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Development of an Augmented Reality Dolanan Song Encyclopedia to Foster Reading Skills in Early Childhood

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Abstract

This research aims to develop and assess the effectiveness of literacy-based storybooks enhanced with augmented reality (AR) as an intervention for the development of executive functions in early childhood. Executive function is a cognitive ability that underlies tasks such as maintaining focus on long-term goals, delaying gratification, and exercising self-control over impulses. The research adopts a 4D development model encompassing four main stages: Define (Definition), Design (Planning), Develop (Development), and Disseminate (Dissemination). This learning medium garnered positive responses from users, with children expressing satisfaction with the appeal of the songs and recognizing the excellence of the 3D pictures and activities in the storybook. The research also evaluates the effectiveness of AR-based encyclopedias in enhancing reading literacy comprehension through pre- and post-test designs. The study revealed an increase in knowledge related to expressing songs. Additionally, there was a modest yet significant improvement in the aspect of responsibility. Children exhibited a greater interest in participating in singing activities with the teacher compared to conventional reading and writing activities.

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INTRODUCTION

Literacy at an early age requires serious attention from educators. Early literacy abilities are not limited to cognitive abilities alone but are complex social-psycho-linguistic activities and influence social and contextual

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aspects which are an integral part of early childhood development (McLachlan & Arrow, 2017). Early childhood literacy can develop and be acquired at home and in their social environment (Sari, et al, 2022). Successful early childhood education requires family support and involvement in school activities and using media (Ulfah, 2020).

In today's digital world, many children are born into a technological environment that will naturally become part of the environment. However, educational approaches are often disconnected from students' real-life contexts. Therefore, there is a need to incorporate technological progress critically and democratically (Hayashi, 1990). Designing learning media is noteworthy if persuasive technology is included in the design strategy, so that it can change someone's behavior (Consolvo et al., 2009; Devincenzi et al., 2017; Sari, et al, 2021). This research aims to provide knowledge that supports the development of executive function through creating reading literacy learning media based on augmented reality (AR) technology (Hermawan, et al., 2021).

AR technology provides children with immersive learning experiences through two basic features of virtual technology: augmentation and interaction (Javornik, 2016). AR integrates virtual reality with the physical world, which helps children to blend in while learning, and interact with virtual objects in the real world. *Augmented reality* is technology that provides the experience of interacting with the real world (Garzón et al., 2019). AR technology is able to provide a learning experience without having to actually leave the house, making it relevant to respond to the situation resulting from the COVID-19 pandemic. These advantages in the field of education have made AR one of the main emerging technologies in education over the last five years (Chen et al., 2016; Martin et al., 2011). Innovation in book based *augmented reality* for educational purposes has become an innovation that shows positive value for students (Chen et al., 2016). It is hoped that the design of reading literacy learning materials based on AR technology can improve reading literacy in early childhood. Our research objectives can be listed as follows:

1. To develop an encyclopedia of dolanan songs to improve reading literacy based on *augmented reality* as an executive function development intervention for young children.
2. To test the effectiveness of the dolanan-based song encyclopedia *augmented reality*.

LITERATURE REVIEW

Early Childhood Literacy

Literacy relates to the concepts of letter knowledge, comprehension, vocabulary, phoneme awareness, writing and reading (Justice & Sofka, 2013; Rosemary & Abouzeid, 2002). Phonological awareness along with written knowledge has an impact on children's reading abilities at the kindergarten level (Browne, 2001; P. M. Rhyner, 2009; Storch & Whitehurst, 2002). This is because phonological awareness is one of the strongest predictors of spelling, decoding and reading comprehension skills.

The research results reveal the approach *whole language* can improve children's ability to learn English because it makes children understand or know how words are formed and how to pronounce them Usman et al. (2020). Draft *whole language* This is an approach that refers to constructivism theory.

The Effectiveness of AR-based Learning Media for Early Childhood

Previous research examined the effectiveness of AR for early childhood education in various fields. For example, Rohaya et al. (2012) found that AR storybooks

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increased students' motivation to learn numbers and read folk tales. Cascales et al. (2013) argue that the use of AR promotes active behavior and student learning achievement. It also improves communication and interaction skills between students and their teachers, and provides a very positive experience for them. Safar et al. (2016) found a very strong correlation between children's interactions in an AR-based English alphabet lesson and their scores on an English alphabet test. Rasalingam (2014) found that AR technology was effective in increasing motivation and engagement in learning in preschool children. The use of AR also improves children's learning outcomes during drama play (Han et al., 2015) and art activities (Huang et al., 2016).

Meanwhile, in the field of literacy education, the use of AR is still limited. Sari et al. (2022) found empirical evidence that students who received AR-based sharia finance socialization had higher knowledge of sharia finance than the control group. Given the scarcity of research on the effectiveness of AR in relation to financial education for preschool students and the low level of financial literacy in Indonesia, this research fills the gap to develop and test the effectiveness of financial literacy storybooks in the AR context. AR can be used and applied to learning media as an innovation, so that learning becomes more interesting and interactive, especially for children (Bower et al., 2014; Pistol & Atasoy, 2017; Karlsson et al., 2017). The coexistence of virtual objects and real environments allows students to experience phenomena that cannot occur in the real world (Klopfer &; Squire, 2008) and develop important practices and literacies that cannot be developed with other technologies (Squire &; Jan, 2007; Squire &; Klopfer, 2007). AR-based media interactivity has a positive impact on students' cognition, attitudes and behavior (Sundar et al., 2012). Using modern educational technology is expected to improve teaching methods. Technology *augmented reality* can encourage children to develop their mental and cognitive skills to a greater level than if they were only taught using traditional methods. To optimize the benefits of AR-based educational tools, Bistaman et al. (2018) suggest the use of collaborative learning when designing and engaging in AR learning environments. Motivation and collaboration will be enhanced by the interaction of teachers and children with the AR system. Therefore, we hope that AR-based financial literacy storybooks with collaborative learning should enable them to develop their cognitive skills.

Fig
AR-ba *ay*

Literacy Membaca Strategy for Early Childhood

In adulthood (13 to 21 years), the strategy used is to build financial skills through experience-based, practical education programs, while for children aged 6 to 12 years, the strategy of introducing reading literacy is used through guidance from parents and other adults to basic reading learning skills and children's attitudes. For children of pre-primary school age (3 to 5 years) an executive function development scheme is used. Executive function is the cognitive ability to focus on long-term goals. Cognitive

abilities such as impulse control (Meier &; Sprenger, 2012) and long-term orientation abilities such as delaying gratification skills (Lynch et al., 2010) are necessary to achieve one's financial goals (Drever et al., 2015). Delaying gratification refers to a person's ability to postpone present pleasure and focus on achieving their long-term goals.

Executive function has three subcomponents: inhibition, working memory and cognitive flexibility (Miyake et al., 2000). Inhibition is the ability to focus on a task in the face of internal and external distractions. This ability is very necessary to achieve goals. Inhibition keeps a person from being tempted by all things that bother him. The stronger the inhibition, the greater our ability to manage emotions (Diamond 2013) and (Drever et al., 2015). Cognitive flexibility is the ability to generate alternative approaches to solving problems, including problems (Diamond, 2013). Working memory is the brain's ability to store and process a lot of information at once. The three subcomponents of executive function are often used in tasks related to money management (Holden et al., 2009; Whitebread & Bingham, 2013). For example, inhibitory control and working memory improve the ability not to be tempted by momentary pleasures (Diamond, 2013) and support the much-needed ability to focus on goals.

Research Methodology

The research and development model is used in developing AR-based reading literacy learning media for children from an early age. According to Dick et al. (2014) S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel (1974), the 4D development model consists of 4 main stages, namely: *Define* (Definition), *Design* (Planning), *Develop* (Development) and *Disseminate* (Dissemination). Figure 1 presents the life cycle of developing reading literacy materials for early childhood in context *augmented reality*.

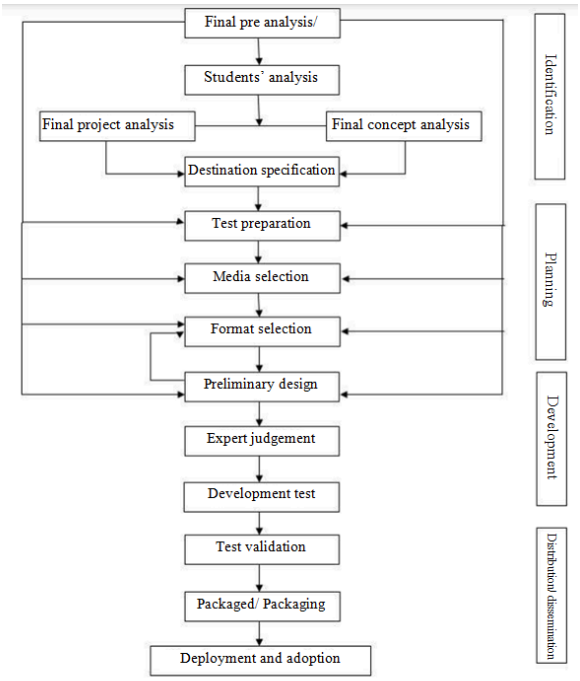

Figure 2. Enklopedia Development Procedures

In the media development process, the researcher first carried out an analysis using data obtained from classroom observations and interviews with teachers. The results of the analysis become the basis for designing reading literacy learning media, so that it can be used effectively based on what is needed. The next stage is the development stage, where the researcher composes *storyboard* and develop learning media based on it. After product development, researchers implemented reading-based literacy learning media *augmented reality*. This stage is product testing and related media assessment.

Researchers use experts to validate AR-based encyclopedia learning media with experts. Where the experts are divided into three material experts assessing the content and two media experts assessing the quality of learning media based on AR technology. The material experts are early childhood education

lecturers, Indonesian language lecturers and kindergarten teachers. The media experts are lecturers at the Faculty of Informatics and lecturers at the Faculty of Education. These lecturers are selected according to their respective areas of expertise in technology development and learning technology.

The final stage in media development is evaluation. Before the evaluation stage, the researchers asked parents and teachers for permission to conduct this research on children. The AR encyclopedia book was implemented in kindergartens in the Sleman and Yogyakarta regions of Indonesia with a total of 40 children, three times a week for three weeks. The average age of participants was 5.2 years and the majority had parents with college degrees. Detailed participant demographic information is in the appendix. The implementation of this learning media uses collaborative learning. Collaborative learning is a model in which knowledge can be created in a population whose members actively interact through sharing experiences (Mitnik et al., 2009). In this case the teacher sings songs with the children in class, demonstrates the use of technology, discusses the values implied in the story and listens to the children's opinions about their learning experiences.

The evaluation phase consists of two parts: user experience and effectiveness testing. In the user experience stage, students respond to the song in terms of its appeal, content, images, 3D images, and activities. An example of a question to determine attractiveness is: 'Did you find this book interesting?' They responded by selecting a smile emoticon for a strong like and a frown emoticon for a strong dislike. Test effectiveness using experimental methods, with pre- and post-test designs.

Table 1. Indicators and tests of executive function

Subcomponent of executive functioning	Definition	Indicator	Test
Inhibition	Ability to focus on tasks in the face of internal and external distractions	Delay gratification	Marshmallow test (Place a marshmallow in front of the student and tell the student that he will get another marshmallow in 15 minutes if he does not eat the first marshmallow)
		Objective	Do you want to play? Do you want to sing? Do you want to listen to a song? Do you want to read? What did you find in that song?
Working memory	The brain's ability to store and process multiple items of information at once	Honesty (The meaning of a song)	What does it mean to be honest? What is the impact when we are honest?
		Responsibility	Were you responsible for queuing to play AR? Did you read the article earlier?
		Discipline	Did you follow the agreed playing rules? When singing, is there a game where you want to take turns?
Cognitive flexibility	Ability to generate alternative approaches to solving problems,	Managing emotions	How do you feel when playing? When fighting, what do you feel?

Table 1 shows the indicators and questions given by the teacher to students. This experimental method is to evaluate the increase in children's understanding of reading literacy. This test is used to test the effectiveness of reading literacy education using an AR-based encyclopedia. Tests are given before and after learning. The marshmallow test is measured by the length of time the child is able to resist the temptation to eat the marshmallow. Other items are assessed by the teacher based on the results of interviews with students with the teacher assessing student answers using a scale score of 1 (don't understand) to 5 (understand). To test the reliability of the items, Cronbach's alpha was calculated. The alpha for the item was 0.71 which indicated the item was acceptable (George & Mallery, 2003).

Findings

The aim of this research is to develop an encyclopedia of children's play songs as an effort to increase reading literacy for early childhood in context *augmented reality*. The development process uses a 4D process (analysis, design, development, implementation and evaluation). The analysis stage is the basic and fundamental stage, so that the material is developed according to the

needs for its development, and for the technology and media that will be used.

The analysis stage in this research consists of several stages, needs assessment and analysis of technology, media and extend data. A needs assessment is an analysis carried out to identify differences between the actual situation and the situation expected by the researcher. In Indonesia, students have financial literacy scores far below the OECD average score (OECD, 2018). Students have challenges in answering some basic financial knowledge. Other students also said that they were not interested in studying financial literacy because of the lack of learning media that was interesting and appropriate to their age level. Based on observations and interviews with teachers, parents and children, there is still a lack of financial literacy learning materials for children based on AR technology. Meanwhile, AR makes learning more interesting and interactive, especially for children. Therefore, developing learning media that suits the preferences of young learners is very important to help childhood improve children's understanding of reading literacy.

Media Analysis

Media analysis aims to choose the right media delivery strategy. Children who become media users belong to the digital generation. Apart from that, there has been an evolution of learning styles from verbal, then visual, to virtual, so that learning media is made to suit children's learning styles using AR technology.

Analysis Phase

The analysis phase was the basic and fundamental stage, so the material was developed according to the need for its development, and for the technology and media to be used. The analysis phase in this research consisted of several stages, a needs assessment and an analysis of the technology, media and the extend data.

Needs assessment

A needs assessment is an analysis conducted to identify differences between the actual situation and the situation expected by researchers. In Indonesia, students have song literacy scores that are far below the OECD average (OECD, 2018). Students have challenges in answering some basic knowledge. Other students also say that they are not interested in learning dolanan songs due to the lack of learning media that is interesting and appropriate for their age level. Based on observations and interviews with teachers, parents and children, there is still a lack of learning materials for children's songs based on AR technology. Meanwhile, AR makes learning more interesting and interactive, especially for children. Therefore, developing learning media that suits early childhood preferences is very important to help children improve their understanding of songs.

Picture. 2 Augmented Reality-based Toy Song encyclopaediaReality for Early Childhood

Technology analysis

The purpose of technology analysis is to identify existing technological capabilities. Nowadays, smartphone technology is affordable and most teachers and parents have android-based smartphone devices. This android-based smartphone technology is used

to access the augmented reality-based children's song encyclopaedia.

Design Stage

Unified Modeling Language (UML) is used to facilitate the explanation of the system design contained in the application. UML is one of the modeling languages used in developing software. UML itself chooses many diagrams, one of which is use case. Use case diagram is a diagram that serves to explain the workflow and functions that run in the application.

In the process of designing the system, we also need other software to design the interface and apply augmented reality to books, applications, and also 3D objects. The following are some of the tools used in the application development process:

1. Blender. Blender is an open-source 3D software that can be used to create 3D models and animations.
2. Unity. Unity is software used to process 3D images, animations, program scripts and others.
3. Corel Draw x7. Corel Draw is used to design menus and texture materials for 3D models.
4. Vuforia. Vuforia is a plug-in or additional feature for Unity that allows us to scan an image, so that an object can be placed in it.

Development Stage

In the early stages of development, several tools were used, such as Corel Draw and 3D Blender. In addition
application development also uses the Vuforia software development kit (SDK) and Android SDK as a basis for developing Android-based augmented reality applications.
The process of making augmented reality applications can be briefly explained as follows:

1. Create 3D content and animations with Blender software, such as 3D objects, animations, and pasting materials for texturing 3D models.
2. 2D content creation using Corel Draw X7, such as the interface for app users, bookmark images in the storybook and textures for 3D objects.
3. After finalizing the content, we set up the framework with Unity by importing Vuforia plug-ins.
4. Next is the database. The first thing to prepare is the marker database. The marker database can be prepared through the official Vuforia website, where all the required markers can be uploaded and the marker files can be converted into files that can be read by Unity. Once downloaded, the database can be imported into the Unity software.
5. Next is to position the markers with the 3D object, as required.
6. All programs can be built using the Android SDK within Unity, and can then be made into Android Application Package (APK) files

Implementation

Product testing
Product testing is a stage of testing learning media. This trial aims to ensure that the learning media developed is suitable for early childhood use. The criteria for assessing learning media using the Learning Object Review Instrument (LORI) developed by ((Sari et al. 2022)) are: 1) content quality, 2) alignment of learning objectives, 3) feedback and adaptation, 4) motivation, 5) presentation design, 6) interaction usability, 7) accessibility, 8) reusability, and 9) conformance to standards.

application development, in this study, considers the LORI theory. However, in this app, only five criteria are implemented (Table 2).

Table 2. Implementation of LORI Theory in the implementation of Encyclopaedia toy songs

No	Item	Deskripsi
1	Content quality	Content quality Relates to balance of ideas and accuracy of levels.
2	Alignment of goals	Goal alignment Learning alignment Focus on learning goals and user characteristics
3	Motivation	Motivation Ability of the media to motivate users
4	Presentation design	Presentation design Use of features such as audio, visuals and animation to enhance the learning process.
5	Ease of interaction	Ease of interaction Ease of navigation, including easy user interface & quality help features

Assessments of content quality, alignment of learning objectives, motivation, and presentation and interaction design were conducted by two media experts. Table 3 shows the results of the material and media assessment.

Table 3. Results of material and media assessment, first validation and second validation after improvement

Table A. First Validation Results (before)

	Content quality	Alignment of goals	Motivation	Presentation Design	Ease of Interaction
Validasi Media 1	56	57	58	69	70
Media expert validation 2	60	62	63	70	70
Media expert validation 3	54	55	60	72	73

Table B. Second Validation Result (after)

	Content quality	Alignment of goals	Motivation	Presentation Design	Ease of Interaction
Validasi ahli 1	68	60	65	75	77
Validasi ahli 2	75	62	76	70	70
Validasi ahli 3	69	55	68	76	78

Information:

Total score conversion. Very decent: 92>x≥74.75; Worthy: 74.75>x≥57.5; Fair

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enough: 57.5>x≥40.25; Not eligible 40.25>x≥23

Subject matter expert validation

The subject matter consists of two study programs, the first is from early childhood education, and one is a lecturer in learning technology, and a kindergarten teacher. Material validation aims to determine the feasibility of learning materials in terms of content quality, suitability with learning objectives, and motivation. Learning materials need to be validated to ensure whether the materials can be used to improve children's cognitive abilities in recognizing children's songs by activating executive functions. Suggestions and comments from material experts are used to revise the content. The results of the test before and after the repair are presented in Table 3 Panel A.

Based on the results of the evaluation from material experts

Based on the results of the evaluation of material experts, there was an increase from quite feasible to feasible in terms of content quality, suitability of learning objectives, and learning, and motivation aspects, after revision. The results of material validation, material expert 1 Check Back to the original book to see the rhythm and add interesting pictures because the target is early childhood. Subject matter expert 2 There needs to be additional notes related to parental assistance and wisdom in using communication tools, subject matter expert 3 Improvement of grammar and the location of time frames or notations. Advice from media experts, media experts 1 Animation needs to be added to help children understand Interaction activities need to be added to increase children's activity. Media expert 2 Add background noise to make it more interesting Interaction activities need to be added.

Figure 3. Animation improvements

Figure 4 improvement with the addition of song beats

Figure 5. Addition of instructions for use

Field Trial

The Field Trial was carried out at ABA Bendo Sari Prambanan Sleman Kindergarten, which is one of the stages of development research,

which tests the effectiveness of the product in accordance with the objectives (Ermiana, Witono, & Khair, 2019). At this stage of the activity, data related to the assessment of respondents or trials and data related to the effectiveness of the use of the product are called effectiveness tests. The trial was carried out in 3 groups, which were divided into small groups, medium groups, and large groups. The results obtained from each field test in each group can be seen in table 4.

Table 4. Student Response Data to AR-Based Toy Song Encyclopedia

No	Trial	Number of Students	Response Results	Category
1	Small-scale	8	96	Very interested
2	Medium Scale	10	95	Very Interested
3	Large-scale	15	75,8	Interested

Criteria for Student Questionnaire Results, 0-20 Very Interested, 21-40 Not Interested, 41-60 Moderately Interested, 61-80 Interested, 81-100 Very Interested

Based on the data in Table 4, the field trial activities, which were carried out in ABA Bendosari Class B Kindergarten, can be concluded that there is a decrease in student responses to Augmented Reality (AR)-based encyclopedia media in large-scale tests. The decrease occurred because there were many different number of respondents, although it was still classified as a decline still close to the interested category.

DISCUSSION

The digital generation was born in a culture where technology is part of the environment. Apart from that, technological advances have also changed students' learning preferences from verbal, visual to virtual. Therefore, it is necessary to integrate technological advances in education. A large number of studies have found empirical evidence about the benefits of using AR technology in schools and colleges (Chen et al., 2017; Sari et al., 2022) but in early childhood it is still scarce. There is still debate about whether the use of AR technology in the early childhood curriculum is appropriate or not. Early childhood teachers need to ensure that the technology used in the early childhood curriculum does not just follow trends. Educational settings must lead learning, not catch up to the technology that children already use in their homes. This research contributes to this field by examining the effectiveness of using AR technology in early childhood for learning reading literacy. The findings of this study support that the interactive characteristics of AR-based media impact their cognition, attitudes, and behavior (Sundar et al., 2012). The use of AR-based reading literacy storybooks can significantly increase knowledge about honesty, discipline and emotional management.

However, the ability to delay gratification, understand the purpose of the song and responsibilities did not have a significant

impact. These findings support Chen et al. (2019) that the effectiveness of using AR in kindergarten settings is still little supported. Possible reasons are the challenges of using AR in early childhood settings, for example technical difficulties regarding mobile phone placement to scan barcodes that can generate 3D images as well as room lighting (Kotzageorgiou et al., 2018). These technical difficulties will trigger cognitive overload which has a negative impact on learning outcomes (Huang et al., 2020). So, it is necessary to emphasize the role of teachers, who have technological literacy, to support the inclusion of AR technology in early childhood education.

CONCLUSIONS AND RECOMMENDATIONS

Cultivating literacy through story-based media *augmented reality* is an effort to activate executive functions that develop rapidly in children aged 5 to 6 years. Reading is an abstract concept for children, so the right media is needed to teach it to children. Technology *augmented* allows children to visualize complex relationships and abstract concepts. This research aims to develop and test the effectiveness of an AR-based encyclopedia. Based on these results, the encyclopedia was successfully designed and developed using a 4D model. This media generates a positive response among users. By using a pre and post-test design, testing the effectiveness of AR-based storybooks shows an increase in reading literacy understanding.

This AR-based encyclopedia significantly increases understanding of certain aspects of reading literacy in early childhood: knowledge of letters, words, and being able to express words. However, the ability to read directly increased only slightly. These findings prove that there is significant potential in using augmented realty as a learning medium for early childhood. It is hoped that the implementation of reading literacy education through appropriate learning media for early childhood can support government programs to increase reading literacy levels. Despite its various contributions, this study has limitations. This research is short term; Further research can develop learning media to teach reading literacy as a long-term implementation, so that the impact can be seen on student behavior and is not only limited to knowledge. Also, further research needs to consider whether AR use causes cognitive overload in young students.

REFERENCES

Beisly, A., Kwan, K.-A., & Shinyoung, J. (2019). Executive function and learning behaviors: Associations with academic skills among preschoolers. Early Child Development and Care, 190(15), 2469-2483. https://doi.org/10.1080/03004430.2019.1585347

Bower, M., Howe, C., McCredie, N., Robinson, A., & Grover, D. (2014). Augmented reality in education-cases, places, and potentials. Educational Media International, 51(1), 1-15. https://doi.org/10.1080/09523987.2014.889400

Cascales, A., Laguna, I., Pérez-López, D. C., Perona Ruiz, P. D., & Contero, M. (2013). An experience on natural sciences augmented reality contents for preschoolers. Lecture Notes in Computer Science, 8022, 103-112.https://doi.org/10.1007/978-3-642-39420-1_12

Chen, C.-H., Lee, I.-J., & Lin, L.-Y. (2016). Augmented reality-based video-modeling storybook of nonverbal facial cues for children with autism spectrum disorder to

improve their perceptions and judgments of facial expressions and emotions. Computers in Human Behavior, 55(Part A), 477-485. https://doi.org/10.1016/j.chb.2015.09.033

Chen, Y., Wang, Q., Chen, H., Song, X., Tang, H., & Tian, M. (2019). An overview of augmented reality technology. Journal of Physics: Conference Series, 1237(2), 022082. https://doi.org/10.1088/1742-6596/1237/2/022082

Chen, P., Liu, X., Cheng, W., & Huang, R. (2017). A review of using augmented reality in education from 2011 to 2016. In E. Popescu, Kinshuk, M. K. Khribi, M. Jemni, N.-S. Chen, & D. G. Sampson (Eds.), Innovations in Smart Learning. Lecture Notes in Educational Technology. Springer, Singapore. https://doi.org/10.1007/978-981-10-2419-1_2

Consolvo, S., Mcdonald, D. W., & Landay, J. A. (2009). Theory-driven design strategies for technologies that support behavior change in everyday life. In Proceedings of the 27th International Conference on Human Factors in Computing Systems (pp. 405-414), Boston, MA, USA. https://doi.org/10.1145/ 1518701.1518766

Devincenzi, S., Kwecko, V., de Toledo, F. P., Mota, F. P., Casarin, J., & Silva da Costa Botelho, S. (2017). Persuasive technology: Applications in education. In 2017 IEEE Frontiers in Education Conference (pp. 1-7). https://doi.org/10.1109/FIE.2017.8190439

Diamond, A. (2013). Executive functions. Annual Review of Psychology, 64, 135-68. https://doi.org/10.1146/ annurev-psych-113011-143750

Dick, W., Carey, L., & Carey, J. (2014). The systematic design of instruction. Pearson.

Drever, A. I., Odders‐White, E., Kalish, C. W., Else‐Quest, N. M., Hoagland, E. M., & Nelms, E. N. (2015). Foundations of financial well‐being: Insights into the role of executive function, financial socialization, and experience‐based learning in childhood and youth. Journal of Consumer Affairs, 49(1), 13-38. https://doi.org/10.1111/joca.12068

Fortin, D. R., & Dholakia, R. R. (2005). Interactivity and vividness effects on social presence and involvement with a web-based advertisement. Journal of Business Research, 58(3), 387-396. https://doi.org/ 10.1016/S0148-2963(03)00106-1

Garzón, J., Pavón, J., & Baldiris, S. (2019). Systematic review and meta-analysis of augmented reality in educational settings. Virtual Reality, 23(4), 447-459. https://doi.org/10.1007/s10055-019-00379-9

George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 update.

Allyn & Bacon. Gun, E. T., & Atasoy, B. (2017). The effects of augmented reality on elementary school students'spatial ability and academic achievement. Education and Science, 42(191), 31-51.

Han, J., Jo, M., Hyun, E., & So, H.-J. (2015). Examining young children's perception toward augmented realityinfused dramatic play. Educational Technology Research and Development, 63(3), 455-474. https://doi.org/10.1007/s11423-015-9374-9

Harvey, H. A., & Miller, G. E. (2017). Executive function skills, early mathematics, and vocabulary in head start preschool children. Early Education and Development, 28(3), 290-307.

https://doi.org/10.1080/10409289.2016.1218728

Hayashi, T. (1990). The Japanese experience in technology: From transfer to self-reliance. United Nations University Press. Holden, K., Kalish, C., Scheinholtz, L., Dietrich, D., & Novak, B. (2009). Financial literacy programs targeted on pre-school children: Development and evaluation. La Follette School of Public Affairs. https://lafollette.wisc.edu/images/publications/workingpapers/holden2009-009.pdf

Hermawan, H. D., Probowasito, T., Saputri, A., Rahayu, D. P., & Taufani, N. K. P. (2021). Studi Kelayakan dan Perancangan Arbook Indonesian History: Media Pembelajaran Sejarah Menggunakan Augmented Reality. Edukatif: Jurnal Ilmu Pendidikan, 3(4), 2359-2371.

Hsu, W. Y., Lane, H. Y., & Lin, C. H. (2018). Medications used for cognitive enhancement in patients with Schizophrenia, Bipolar disorder, Alzheimer's disease, and Parkinson's disease. Frontiers in Psychiatry, 9, 91. https://doi.org/10.3389/fpsyt.2018.00091

Huang, Y., Li, H., & Fong, R. (2016). Using augmented reality in early art education: A case study in Hong Kong Kindergarten. Early Child Development and Care, 186(6), 879-894. https://doi.org/10.1080/03004430.2015.1067888

Huang, R., Tlili, A., Chang, T. W., (2020). Disrupted classes, undisrupted learning during COVID-19 outbreak in China: Application of open educational practices and resources. Smart Learning Environments, 7, 19. https://doi.org/10.1186/s40561-020-00125-8

Javornik, A. (2016). 'It's an illusion, but it looks real!' Consumer affective, cognitive and behavioural responses to augmented reality applications. Journal of Marketing Management, 32(9-10), 987-1011. https://doi.org/10.1080/0267257X.2016.1174726

Karlsson, I., Bernedixen, J., Ng, A. H. C., & Pehrsson, L. (2017). Combining augmented reality and simulationbased optimization for decision support in manufacturing. In Proceedings of the 2017 Winter Simulation Conference (pp. 3988-3999). https://doi.org/10.1109/WSC.2017.8248108

Klopfer, E., & Squire, K. (2008). Environmental detectives-the development of an augmented reality platform for environmental simulations. Education Technology Research and Development, 56, 203-228. https://doi.org/10.1007/s11423-007-9037-6

Kotzageorgiou, M., Kellidou, P. M., Voulgari, I., & Nteropoulou, E. (2018). Augmented reality and the symbolic play of pre-school children with autism. In K. Ntalianis, A. Andreatos, & C. Sgouropoulou (Eds.), Proceedings of the 17th European Conference on e-Learning (pp. 273-280). University of West Attica.

Sari, R. C., Sholihin, M., Yuniarti, N., Purnama, I. A., & Hermawan, H. D. (2021). Does behavior simulation based on augmented reality improve moral imagination?. Education and Information Technologies, 26, 441-463.

Sari, R. C., Aisyah, M. N., Ilyana, S., & Hermawan, H. D. (2022). Developing a financial literacy storybook for early childhood in an augmented reality context. Contemporary Educational Technology, 14(2), ep363.

Leacock, T. L., & Nesbit, J. C. (2007). A framework for evaluating the quality of multimedia learning resources. Educational Technology & Society, 10(2), 44-59.

Lynch Jr., J. G., Netemeyer, R. G., Spiller, S. A., & Zammit, A. (2010). A generalizable scale of propensity to plan: The long and the short of planning for time and for money. Journal of Consumer Research, 37(1), 108-128. https://doi.org/10.1086/649907

McLachlan, C. J., & Arrow , A. W. (2017). Literacy in the Early Years: Reflections on International Research and Practice. Singapore: Springer.

Ulfah, M. (2020). Integrative Holistic Approach Based on Family Strengthening. Obsession Journal, 10-19.