Script knowledge representation in game designing for instructional media

D D S Fatimah*
Department of Informatics, Sekolah Tinggi Teknologi Garut, Jl. Mayor Syamsu No. 1, Garut, 44151, Indonesia
*dini.dsf@sttgarut.ac.id

Abstract. Script is one of knowledge representation in artificial intelligence. Script consists of four parts: input conditions, tracks, properties, roles, scenes, and results. Script can be used to model artificial intelligence knowledge like in game designing. The use of script in game designing is relatively rare despite the fact that script representation provides comprehensive components to display a game. This research is aimed to use Script technique in game designing. To this end, a Multimedia Design Method was used. This method consisted of several steps. The first step was concept. The second was designing script, storyboard, and navigation structure. The third was material collecting. The fourth was assembly. The fifth was testing. At the testing stage, the application designer and users carried out alpha and beta testings. The sixth was distribution. At this last step, the application was stored into a media storage. The designing resulted in game software for instructional media for elementary school students. This research came into a conclusion that Script knowledge representation could model sufficient game design components.

1. Introduction
Education nowadays utilizes various technological devices to facilitate effective and efficient instructions. The use of technology is one of important factors in improving the quality of life [1], including in education. One of technology uses in education is Computer-Aided Instruction, which utilizes multimedia products. Multimedia is a digital product that represents and combines text, sounds, pictures, animation, audio, and videos and can be used as a tool and link so that a user can navigate, interact, work, and communicate [2]. In education, multimedia can be used as instructional media or personal learning media [3] [4]. The use of multimedia for instructions has been proven to create fun learning environments [5] [6], improve learning motivation [7], enhance learning effectiveness [8] [9], enhance understanding [10], promote student-centered instruction [2], and become an efficient investment of learning aid [11].

One of information-technology based multimedia products is a game. Children and teens love games. Therefore, instructional materials packaged in the form of digital game are expected to promote learning enthusiasm and improve learning outcomes. History is one elementary school subjects, which demands children to get to know national heroes [12]. In an effort to improve efficient and effective instruction, in this study an instructional game was designed using Script knowledge representation.

The game is a national hero picture puzzle that can be solved to display correct a national hero picture. Game materials in artificial intelligence terminology can be categorized as knowledge [13].
Knowledge can be represented in the form of semantic networks, logics, tree diagrams, frames, scripts, and production systems. Knowledge representation is a way to represent acquired knowledge in a particular scheme/diagram to tell particular knowledge from other knowledge and can be used to test the truth of its reasonings.

The purpose of designing was to develop an interactive instructional media for elementary school students that contained instructional materials about Indonesia’s freedom fighters. The instructional aid in the form of a game is expected to make students fond of history instructional materials and help achieve the instructional objectives efficiently [14] [15] [16].

2. Methodology
Game design method using multimedia development method, but in this research is limited to the concept and design stage only. [12] The concept stage is the first stage to determine the purpose of making the game, who game users, and analyze the needs of making puzzle game recognize the hero of Indonesian independence. The design stage is limited to design knowledge for games. Design knowledge using Script knowledge representation techniques. The script was originally used to set the conceptual structure of a knowledge. The script then develops into a representation of knowledge to describe the sequence of events [17].

As a knowledge representation technique to facilitate understanding about the sequence of events in a game, Script consists of: (1) input conditions, which refer to particular conditions to be met before running a game, (2) tracks, which refer to variations in a game like levels, times, and places that support the game themes, (3) properties, which contains supporting objects to be used in the game, (4) roles, which refers to roles in the game like an independence hero whose picture is used in the puzzle, (5) scenes, which refer to scenes played in the game from the moment a user logs in until the game is over, and (6) results, which refer to the feelings of users after playing the game [13].

3. Result and discussion
The concept of game development includes the purpose of making the game, who game users, as well as the results of the needs analysis of game creation. [5] The purpose of making a puzzle game is to facilitate students to absorb learning materials of Indonesian history, especially to recognize the heroes of Indonesian independence. This game is intended for elementary school students, teachers, and observers of Indonesian history education. The results of game game needs analysis indicate the need for game materials including pictures of heroes and their roles in the era of independence covering before, during independence, and thereafter (to maintain independence). Other requirements include hardware and software that are of sufficient specification for the creation of multimedia applications. The software used to design the game was application developers and audio and picture processors [18]. The puzzle game knowledge was designed using Script as illustrated in Figure 1. Script is a representation of knowledge that describes human activities in society and between humans and the environment [19]. Script for this game used knowledge of Indonesia history about events just before the independence, during the proclamation of independence, and when defending the independence. Each of historical events was represented in hero pictures that became the puzzle. The three eras in the course book is discussed in Chapters I, II, and III. In the game, these became Tracks I, II, and III respectively. Every track had their respective properties (prop), roles, scenes, and results.
Figure 1. Script design for puzzle game of Indonesian independence heroes.

Figure 1 shows the design of the script in question, here is shown the script for the puzzle game consists of input conditions, tracks, prop, roles, scenes, and results. The input condition is a prerequisite for running this application by pressing the 'start' button so that it displays the Chapter I, Chapter II, and Chapter III options menu. Track is a variation of puzzle game, in this game there are three choices in the form of images of Chapter I, Chapter II, and Chapter III. Prop is a game support equipment consisting of music, background images, buttons to start, randomize images, repeat, close, etc. Roles is a role in running game that is game player.

Scenes are in-game scenes, a sequence of game views from start to finish. The sequence of the Puzzle Games scene is as follows:

Scene1: Displays the whole picture as shown in Figure 2. Scene2: Images are scrambled, and the user must rearrange the image pieces so that the image back whole. Scene3: Images are returned to full. Scene4: Displays the game's final page.

Results, is the result of performing the entire stage of the game if it has been played by the user. These results can describe a user's feelings after playing a game, whether happy, disappointed, or rewarded. Implementation of the design results can use a sad, disappointed, joyful, and appreciative simulation with a trophy picture, or an encouraging greeting [18].

Figure 2. Unimpaired puzzle game display.
Roles refer to pictures of heroes used in the game like the picture of Ir. Soekarno, Dr. Radjiman, etc. Scenes refer to the sequence of game page displays. Scene 1 displays correct picture as shown by Figure 2. Scene 2 displays an impaired picture puzzle that a user should solve. In Scene 3, the picture is repaired. Scene 4 displays the last page of the game. The script result is the playing result of every step in the game. This result could represent the user’s feeling after playing the game like happy and disappointed or a reward. The design of the result may use a sad, disappointed, or happy face to represent the user’s feeling, a trophy or a “Congratulations!” to represent a reward.

In addition to the puzzle game, this instructional media is also equipped with description of the heroes and quizzes to evaluate the learning outcomes as shown in Figure 3 and 4. Figure 3 shows that the introduction the independence heroes is not only through picture puzzles, but also through the description their profiles and what they did to prepare, proclaim, and defend the independence. Figure 4 shows that the application features quizzes to evaluate the learning outcomes. The evaluation also displays texts, audio, and pictures to test the learning achievements. The quizzes comprehensively contains questions related to materials of Chapters I, II, and III [20].

The use of multimedia could improve the instruction effectiveness because this multimedia is equipped with audio, pictures, and texts to involve various senses to facilitate students’ understandings about instructional materials. The use of national hero pictures in the puzzle game make students observe the patriot figures so that they could get to know them. [15] [20].

4. Conclusion
This research proves that script knowledge representation supports game development because it can specify knowledge needed in a game development. The function and benefit of the developed game was tested on elementary school teacher and students in Garut. The results revealed that all functions could run perfectly. Data on the game use benefit were collected through questionnaire addressed to the teacher and students. It was revealed that the game was well-accepted by the teacher and students at the research site because the application was user-friendly and made learning fun. Script knowledge representation needs to be developed by the users to design games and multimedia systems, especially to facilitate students’ learning.

References
[1] M A Ramdhani, H Aulawi, A Ikhwana and Y Mauluddin 2017 Model of Green Technology Adaptation in Small and Medium-Sized Tannery Industry Journal of Engineering and Applied Sciences 12(4) pp. 954-962
[2] S Sari, D M Aryana, C Z Subarkah and M A Ramdhani 2018 Multimedia Based on Scientific Approach for Periodic System of Element IOP Conference Series: Materials Science and Engineering 288(1) p. 012137

[3] J A Bryant 2011 Children and the Media: A Service-Learning Approach. Integrating Service-Learning Into the University Classroom (Massachusett: Jones and Bartlett Publisher) p. 53.

[4] I Farida, I Helsy, I Fitriani and M A Ramdhani 2018 Learning Material of Chemistry in High School Using Multiple Representations IOP Conference Series: Materials Science and Engineering 228(2017) p. 012078

[5] G J Hwang, L H Yang and S Y Wang 2013 A concept map-embedded educational computer game for improving students' learning performance in natural science courses Computers & Education (69) pp. 121-130

[6] R Aisyah, I A Zakiyah, I Farida and M A Ramdhani 2017 Learning Crude Oil by Using Scientific Literacy Comics Journal of Physics: Conference Series 895(1) p. 012011

[7] S Sari, R Anjani, I Farida and M A Ramdhani 2017 Using Android-Based Educational Game for Learning Colloid Material Journal of Physics: Conference Series 895(1) p. 012012

[8] N Whitton 2014 Digital games and learning: Research and theory (New York and London: Routledge)

[9] F S Irwansyah, I Lubab, M A Ramdhani and I Farida 2017 Designing Interactive Electronic Module in Chemistry Lessons Journal of Physics: Conference Series 895(1) p. 012009

[10] I Helsy, Maryamah, I Farida and M A Ramdhani 2017 Volta-Based Cells Materials Chemical Multiple Representation to Improve Ability of Student Representation Journal of Physics: Conference Series 895(1) p. 012010

[11] F S Irwansyah, Y M Yusuf, I Farida and M A Ramdhani 2018 Augmented Reality (AR) Technology on The Android Operating System in Chemistry Learning IOP Conference Series: Materials Science and Engineering 288(2017) p. 012068 2018

[12] A C Luther 1994 Authoring Interactive Multimedia (The IBM Tools Series) (New York: AP Professional)

[13] D D S Fatimah, D Tresnawati and C S Ma'rup 2017 Perancangan Game Puzzle Untuk Pembelajaran Menggunakan Metodologi Multimedia Jurnal Algoritma 14(2)

[14] S Rahayu and R Ardiansyah 2016 Pengembangan Aplikasi Tata Cara Wudhu dan Shalat untuk Anak Menggunakan Sistem Multimedia Jurnal Algoritma 13(1)

[15] R A Rahman and D Tresnawati 2016 Pengembangan Game Edukasi Pengenalan Nama Hewan dan Habitatnya dalam 3 Bahasa sebagai Media Pembelajaran Berbasis Multimedia Jurnal Algoritma 13(1)

[16] R Soleh, E Retnadi, and D Tresnawati 2015 Pengembangan Multimedia Pembelajaran Pendidikan Agama Islam dan Budi Pekerti Kelas IV Sekolah Dasar Menggunakan Metode Luther Jurnal Algoritma 12(1)

[17] S Russell and P Norvig 2009 Artificial Intelligence: A Modern Approach (Englewood Cliffs: Prentice Hall)

[18] C D Lee 2017 Toward a framework for culturally responsive design in multimedia computer environments: Cultural modeling as a case in Culture, Technology, and Development (New York, Psychology Press) pp. 42-61

[19] S Lucci and D Kopee 2016 Artificial Intelligence in 21t Century A Living Introduction (Dulles: Mercury Learning and Information)

[20] P L Talley 2017 Multimedia personal historical information system and method (U.S. Patent) 9 742 753