Edu Komputika 9 (2) (2022)

Edu Komputika Journal

http://journal.unnes.ac.id/sju/index.php/edukom

Development of Southeast Asian Geographic Introduction Education Game for Elementary School

Mohammad Faqih Eza 'Ammar, Diah Priyawati✉, Fatah Yasin Al Isyadi, dan Endang Wahyu Pamungkas

[1]Jurusan Teknik Informatika, Fakultas Komunikasi dan Informatika, Universitas Muhammadiyah Surakarta

Info Artikel

Sejarah Artikel:
Diterima: November 2022
Direvisi: Januari 2023
Disetujui: Januari 2023

Keywords:
Construct 2, Education Game, SDLC, Southeast Asian Geography, Waterfall

Abstrak

Pengenalan peta Asia Tenggara merupakan salah satu pokok bahasan Ilmu Pengetahuan Sosial di SD. Dengan metode pembelajaran manual konvensional, siswa mudah bosan dan menyulitkan siswa untuk tertarik dengan hal tersebut. Permainan edukasi dapat dijadikan alternatif terhadap metode pembelajaran konvensional untuk meningkatkan minat belajar siswa. Keuntungan dari permainan edukatif dibandingkan dengan metode pembelajaran tradisional adalah memiliki lebih banyak visualisasi dan interaktivitas. Pengembangan game edukasi pengenalan geografis Asia Tenggara yang disebut 'Eksplorasi ASEAN' dilakukan dengan menggunakan metode SDLC dari Royce dengan model waterfall. Permainan ini diharapkan mampu membantu siswa dalam belajar tentang geografi Asia Tenggara. Uji coba permainan dilakukan dengan purposive sampling di "SD Muhammadiyah 2 Surakarta" melibatkan tiga guru kelas enam dan 20 siswa kelas enam dengan kuesioner sebagai metode pengumpulan data. Berdasarkan pengujian Blackbox dapat disimpulkan bahwa game berjalan seperti yang diharapkan pada smartphone dan komputer pribadi. Pada penelitian ini, tes pada game dari validasi ahli material berada pada kategori 'Sangat Layak'. Adapun hasil tes SUS yang dilakukan oleh siswa, sistemnya masuk kategori 'Acceptable'. Hasil tes menyimpulkan bahwa permainan edukasi telah memenuhi persyaratan materi dan layak dijadikan sebagai bagian dari media pembelajaran.

Abstract

Southeast Asian map introduction is one of the subject matters of Ilmu Pengetahuan Sosial in elementary school. With the conventional manual learning method, students are easily bored and makes it difficult for students to be interested in the matter. Education game can be used as an alternative towards the conventional learning method to increase the student's interest in learning. The advantage of educational games compared to traditional learning method is that it has more visualization and interactivity. The development of Southeast Asian geographic introduction education game called 'Eksplorasi ASEAN' was made using Royce's SDLC method of waterfall model. The game is hoped to be able to assist students in learning about southeast Asian geography. The game trial was conducted with purposive sampling at "SD Muhammadiyah 2 Surakarta" involving three sixth grade teachers and 20 sixth grade students with questionnaires as data collection method. Based on Blackbox testing it can be concluded that the game is running as expected on smartphones and personal computers. In this study, the test on the game from material expert validation was in 'Very Worthy' category. As for the results of SUS test conducted by the students, the system was in 'Acceptable' category. The test results concluded that the education game has met the material requirements and appropriate to be use as part of learning media.

✉ Alamat korespondensi:
Teknik Informatika, Fakultas Komunikasi dan Informatika, UMS
Jl. A. Yani Tromol Pos I Pabelan Surakarta, 57102
E-mail: diah.priyawati@ums.ac.id

ISSN 2252-6811
E-ISSN 2599-297X

INTRODUCTION

Currently, the current education system in Indonesia is required to use the 2013 curriculum. The 2013 curriculum saw the use of integrative thematic learning where students are expected to learn creatively, critically and have an easier time understanding the subject matter. 2013 curriculum also encourage teachers to make learning experience more fun and give students room and time to develop various attitudes, knowledge, and skills (Rokhimawan et al., 2022).

Map introduction is one of the subject matters in Indonesian social science subject or Ilmu Pengetahuan Sosial (IPS) for elementary school students which contains maps, definition, history, and profile of Southeast Asian countries. The problem arise when the current way of teaching students with the introduction of Southeast Asian countries still rely on the use of traditional text books which makes it difficult for students to be interested in the matter (Sanjaya, 2018).

Video game is an electronic based entertainment media that were made to be as interesting as possible for the players to get a satisfactory impulse and is considered one of a learning media (Fathoni et al., 2018; Wafda Adita Rifai, 2019). The use of video games as an educational tool has been going on for at least a decade and has been proved many times to be effective for millennials to use as they are 2 slow to respond to the traditional learning methods (Almeida, 2012).

With the problem apparent, emerged an idea of creating an Edu-game to be used to help elementary school student to learn Southeast Asian map interactively. The game will be made with interactive map in mind where students can see each nations profile by interacting the interactive map. The game will also include a trivia quiz to test the student's knowledge on Southeast Asian maps. The game will be made with HTML5 based game creation software Construct 2 on web platform and the UI or User Interface will be made with sprite making software Aseprite. The game making process will use Royce's Software Development Life Cycle (SDLC) waterfall model with the reason of it being the most popular and straightforward approach of software development model (Ahmad et al. 2017). And this model is suitable for small projects with clear requirements. This reinforces the concepts of define before design and design before code (Madhukar Salve, Neha Samreen, and Khatri-Valmik 2018).

METHOD

The method used to conduct the research on making the Edu-game is Royce's Software Development Life Cycle (SDLC) Waterfall Model, as seen on Figure 1.

Figure 1. Software Development Life Cycle (SDLC) waterfall model

A. Requirement Analysis

An analysis to determine the necessary hardware, software, and data to support the design and Edu-game making process that will be appropriate to users. Separated as functional and non-functional requirements.

Functional requirements were collected through reference books for elementary school level pursuit packages with the theme 'Serumpun Asean' which contains the geographical profiles of various Southeast Asian countries that can be used as references for the contents of this Edu-game as it follows the 2013 curriculum.

From the data obtained, it can be concluded the requirements necessary for the game are map of the whole region separated by borders for each nation, lists of ASEAN nations, profile for each nation(National Flag, National Crest, National language, Date of independence, Capital city, Government, Currency, Landmarks) and simple trivia quizzes (Blind maps and Questions).

For the non-functional requirements, it had been analyzed and the system must be able to run on minimum of 2Ghz CPU, 512MB of RAM, Windows 7 Operating system, Internet browser with HTML5 Capability and internet connection.

B. Design

Designing the game involve creating an Activity Diagram and Storyboard with the already determined perquisites from the requirement analysis.

Activity Diagram concept of activity of a user to the software can be described in an Activity Diagram. The Activity Diagram can be seen on Figure 2.

Storyboard is an overview or concept of the plot of the educational game. It is used to help giving an overview of how the game going to look from the UI design standpoint. The game will be made in 4:3 ratio to prevent information spread all over the place (Deng et al., 2008). Story explanation can be seen in Figure 3 to 7.

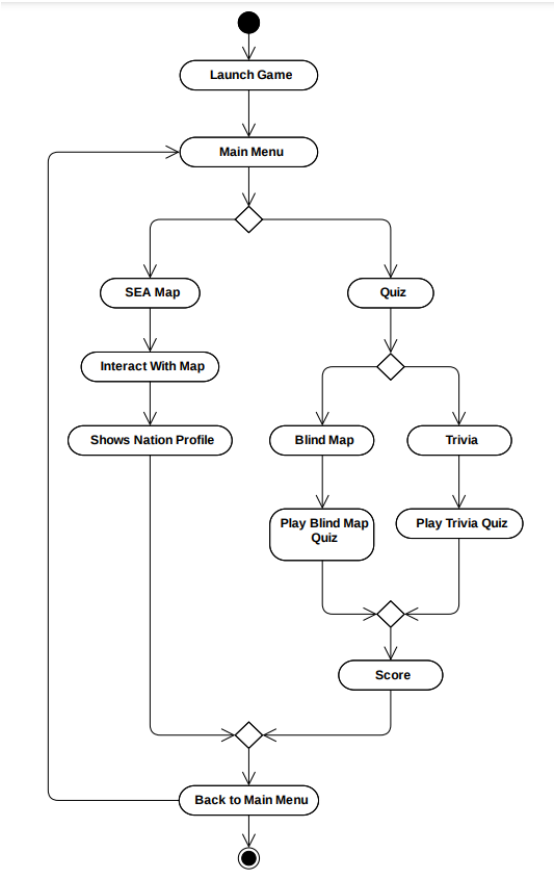

Figure 2. Activity diagram

Storyboard of main menu is the main page of the game shown in Figure 3. It's the first page the players see when they first enter the game.

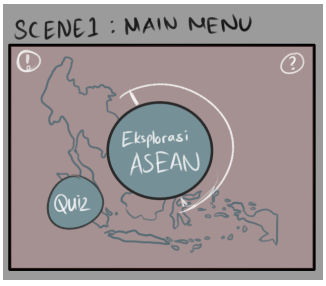

Figure 3. Storyboard of main menu

The second scene shows the 'explore ASEAN' page where players are shown a map of Southeast Asia shown Figure 4. The map is interactive: each country shown can be clicked to show an extended of information regarding selected country. Quiz menu allows the player to select between which kind of quiz they want to play shown in Figure 5.

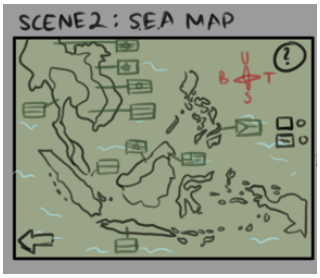

Figure 4. Storyboard of explore map

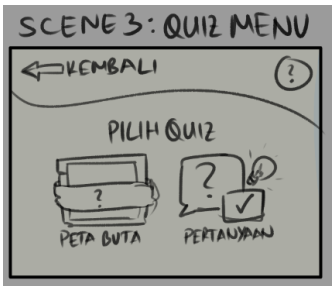

Figure 5. Storyboard of quiz menu

One of the two available quiz type is blind map shown in Figure 6. The blind map gives players a chance to recognize Southeast Asian country by its visual geographical characteristic. The player will be given a map of a country and asked to guess which country it is.

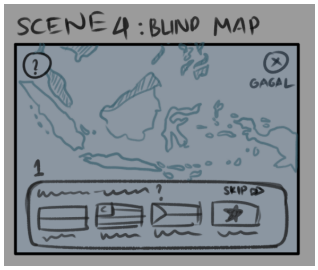

Figure 6. Storyboard of blind map scene

The second type of quiz features trivia questions related to information given by the 'Explore Map'. The players will be given questions with multiple choice answers shown in Figure 7.

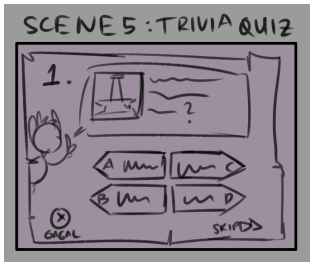

Figure 7. Storyboard of trivia questions

C. Development

Music and sounds can create the atmosphere and ambiance that is going to set the mood for players (Lear et al., 2021). Sounds and music were obtained from loyalty-free sources on the internet. The sounds then will be edited using sound editing software Audacity. The creation of the game itself used Construct 2 game making software. Construct 2 allows the creator to make games with layout and code blocks.

1. Creating the visual assets for the game.

The creation of assets to be used in the education game will be made by the author using software called Aseprite. Aseprite is a software to create pixel art to be used as game assets. The finished assets then will be exported to be used in Construct 2 game making software. All of the in-game asset will be made manually except for Country Emblems, and Photos of landmarks which are going to be taken from the internet

2. Audio Assets

Audio assets that are going to be used in the game will be taken from the internet. The audio assets of the consists of sound effect and music which both are going to be taken from the internet then will edited using Audacity to convert the audio files into the supported audio extensions for Construct 2 game making software.

3. Game Development

After both assets were completed, the process of developing the game began. The development of the game uses Construct 2 game making software. The software uses block-code as well as layouts to create a fully functional game.

D. Testing

Once the application or game is completed, tests were performed using the Blackbox test on several application systems such as graphical interface, sound, and controls in the software or game to find out if it is in accordance with the specified function or not (Wafda Adita Rifai, 2019). Testing is carried out by creating a test table that contains the part being tested and the result be put into the table to be assessed. Testing to users is carried out in two steps, namely validation by material expert and System Usability Scale (SUS) Test.

E. Implementation and Evaluation

The last step of the development life cycle. This step saw the implementation of the Education Game. The implementation will be conducted on SD Muhammadiyah 2 Surakarta. First, the game will go through Material Experts for validation test. The population of this validation test is all of 6th grade teachers with the total of 3 teachers. This test will be conducted by asking the teachers to play the Edu-game then they will be given questioners to fill as well as their approval for the Edu-game. The final test will be conducted towards students of SD Muhammadiyah Surakarta. The students will be asked to try out the Edu-game and fill out google form. The sampling technique used is a purposive sampling with inclusion criteria of 6th grade students. A modified System Usability Scale (SUS) that were suited for children will be used to test the students and the System Usability Scale SUS questionnaire uses a 5-point Likert scale to assess the level of conformity with ten statements regarding usefulness and learning ability (Putnam et al., 2020). The results of the questionaries can be used to evaluate the final product of the game.

RESULTS AND DISCUSSIONS

The development of the game resulted in the creation of 'Eksplorasi ASEAN' education game that was hosted on 'itch.io' domain and can be accessed via internet browser by practically anyone, this game would be used to help students learn South East Asian Countries easier due to the Interactive nature of the game.

A. End Results of The Education Game

1. Main Menu

The first thing that the players will see shown in Figure 8. In the main menu, it consists of several buttons which are 'eksplorasi asean' button that will take players to the interactive maps, 'quiz' button that will take players to quiz selection menu, settings button, about button, and instruction button.

Figure 8. Main menu

2. Interactive Map 'Eksplorasi ASEAN'

After players clicked 'eksplorasi asean' button from the main menu, players will be taken to the interactive map shown in Figure 9. Players can click at any countries within the map to display the information about that country. There are also three buttons which are back button, instruction button and toggle flag button.

Figure 9. Interactive map

3. ASEAN countries details

When players clicked one of the countries from the interactive map, some panels will pop up. Inside the panels are information about a country that had been clicked by the player as seen in Figure 10.

Figure 10. Country details

4. Quiz Menu

The quiz menu is where players will go after they pressed the quiz button from the main menu as seen in Figure 11. Here, players are given options to which kind of quiz they want to do. There are several buttons here such as back button, 'Peta Buta' button that will take players to the blind map quiz and 'Pertanyaan' button that will take players to the trivia quiz.

Figure 11. Quiz menu

5. Quizzes

The quizzes consist of Blind Map Quiz and Trivia Quiz. After player clicked on either 'Peta Buta' or 'Pertanyaan' button from the Quiz Menu, players will be taken to the selected quiz type. The quizzes consists of two layouts or panels; Instruction layout, Quiz layout.

Inside instruction layout, an instruction will be shown to players on how to play the quiz. As well as a start button to start the quiz as seen in Figure 12.

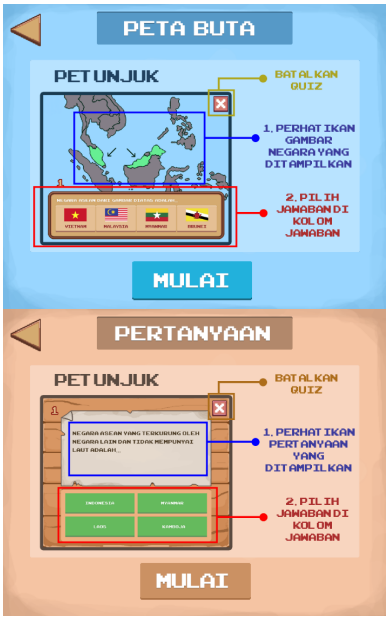

Figure 12. Instruction layout

The quiz layout will show up after players clicked the start button on the instruction layout as seen in Figure 13. The quiz is a set of ten

multiple-choices questions. For the Blind Map quiz, the players are given sets of geographical maps of an ASEAN country and for the Trivia quiz, players are given a set of ten text questions that has been randomized from 34 questions.

The players are expected to answer the question by clicking one of the four buttons containing the answer. If the selected answer is wrong then a popup will appear saying that their answer is wrong and vice versa. There is also a cancel button for the players to cancel the quiz and return to the instruction panel. After players answered the ten questions, a score will appear showing how many answers they got right.

Figure 13. Quiz layout

B. Blackbox Testing

Blackbox testing has the purpose of knowing whether the functions of the features in the game are running as expected (Rifaldi et al., 2021). Table 1 shows the results of black box testing.

Table 1. Blackbox Testing Results

Layout	Action	Output	State
Main Menu	Click interactive map button	Go to Interactive map Interaction layout	Valid
	Click quiz button	Go to Quiz menu Instruction layout	Valid
	Click instruction button	Show instruction panel	Valid
	Click about button	Show about panel	Valid
	Click settings button	Show settings panel	Valid
Settings Panel	Click 'Suara' button	Mute sound effect	Valid
	Click 'Music' button	Mute music	Valid
	Click close button	Close settings panel	Valid
About Panel	Next page button	Go to next page of the about page	Valid
	Previous page button	Go to previous page of the about page	Valid
	Click close button	Close about panel	Valid
Main Menu Instruc-tion Panel	Click close button	Close instruction panel	Valid
Interac-tive Map	Click instruction button	Show instruction panel	Valid
	Click any country inside the interactive map	Show profile of the selected country	Valid
	Click the middle panel of the country profile	Show more detail inside the profile of the selected country	Valid
	Click close button on the country profile panel	Close profile panel	Valid
Interac-tive Map Instruc-tion Panel	Click next button on the instruction panel	Show next page of the instruction	Valid
	Click previous button on the instruction panel	Show previous page of the instruction	Valid
	Click close button	Close instruction panel	Valid

Layout	Action	Output	State
Quiz Menu	Click 'Peta Buta' button	Go to Blind Map quiz	Valid
	Click 'Pertanyaan' button	Go to Trivia quiz	Valid
	Click back button	Back to main menu	Valid
Blind Map Quiz Instruction	Click 'Mulai' button	Start the Blind Map quiz	Valid
	Click close button	Close instruction panel	Valid
Blind Map Quiz	Click one of the answers	Selected answer checked and show whether the selected answer Correct or False	Valid
	Click the cancel button	Show cancel confirmation panel to return to Instruction layout	Valid
	Click yes button on cancel confirmation panel	Go to Blind Map instruction layout	Valid
	Click no button on cancel confirmation panel	Close the cancel confirmation panel	Valid
	Question finished on the 10th question	Show score panel and show how many correct answers	Valid
Blind Map Score Panel	Restart quiz button	Go to Blind Map instruction layout	Valid
	Home button	Go to Main Menu	Valid

C. Validation by Material Experts

Validation by material experts was done by three 6th grade teachers of SD Muhammadiyah 2 Surakarta. The questionnaires given to the material experts consist of ten modified question statement from (Megayanti, 2021) can be seen on Table 2.

Table 2. Material Expert Questionnaire Statements

Designation	Statements
P1	The suitability of the questions presented in the learning educational game with basic competencies, indicators and learning objectives
P2	Suitability of presentation with the media used
P3	The image used is according to the material
P4	Accurate use of terms and symbols
P5	Ease of material and questions to reach
P6	The level of difficulty of the questions is in accordance with the existing material
P7	Variation of questions
P8	Clarity of instructions for use in Educational Games
P9	Questions can be re-reviewed
P10	The content of educational games as a whole can motivate students in learning

The respondents were asked to give their responses on the statements with the respond in the form of scores within range of 1 to 4 with criteria of:

a. 1 = Very Poor
b. 2 = Poor
c. 3 = Good
d. 4 = Very Good

The three respondents are given designations of R1, R2, and R3. The data derived from material expert questionnaires were analyzed using the percentage descriptive formula adapted from (Yudianto et al. 2019) as in (1).

$$P = \frac{S}{N} x100\% \quad (1)$$

Keterangan:
P = Percentage
S = Total Score
N = Maximum Score

The table conversion for the result of the formula above were based on (Yudianto et al. 2019) can be seen on Table 3.

Tabel 3. Material Expert Data Conversion

Percentage (%)	Category
85 – 100	Very Worthy
69 – 84	Worthy
53 – 68	Quite Worthy

The results of the validation results by material experts as shown in Figure 14.

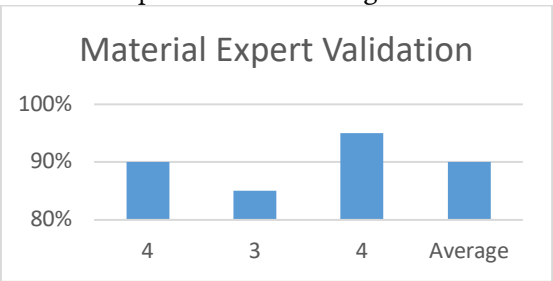

Figure 14. Material experts validation results

Based on the results of material experts shown in Figure 14, It shows the overall average assessment carried out by the three material experts obtained a value of 90% which is categorized as 'Very Worthy' to use for learning media.

D. System Usabilit Scale (SUS) Test

The SUS test allows us to evaluate a system efficiently and give the system a clear and reasonably precise score. In this case the system is 'Eksplorasi ASEAN' Edu-game. The SUS test consists of ten item questionnaires with Likert scale of five responses for each question ranging from 'Strongly Agree' to 'Strongly Disagree'. In this research the scale of the responses had been converted into numbers or score with the conversion seen on Table 4.

Table 4. Likert Scale Data Conversion

Category	Scores
Strongly Agree	5
Agree	4
Neutral	3
Disagree	2
Strongly Disagree	1

The questions statement for this SUS test were based on a modified SUS test questionnaires optimized for children under the age of 12 by (Putnam et al., 2020). The questionnaires statements can be seen on Table 5.

Table 5. Modified SUS Test Statement for Children

Designation	Statements
P1	I feel like I will play this Educational Game often
P2	I find this Educational Game confusing
P3	I find this Educational Game easy to play
P4	I need help from an expert to continue playing this Educational Game
P5	I know what to do next while playing this Educational Game
P6	I feel something is not making sense in this Educational Game
P7	I think my friends can learn to play this Educational Game quickly
P8	I have to do weird things to play this Educational Game
P9	I feel confident while playing this Educational Game
P10	I have to learn many things before I can play this Educational Game (Not related to question material)

The questionnaires were given as google-form link that was entrusted by the researcher to the teacher to be conveyed to students via group chat. Inside the google-form were web-link towards the Edu-game as well as the ten questionnaire statements. The respondents consisted of 20 sixth grade students of SD Muhammadiyah 2 Surakarta who tried the game from their home. These respondents will be given designations of 'R1', 'R2', 'R3', 'R4' and so on up to 'R20'.

The calculation of the SUS score will be determined looking at a respondent's answers and the corresponding number score for each response, then the overall SUS score can be calculated by using the following framework (Smyk, 2020). First, add up the total score for all odd-numbered questions, then subtract 5 from the total to get (X). Second, add up the total score for all even-numbered questions, then subtract that total from 25 to get (Y). Finally, add up the total score of the new values (X+Y) and multiply by 2.5.

By following the scoring calculation method above, the result of an SUS score of 0 to 100 can be seen. Then we compare the resulted score with the acceptability score range shown on SUS data result conversion on Table 6 by (Smyk, 2020).

Table 6. SUS Acceptability data Conversion

Score	Statements
0	Not Acceptable
10	
20	
30	
40	
50	Marginal
60	
70	
80	Acceptable
90	
100	

The results of SUS score from 20 sixth grade students and the total average can be seen on Figure 15.

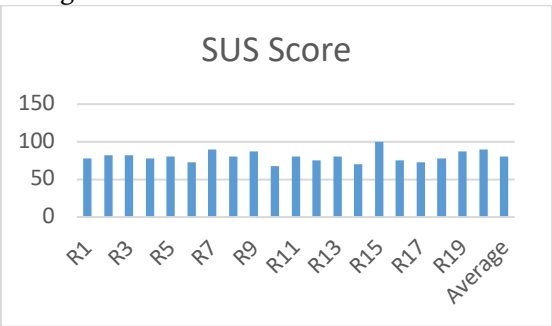

Figure 15. SUS scores

Based on the result taken from the questionnaires, it can be seen that the average score of 20 students was 80.25 which based on the acceptability data conversion from Table 6 is considered as acceptable.

CONCLUSION

Based on the conducted research, it can be concluded that the author had made a Southeast Asian Geographic Introduction Education Game for Elementary School called 'Eksplorasi ASEAN' that can be accessed via web-browser on Personal Computer or Smartphones. In this study the author concluded that based on Blackbox testing on 'Eksplorasi ASEAN' education game, the game ran as expected without any problem. Furthermore, with the material expert validation average score 90% as well as average SUS test score of 80.25 or 'Acceptable' shows that the education game has meet the material requirements and fit for use as learning media.

REFERENCES

Almeida, L. C. (2012). The Effect of an Educational Computer Game for the Achievement of Factual and Simple Conceptual Knowledge Acquisition. *Education Research International*, *2012*, 1–5. https://doi.org/10.1155/2012/961279

Deng, Z., Guo, Y., Gu, X., Chen, Z., Chen, Q., & Wang, C. (2008). A comparative review of aspect ratio conversion methods. *Proceedings - 2008 International Conference on Multimedia and Ubiquitous Engineering, MUE 2008*, 114–117. https://doi.org/10.1109/MUE.2008.112

Fathoni, K., Utomo, A. B., Hangga, A., & Pamungkas, O. P. (2018). Pengembangan Media Pembelajaran Al-Qur'an Berbasis Android di TPQ Al-Falah Semarang. *Edu Komputika Journal*, *5*(2), 110–116.

Lear, J., Mcclatchey, R., & Scarle, S. (2021). *The Video Game Asset Pipeline A Pattern Approach to Visualization*.

Megayanti, N. L. (2021). PENGEMBANGAN MEDIA PEMBELAJARAN BERBASIS GAME EDUKASI LABIRIN MATEMATIKA PADA MATERI OPERASI PECAHAN SMP KELAS VII. *Journal of Mathematical Behavior*, *42*, 20–32. https://doi.org/10.1016/J.JMATHB.2016.02.001

Putnam, C., Puthenmadom, M., Cuerdo, M. A., Wang, W., & Paul, N. (2020). Adaptation of the system usability scale for user testing with children. *Conference on Human Factors in Computing Systems - Proceedings*, 1–7. https://doi.org/10.1145/3334480.3382840

Rifaldi, A., Kurniawan, P., Mulwinda, A., & korespondensi, A. (2021). Edu Komputika Journal Lestari Media Pembelajaran Interaktif Tumbuhan. *Edu Komputika*, *8*(1), 1–12. http://journal.unnes.ac.id/sju/index.php/edukom

Rokhimawan, M. A., Badawi, J. A., & Aisyah, S. (2022). *EDUKATIF : JURNAL ILMU* PENDIDIKAN *Model-Model Pembelajaran Kurikulum 2013 pada Tingkat SD / MI*. *4*(2), 2077–2086.

Sanjaya, M. H. (2018). *PENGENALAN GAME EDUKASI PETA ASIA TENGGARA MENGGUNAKAN CONSTRUCT 2*. Perpustakaan Universitas Teknokrat Indonesia.

Smyk, A. (2020). *The System Usability Scale & How it's Used in UX | Adobe XD Ideas*.

Wafda Adita Rifai. (2019). Pengembangan Game Edukasi Lingkungan Berbasis Android. *Fitzpatrick's Dermatology*, *53*(9), 1779–1791.