



Arbi Care: an innovative educational game to increase healthy behavior in diarrhea prevention among preschoolers

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Abstract

Innovation is needed to improve healthy behaviors of children in order to prevent diarrhea. Education through games is widely recommended as a way to change behavior in children. This study describes the process of developing an educational game to increase healthy behaviors of preschool children. This study used research and development design techniques with four stages, including: define, design, develop, and disseminate. Observation sheets were used to assess the effectiveness of the game in educating children. The process of developing this educational game included several phases: 1) exploration of the characteristics of games favored by children; 2) design of the intervention based on games preferred by children; 3) validation of the game prototype by experts and testing of the game by preschool children, and 4) revision of the game in order to obtain a game focused on diarrhea prevention that can be used as a behavioral health intervention. Results showed that in testing of the game by ten preschool were able to play and understand the message of the game 92% of the time. The results showed that the Arbi Care game can be used as a learning device to increase healthy behavior in preschool children.

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Introduction

Diarrheal disease is currently still the second major cause of children's death in developing countries. The Indonesian Basic Health Survey (IBHS) shows that the number of children who have had diarrhea in Indonesia has increased over time, from 11% in 2002, to 13.7% in 2007, with the most recent survey results reporting 14% in 2012¹.

Preschoolers are the second largest group having diarrhea¹. One nursing intervention in the treatment of diarrhea is to provide health education to children. However, nurses experience limitations to providing education to children

due to high workload, a greater priority on other interventions, and a lack of educational media for children, especially media with content specifically about how to prevent diarrhea in preschoolers.

The preschool period is a transition period from the dominance of parental control toward control by children themselves. In this phase, children learn independently from play². As digital technology has developed, children have grown to like computer-based or electronic games. Educational games are a medium that aims to convey information in an entertaining way³. Educational games are a fun medium for educating children in areas such as language skills, logical

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thinking, and interacting with the environment⁴. Games allow players to experiment with decision-making and problem solving under risk-free conditions and in an active learning environment⁵. Video games are also recommended as an effective media to change behavior in children⁶.

Various studies have explained that the causes of diarrhea are poor community hygiene and health practices⁷⁻⁹. To prevent diarrhea it is necessary to teach healthy behaviors for children. Education to change children's behavior through a video game is based on social cognitive theory and the elaboration likelihood model of persuasion, including stages of attention, saving/retention, production, and motivation⁶. The first factor in the success of changing children's behavior through video games is children's interest in the educational game itself: they should be interested and willing to play the game repeatedly. Thus the first step for the developer of an educational game for preschoolers should be to discover the game characteristics favored by preschoolers themselves. This article presents the development process of an educational game to prevent diarrhea by increasing healthy behaviors of preschoolers.

Method

Research and development design was used in making this educational game, with four stages: define, design, develop, and disseminate¹⁰. The samples used in this study were preschoolers aged 3-6 years. In the define stage, researchers conducted a qualitative descriptive study to determine the game model favored by preschoolers. In the design stage, the researchers created the description of the game's story, which contains content that can be applied to the prevention of diarrhea by preschoolers. The researchers also cooperated with game developers to create the game prototype. In the develop stage, the researchers presented the product for validation by pediatric nursing media experts, specialists in health communication, and specialists in children's health promotion media. Expert inputs were used to make revisions to the game prototype, which was then tested with preschool children. There were 10 children aged 3-6 years involved in the trial phase of this product. Evaluation of the product as used by children was conducted using an observation sheet with indicators of ability to understand the game, interest in the game, and ability to learn from the game. In the disseminate phase, the researchers presented results through articles and a conference. Qualitative data obtained was processed through stages of data abstraction and data interpretation. Quantitative data obtained was processed according to the frequency distribution. Before being tested by preschoolers, the study received ethical clearance from the Faculty of Nursing, Universitas Indonesia.

Results

Define stage

To obtain an interesting educational game for preschoolers, it is necessary to get information directly from the children themselves. Qualitative studies from this research obtained

information about preschoolers' favored game characteristics, which are: 1) a moving main character, attractive and containing elements of fantasy; 2) a game model that contains varied activities, facilitates an adrenaline rush, has a reward, and contains educational elements, and 3) use of primary colors, namely red, yellow, blue, and a combination of the three colors.

Design stage

This stage involved drafting the educational game to prevent diarrhea by increasing healthy behaviors of preschoolers, as follows:

1. Based on information from the qualitative study, designers portrayed characteristics of the main characters, consisting of a girl and a boy intended to function as representatives of the players, so that the children would feel as if they were the ones engaged in the game. The intention is to make both positive and negative impacts of the character easily accepted by children's five senses⁵.

The characters are depicted in ways such as the following:

- Boy character: wearing a red shirt, blue pants, black hair, black eyes, and yellow sandals. The distinctive style of a boy will be illustrated with hands clenched, as if saying "yes!" This is based on observations of the typical style of most of the boys.
- Girl character: wearing a pink shirt, purple skirt, using accessories in the hair (two hair ties), black eyes, and pink sandals. Girls seemed to lift one of their hands, showing a distinctive style; the authors observed that the majority of the children's current style was the "peace" symbol.

2. Healthy behaviors in the prevention of diarrhea draw from Ministry of Health guidelines (2012)¹¹, but were selected based on which behaviors can be readily applied by preschoolers. These included hand washing with soap and the practice of clean eating with balanced nutrition. The game scenario requires players to meet the needs of children, including nutritional needs; the need for elimination, and the needs to play, rest, and sleep in a balanced manner. Here is an overview of the model of the educational game to prevent diarrhea through healthy behavior for preschoolers (Table 1).

In addition to the core learning objectives of diarrhea prevention above, there are three mini games that are included to promote healthy behaviors that support diarrhea prevention in preschoolers. First mini game involves organic and inorganic waste sorting to encourage children to do the physical activity in everyday life, second mini game involves choosing healthy food, and the third mini game involves riding bicycle as the representative of importance physical activity as the way to prevent diarrhea. Including the variation of this mini game prevents boredom while children are playing the game. Preschoolers tend to be pleased with such diverse forms of activity and music in games¹².

3. With diarrhea prevention as the goal, an Android-based game application called Arbi Care was then developed

Table 1 Overview model of educational game to prevent diarrhea through healthy behaviour for preschoolers

Learning objective	Game model
Emphasize the importance of hand washing with soap at two critical points, namely: • Before eating • After using the toilet	When a child says "I'm hungry", the player must click on the dining table. However, the choice to eat cannot be selected if the child has not clicked on the sinks to wash hands first. The same thing happens when players meet the needs of children for toilet elimination. Players cannot get out of the toilet before clicking on a sink to wash hands after toileting. When clicking on the sink to wash hands, the player will be asked to order the steps of proper hand washing
Demonstrate the practice of clean eating, namely: • Wash any cutlery that has fallen before reusing • Choose healthy foods and beverages	When children are eating, the spoon suddenly falls, and a short tutorial video emerges on the proper behavior when cutlery falls There is a mini game in which the player is asked to choose which one is the healthy food and beverage. For each healthy food chosen, the player will receive a star score
Teach how to choose a diet with balanced nutrition	When clicking on the dining table, the player will be asked to select the menu. Players must fulfill the four components of balanced nutrition, namely carbohydrates, proteins, fruits, and vegetables, in the diet that is selected

through collaboration with game developers. During the making of the game prototype, meetings and intense communications were held each week with the game developers to ensure the product was made in accordance with the script prepared for diarrhea prevention educational purposes. The first prototype of the game took about three months to complete.

Develop stage

After the Android-based game application to prevent diarrhea was completed, the next step was validation by experts that took part in expert seminars. These activities were conducted in order to obtain expert inputs to improve the game application prototype created. At this stage the researchers presented the product for validation by pediatric nursing media experts, specialists in health communication, and specialists in children's health promotion media. The product was presented with a simulation of how it is used, and then the experts provided a feasibility assessment of the product prototype and offered inputs for improvement. The Arbi Care prototype was considered feasible but needed revisions. The revised prototype was then tested by ten game players, namely children of preschool age, to determine the effectiveness of the game. The preschool game users obtained a mean score of 92%, indicating that Arbi Care, the Android-based game application to prevent diarrhea, can be used as educational media.

Discussion

The results of this study indicate that children are interested in playing the Arbi Care game provided, are capable of playing the game, and are able to understand the game's message. Baranowski et al (2008) suggested that the effectiveness of an educational game in changing healthy behavior in children is determined both by the extent that children are interested in the game and by the amount of time children persist in playing the game⁶. The longer the

children play a game, the more educational information they can be exposed to.

The Arbi Care game was developed in accordance with characteristics children favored in games, including varied activities, adrenaline stimulation, prizes or rewards, and educational elements. Children's favored activities in electronic games involved caring or nurturing, color matching, shooting, designing, and serving. Games stimulating adrenaline, e.g. through obstacles or racing, were also favored. When playing a game, children expect to receive a prize, which can be a trophy, something new in the game, or a score. The game model favored by preschoolers involved a varied game and contained educational elements.

These results align with research by Nisa and Indrayana (2012), which identified board game design characteristics preferred by children aged 5-6 years¹³. They stated that the primary psychographic characteristics of preschoolers are: 1) like to ask questions and are interested in what they do not know; 2) like active movement; 3) have a high sense of curiosity; 4) have a good sense of imagination; 5) always want to be involved in something; 6) love to interact with peers; 7) are interested in new things, and 8) exhibit high creativity.

Similar findings from Delima et al (2015) are also presented in research results that aimed to inform educational media design by identifying the needs of early childhood users¹². Observations related to children in the fifth standard's interest in a multimedia application include: 1) boys and girls interact with multimedia applications differently, in that girls are more interested in the visual display, while boys are more interested in assessing control, speed, and navigation; 2) children preferred the game's main characters to be exciting, funny, and cheerful; 3) children like flashy colors; 4) challenge is a very important aspect of the game in order to arouse the curiosity of children and improve the child's interest in the game; 5) words of appreciation and inspiration are very important in motivating children; 6) forms of activity in the game should be varied to avoid children's boredom, and 7) most children liked games to utilize music and sounds¹².

The game display is most interesting for the target player if it reflects favored characteristics. For example, preschoolers 3-5 years old characteristically engage in imaginative play with some fantasy and informal games². This creates pleasant learning conditions for children and stimulates development of a child's mindset.

The developed game is educational—a type of media with a specific purpose not only of providing entertainment but of stimulating interactive learning that provides the opportunity for players to build knowledge and understanding independently³. There are two general categories to distinguish games, namely mini games and complex games. Mini games are generally played for less than an hour at a time, have a specific content focus, and can be developed by a small team of two to three people. Complex games involve many levels and require various teams of designers, programmers, and artists¹⁴. The Arbi Care game developed in this study is categorized as a digital mini game.

Developing an educational game for the preschool age group has great potential to impact child development. Preschool age children's growth and development reflects a period in which the majority of children have control over their body functions, are able to interact and cooperate with others, are using language to symbolize ideas, and demonstrate an increasing attention span and memory. In this period the psychosocial development of children is creating a sense of initiative. Therefore, preschool children are very enthusiastic to learn new things. Children play and learn to try to achieve success and satisfaction in doing activities. This is a very appropriate period to instill concepts of good behavior, including healthy behaviors; cultivation of the concept of good behavior during this period will lead to good behavior later in life².

Conclusions

This study shows that an educational game to prevent diarrhea can be effectively designed for preschoolers. The majority of children are expected to be able to apply the game Arbi Care's content to everyday life, as they become familiar with and begin to practice healthy behaviors that prevent diarrhea. In addition, Arbi Care can be used as an intervention medium for nurses providing education to children admitted with diarrhea. Further research is needed to look at the effectiveness of the educational game Arbi Care in increasing healthy behaviors and preventing diarrhea among preschoolers.

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