final evaluation of the whole ADDIE process.

IV. CONCLUSION

The research and development of the Android-based puzzle adventure learning media is an alternative answer to the use of innovative learning media amid the era of digital technology as today. The teacher as a facilitator and mediator must always strive to develop learning, especially through the use of learning instruments (media) that are relevant and in accordance with the demands of the times. Therefore, the teacher should always be motivated to become an innovative teacher, especially in creating the learning media that meets the needs of students.

V. REFERENCE

- Aizikovitsh-Udi, Einav., & Cheng, D. (2015) Developing Critical Thinking Skills from Dispositions to Abilities: Mathematics Education from Early Childhood to High School. *Creative Education*, 6, 455-462 <http://dx.doi.org/10.4236/ce.2015.64045>
- Arsyad, A. (2013) *Learning Media*. Jakarta: Raja Grafindo Persada.
- Binkley, M., et al. (2012) Defining twenty-first century skills, in P. Griffin, B. McGaw, & E. Care (Eds). *Assessment and Teaching of 21st Century Skills*. Dordrecht. Springer.
- Chung, H. S., & Ching, H.,C. (2013) A Mobile Game-based Insect Learning System for Improving the Learning Achievements. *Procedia - Social and Behavioral Sciences*, 103: 42-50. doi: 10.1016/j.sbspro.2013.10.305. Accessed from: <https://doi.org/10.1016/j.sbspro.2013.10.305>
- Dick, W., Carey, L., & Carey, J, O.(2009). *The Systematic Design of Instruction*. University of South Florida: Emeritus.
- Ernawati, I., and Sukardiyono, T. 2017. Uji Kelayakan Media Pembelajaran Interaktif Pada Mata Pelajaran Adiministrasi Server. Universitas Negeri Yogyakarta. *Jurnal Elinvo (Electronics, Informatics, and Vocational Education)*, Volume 2, Number 2

Klimovienė, G., Urbonienė, J., & Barzdžiukienė, R. (2006) Developing critical thinking through cooperative learning. *Kalbų studijos*, (9), 77-84.

Ministry of Education and Culture. (2016) Permendikbud Number 21 of 2016 concerning Educational Assessment Standards. Accessed on October 20, 2018 from <http://www.bspn-indonesia.org/uploads2009/06>.

Sukmadinata. 2016. *Metode Penelitian Pendidikan*. Bandung: PT Remaja Rosdakarya

Widiara I Ketut. (2018) Blended Learning Sebagai Alternatif Pembelajaran di Era Digital. *Jurnal Purwadita*. Vol.2. No. 2, September 2018.