

ORIGINAL ARTICLE

The difference between digital educational game and powerpoint-based video on oral hygiene knowledge in children aged 7-8 years : a quasi-experimental

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ABSTRACT

Introduction: Oral and dental health problems can be prevented through dental health education in which methods and media play an important role in increasing knowledge. Media that is often used in schools is still conventional, therefore research on modern media use is needed. This study intended to analyze the difference between digital educational games and PowerPoint-based videos in improving oral hygiene knowledge. **Methods:** This study method was a quasi-experimental with a non-equivalent control group and pretest-posttest design. The study population were 36 second-grade students at Elementary School 20 Kalumbuk, in Padang, Indonesia, selected using total sampling, with inclusion criteria being 7-8 year olds who brought informed consent forms which were already signed by parents and were in good overall health. The sample that met the inclusion criteria was 32 students and were divided into two groups. A total of 16 students in the experimental group (Group A) received oral health education through digital educational game media, while the remaining 16 students in the control group (Group B) were provided with PowerPoint-based video media. Data were collected by giving questionnaires both before and after education. The data analysis was using a paired t-test and an independent t-test. **Results:** The oral hygiene knowledge average increased 2.94 in Group A and 1.68 in Group B. The paired t-test showed significant improvement in both groups ($p = 0.000$). The independent t-test revealed a significant difference between digital educational games and PowerPoint-based videos ($p = 0.037$). **Conclusion:** There is a significant difference between digital educational games and PowerPoint-based videos in improving dental and oral hygiene knowledge among children aged 7-8 years. The digital educational games demonstrated a higher increase in knowledge compared to the PowerPoint-based videos.

KEYWORDS

digital educational game, Powerpoint-based video, oral hygiene knowledge

INTRODUCTION

Oral health is an important component of health that can affect a person's quality of life.¹ Maintaining oral hygiene is crucial for achieving good oral health, and this can be accomplished by brushing teeth.² The results of the Basic Health Research in 2018 show that of 94.7% of the Indonesian population who brush their teeth every day, only 2.8% do it at the right time, which is at least 2 times a day after breakfast and before going to bed. In the age group of 5-9 years, it was observed that 93.2% brushed their teeth every day. However, only 1.4% did it at the right time. In West Sumatra Province, it was recorded by the same age group that 0,41% brushed their teeth properly.³

The age group 5-9 years, comprising 67,3%, represents the largest segment with the oral issues are caries and periodontal disease. The high rate of poor oral health among childrens is due to insufficient dental and oral health education and is exacerbated by the high number of childrens consuming of sugary snacks and carbonated drinks.^{4,5} Providing dental and oral health education to school-age children, is crucial because at this stage children begin to develop habits to maintain health from an early age until adulthood.⁶ Children, as one of the targets of education, have certain characteristics according to their age and cognitive development. Children aged 7-8 years, according to Jean Piaget (1896-1980), are in the concrete operational development phase. They are already able to think logically and do reasoning to solve simple problems, so the materials, methods, and media used in the educational process must be adjusted so that children can understand the material and educational goals are achieved.^{7,8}

Traditionally, oral hygiene education is delivered by dentists through lectures, but this approach has limitations, including a shortage of dentists, difficulty reaching large populations, a potentially boring and unmemorable format, and lack of cultural relevance.⁹ In recent years, there has been a growing interest in the potential impact of smartphone applications on oral health knowledge and behavior.¹⁰ Children born in 2011-2025, or the Alpha generation, are very familiar with information and communication technology that has become part of their daily lives.¹¹

The result of the Asian Parent Insight Survey in 2014 conducted in five countries in the Southeast Asian region, including Indonesia, was that 98% of children aged 3-8 years use smartphones. This includes 67% who used their parents' phones, 18% who had access to those of relatives or family members, and 14% who owned their own smartphones. Applications that are widely used on smartphones by children in this age range are game applications, namely 89% for boys and 74% for girls.¹² This phenomenon is the basis for utilizing smartphones as technology-based learning media (mobile learning) by developing educational game applications, also known as digital educational games.¹³

A digital educational game is an interactive learning multimedia in the form of a game application that contains educational values. The application can be accessed through digital devices such as computers, laptops, and smartphones.¹⁴ It is presenting a concrete object in a real learning situation through playing simulation and in accordance with the child's thinking.⁷ One of the android-based dental and oral health education games that can be found on the Google Play Store is the game application "Belmain-belajar sikat gigi". The game is suitable for children up to the age of 8 and has been recognized by teachers as a fun and interesting application for learning or playing. The game "Belmain-belajar sikat gigi" can be used to learn how to maintain oral hygiene. The child will play a simulation of brushing teeth, which makes it easier to remember. Children can also read material repeatedly so that children can learn independently anytime and anywhere.

Another interactive learning multimedia that is most widely used in education is Microsoft office PowerPoint. The media not only displays text, but is combined with elements of images, animation, and music in presenting material to students.¹⁵ Microsoft office PowerPoint can be used to create learning videos which are one of the e-learning-based teaching materials. PowerPoint-based videos are developed to attract the Alpha generation who like the use of sophisticated technology.¹⁶ The advantages of video-based learning are that it can present learning objects in real time, and reduce learning boredom because it can be used not only at school but also on students' smartphones so that it can be studied anytime and anywhere.¹⁷

This research was conducted on children aged 7-8 years who are generally in the second grade of elementary school. The age range of 7-8 years is in the transition period from baby teeth to permanent teeth due to the condition of the teeth that are just growing and immature teeth so oral hygiene education needs

to be given at this age to prevent caries, etc.⁴ The highest caries cases in Padang in 2022 were in the work area of the Kuranji Public Health Center.¹⁸ The results of the health screening report of students at 14 elementary schools under the guidance of Kuranji Public Health in 2022 found that the highest of caries in second grade of students at Elementary school 20 Kalumbuk Padang with a percentage of 60% or 23 out of 38 students.¹⁹

The media used in dental health education by elementary school district health centers is still conventional, such as lectures. which may be one of the causes of primary school students' lack of knowledge resulting in high caries rates. Multimedia in the form of games and PowerPoint-based videos was chosen in order to en-counter digital natives' interests and learning strategies.⁵ There has been no previous research examining the use of modern media to improve knowledge of dental and oral hygiene. This study aims to analyze the difference between digital educational games and PowerPoint-based video on oral hygiene knowledge in children aged 7-8 years.

METHODS

This research is quasi-experimental research with a non-equivalent control group pretest-posttest design conducted at Elementary school 20 Kalumbuk Padang on March 16-17, 2023. The population in this study comprised all 36 second-grade students of Elementary school 20 Kalumbuk Padang. The research sample was selected using a total sampling technique of 32 students who met the predetermined inclusion criteria. The second grade students of Elementary school 20 Kalumbuk Padang aged 7-8 years who brought informed consent signed by parents/guardians and were in good physical and psychological health could take part in the study while students who were not present during the pretest, education, and posttest were excluded. Furthermore, the sample was divided into 2 treatment groups, namely the experimental group (Group A) and the control group (Group B), with each group consisting of 16 students. This research was conducted in different classrooms in each group.

The study began with students filling out a pretest in the form of a questionnaire for 15 minutes. The questionnaire consisted of 15 multiple choice questions using simple language according to the limited writing and reading ability of the students.

The second stage was the provision of oral health education in each group. Each group was given a different oral health education intervention. Group A was given an oral health education intervention through the game application "Belmain-belajar sikat gigi" for 30 minutes. This game, released in 2021 by Joy Leap Studio, has been updated continuously until now. Download the app from the Google App Store using the link below (<https://play.google.com/store/apps/details?id=com.joyleap.belmainsikatgigi>). and play online. Another group, group B, was given education through a 3-minute PowerPoint-based video that can be accessed on the YouTube channel "Dhefa azarys" (<https://youtu.be/FNKkTqiXsMk?feature=shared>).

The game contains material on how to maintain oral hygiene and its application in the form of game simulations. Students were required to complete the mission for saving Nana Tooth Island from the monster of cavities starting from choosing foods that are good for teeth then brushing steps that are good and correct. The toothbrush animation in the game will move to kill germs according to the brushing motion. The material presented can be selected through a menu that is separate from the mission, so that the sample can understand the theory before or after running the mission. Meanwhile the PowerPoint-based video presents educational content that has been adapted to the material contained in the game application belmain-belajar sikat gigi in the form of moving animations.

Students get education through seeing text and hearing voice explanations throughout the video. After receiving oral health education, participants in each group were given a 20-minute break before filling out a posttest questionnaire with an additional 15 minutes allocated for it.

The data normality test used was Shapiro Wilk with normally distributed data results. The statistical analysis used to determine whether there is a difference in knowledge before and after providing dental and oral health education using digital educational games and PowerPoint-based videos is a paired sample t-test, while comparing and seeing differences in changes in knowledge levels after dental health education is carried out. and mouth using digital educational games and PowerPoint-based video media is an independent t-test

RESULTS

The frequency distribution of subjects based on gender and age can be seen in Table 1. The majority of the subjects were female, accounting for 56.2%, and the most common age group was 8 years old.

Table 1. Characteristics of students

Characteristics	Group A		Group B	
	n	%	n	%
1. Age (years)				
7	8	50.0	6	37.5
8	8	50.0	10	62.5
2. Gender				
Male	7	43.8	7	43.8
Female	9	56.2	9	56.2

Bivariate analysis was used to analyze the difference of digital educational games (Belmain-belajar sikat gigi) on oral hygiene knowledge of second grade students at Elementary school 20 Kalumbuk Padang. The Shapiro-wilk data normality test results showed that all pretest and posttest mean values in both groups had a p value > 0.05, indicating that the data was normally distributed. The Levene test results also showed a value of p = 0.73 suggesting that the data had the same variance (homogeneous), allowing for the continuation of data processing using the parametric t-test.

Table 2. Knowledge level of group A & B students (paired sample t-test)

Group	n	Variables	Mean \pm sd	Difference Average \pm sd	95% IK	P value
A	16	Pretest	8,75 \pm 1,844	2,94 \pm 1,569	2,10 \pm 3,7 7	0.000
		Posttest	11,69 \pm 1,99 1			
B	16	Pretest	8,38 \pm 1,784	1,68 \pm 0,94	1,18 \pm 2,1 9	0.000
		Posttest	10,06 \pm 2,20			

The results of the study in Table 2 after the paired t-test in groups A and B showed that both produced a value of p = 0.000 (p < 0.05), meaning that there was a significant difference in the level of oral hygiene knowledge students of pretest (before) and posttest (after) education using the game application Belmain-belajar sikat gigi and the PowerPoint-based video.

Table 3. Differences in knowledge level of group A and group B students

Variables	Group	
	A	B
Pretest	8.75	8.38
Posttest	11.69	10.06
Difference in Improvement	2.94	1.68

Based on Table 3, group A experienced an average increase in knowledge of 2.94, while group B was 1.68. These results indicate that the education group with the game application media "Belmain-belajar sikat gigi" experienced a higher increase in knowledge than the education group using PowerPoint-based video media.

Table 4. Independent sample t-test of group A and group B

Group	n	Mean \pm sd	Mean Difference \pm sd (IK 95%)	P value
A	16	11.69 \pm 1.99	1.63 \pm (0.10-3.14)	0.037
B	16	10.06 \pm 2.20		

The result of the study, as shown in Table 4 after conducting an independent t-test between groups A and B, revealed a value of $p = 0.037$ ($p < 0.05$). This suggests a notable disparity in influence among students who received education through "Belmain-belajar sikat gigi", compared to those using the PowerPoint-based video.

DISCUSSION

Statistical test results using paired t test (table 2), it showed a p value of group A = 0.000 ($p < 0.05$), indicating an increase in oral hygiene knowledge from the pretest score of 8.75 ± 1.844 to the posttest score of 11.69 ± 1.99 , with a difference of 2.94 ± 1.569 after using the digital educational game. It is meaning that there was influence of digital educational games on increasing oral hygiene knowledge s in the experiment group.

Oral health education process is influenced by the appropriateness and suitability of the use of methods and learning media, because the media utilized not only provides information, but must also provide experience.²⁰ Digital native children, especially elementary school children, were interested in increasing their knowledge and prefer learning while playing with interesting games. It was making easier for them to accept and remembered the content of the material because games involve more senses in learning activities.⁵ These results are in line with other studies by Muliadi et al. (2018) stated that the android-based monopoly game is effective as a medium for oral health education because it presents interesting animations, text, images, and music so that students are not easily bored.²⁰ This is in accordance with previous research conducted by Kashyap et.al (2022) which showed that game-based education proved improving oral health knowledge.²¹

Table 2 also demonstrated a p value of group B = 0.000 ($p < 0.05$), indicating an increase in oral hygiene knowledge from the pretest score 8.38 ± 1.784 to the posttest score of 10.06 ± 2.20 with a difference of 1.68 ± 0.94 after using Powerpoint-based video. It showed that there was an impact of Powerpoint-based video on increasing oral hygiene knowledge s in the control group. PowerPoint can display an attractive presentation by presenting images, text, audio, animation, and video. The results of this study are also supported by research conducted by Herlina & Saputra (2022), found that using Microsoft PowerPoint is suitable as a practical learning media because it can provide more apparent learning materials, increase students' learning enthusiasm, and create an interactive learning environment.²² Students can witness what cannot be experienced directly by watching videos, for example, how to brush their teeth, thus increasing the success of oral health education.²³ This research is supported by previous research by Fhonna et al. in 2021, which states that PowerPoint-based video media is influencing student learning outcomes increase because the presentation of material is in simple language, and there are clear images so that students easily understand the material.²⁴

The use of the game application Belmain-belajar sikat gigi in providing education is more influential than PowerPoint-based video media, as evidenced by the findings in Table 3 which demonstrate a higher degree of improvement in oral hygiene knowledge through the use of the game application. Independent t-test (Table 4) results showed a value of p between groups A and B = 0.037 ($p < 0.05$), indicating a significant difference in the increase of knowledge in children who received education through digital educational games compared to those who learned from the PowerPoint-based video presentation. This happens because the use of different media can affect the level of children's mindset in understanding the subject matter.²⁵ Children's mindset is shaped by age-appropriate cognitive development and intervention in the form of stimuli that help children develop their abilities. Jean Piaget's theory states that cognitive development in elementary school-age children is generally in the concrete operational phase. Children can already think logically related to concrete or real events, so learning activities directly or using real objects such as game media is the appropriate learning and best with children's thinking.⁷ Dale states in his theory that the more real the object studied, the more concrete the knowledge obtained by the child, and the more indirect the knowledge obtained, the more abstract the knowledge.²⁶

The game application Belmain-belajar sikat gigi used in the experimental group encouraged students to be more interactive in learning activities.⁵ The game requires students to think creatively and move actively (motorically) to be able to complete the game so that students are more focused in the learning process. Learning activities while playing also use more senses (sensory), such as the sense of hearing and the sense of sight, so that it triggers students' memory to absorb the material more easily.²⁷ The PowerPoint-based video media applied to the control group makes children only able to control the video or audio without any other interaction, so that student interaction in the learning process is low.²⁸ This is also in accordance with Dale's Cone of Experience theory, which states that by doing something real or direct, such as playing in the learning process, children can absorb the material provided as much as 90% while learning by seeing and hearing; for example, by watching videos, children can absorb material only as much as 50%.²⁶

This research is supported by previous research by Nugrahmi et al. in 2017, where there was a significant difference in counseling using the "gigi.id" application rather than playing videos. This can occur due to the possibility of different learning styles for each student, which causes the absorption of oral health counseling material to be different.²⁹ Students' learning styles can be known through their learning modalities. DePotter (2002) states that there are three learning modalities, namely visual, auditory, or kinesthetic modalities (V-A-K). Each student is different in acquiring, storing, and applying knowledge, so there is no learning style that is better than others. These three learning styles are owned by everyone, but most are more dominant in one of these three learning modalities. Students who learn according to their dominant learning style can cause the subject matter to be more easily accepted and understood.³⁰

The findings of this study also align with research by Indah et al. in 2021, which found a significant difference in understanding oral health materials between receiving counseling through audiovisual media and through guessing games.³¹ Another study conducted by Setiadi et al. in 2020 also proved that playing snakes and ladders is more effective as a medium for oral health education in elementary school children than watching videos.³² This is because game media has a motoric advantage over video media, which is more passive. Motor skills are developed through the speed of hand-eye coordination needed to win the game. students can also interact by touching the screen of the device or pressing certain buttons to make choices, or make decisions. as a pedagogical activity that allows children to understand their world through a digital environment. It can improve concentration, reading skills such as understanding simple rules. Gesture recognition technology is the answer to developing digital educational games that

are more suitable for early childhood learning which is more likely to explore affective and psychomotor.³³ Therefore, digital educational games are multisensory and child-centered, by connecting prior knowledge, through feedback, self-evaluation, or through social learning. Children can gain factual knowledge and virtual experience, then apply it to form behaviors that are a combination of learning and play activities.³⁴

It is necessary to conduct further research on the digital educational game "Belmain-belajar sikat gigi", which is accompanied by increased features in the game. Changes at the advanced level, namely changes in attitudes and behavior, also need further research to find out whether it can change attitudes and oral health behavior for the better.

In this study there are limitations that researchers use to utilize Belmain-belajar sikat gigi applications that are still android and 2D. The researcher also found the difficulty in controlling the environment and the limited space during the research activities. School has limited classrooms so there is only one classroom that can be used. This can make the atmosphere of the room less conducive and possibly disrupt student concentration in participating in learning activities

CONCLUSION

Based on the research findings, it was concluded that there is a significant difference between the use of digital educational games and PowerPoint-based videos in improving dental and oral hygiene knowledge among children aged 7-8 years at elementary schools 20 Kalumbuk, Padang, Indonesia. A higher increase in knowledge was observed with the use of digital educational games. In line with the improvement in students' knowledge, as evidenced by the pre-test and post-test average scores, it is recommended to implement a School Dental Health Program (UKGS) in collaboration with the local health department. Implication of this research initiative leverages digital educational games as a tool for health education to further enhance students' knowledge and empower them to maintain proper dental and oral hygiene.

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Data Availability Statement: Data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study.

Conflicts of Interest: The authors declare no conflict of interest.

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