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The Impact of Handwashing Education Using Puzzle Media on Handwashing Behavior Among Elementary School Children: A Pre-Experimental Study

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ABSTRACT Clean and healthy living behavior by washing hands is an important effort to minimize the emergence of disease. However, many people, including children, do not know how to properly maintain hand hygiene. The aim of the research was to determine the effect of hand washing with soap education using puzzle media on the hand washing behavior with soap of elementary school aged children. The research used a pre-experimental design with a One Group Pretest-Posttest Design approach. The sample consisted of 56 students as the intervention group. Data analysis used the Wilcoxon Signed Ranks Test. The use of puzzle media has been proven to have an influence with a significance value of $0.000 < 0.005$ on behavior in the domain of knowledge, attitudes and actions in elementary school age children. Teachers, health workers and the general public can provide education through puzzle media to children because it is interesting, easy to understand and affordable. The implication of the research is that puzzles can be a recommendation in increasing the interest of elementary school age children in implementing knowledge domain behavior, attitudes and actions in washing hands with soap correctly.

INDEX TERMS Education, Elementary School Age Children, Hand Washing with Soap, Puzzle

I. INTRODUCTION

Poor implementation of a culture of clean and healthy living behavior can lead to a variety of diseases in children. Since children are the nation's future inheritors, their health status is a reflection of the country's overall health. Keeping hands clean is one culture of clean living that can be implemented from an early age, but there are still many who don't know how to keep hands clean properly [1]. Hand washing and hand hygiene are very important things to remember in the hospital practice as well as daily life [2]. Hand hygiene which Regularly wash hands with soaps and when washing facility [3].

Hand hygiene is broadly recognized as a critical intervention in reducing the spread of disease-causing pathogens in both professional and personal uses [4]. As humans involuntarily touch their faces over 20 times per hour a hand washing with soap and water is recommended to

avoid hands to face transmission [5]. The habit of washing hands is one of the community behaviors related to clean and healthy living [6]. According to the [7], existing evidence shows that compliance with hand hygiene recommendations during health service delivery is still less than optimal throughout the world. According to [8], the proportion of correct handwashing behavior in Indonesia aged ≥ 10 years is 49.8%. The researcher's observations and preliminary data revealed that 8 out of 10 students failed to wash their hands during lunch breaks, and 5 out of 10 students did not wash their hands after using the bathroom. Therefore, efforts to increase hand washing can be a solution to preventing disease transmission [9].

The prevalence of diseases in children aged 5-14 years in Indonesia includes ISPA 15%, pneumonia 15%, pulmonary tuberculosis 15%, hepatitis 15%, diarrhea 15%. The emergence of these diseases can arise due to poor

personal hygiene behavior and not getting into the habit of washing hands with soap [8]. So there are still many diseases out there that can harm children aged 5-14 years which are caused by a lack of compliance with washing their hands with soap [1].

Health behavior is an action that includes social change, improved capability, and an escalation in quality of life [10]. Three domains divide human behavior: knowledge, attitude, and action [10]. Children of school age can be defined as those between the ages of 6 and 12 [11]. At this stage, children are able to learn something new until they have broad insight into knowledge, know a new world, and interact with others [12][13].

Puzzles are a learning medium with visual methods that are very suitable for children of school age due to the nature of the child's learning [14]. Puzzles are an interesting and fun media for children's games and can improve children's cognitive abilities. By using puzzle media, children's cognitive abilities will be achieved, for example classifying objects based on color or shape or size, classifying objects into the same group or similar groups or paired groups with two variations and the ability to think to solve simple problems [15].

Based on previous research, it is stated that there is an influence of health education using puzzle media on hand hygiene behavior in school-aged children at Waru Waipia Christian Elementary School [15]. In line with research where there is an influence of applying the puzzle playing method to improve the ability to wash hands cleanly in moderately mentally retarded children [16]. Students can use this puzzle to improve their understanding of handwashing and soap-related health education.

The research aims to determine the impact of hand washing with soap using puzzle media on behavior in the domains of knowledge, attitudes, and actions handwashing with soap use in children of primary school age. The research gap from the results of previous research is evident from the process of analyzing hand washing behavior with soap in elementary school children which considers 3 domains, namely Action, Attitude and Knowledge. Then, research has never been conducted on the influence of puzzles on hand washing behavior in grade 3 children at SDN Menur Pumpungan 5 Surabaya, which is also a research gap.

II. METHOD

Research uses pre-experimental design through the One Group Pretest-Posttest Design approach. This research design was used for the reason that the researcher wanted to analyze the effect of correct hand washing behavior with soap through a Pretest without the use of Puzzle learning and a Post Test using Puzzle learning so that the differences in results in hand washing behavior with soap in elementary school children could be identified. The reason for choosing the one group pretest posttest design is so that one group receives intense and planned training, so that the results obtained can be maximized [17].

The study's subject was an intervention group with a sample of 56 elementary school 3rd grade students. The reason for using a sample of 56 grade 3 students at SDN Menur Pumpungan 5 was because students at this age were able to understand the lessons given. The stages of development experienced by children aged 6-9 years are physical, emotional, social, cognitive, language and speech development [18]. The independent variable in the research is the puzzle media, while the dependent variable is the child's hand washing behavior with soap. We conducted the research at Menur Pumpungan IV/236 primary school in Surabaya on February 2024.

One of the research instruments is a puzzle medium with six pieces, each of which contains handwashing steps detachable from the mount. In this study, we measure the level of behavior in the domains of knowledge, attitudes, and actions. We accomplish this by using knowledge questionnaires with categories of good, enough, and not enough, an attitude questionnaire with positive or negative categories, and observation sheets with steps for washing students' hands categorized as good, enough, and not enough.

Data collection was carried out by distributing questionnaires assessing hand washing behavior with soap from the aspects of knowledge, attitudes and actions. Data collection was carried out twice during the pretest before learning with puzzles and the post test after learning with puzzles. Learning was carried out over four meetings. At the first meeting, we did a pretest and observed how people washed their hands with soap. At the second meeting we will present material about washing hands with soap, using puzzle steps as media, and attach examples of puzzle images that illustrate the correct steps for washing hands. At the third meeting we will get a presentation on how to wash hands using soap puzzle media, but without attaching an example of a puzzle image of the correct steps for washing hands. At the fourth meeting we conducted a posttest and observed how people washed their hands with soap.

The analysis technique uses the Wilcoxon Signed Rank Test because it is able to compare two related samples or repeated measurements on the same subject when the data does not meet the requirements of a normal distribution. Before carrying out data analysis, validity and reliability testing was carried out. In the validity test, the results obtained were that of the 15 questions in the knowledge questionnaire, all questions were said to be valid because they had a calculated r value greater than the r table. In the results of the validity test of the attitude questionnaire from 10 statement items, all statements were said to be valid because they had a calculated r value greater than the r table. Then, for the reliability test, the Cronbach's Alpha value obtained on the knowledge questionnaire was $0.795 > 0.50$, and on the attitude questionnaire it was $0.740 > 0.50$, which means that the knowledge and attitude questionnaire was declared reliable.

III. RESULT

The results of this study looked at the influence of soap-hand washing education with puzzle media on behavior that covers the domain of knowledge, attitudes, and hand washing actions with soap in primary school children.

A. Characteristics of Respondents

Table 1. Characteristics of Primary School Children by Age and Gender

Characteristics		Frequency (n)	Percentage (%)
Age	8 years	6	10,7
	9 years	45	80,4
	10 years	4	7,1
	11 years	1	1,8
	Total	56	100
Gender	Man	35	62,5
	Female	21	37,5
	Total	56	100

According to Table 1, the age characteristics of the primary school children who were respondents were almost entirely 9 years old and a minority 11 years old.

B. Statistical Test Result

Table 2. Frequency Distribution of Basic School Child Behavior in Hand Washing with Soap Before Education Hand Washing with Soap Using Media Puzzle

Behavioral Level	Category	Before Education Wash Hands with Soap Using Puzzle Media	
		n	%
Knowledge	Good	48	85,7
	Enough	8	14,3
	Not Enough	0	0
	Total	56	100
Attitude	Positive	56	100
	Negative	0	0
	Total	56	100
Action	Good	2	3,6
	Enough	7	12,5
	Not Enough	47	83,9
	Total	56	100

Based on table 2, the distribution of frequency levels of behavior of children of primary school age before given health education hand wash with soap with puzzle media, almost entirely have knowledge of hand wash using soap well and none have less knowledge hand washing by soap, overall have a positive handwashing attitude using the soap and no one have a negative hand wash attitude with the soaps, a small part have the ability to hand wash action using the soap well, and almost all have the capacity to hand wash action using soaps less.

This is in line with previous research where regarding the level of children's knowledge before being given puzzle play therapy intervention, almost all grade 1 children in this study had good knowledge [1]. The level of behavior in the

knowledge domain of elementary school aged children who were respondents regarding hand washing can be said to be quite good before being given health education. This is because during the pandemic and after the Covid 19 pandemic, schools have provided education about hand washing, so that in general students already know what washing hands with soap is.

Table 3. Frequency Distribution of Basic School Child Behavior in Hand Washing with Soap After Education Hand Washing with Soap Using Media Puzzle

Behavioral Level	Category	After Education Wash Hands with Soap Using Puzzle Media	
		n	%
Knowledge	Good	55	98,2
	Enough	1	1,8
	Not Enough	0	0
	Total	56	100
Attitude	Positive	56	100
	Negative	0	0
	Total	56	100
Action	Good	46	82,1
	Enough	8	14,3
	Not Enough	2	3,6
	Total	56	100

Based on table 3, the distribution of frequency levels of behavior of primary school children after given health education hand wash with soap with puzzle media, almost entirely have knowledge of hand wash using soap well and none have less knowledge of hands washing by soap, overall have a positive handwashing attitude using the soap and no one have a negative hand wash attitude with the soaps, almost all have the ability to hand wash action by the soapy well, and a small portion have less hand washing ability by the soap.

Previous research stated that almost all of them had good knowledge after being given education using puzzle media [19]. The results of the post test questionnaire on hand washing knowledge for elementary school aged children in this study showed that the children already understood the knowledge of hand washing, especially in terms of how washing hands can prevent disease and stop the spread of germs, washing hands needs to be done before and after eating, and washing hands is not necessary. Just use running water so that the results of the post test on children's hand washing knowledge are almost entirely in the good category.

Table 4. Distribution Educational Health Impacts of Hand Washing with Soap Using Media Puzzle on Handwashing with Soap Behavior of Children of Primary School

Behavioral Level		Mean	SD	95%CI	p-value
Knowledge	Pre Test	13,32	1,336	12,96-13,68	0,000
	Post Test	14,39	0,802	14,18-14,61	
Attitude	Pre Test	3,35	0,089	3,33-3,37	0,000
	Post Test	3,48	0,068	3,46-3,50	
Action	Pre Test	2,39	1,155	2,08-2,70	0,000
	Post Test	5,37	1,054	5,09-5,66	

According to table 4, there was an improvement in student behavior in the domain of knowledge between the pre-test and post-test levels. The Wilcoxon Signed Ranks Behavioral Handwashing Test in the knowledge domain yielded a significant value ($p = 0.000$; $CI = 14,18-14,61$), indicating that teaching children of primary school age to wash their hands with soap has an impact on their knowledge-related behavior. Based on the level of behavior in the attitude domain, the known mean value of the pretest is 3.35, whereas the posttest is 3.48. The Wilcoxon test yields a significant value ($p = 0.000$, $CI = 3.46-3,50$), indicating a noteworthy impact of education involving handwashing with soap and puzzle media on the attitudes of primary-school children. The degree of conduct in the action domain led to an increase in the known value of the pretest from 2.39 to 5.37.

School-age children after being given health education on washing hands with soap using puzzle media can increase their knowledge about washing hands because puzzles can be easily understood by students. Students are able to classify, arrange, and connect the steps for washing hands listed on each puzzle piece. This is because when children see and arrange each piece of the handwashing puzzle, children will automatically see, read, and remember the sequence of the 6 steps for washing hands depicted in the puzzle. So it can be concluded that education with puzzle games can be accepted and understood well by elementary school-age children so that there is an increase in behavior in the domain of knowledge about washing hands with soap. This is in line with research conducted by [9] which also stated that there was a significant relationship between attitudes and handwashing behavior with soap in students in the study.

IV. DISCUSSION

The study's results demonstrated the impact of soap-based handwashing education through puzzle media on the handwashing knowledge and behavior of primary school-aged children. Giving hand washing education using puzzles can improve student hand washing behavior in the domain of knowledge. According to [20], demonstrates the impact of

soap-based hand washing via the media game Snake Staircase on fourth-grade students' understanding of diarrhea prevention. According to [19] also proves the influence of personal hygiene of handwashing using soap with puzzle media on the knowledge of students, where the whole student has knowledge of washing hands with soaps well after being given education through the media puzzle.

The senses of hearing and vision play a major role in acquiring knowledge, which is the result of an individual learning about an object through their own senses [21]. Edgar Dale's Nugget contains a demonstration learning medium in the form of a game tool with a non-moving image design, making it suitable for children of primary school age [22]. Memory reaches its maximum intensity and strength at the age of 8 to 12 years [23]. According to [24], classifying, compiling, and interpreting numbers are three skills shown by children aged 6 to 12. With these characteristics of intellectual development, educators, through training activities and practical practice, develop such competence in the learning process.

After learning how to wash their hands with soap through a puzzle, school-age children can enhance their understanding of hand hygiene because puzzles are easily comprehensible to them. This is because the puzzle is easy to understand and allows students to see, read, and remember the six-step sequence of washing the hands drawn in it. Therefore, we can conclude that primary school children understand education hand wash through puzzle games.

The research findings demonstrated the influence of educating children of elementary school age about handwashing with soap through puzzle media on their behavior in this area. According to [9], demonstrating a significant correlation between attitudes and students' soap-using handwashing behavior. Other studies also showed a relationship between attitudes and interest in hand washing with soap [25]. According to [26] found that after receiving education through gaming media, all respondents had a positive attitude towards handwashing.

Attitude is the tendency to think, understand, and behave, as well as the nervous system's readiness to give a specific response [21]. The puzzle game is the activity of disassembling and reconfiguring parts of one image into an integral shape [1]. Puzzles help children learn to solve problems and improve concentration [27]. According to [28], one of the characteristics of attitude is that attitude has a driving force (motivated). Puzzle media can teach an unmotivated child how to wash their hands, thereby fostering motivation. Children not only love the game but also become more careful and stubborn when playing puzzles. After receiving health education about hand washing through puzzle media, students' behavior improves, demonstrating their understanding and appreciation of the significance of proper hand washing. Children of primary school age can readily embrace education through puzzle games.

The results of the study showed the influence of giving education on handwashing using soap through puzzle media on behavior in the domain of hand washing with soap action in children of primary school age. According to a study by [29], health education using simulation methods has an impact on the practice of washing hands with soap after treatment. According to [15] research, health education with puzzle media has an influence on the hand hygiene skills of school-age children. According to [30] found that elementary school students improved their hand washing skills with puzzle media after receiving training.

The puzzle learning medium's purpose in children is to teach them how to solve problems quickly, carefully, and thoroughly, as well as to instill a reluctant attitude when facing problems [27]. When the child concentrates on reassembling the puzzle pieces that contain handwashing steps, the child will feel challenged, and there will be a desire to solve the puzzles. The child's ability to reassemble the puzzle pieces will improve as their skills improve. Children can draw conclusions on the problem after trying and combining pictures over and over again. Puzzles can help children remember handwashing steps. When children practice hand washing directly with running water and soap, they can follow the taught sequence. This is because they automatically remember the correct hand wash steps when they assemble the hand wash puzzle. Researchers concluded that using puzzle media to practice hand washing with soap influenced the behavior of primary school children in this domain.

Giving puzzle media can affect students' knowledge about personal hygiene hand washing. It is hoped that the hand washing puzzle media can be used as a medium in increasing student knowledge [19]. According to the research results, providing health education through puzzle media, such as hand wash with soap, has a significant impact on the knowledge, attitudes, and actions of elementary school-aged children. However, the civil society can also impart knowledge to students or their children through engaging media games, ensuring their acceptance of the imparted knowledge. The benefit of this research is that it can be a recommendation for teachers and the community in improving the ability of elementary school children to behave properly in washing their hands in terms of knowledge, attitudes and actions so that it can improve the health of children. The weakness of the research is that the research subjects are limited to Grade 3 Children at SDN Menur Pumpungan 5 Surabaya so that the research results cannot be generalized to other schools.

V. CONCLUSION

Research findings demonstrate that incorporating puzzle media into health education about hand washing with soap significantly influences the hand washing behavior of primary school-aged children. We suggest that schools implement routine learning about hand washing using a game medium, such as a puzzle, to facilitate children's acceptance of

the lessons. Schools can give lessons about washing hands once every 1 or 2 months so that children can recall the knowledge they have acquired and become accustomed to washing their hands at all times. Future researchers could modify the data collection method by forming a learning group consisting of five students, who would be guided by a facilitator during the intervention. This approach would enhance the understanding of the given material and increase the children's focus when playing media puzzles. Then, future researchers will need some research assistants to help during the data collection process.

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