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ORIGINAL RESEARCH

THE EFFECT OF AUGMENTED REALITY (AR)-BASED MAZEDENT MEDIA ON ORAL HEALTH KNOWLEDGE IN CHILDREN WITH MILD INTELLECTUAL DISABILITY

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ABSTRACT

Introduction: *Mazedent is an augmented reality (AR)-based game application that integrates interactive 3D objects and voiceovers to deliver engaging dental and oral health education for children with mild intellectual disabilities.* ***Aim:*** *This study aimed to evaluate the effect of Mazedent on dental and oral health knowledge among students with mild mentally retarded at SLB Negeri 1 Makassar and SLB Arnadya.* ***Method:*** *A pre-experimental design with pre-test and post-test was used, and knowledge was measured using a questionnaire.* ***Result:*** *The average number of correct answers increased from 3 before the learning session to 12 after, indicating a significant improvement. The comparison test conducted using the Wilcoxon signed-rank test with p value < 0.05.* ***Conclusion:*** *These results suggest that AR-based Mazedent is an effective educational tool for enhancing dental and oral health knowledge in children with mild intellectual disabilities.*

Keywords*: application, Mazedent media, Augmented Reality (AR), dental health, knowledge*

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INTRODUCTION

Dental and oral health problems in Indonesia remain among the most prevalent health issues. Based on data from the 2023 Indonesian Health Survey. Dental caries is one of the most common oral health problems affecting people of all ages worldwide. Epidemiological data indicate that its prevalence remains high globally, making it a significant public health concern.[1,2,3]

Dental health in early childhood is one part of child development that needs attention. Intellectual disability is a term used to describe individuals with below-average general intellectual function.[4] Intellectual disability is also known as brain weakness, memory weakness, mental retardation, and children with intellectual disability also experience mental retardation in adapting to the environment.[4] They are less able to think about abstract, difficult, and complicated things.[5] The various limitations that children with mental retardation have, make them unable to maintain good oral hygiene.[4,5] People with intellectual disability tend to have poor oral hygiene and periodontal disease and have a higher risk of caries than other children

with special needs.[6,7] Social problems in children with special needs also affect the educational needs of these children, including children with special needs who have less knowledge, especially in the field of dental and oral health. Low knowledge about how to maintain dental health supports high caries rates in children with special needs.[4,5,6,7,8]

Children with intellectual disability have higher caries rates and worse oral hygiene compared to children in general. The high incidence of dental caries in children with intellectual disabilities is influenced by limited knowledge and inadequate community behaviors regarding oral health care. Food residue that sticks to the teeth of children with intellectual disability that is not cleaned can cause tooth decay which causes teeth to become porous and have holes. The impact caused by dental caries that occurs in children with intellectual disability will inhibit the development process. Lack of knowledge in children can be caused by the lack of optimal counseling from the health task force, such as information about tooth brushing patterns which is one of the causes of children ignoring dental and oral health problems.[9,10]

Counseling is one of the health services that can be provided to normal children and children with special needs in order to improve the status of dental and oral health. The results of Constantika et. al.'s research stated that dental health education using animated video media resulted in an increase in dental and oral health knowledge in mentally retarded children by 57.86%.[11.12]

Mental retardation has weaknesses in thinking and reasoning. As a result of these weaknesses, mentally retarded children do not have the ability to learn like children in general so that understanding learning materials is still a problem in conventional learning. Conventional learning also makes children bored, because the material presented is repeated and prioritizes memorization which makes the learning method for mentally retarded children less appropriate. To maximize children's abilities, the education system with conventional methods must be changed to modern technology methods.

The message is that the development of information technology can be used as a supporting facility in the education sector. In the world of education, technology has its own role in the teaching and learning process, one of which is learning through android-based game media. Educational facilities that provide interesting and motivating learning combined with games can increase interest in learning. Games can also be used as a learning method and help train intelligence and problem-solving skills.[13]

Novayanti et al. in the development of 3D mobile educational games for recognizing surrounding objects have been successfully developed to meet the needs of mentally retarded students and teachers in order to create alternative learning media that are interesting, motivating and can be used anywhere and anytime.[14] Based on the results of the study by Sari Wulan et. al. Which has been conducted on mild mentally retarded students of class X SLB Negeri Gedangan Sidoarjo, it can be stated that

the Vorily© educational game is suitable for use and applied in the learning process of understanding English. The Vorily© educational game is an innovative and copyrighted learning tool developed to enhance student engagement and understanding through interactive and enjoyable educational experiences. Its protected status ensures the originality and integrity of its content.[14,15]

Mazedent is an educational game-based application designed to improve children's knowledge and skills in maintaining oral hygiene. The application features an attractive user interface and includes interactive animations, a virtual tooth-brushing game, and audio narration to support comprehension. What makes Mazedent unique is its design, which specifically considers the learning needs of children with intellectual disabilities, offering simplified visuals and user-friendly navigation.

Mazedent was chosen for this research for several key reasons. First, it utilizes a technology-based approach that aligns with the visual-auditory learning style common in children with mild intellectual disabilities. Second, it promotes an enjoyable learning experience, increasing engagement during the educational process. Third, to date, there is limited research evaluating the effectiveness of such applications in the context of dental health education for children with special needs.

The decision to focus on children with mild intellectual disability as research subjects is based on the fact that they retain the capacity to learn and develop practical life skills, especially when supported by appropriate educational tools. With the right interventions, they can demonstrate meaningful improvements in understanding and performing self-care tasks, including oral hygiene practices. This study therefore aims to assess the effectiveness of Mazedent in enhancing their oral health knowledge and skills.

Visual documentation of the Mazedent interface and the educational intervention process will be included in the appendix and results section to provide a clearer picture of the application’s features and its implementation in this study. Based on the description above, the researcher is interested in knowing "The Effect of Using AR (augmented reality)-based Mazedent Media on Dental and Oral Health Knowledge of Mildly Mentally Retarded Children".

METHODS

This study uses a pre-experimental research type with a pre-test and post-test design. This study was conducted in two locations, the first at SLB Negeri 1 Makassar, Jalan Daeng Tata Raya, Bonto Duri Village, Tamalate District, Makassar City, South Sulawesi. The second location was at SLB Arnadya, Jalan BTN Makkio Baji, Bangkala, Manggala District, Makassar City, South Sulawesi. This study was conducted in October 21-December 9, 2024. The population in this study were all students with Mild Mental Retardation at SLB Negeri 1 Makassar, totaling 18 students with Mental Retardation and SLB Arnadya, totaling 18 students with Mental Retardation. The research sample was the entire population, hereinafter

referred to as the subject. The type of data used is primary data containing questions. The processing of research data was carried out using SPSS version 29 calculations. Data analysis used the Kolmogorov Smirnov normality test and the Wilcoxon test. The results of the study are presented in the table.

The Mazedent application features a variety of interactive components designed to enhance children's cognitive development through engaging maze-based gameplay. At the core of the application is a digital maze game that challenges children to find the correct path from start to finish. This activity is not only entertaining but also trains logical thinking, concentration, patience, and problem-solving skills. Each time the player successfully navigates the maze, they unlock a new level with increasing difficulty, making the game progressively more challenging and stimulating.

One of the unique elements of Mazedent is its integration with Augmented Reality (AR). After completing each maze, children are presented with educational visualizations in 2D or 3D formats through AR, such as animated objects, letters, or numbers. This immersive experience bridges the gap between the digital and physical worlds, making learning more tangible and memorable. The design of the application is child-friendly, with a simple interface and colorful visuals that make it easy and enjoyable for young users to navigate.

In addition to its gameplay features, Mazedent also serves as a tool for educational evaluation through pre-test and post-test assessments. These assessments are conducted to measure the effectiveness of the game in improving various developmental aspects. The pre-test evaluates the child's initial knowledge and abilities, including recognition of shapes, colors, letters, numbers, logical reasoning, and concentration. After playing Mazedent, a post-test is administered to observe any improvements in these areas. The comparison between the two tests helps determine the impact of the application on cognitive growth, memory retention, fine motor skills, and motivation to learn. Thus, Mazedent is not only a game but also a meaningful educational media platform tailored for children's learning needs.

RESULTS

All research results were recorded, and data processing and analysis were carried out using SPSS version 29.

Table 1. Comparison test of the ability to answer yes before and after using AR (Augmented Reality) based mazedent media as a learning media for dental and oral health

Group	Mean	Std. Deviation	*p-value Wilcoxon Test*
Pre	3,216	2,229	0,000
post	12,568	0,765	

Based on Table 1, the interpretation shows that on average, the subjects were able to answer three questions correctly before the learning intervention. After the intervention, the average number of correctly answered questions increased to twelve. The comparison test conducted using the Wilcoxon signed-rank test yielded a p-value of less than 0.05, indicating a significant difference between the scores before and after the intervention.

DISCUSSION

This study is a pre-experimental study involving 18 subjects with mild mental retardation at SLB Negeri 1 Makassar and 18 subjects at SLB Arnadya. This study was conducted with two measurements of subject knowledge, namely before (pretest) and after (posttest) with the aim of determining the effect of using Augmented Reality (AR) based mazedent media on knowledge of dental and oral health of mild mentally retarded children.

In the comparative test table of the ability to answer yes before and after using Augmented Reality *(*AR) based mazedent media as a learning medium for dental and oral health, there is a difference before and after the treatment is given, this shows the average number of 'yes' responses given by the subject to three questions before the treatment and after treatment the ability to answer yes to the subject is an average of 12 questions. This shows an increase in subjects before and after treatment.

The results of this study are in line with Romadhon et. al. said that there is a difference in learning outcomes after using learning media for brushing teeth simulation for mentally retarded children and also research conducted by Wahyuni et. al. said that the results of the study that had been conducted at SLB Bnina Bangsa Sidoarjo showed that there was an influence of the picture and picture learning model on the ability to brush teeth of intellectual disabilities.[16,17]

Children with intellectual disabilities clearly experience obstacles and retardation in intellectual mental development far below average so that they experience difficulties in academic, communication and social tasks, so that they require special needs education services. Learning strategies for children with intellectual disabilities must also be well prepared so that the learning process becomes more interesting and students with intellectual disabilities are more enthusiastic in the learning process. Technology can be utilized in making media so that it fosters enthusiasm and is able to attract students' interest in learning.[18]

Research conducted by Velinda et. al. shows that digital-based interactive media can provide benefits to increase the creativity of children with special needs in Elementary Schools. Children with special needs must get the right methods and media to increase their creativity, one of which is interactive media, conversely if the methods and media are not right then learning will be boring for them.[19]

The success of developing Augmented Reality (AR) technology applications for educational media has resulted in the integration of several features, including the ability to display 3D objects, sound, and colorful images. This application facilitates the learning process by allowing students to explore and familiarize themselves through the use of 3D models and high-resolution images. This application also has the potential to introduce the concept of Augmented Reality (AR) technology to children, especially children with special needs, thereby enhancing their educational experience.[20]

Research conducted by Banyuningrum et. al. said that Augmented Reality media is one of the effective media in improving the ability to

recognize pets in grade IV Mild Mentally Disabled students.[21] Another study conducted by Kurniawan et. al. said that the application of Augmented Reality (AR) based transportation learning media for mentally disabled children used for learning has a positive impact on students.[22]

In the study conducted using Augmented Reality (AR) based Mazedent media, the aspect that distinguishes the learning game used is that the game will display challenges in the form of winding roads where players must find a way out in order to display 3D objects with voice overs containing dental and oral health which is useful for providing information with an attractive appearance for children with mild mental retardation.

CONCLUSION

Based on the results of the study conducted at SLB Negeri 1 Makassar and SLB Arnadya, it was concluded that there was an influence in the use of Augmented Reality (AR)-based Mazedent media on the knowledge of dental and oral health of children with mild mental retardation. The subjects were able to answer an average of 3 questions correctly prior to the learning intervention, which increased to an average of 12 questions following the intervention. This shows that digital media can have an effect on learning and increasing the knowledge of children with mild mental retardation.

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