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Augmented Reality "Megoak-Goakan" The Traditional Balinenes Games for Learning

By

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Abstract

This study aims to develop learning media based on Augmented Reality (AR) multimedia in the Balinese Traditional Game Megoak-goakan. The research method used is the research and development method with the Dick and Carey development research model and literature review on the benefits and affordability of AR. The stages in this development research are 1) needs analysis, 2) development of Augmented Reality-based learning media, and 3) product validation test. Data collection for learning media validation uses an assessment instrument with a Likert scale. The results of this development research in the form of software with Augmented Reality technology on Optical Instruments. Augmented Reality-based multimedia learning media has gone through a validation test stage with an average percentage of achievement of 91% according to material experts and 90% according to learning media experts. From the results of this study, it can be concluded that Augmented Reality-based multimedia learning media meets the requirements with quality very good to be used as a supporting medium in the traditional game of Megoak-goakan learning activities.

Keywords: Learning Augmented Reality the Traditional Balinenes Games Megoak-Goakan

Introduction

Information and communication technology (ICT) is undergoing rapid development and increasingly affects education. The emerging technologies engaged students more thoroughly in learning and improved teaching quality (Penprase, 2018). In the fourth industrial revolution, Augmented Reality (AR) technology was listed as one of the 12 emerging analog technologies (Lee et al.,2018). The report of America Technology Virtual & Augmented Reality (VR/AR) pointed out that "AR technology has the potential to be a standard tool in education and could revolutionize how students are taught for both the K-12 segment and higher education (Goldman Sachs, 2016, p.30). AR technology is called virtual objects superimposed on the real world, providing users access to rich and meaningful multimedia content (Billinghurst et al., 2016). AR technology is increasingly being utilized in the educational area compared to the internet-based learning environment. AR technology's features and distinct advantages reformed the teaching environment and enabled students to

interact with the real environment, which was considered an impossible learning approach before (Billinghurst, 2017).

Augmented Reality (AR) is the technology that overlaps virtual objects with real-world objects (Akçayır, 2017). It has three main features: the combination of real and virtual worlds, real-time interaction, and 3D registration. The past few years have witnessed growing popularity in the research interest for AR since mobile devices such as smartphones and tablets have offered users much easier and cheaper AR access than before (Akçayır, 2017). Positive effects of AR technology on students' learning were identified in previous studies in the development of skills and knowledge, enhancement of learning experiences, and improvement of collaborative learning (Wu et al., 2013). AR in education could improve learning efficiency and provide a more fun experience for students.

Serious games can be defined as computer games with educational purposes and see entertainment as an added value. Serious games are gaining increasing importance in education, providing an enhanced experience in learning (Carvalho et al., 2015). They were found to be effective concerning learning and retention. Other frequently reported outcomes included knowledge acquisition and motivational outcomes. AR games refer to digital games played in a real-world environment with a virtual layer on top of it (Squire, 2017). It is possible for players to interact with objects in the virtual world and people in the real world, avoiding social isolation. With AR technology's advantages and positive outcomes and serious games in the educational field, a growing number of studies focusing on AR games for learning have emerged in the past few years.

Indonesia has cultural diversity, one of which is traditional games. This game has been carried out by the community for generations and is part of the local culture, which contains many educational and cultural values. The traditional game in Buleleng Regency is the Megoak-goakan game. The history begins in the 17th century, when Ki Barak Panjisakti, a reputable king of Buleleng, learned that the Blambangan Kingdom continuously tried to conquer Buleleng. The King of Blambangan had a desire to turn the land of Buleleng into part of his territory. However, although Ki Barak Panjisakti was very powerful and successfully conquered many territories, his battle against Blambangan was not glorious. His troops were desperate due to this condition. Hence, to bring back the spirit, the king ordered all troops to play this traditional game called Goak-Goakan.

Megoak-Goakan means acting like a crow who attempts to defeat a snake by catching the snake's tail. In this case, King Panji acted like a Goak or crow, while the warlords acted like snakes who tried to protect their tails. Finally, King Panji won the game and then asked for a special present from his warlords. Yes, he wants the Blambangan Kingdom to be part of his territory. To grant the king's wish, the troops went back to war against the Blambangan Kingdom and came back with a victory.

In our project, we like to maintain the atmosphere that comes from the physical tangibility of tools used in a game. However, we also investigate the advantage of digital technologies that help beginners understand the game's complex rules without losing interest. We use augmented reality technologies that offer information projected on existing game elements. As a new case study, we have developed a digitally enhanced Megoak-goakan game and evaluated how digital enhancement increases. In addition, this study aimed to determine the advantages and affordance of AR-based games.

Method

The research method used in this study is the research and development method, namely by developing a product and testing its effectiveness (Sugiono, 2013). According to Brog and Gall, the educational research and development model used is the systems approach model designed by Walter Dick and Lou Carey (Gall, 2003). AtwiSuparman modified the Dick & Carey model as a modern instructional design book into an instructional development model. According to Atwi, the steps for implementing research and development are a. Identifying Instructional Needs and Writing General Instructional; b. Doing Instructional Analysis; c. identifying Early Behavior and Characteristics of Learners; d. Writing Specific Instructional Goals; e. Developing Learning Outcome Assessment Tools; f. Developing Instructional Strategies (The instructional strategy sections emphasize components for developing learner learning, including pre-instructional activities, content presentation, student participation, assessment, and follow-up activities).

Developing Instructional Materials (When we use the term instructional materials, we include all forms of instruction such as teacher guides, modules, overhead transparencies, videotapes, computer-based multimedia, and web pages for remote instruction.); h. Designing and Carrying Out Formative Evaluation (A small-scale field test was carried out in the formative evaluation to carry out a readability test. Each type of assessment provides different information for the designer to use in improving Instructional); i. Instructional System; j. Implementation, Summative Evaluation, and Diffusion of Innovations. This research has reached the stage of carrying out a formative evaluation of augmented reality in the traditional Balinese game Megoak-goakan. We also conducted a literature review. These literature reviews mainly focused on the advantages and affordances of AR.

Result

The development of Augmented Reality multimedia begins with creating a 3D animation of the Megoak-goakan game. Next is to make audio about the explanation of the game. Then prepare a video about the formation of shadows in each game. After all the components needed in multimedia are collected, the next step is combining components and making them Augmented Reality-based multimedia.

The next stage is conducting a validation test by a material expert. The Augmented Reality multimedia validation results by material experts show a percentage of 91% with very good interpretations on all indicators, namely the suitability of the content and the suitability of the concept.

As for some suggestions given by material experts, namely, the animation of the eye should be able to show the parts of the eye directly, refine the animation to make it look more like the original, and add a final evaluation to the media.

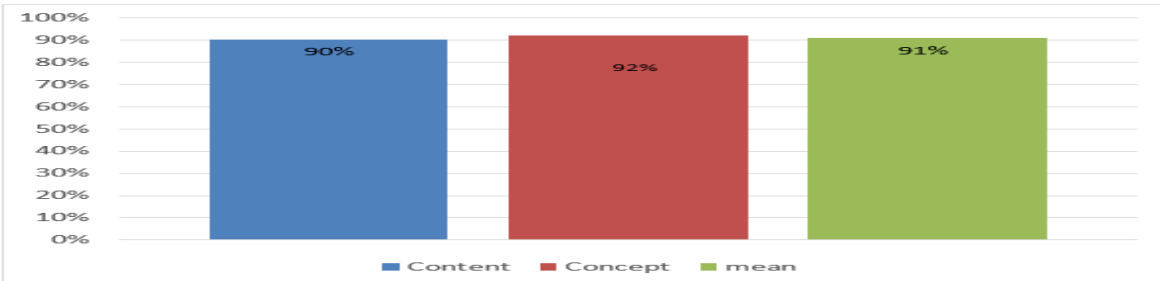

Figure 1. *Validation Test Results by Material Experts*

Next is the validation test for media experts. The validation results by media experts showed that the achievement percentage was 90%, with a very good interpretation of visible, interesting, simple, and design indicators. Meanwhile, useful, accurate, and structured indicators are good.

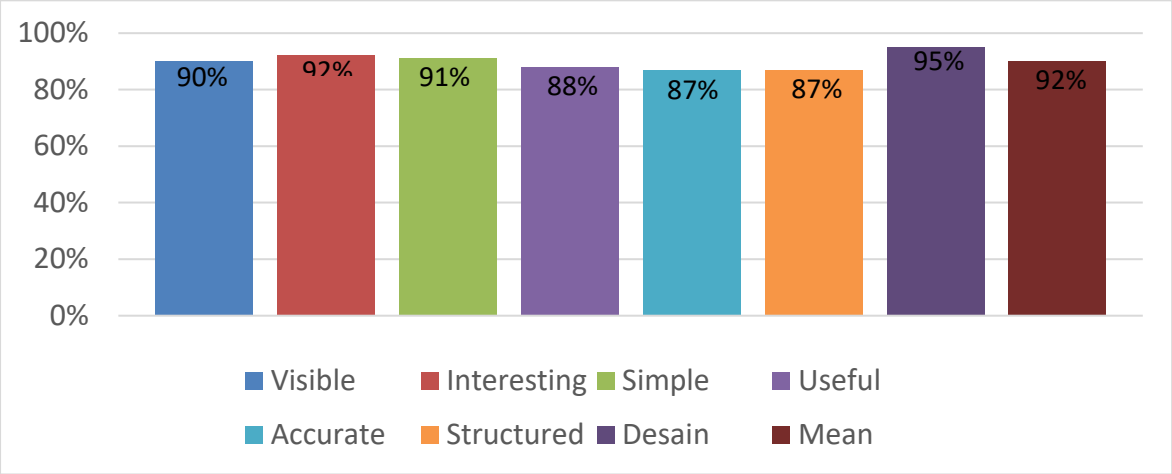

Figure 2. *Validation Test Results by Media Experts*

Suggestions given by media experts are that on the menu how to use new scenes are added so that they do not need to be connected to the internet, complete short descriptions and videos of the use of media that will be used for the publishing process.The following is an Augmented Reality multimedia display on the subject of the Megoak-goakan game that has been developed:

Figure 3. *Main Menu Display*

Figure 4. *Instruction Guide Display*

Figure 4. *AR Megoak-goakanExit Display*

Discussion and Conclusion

The features of AR lead to a variety of positive effects on learning. The interactive 3D models in AR can enhance students' learning experience and collaborative skills; the combination of the real world and the virtual world in AR can support the study of the invisible concept and content; and the rich instructional materials can attract and immerse students into the learning (Wu et al., 2013). In addition, some literature drew attention to the social impacts of AR on students. For instance, AR technology provides more opportunities for students to communicate and collaborate in the real world (Kamarainen et al., 2013). The social interactions between students and teachers and their parents were also encouraged (Schrier et al., 2016). Structured literature reviews were found on AR for educational purposes. For example, one systematic review of AR for education investigated 68 AR studies in education and concluded several advantages and challenges (Akçayır, 2017). In this review, the advantages of AR in educational settings were classified into learner outcomes, pedagogical contributions, interaction, and others. In another review, the definitions, taxonomies, and technologies of AR technology were introduced, and the AR features, their affordances, and the solutions for AR challenges were discovered (Wu et al., 2013). Different affordances of location- and image-based AR for science learning were also studied (Dunleavy et al., 2019). The review on AR trends in education found the educational field and purposes, target group, advantages, and data collection methods and discussed the trends for AR in educational settings (Bacca et al., 2014).

Regarding "learning achievement," half of the reviewed studies reported that AR learning games led to effective outcomes in achieving learning gains in terms of learning content (Ibáñez et al., 2014). The positive effects also included enhancing learning efficiency (15%) and cognitive skills like problem-solving, critical thinking, and multitasking (12%). One study (4%) reported that AR learning games could reduce students' cognitive load. On the contrary, another study showed that students frequently felt overloaded and confused due to many materials and tasks during the gameplay (Dunleavy et al., 2019). The rest of the reviewed studies (19%) either found AR games were ineffective in learning achievement or did not focus on the learning achievement in their studies.

The motivation aspects involved engagement, satisfaction, fun, enjoyment, interest, attention, confidence, and students' positive attitudes, e.g., SysteM (Freitas et al., 2018) and AR-based educational game (Hwang et al., 2015). Previous studies frequently reported that students described the learning experience with AR games as joyful and playful, as they had fun playing AR games to learn school knowledge (Lu et al., 2014). In our review, we found a

similar result: most students (62%) mentioned AR learning games as fun, interesting, or enjoyable, e.g., AR gaming in sustainable design education (Ayer et al., 2016). Nearly half of the studies (46%) also reported that AR learning games engaged them more than traditional learning methods, e.g., AR system for a visual art course (Di et al., 2013). In addition to these two effects, AR learning games were also evaluated to "enhance satisfaction" (19%), "enhance the willingness to learn" (19%), "enhance attention" (15%), "enhance confidence" (15%), and "enhance positive learning attitude" (15%).

Considerably less well-studied were the retention effects. Nearly all studies tested the outcomes immediately after using the AR games. In addition, most of the students never used AR games before, so a potential novelty effect of new technology might influence the research results. Therefore, more research should focus on short-term and long-term impacts on students after learning AR games.

Different measurements were used to evaluate the effects caused by AR learning games. The review found that the most frequently (38%) used measurement of learning achievement was a pre-test and post-test knowledge test, which examines the improvement of students' knowledge content learning before and after using AR learning games (Lu et al., 2014). Three studies (12%) used post-test in their experiments, e.g., AR for preschoolers for Natural Science (Bressler, 2013). From the result, we can see that only 50% of studies measured learning achievement in terms of the knowledge content, indicating the rest did not use a proper test or did not focus on learning.

Regarding motivation, most previous studies (65%) used observation as the main evaluation method during students' learning and playing process. The questionnaire also held high popularity (58%) in measuring motivation, e.g., using AR games to teach 21st-century skills (Schrier et al., 2016). Some studies introduced and explained the questionnaire questions in their studies. Keller's ARCS Motivation Model was frequently adopted as the motivation questionnaire, e.g., the AR system for a visual art course (Di et al., 2013). In contrast, other studies did not accurately explain how they created and evaluated their questionnaire questions to measure their motivation. Interviews were also widely used to collect qualitative data (42%). Pre-survey and post-survey (15%) were used to investigate the changes in attitudes before and after using AR games.

Collaboration and interaction have emerged as the main advantages of AR in education (Bacca et al., 2014) since the technology allows users to work or study face-to-face in real life. Based on reviewed studies, we found three main types of social interactions: interactions among students, teachers, and students and parents.

Most of the social interaction effects were found among students, and the main effect was encouraging collaboration (46%). In some AR games, students were required to work in groups to solve a certain task, while group competition (31%) was also promoted. Evidence was also noted in the desire to share experiences with classmates (8%). Unlike the rich social interactions among students, the only social interaction between students & teachers (15%) and students & parents (8%) was guidance.

Frequently, little attention was paid to the study of how these social interactions affected learning achievement or motivation in turn. The attitude of classmates, the feedback from teachers, and the help from parents may all impact children's learning outcomes. In addition, AR games should focus more on the interactions between student and teacher, student and parents.

The conclusion is that Augmented Reality-based learning media in the traditional Balinese game Megoak-go will meet the requirements with very good quality to be used as supporting media in learning activities. After the review of previous studies of AR learning games, we have six interesting findings. Most current AR learning games are played outdoors or in the classrooms. However, since students spend much time at home and play digital games, it might be more effective to design AR learning games that can be played at home, encouraging them to study spontaneously and have more fun. A notable gap was found in the retention effects. Nearly all studies tested the outcomes immediately after using AR learning games, and more research should be done on both short-term and long-term effects. As for the measurements in previous studies, some commonly used instruments were addressed, while some studies did not mention how they created and evaluated their instruments. More attention should be paid to the proper measurements for the effects. Social interaction effects were found by playing AR learning games, especially among students. However, little research focused on how these social interactions affected learning achievement or motivation. Also, more social effects were found among students than between students, teachers, or parents. The AR games that focus more on the interactions between student and teacher or student and parents may benefit both sides.

In addition, we came up with five recommendations for the design of AR learning games in order to maximize the positive effects, which are: (1) involve learners in the design process, (2) always have clear learning objectives, (3) design to encourage social interactions, (4) identify effects of AR features.

In summary, though the positive effects of AR learning games were widely recognized in the past decade, more research still needs to be done in the future.

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