

# We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

185,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index  
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?  
Contact [book.department@intechopen.com](mailto:book.department@intechopen.com)

Numbers displayed above are based on latest data collected.  
For more information visit [www.intechopen.com](http://www.intechopen.com)



# Health Education to Prevent Diarrhea in Preschoolers

*Arbianingsih Tiro*

## Abstract

Preschoolers are the second largest group suffering from diarrhea. Numerous studies have identified poor community hygiene and health practices contributing as causes of diarrhea, making it necessary to teach children healthy behavior for prevention. Healthy behavior can reduce the risk of diarrhea by 36–48%. Unfortunately, health education is commonly given to parents, but it is limited for children. Preschool is a period of transition from parental control to self-control. This period is also the best time to build concepts and ideas with constant reason. Applying an important concept for healthy behavior in this period will help to develop a child's mindset in the future to prevent diarrhea. Health education to prevent diarrhea is pivotal to identify health behavior of preschoolers. When preschoolers' health behavior has been identified, then it can be used to design an effective education model in preventing diarrhea.

**Keywords:** diarrhea prevention, educational game, healthy behavior, health education, preschoolers

## 1. Introduction

One of the goals of the Sustainable Development Goals in 2030 is the third goal of reducing child mortality. It is estimated that around 5.9 million children under age five died in 2015 due to preventable diseases [1]. Southeast Asia is the third place for the highest child mortality in the world after sub-Saharan Africa and South Asia. Among ASEAN countries, Indonesia ranks fourth for the highest under-five mortality rate [2]. The most common cause of death of children under five in the world is pneumonia by 18% and diarrhea by 15% [3].

The main factor causing diarrhea is the effect of poor living behavior in the community. The longitudinal study conducted by Santos et al. in preschool children with diarrhea in Brazil found that the duration's determinant of diarrhea was the low ability of the community (low family purchasing power) caused by environmental conditions and children's characteristics and clean behavior [4]. Furthermore, in reducing the incidence of diarrhea, an effective method is selective eating and maintaining personal hygiene [5]. The study conducted by Kariuki et al. in Turkana district, Kenya, found that hygiene and sanitation interventions could reduce the prevalence of diarrhea in children under five from 91.3 to 78.3% [6].

There are several behaviors that can contribute to the incidence of diarrhea, including handwashing with soap, unhealthy snack behavior, and the habit of cutting nails and biting fingers [7, 8]. Those behaviors can contribute to intestinal infections which is one of the causes of diarrhea. Both hands are also the main

pathway for the entry of germs into the body because the hands are part of the body most associated with the mouth and nose. The habit of washing hands with soap can reduce the incidence of diarrhea by up to 50% or the same as saving about 1 million children in the world each year [9].

To create healthy behavior, it should be instilled early. Preschool age is an early age for reasoning and constant ideas that are grounded. Planting the concept of healthy behavior at this age will form a healthy lifestyle later on. This preschool period is a transition period from the dominance of parental control to control by the children themselves. In this phase, the children have been able to internalize the standards and values that develop around them, and play is part of the life of preschoolers [10]. The study conducted by Peñalvo et al. stated that health promotion for children aged 3–5 years by integrating behavioral interventions into school curricula in Spain was effective in improving children's healthy behavior [11].

Educating healthy behavior to children in their early life requires appropriate educational strategy. Therefore, things that are needed for that are (1) knowing the behavior of people to prevent health which can be taught to children in school, (2) knowing the health education model that can be applied to children, (3) knowing the effectiveness of the education model that can improve the use of behaviors in diarrhea prevention, and (4) knowing the components of the educational model that must be considered in providing health education.

## **2. Healthy behavior of diarrhea prevention in preschoolers**

Healthy behavior is a person's actions or activities carried out by someone, both directly and indirectly, where habits and practices lead to ways to maintain, restore, and improve their health and prevent the risk of disease [12, 13]. Healthy behavior is important to be taught early because this will form a healthy lifestyle in the future. Children who understand healthy behavior will be familiar and not easily lost at the next stage of development. Children will learn healthy behaviors from what they see, hear, and experience. For children in this age group, the most pleasant and effective method is playing, which is a way for children to understand, adjust, and develop life experiences [14].

There are eight indicators of healthy and clean life behavior for early childhood (refer to the Ministry of Health). Eight school healthy and clean life behavior indicators, which can be applied to early childhood, are washing hands with running water and using soap, consuming healthy snacks in the school canteen, using clean and healthy latrines, eradicating mosquito larvae, not smoking in schools, exercising regularly, measuring weight and height each month, and disposing of garbage in its place [15]. Briefly, there are five healthy behaviors in preschoolers that can be intervened [13, 16]:

- Washing hands with running water and using soap: Germs and viruses can survive up to 2 hours on the surface of the skin, tables, door handles, toys, and so on. Hand hygiene that is not properly maintained can cause diseases such as diarrhea, cough, runny nose, and fever. It is crucial to know how to wash hands well and encourage children to wash their hands before eating, after playing, after going to the toilet, and after traveling.
- Consuming nutritious foods: It is pivotal to advice children to be careful in eating snacks and food/drinks. Parents should serve children balanced nutritious foods, including staple foods (rice, noodles, and rice noodles), side

dishes (meat, fish, chicken, tofu, and *tempe*), vegetables, and fruit every day. Making eating activities is a fun time. Do not force children to eat because the most important thing for children is not the quantity of food but the quality of what they eat.

- Maintaining environmental cleanliness: Some activities that children can perform are disposing garbage in its place, putting shoes in place, putting dirty eating utensils in place, using footwear when being outside of the house, covering the mouth when coughing and sneezing, keeping away from cigarette smoke, kitchen smoke, smoke burning garbage, and motor vehicle fumes, cleaning toys regularly, and defecating and urinating in the toilet.
- Using clean water and clean latrines for daily needs: It is important to teach children to defecate in the toilet. Encourage children to use clean water for bathing twice a day, shampooing every other day, brushing their teeth at least twice a day, cleaning their ears every time they shower, and washing their feet after each trip and each time going up to bed.
- Do not smoke and do physical activities: Teach children about the dangers of smoking for health. Regular physical activity is important for improving well-being and maintaining physical fitness [17].

Healthy behavior varies due to several factors, including (1) access to healthcare facilities, (2) attitudes toward health workers, (3) perceptions of disease threats, (4) knowledge of diseases, (5) characteristics of social networks, and (6) demographic factors. The second to fifth factors are part of cognitive factors (beliefs, attitudes, and knowledge). Cognitive factors are determinants of the most important intrinsic factors for changing behavior [12].

In short, the important healthy behaviors that need to be taught to preschoolers are handwashing practices, clean eating practices, and eating balanced nutrition.

## 2.1 Handwashing practice

Handwashing with soap is one of the clean and healthy behaviors. Nowadays, the behavior of washing hands with soap has become a worldwide concern because the problem of lack of practice of handwashing behavior does not only occur in developing countries but also in developed countries. Thereby, the United Nations (UN) general meeting stipulated the Global Handwashing Day on October 15, 2008. This is a manifestation of the need to improve the practice of personal hygiene and sanitation throughout the world. The Global Handwashing Day which is celebrated by many countries in the world is an effort to improve handwashing with soap culture globally, so that the spread of diseases caused by the environment and human behavior such as diarrheal diseases can be reduced [18]. The behavior of handwashing with soap can reduce gastrointestinal disease by 31% and respiratory tract disease by 21%. Washing hands using non-antibacterial soap shows greater benefits than antibacterial soap [19].

Washing hands with soap is an effort to prevent disease. This is done because hands often become agents that carry germs and cause pathogens to move from one person to another, either by direct contact or indirect contact (using other surfaces such as towels and glasses). Hands that come in direct contact with human and animal feces or other body fluids (such as snot) and contaminated food/drinks when not washed with soap can move bacteria, viruses, and parasites to other people who are not aware that they are being infected [1].

Handwashing with soap should be done at five important times: (1) before eating, (2) after defecation, (3) before holding the baby, (4) after changing diapers or cleaning up a child who has used the toilet, and (5) before preparing food. Washing hands using soap and running water can break the germ chain attached to the fingers. Communities including children often ignore handwashing using soap with running water because of a lack of understanding of health [17].

Factors that influence handwashing behavior: (1) environment (parents, care-givers, teachers, friends, and customs); (2) body image showing the importance of maintaining cleanliness for the individual; (3) knowledge about the importance of cleanliness and motivation of individuals in the care of personal hygiene; (4) culture, belief, and individual personal values for personal hygiene care; and (5) socioeconomic status [20].

According to the WHO, there are 10 steps in washing hands with soap and water: (1) wet hands with water; (2) apply hand soap; (3) flatten soap with both hands until the palms are exposed to soap; (4) rub the back of the right hand with the left hand until between the fingers then alternately the left hand; (5) put the palms together with the fingers crossed between fingers; (6) place the back of the finger on the other palm with fingers interlocking; (7) rub the thumb by holding the left thumb with the right hand and then rotating the opposite; (8) rub the fingers of the right hand on the left hand to clean the nails of the right hand, and vice versa; (9) rinse with running water; and (10) use a dry and clean towel or disposable tissue to dry your hands (**Figure 1**) [22].

## **2.2 Clean eating practices**

One factor that causes diarrhea in children is consuming unhealthy foods. Elementary school children like to eat ice and cakes where many food processing does not meet hygiene standards. Some of them are preparation and storage of food ingredients, cross-contamination from raw materials to cooked foods, less clean cooking utensils, and ingredients that use coloring agents, preservatives, or artificial sweeteners. This can cause digestive problems in children causing diarrhea [23].

The results of the study conducted by Pradipta et al. found that there was a relationship between hygienic snacking habits and the incidence of diarrhea where children who had more unhygienic snacking habits experienced diarrhea. Unhealthy snacks are snacks that contain artificial food colors and food that is infested with flies or other insects. In addition to food sanitation, sanitation of tableware also needs attention [24]. It is important to teach children that if they are eating and utensils fall on the floor, they should be washed before using it again, and if the food falls on the floor, it should not be eaten [25].

## **2.3 Eating a balanced diet**

Balanced nutrition is food consumed by individuals in 1 day that is diverse and contains energy, building materials, and regulating substances according to their body needs [26]. Nutritional needs are a very crucial requirement in helping the process of growth and development in children. Malnutrition in children causes children to be susceptible to disease. Poor nutritional status causes children to experience diarrhea [27].

The consumption pattern of balanced nutrition quality food requires the need for food diversification in the daily menu. This requires the availability of energy sources (carbohydrates and fats), sources of building materials (proteins), and sources of regulatory substances (vitamins and minerals). Diverse food is very important because there is no one type of food that can provide nutrition for a person in full [28].





**Figure 1.**  
*How to wash hands properly and correctly [22].*

The National Agency of Drug and Food Control of Republic of Indonesia (NADFC) 2013 exemplifies the composition of balanced nutrition in school children consisting of:

- Carbohydrates: rice, noodles, corn, bread, sweet potatoes, cassava
- Protein: meat, fish, chicken, tempe/tofu, eggs, milk
- Vegetables: spinach, mustard, tomatoes, carrots, water spinach
- Fruit: banana, papaya, pineapple, watermelon, apples

To measure healthy behavior in children, there are several instruments that have been used by several previous studies:

- Structured observation instruments to measure healthy behavior in children and their caregivers developed by Strina et al. which consisted of 23 items of hygienic and unhygienic behavior related to the incidence of diarrhea [12]. Generally, the observed items included the source of drinking water, washing vegetables before consumption, washing hands with soap before eating and after defecation, taking a shower before breakfast or lunch, eating while sitting on the floor, and what is done if food/utensils and drinks fall to the floor.
- Agustina et al. developed a clean eating practice instrument for diarrhea children in Indonesia based on the results of a survey and discussion with community health center staff and mothers with preschoolers. To measure the incidence of diarrhea, the mother was given an observation sheet on the time, frequency, and appearance of a child's stool. Observations were carried out every day for 7 days starting at 8 o'clock, and observation sheets would be collected every day. To measure food hygiene practices, structured interviews refer to 36 items which include the behavior of mother and child handwashing, food preparation, cleaning of kitchen equipment, sources and safety of drinking water, habits of buying ready-to-eat food, cleanliness of children's milk bottles, and cleanliness of the house and environment around it [29].
- Instruments in research conducted by Garg et al. also measured behavior in children related to handwashing. The semi-structured questionnaire filled by children was developed to find out the knowledge and practice of handwashing. The questionnaire items developed included the effects of handwashing on health, diseases caused by unclean hands, materials needed for handwashing, duration and techniques of handwashing, critical time for washing hands (before eating, after toileting, before preparing food, and after holding dirty items), handwashing practices, and sources of information.

Moreover, Kim et al. developed behavioral instruments to identify handwashing behavior, the stages of behavior change, self-efficacy, positive or negative attitudes, and a food safety knowledge [16]. The instrument consists of five parts that measure [1]: proper handwashing behavior, measured by the Likert scale 1 = never and 5 = always [2]; identify the stages of behavior change, measured by giving three options: do not consider handwashing behavior important, consider handwashing behavior important even though they have not practiced it well, and realize the importance of handwashing behavior and will apply it within the next 6 months [3]; knowing self-efficacy, measured using the item "I can wash my hands after I get out of the bathroom despite being in a hurry" with scoring 1 = completely unsure and 5 = very confident [4]; knowing positive or negative attitudes; and a food safety knowledge questionnaire consisting of 10 items [16].

### **3. Health promotion model to change health behavior in preschoolers**

Health programs for preschool children generally focus on developing children's sense of responsibility for their health and safety. The main thing for this condition is an increase in knowledge about health habits. Therefore, activities provided for preschool children in teaching basic habits about hygiene and more specifically help them (a) realize the importance of health, nutrition, personal hygiene, and exercise

to maintain health, (b) learn basic rules of hygiene (handwashing, brushing teeth, etc.), (c) distinguish between substances and healthy and hazardous foods, and (d) learn about the role of several health services and be informed about the risks of disasters that can occur such as fires, earthquakes, floods, etc. and learn how to protect themselves.

There are several health promotion models that can change healthy behavior in children as follows.

### **3.1 Educational game**

An educational game is very interesting to develop. There are several advantages of educational game compared to conventional education methods. One of the main benefits of the educational game is the visualization of real problems. The Massachusetts Institute of Technology (MIT) succeeded in proving that games are very useful for improving the logic and understanding of players about a problem through a game project called Scratch. Based on the results of previous studies, there is no doubt that educational game can support the educational process [30, 31]. Educational games excel in several aspects when compared to conventional learning methods. One significant advantage is the existence of animation that can improve memory so that children can store subject matter in a longer time than conventional teaching methods [32]. Simulation-based educational games are designed to simulate existing problems so that essences or knowledge can be used to solve these problems. Simulation games can be used as one of the educational media that can be learned and done individually. Based on the patterns possessed by the game, players are required to learn so that they can solve existing problems. The status of the game, instructions, and tools provided by the game will actively guide players to explore information so that it can enrich their knowledge and strategies while playing.

### **3.2 Sociodrama**

Health education that incorporates therapeutic sociodramatic games can help school-age children to change their behavior. School-age children are in the development with concrete stages in which they can reflect on events and actions that they see in real terms. The sociodramatic play reflects real events, so it can motivate children to act according to what they experience during role-playing. For example, a child who plays the role of a patient suffering from diarrhea will be encouraged to believe that it is not optimal to be infected with the disease; thus it motivates the child to develop preventative behavioral diarrhea. Peers play an important role in developing health and hygiene behavior, which is why researchers have chosen them as role partners, making this relationship in an effort to better describe diarrhea prevention behaviors. Therefore, a sociodramatic therapeutic game is expected to improve the prevention of diarrhea among school-age children.

Sociodramatic games improve diarrhea prevention behavior in school children. This interactive health education method meets the needs and developmental stages of school-age children. Therapeutic sociodramatic games involve the concept of learning while working and by directly practicing healthy behavior. It can accelerate the process of behavior change, which will help in strong memorization by school-age children. Therapeutic sociodramatic games have become a variety of nursing interventions in the form of interesting games among school-age children. Therapeutic sociodramatic games can also be integrated into school subject curricula, such as arts and culture, physical education, and cocurricular activities as programs to promote preventive behavior by the health movement in schools.



### **3.3 Educational video**

An educational video is one of the health promotion methods for Preschoolers. This is effective because the information received or stimuli that enter through the five senses, visually through the eyes and hearing through the ears, will be recorded by sensory memory. If the information or stimuli are not taken care of, they will be immediately forgotten, but if you pay attention, the information will be transferred to the short-term memory system. After being in the short-term memory system, the information is transferred again with the repetition process to the long-term memory system to be stored [33].

### **3.4 Singing**

The most effective method in changing behavior, from behavior that is detrimental to health toward behavior that benefits health, is through health education. Health education can be done using various methods, one of which is the singing method. The singing method is very appropriate given to preschoolers because it is a fun method that makes children more active and creative, and the lessons are given more effective for children [34].

From some of the studies above, an effective promotion model used in children is through playing activities that include educational activities, videos, role play and songs. Referring to these health promotion models that are declared effective, they can actually be combined in one game model. Games can also help children to practice making the same decisions with real life without risk [35].

In the digital era, gadgets are the main requirement. It also appears that the type of game that children love today is playing games. Nowadays, the use of video games in children is increasing. In the United States, boys and girls have an average of 5.5 hours/week playing games [36]. Children aged 2–7 years in the Netherlands spend an average of 3–5 hours/week playing games, and children aged 8–9 years spend an average of 9 hours/week playing games [37]. Thereby, games are a great potential to be used as an educational medium for preschoolers.

## **4. The effectiveness of educational games on improving children's healthy behavior**

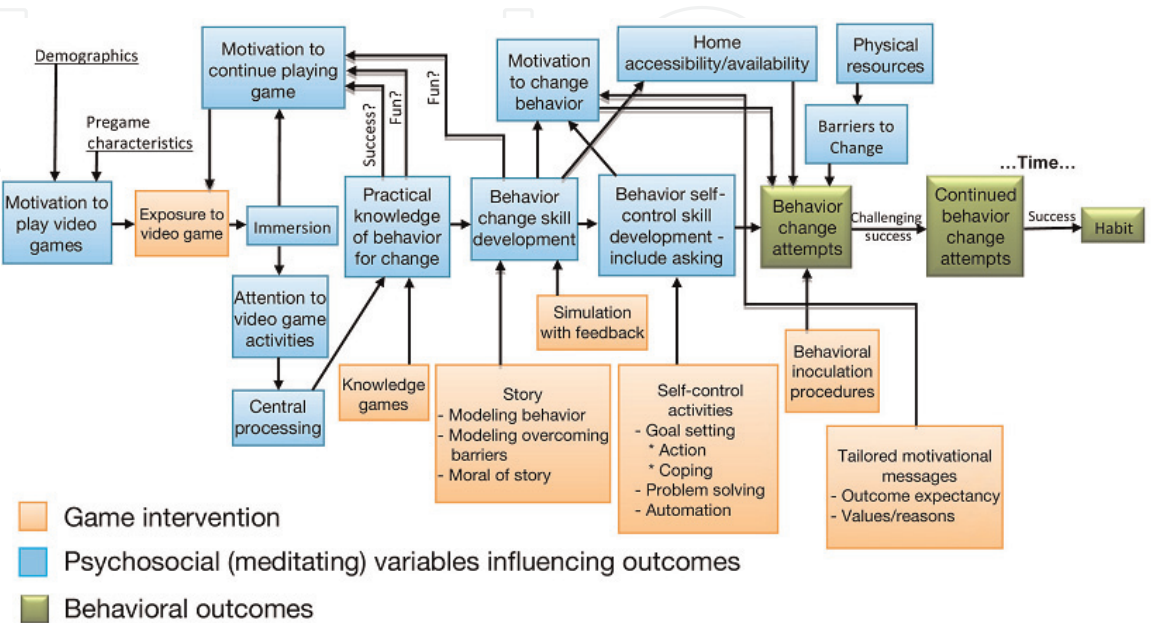
Intervention using games to change behavior is now one of the ways in health promotion in groups of children. Some studies depict that participants show positive behavioral changes after they are given a game playing intervention. In-game stories allow players to imitate, gain identified experiences from others, and learn about the moral contained in the story. A comprehensive model for learning to change behavior in video games is based on social cognitive theory and elaboration likelihood models that include the stages of attention, retention, production, and motivation. Baranowski et al. propose a conceptual model of variables that mediate behavior change. This concept model is based on components of four theories, namely, the theory of self-determination, transportation, elaboration probability, and social cognitive [38].

The theory of self-determination states that motivation initiates changes in a person's behavior primarily intrinsic motivation. Video games can motivate children by first motivating children to start playing, keep playing, and change behavior. Transportation theory states that to change behavior, someone must be able to dissolve in the story so that it is easy to influence through the message in the story.

Elaboration likelihood model states that getting and maintaining someone’s attention is the first step to provide information to someone to change behavior. The social cognitive theory states that changes in a person’s behavior are a function of increasing one’s skills and self-efficacy to perform new behaviors [38] (Figure 2). The following is a conceptual model framework for how video games affect behavior change:

Stories in a game are made so that players can be dissolved in the story and focus on characters with the expected behavior model. Behavior simulation can be done by providing a virtual environment so that children are familiar with behavioral skills. Behavioral procedures can be introduced by giving an opportunity to players to try behavior changes through their character in the game. Although various studies related to video games have measured outcome such as knowledge to complex behavioral changes, it is not possible to know changes in attributes of specific components of the game due to the complexity of the game itself [39]:

- Factors that encourage learning or the implementation of behavior that is influenced by media [14].
- Age. Young children focus on behavior and not on motivation or effect. They see alternatives as concrete, and they remember things in the program.
- Identifying characters or situations. Children will more often imitate the behavior of others and the same situation with people and situations in their own lives.
- Award and punishment syndromes. Children will imitate the behavior they see as valued or not punished if the behavior is desired. They tend to rarely repeat an action they see being punished, and their attention is immediately attracted when they see an action that they know must be punished but apparently not punished.
- Opportunity to reproduce behavior. Children will imitate behavior when given the right environment or if violence seems to be an acceptable solution. When children see the situation on television, they will use this information if they face a similar situation that requires resolution.



**Figure 2.**  
*The conceptual framework of video games influences behavior change.*

- Motivation to reproduce behavior. Children will imitate behavior when given the right payment: expect appreciation or no punishment. Some children have self-control, while the other children do not have it.
- The game becomes one of the effective methods of learning activities in children. This was stated by Teed in a study of game-based learning (GBL) [40]. Games are effective in elevating learning activities because games are able to motivate students to learn. The process of learning through games begins with children's interest in the game where the game is seen as fun and capable of drowning them in the material so that they learn more effectively. Furthermore, learning through games is able to encourage students to learn from their mistakes in the game so as to make children learn from their decision-making mistakes in playing. These reasons prove that play is an appropriate method that can be used to improve children's knowledge. The game has great potential to be used as a method of increasing knowledge early so that it is expected to have an effect on achieving a behavior that supports the creation of improved health status and is more permanent for children in the future.
- In addition to knowledge, the core concept that promotes increased healthy behavior through gameplay is self-efficacy.
- Mikropoulos and Natsis state that self-efficacy affects students' choices in learning. Through self-efficacy, students can be more challenged in learning and have the ability to survive to learn even in difficult conditions [21, 22]. Ketelhut who observed 7-year-olds who played virtual games about the environment shows that students who have high self-efficacy also display better behavior [41].
- In playing games, players will be brought in a narrative story game which is a flow of information that delivers games to a concept of an educational game. According to the narrative-centered learning theory developed by Gerrigs (1993), there are two cognitive processes of a comprehensive narrative. Firstly, the readers will be taken to a place and time where they will feel like they are in the real world. Secondly, they will play their own stories, draw conclusions, and gain emotional experiences from interactions with narratives [23]. The game also provides information that is narrative, so students learn from the narrative experiences that they obtain.
- Self-efficacy is an important component of the learning process. Self-efficacy affects understanding and appearance, an adaptation of behavior, and conditions to be achieved. Self-efficacy refers to the self-perception of a person's skills and abilities to do action well. Self-efficacy is formed through change intolerance at each stage of the behavior change process. Hence, self-efficacy is a pivotal precondition that is important to be maximized in achieving behavior change.
- Feist and Gregory perceive that there are four factors that influence self-efficacy, namely, past experience of the success of carrying out these actions, the influence of social modeling seen from role models, social persuasion, and physical and emotional status. After the intervention, the children are no longer given any intervention and are merely observed. This condition will show how much behavior they have learnt is internalized into their daily life.

Preschool children's self-efficacy assessment in this study based on statement aspects and appearance aspects. Many aspects that have decreased are aspects of appearance [26].

- The majority of educational games have an impact on children's knowledge, attitudes, and motivations [27]. Educational games have a primary target for behavioral mediators such as self-efficacy. This change in the behavior mediator is expected to produce the expected behavior. The selection of the target mediator is based on a theoretical basis that is used as a source in developing strategies to change behavior [39].
- The theory of Fisch's capacity model in Lavigne's paper states that the success of transferring learning outcomes depends on the child's ability to produce concepts that represent the appearance of television and the ability to identify similar contexts in daily life [28]. In Nola J. Pender's health promotion model theory, practice is the expected result of a series of behavioral change processes. Therefore, altering practices is the last component to be achieved in a health promotion intervention through educational games for preschoolers.

## **5. The components of game favored by children**

The attractive components of game as a medium of education for children need to be known. This is the key in ensuring the effectiveness of a game as an educational medium. The result of the study in investigating game components favored by children conducted by the author can be considered in designing the game as the educational media for the characteristics of the main character, the model of the game presented, and the color that dominates the game.

The characteristics of the main character that children enjoy in a game are moving creatures or object, consisting of evolutionary and an attractive appearance. The main character is one of the main things that attracts kids to play a game. If the main character is interesting, the children will try to play the game. This is important in the development of educational games because the attraction of children to play games is a step forward in providing educational information [29]. One of the characters of the game that is also appealing and is loved by preschoolers is a funny and cheerful character [42]. Preschoolers aged 3–5 years old have imaginative playing characteristics which are both fantasy and informal. The imagination provides an opportunity for players to experience decision-making of problem resolution in risk-free conditions [35]. This will create a pleasant learning environment for children as well as stimulate improvement in mindset.

In developing the method for preschoolers, it must take into account four things that are clear and consistent instruction, challenging learning environment, having a choice in controlling the game, and having an attractive appearance. An attractive display includes images of background, image descriptions, and sound that are appropriate with children. An appealing appearance of the game will increase the interest of children in the learning process. Therefore, it will stimulate cognitive cognition of children in the learning process.

The characteristics of the game that are loved by children are varied such as giving prizes and having varied games. Preschool age is the best age to learn quick. Children have great curiosity and want to know things about work [43]. Preschoolers also have psychographic characteristics that are like being active, high curiosity, happy to be involved with something new, and having high creativity [44]. Schoolchildren enjoy imitative, imaginative, and dramatic games where in the



game can give them the right condition to express themselves. Preschoolers are generally given cognitive game [42]. In educating preschoolers, it needs components: audiovisual, interaction, termination, and positive reinforcement to result positive learning process.

Positive reinforcement is pivotal in developing educational game to increase children's motivation particularly intrinsic motivation. This may motivate children to play and learn something so as to they can feel the story of the game. The game players may obtain active learning experience, so it may elevate children's ability in analyzing, synthesizing, and evaluating [35].

The primary colors used are red, yellow, and blue and the secondary colors are green, orange, purple, and pink. Children are fonder of learning through visually interesting, colorful, and interactive objects than just textbook and oral learning. Video games with color, sound, and attractive appearance significantly increase children's interest in learning. This will lead to dissolution in the education message delivered through the game. All the interests are increasingly becoming more important for learning, so that this will increase the motivation of children in learning.

## **6. Conclusion**

Health education to prevent diarrhea is important to identify health behavior of preschoolers. When preschoolers' health behavior has been identified, then it can be used to determine an effective education media in preventing diarrhea. The basic healthy behaviors to be taught to children are washing hands using soap in critical time, healthy eating behavior, and eating balanced nutrition. The effective educational medium to teach healthy behavior in preschool children is game. The components of a game favored by children are the main character, the model, and dominant color of the game.

## **Acknowledgements**

I would like to thank A. Adriana Amal and Fitriani for their assistance in translation in order to write this chapter. I would also like to thank all authors whose works I cited in this work for their valuable contribution to knowledge.

## **Conflict of interest**

The author declares no conflict of interest.

IntechOpen

IntechOpen

### **Author details**

Arbianingsih Tiro  
Alauddin State Islamic University, Makassar, Indonesia

\*Address all correspondence to: [arbianingsih.tiro@uin-alauddin.ac.id](mailto:arbianingsih.tiro@uin-alauddin.ac.id)

### **IntechOpen**

© 2020 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

## References

- [1] WHO. The Sustainable Development Goals Report 2017 [Internet]. Washington, USA; 2017. Available from: [https://www.paho.org/hq/index.php?option=com\\_docman&view=download&category\\_slug=160-en-9007&alias=40341-ce160-14-e-341&Itemid=270&lang=en](https://www.paho.org/hq/index.php?option=com_docman&view=download&category_slug=160-en-9007&alias=40341-ce160-14-e-341&Itemid=270&lang=en)
- [2] Ministry of Health. Indonesia Health Profile (in Indonesian) [Internet]. 2014. pp. 1-382. Available from: <http://www.depkes.go.id/resources/download/pusdatin/profil-kesehatan-indonesia/profil-kesehatan-indonesia-2012.pdf>
- [3] Faijer DJ, Bay G, Miller T. UNICEF. Level and Trends in Child Mortality; 2011
- [4] Santos CAST, Strina A, Amorim LD, Genser BB, Assis AMO, Prado MS, et al. Individual and contextual determinants of the duration of diarrheal episodes in preschool children: A longitudinal study in an urban setting. *Epidemiology Infection*. 2012;**140**(4):689-696
- [5] Liyold R, Bennnett C. Travellers' diarrhea: Causes, prevention and treatment. *Nursing Standard*. 2012;**26**(40):51-56. DOI: 10.7748/ns2012.06.26.40.51.c9137
- [6] Kariuki JG, Magambo KJ, Njeruh MF, Muchiri EM, Nzioka S. Effects of hygiene and sanitation interventions on reducing diarrhoea prevalence among children in resource constrained communities: Case study of Turkana District, Kenya. *Journal of Community Health*. 2012;**37**(6):1178-1184. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/22477669>
- [7] Rosidi A, Handarsari E, Mahmudah M. The relationship of handwashing habit and food sanitation with diarrhea incidence in children of podo 2 elementary school, Kedungwuni District, Pekalongan regency (in Indonesian). *Journal Kesehatan Masyarakat Indonesia*. 2012;**6**:76-84
- [8] Rompas MJ, Tuda J, Ponidjan T. The relationship of handwashing with soap with the incidence of diarrhea in children (in Indonesian). *Journal Keperawata*. 2013;**1**:1-8
- [9] Team GHD. Planner 's Guide
- [10] Hockenberry MJ, Wilson D. Wong's Essentials of Pediatric Nursing. 8th ed. Canada: Mosby Elsevier; 2009
- [11] Peñalvo JL, Santos-Beneit G, Sotos-Prieto M, Martínez R, Rodríguez C, Franco M, et al. A cluster randomized trial to evaluate the efficacy of a school-based behavioral intervention for health promotion among children aged 3 to 5. *BMC Public Health*. 2013;**13**(1):1-6
- [12] Strina A, Cairncross S, Barreto ML, Larrea C, Prado M. Childhood diarrhea and observed hygiene behavior in Salvador, Brazil. *American Journal of Epidemiology*. 2003;**157**(11):1032-1038
- [13] Agustina R, Sari TP, Satroamidjojo S, Bovee-oudenhoven IMJ, Feskens EJM, Kok FJ. Association of food-hygiene practices and diarrhea prevalence among Indonesian young children from low socioeconomic urban areas. *BMC Public Health*. 2013;**13**:977
- [14] Widjaja M. Mastering Diarrhea and Poisoning in Toddlers (In Indonesian). Jakarta: Kawan Pustaka; 2000
- [15] Garg A, Taneja DK, Badhan SK, Ingle GK. Impact of a school-based hand washing promotion program on knowledge and hand washing behavior of girl students in a middle school of Delhi. *The Lancet*. 2013;**57**(2):57-60
- [16] Kim EJ, Pai AJ, Kang N, Kim WK, Kim YS, Moon H. The effects of food safety education on adolescents' hand

hygiene behavior: An analysis of stages of change. *KoreaMed Synapse*. 2012; **6**(2):169-174

[17] Thompson D, Baranowskia T, Cullen K, Watson K, Liu Y, Canada A, et al. Design of video games for children's diet and physical activity behavior change. *International Journal of Computer Science in Sport*. 2014; **9**(2):3-17

[18] Ministry of Health. Handbook for Eradicating Diarrhea (in Indonesia). Jakarta: Ditjen PPM & PL; 2009

[19] Aiello AE, Coulborn RM, Perez V, Larson EL. Effect of hand hygiene on infectious disease risk in the community setting: A meta-analysis. *American Journal of Public Health*. 2011; **98**(8): 1372-1381

[20] Eko L. The Relationship between the Habit of Washing Hands of Pre-School Children and the Incidence of Diarrhea in the Working Area of the Surakarta Public Health Center (in Indonesian). Surakarta: Universitas Muhammadiyah; 2012

[21] Mikropoulos TA, Natsis A. Educational virtual environments: A ten-year review of empirical research (1999–2009). *Computers in Education*. 2011; **56**(3):769-780. Available from: <http://dx.doi.org/10.1016/j.compedu.2010.10.020>

[22] WHO. Guidelines on Hand Hygiene in Health Care First Global Patient Safety Challenge. Switzerland: WHO Press; 2009

[23] Meluso A, Zheng M, Spires HA, Lester J. Enhancing 5th graders' science content knowledge and self-efficacy through game-based learning. *Computers in Education*. 2012; **59**(2): 497-504

[24] Khomsan A. Food and Nutrition for Health (in Indonesian). Jakarta: PT Raja Grafindo Persada; 2004

[25] Pradipta HA, Noor S. The relationship of snacking behavior with the diarrhea incidence in elementary school children: In Cempaka district, Banjarbaru (in Indonesian). *Berkala Kedokteran*. 3 June 2016; **9**(1): 93-100

[26] Feist J, Gregory JF. Theories of Personality. 7th ed. Boston: McGraw-Hill Higher Education; 2009

[27] Connolly TM, Boyle EA, Arthur EM, James T. A systematic literature review of empirical evidence on computer games and serious games. *Computers in Education*. 2012; **59**(2):661-686

[28] Lavigne H. The Priming Effects of Video Viewing on Preschoolers Play Behavior. Massachusetts: University of Massachusetts; 2012

[29] Baranowski T, Buday R, Thompson DI, Baranowski J. Playing for real: Video games and stories for health-related behavior change. *Medicine (Baltimore)*. 2009; **34**(1):74-82

[30] Clark RE. Evaluating the Learning and Motivation Effects of Serious Games. Rosier School of Education Center for Creative Technologies; 2006. Available from: [http://projects.ict.usc.edu/itgs/talks/Clark\\_Serious.Games.Evaluation.ppt](http://projects.ict.usc.edu/itgs/talks/Clark_Serious.Games.Evaluation.ppt)

[31] Clark RE, Choi S. Five design principles for experiments on the effects of animated pedagogical agents. *Journal of Educational Computing Research*. 2005; **32**(3):209-225

[32] Clark D. Games and e-learning. Sunderland: Caspian Learning; 2006

[33] Bhinnety M. Structure and process of memory. *Buletin Psikologi*. 2008; **16**(2). DOI: <https://doi.org/10.22146/bpsi.7375>

[34] Listyowati. The Use of German Singing Method in German Language



Learning in Class X3 High School  
Laboratory of Universitas Negeri  
Malang (in Indonesian)

[35] Akl EA, Kairouz VF, Sackett KM, Erdley WS, Mustafa RA, Fiander M, et al. Educational games for health professionals. *Cochrane Database of Systematic Reviews*. 2013;(1): CD006411

[36] Gentile DA, Anderson C. Video games. *Encyclopedia of Human Development*. 2006;**3**:1303-1307

[37] Greitemeyer T, Osswald S. Effects of prosocial video games on prosocial behavior. *Journal of Personality and Social Psychology*. 2010;**98**(2):211-221

[38] Thompson D, Baranowskia T, Cullen K, Watson K, Liu Y, Canada A, et al. Food, fun, and fitness internet program for girls: Pilot evaluation of an e-health youth obesity prevention program examining predictors of obesity. *Preventive Medicine*. 2008; **47**(5):494-497

[39] Buday R, Thompson D, Baranowski T, Lyons EJ. Developing games for health behavior change: Getting started. *Games for Health Journal*. 2013;**2**(4):83-190

[40] Teed R. Game-based learning. Science Education Resource Center of Carlet Collection. 2012;**15**. Available from: <https://serc.carleton.edu/introgeo/games/index.html>

[41] Ketelhut DJ. The impact of student self-efficacy on scientific inquiry skills: An exploratory investigation in River City, a multi-user virtual environment. *Journal of science education and technology*. 1 February 2007;**16**(1): 99-111

[42] Delima R, Arianti NKPB. Identification of user needs for educational game applications for children 4 to 6 years old (in Indonesian). *J Tek Inform dan Sist Inf*. 2015

[43] James SR, Ashwill J. *Nursing Care of Children: Principles and Practice*. 3rd ed. Canada: Saunders Elsevie; 2007

[44] Nisa DA, Indrayana. Designing of Board Games as Learning Media for Traffic Signs for Kindergarten Children Aged 5–6 years Old (in Indonesian); 2012