

THE EFFECT OF VISUAL NOVEL BASED PC GAME: FRUIT AND VEGGIE STORY TO INCREASE KNOWLEDGE, FRUIT AND VEGETABLE CONSUMPTION AMONG SCHOOL-AGED CHILDREN

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ABSTRACT

Lack of knowledge regarding fruit and vegetable could result in low consumption of those food among Indonesian children. A PC game named Fruit and Veggie Story that we have developed could act as an educational means for children to learn about the importance of consuming fruit and vegetable in a pleasant way. This study aimed to measure the effectiveness of Visual Novel PC Game: Fruit & Veggie Story to increase knowledge as well as fruit and vegetable consumption among school-aged children. This study was a quasi-experiment two groups with pre-post tests. 50 students from class 2A and 2B at SD Muhammadiyah Bumiayu were assigned into experiment and control groups. After playing the game daily for a week, respondents in the experiment group were measured over their knowledge using a questionnaire consisting of 10 MCQ questions. Moreover, after one week period, the students' consumption was measured using a food recall diary. The data were presented in frequency, percentage and analysed using paired T-test and independent T-test. The results showed that the average knowledge score before the intervention was 5.76, while after the intervention it increased to 8.12. The average of fruit and vegetable consumption before the intervention was 463.20 grams and after the intervention it increased to 577.44 grams (P= 0.000). The Fruit and Veggie Story PC game is a technology innovation in education to effectively increase knowledge regarding fruit and vegetable. It is also able to encourage children to eat more of those food.

Keywords : PC game, fruit and vegetable consumption

ABSTRAK

Kurangnya pengetahuan tentang buah dan sayur dapat mengakibatkan rendahnya konsumsi makanan tersebut di kalangan anak Indonesia. Sebuah game PC bernama Fruit and Veggie Story yang kami kembangkan dapat menjadi sarana edukasi bagi anak-anak untuk belajar tentang pentingnya mengkonsumsi buah dan sayur dengan cara yang menyenangkan. Penelitian ini bertujuan untuk mengukur efektivitas Visual Novel PC Game: Fruit & Veggie Story terhadap peningkatan pengetahuan serta konsumsi buah dan sayur pada anak usia sekolah. Penelitian ini merupakan eksperimen semu dua kelompok dengan pre-post test. 50 siswa dari kelas 2A dan 2B di SD Muhammadiyah Bumiayu dibagi menjadi kelompok eksperimen dan kontrol. Setelah bermain game setiap hari selama seminggu, responden pada kelompok eksperimen diukur pengetahuannya menggunakan kuesioner yang terdiri dari 10 soal MCQ. Selain itu, setelah periode satu minggu, konsumsi siswa diukur menggunakan catatan harian food recall. Data disajikan dalam frekuensi, persentase dan dianalisis dengan menggunakan uji T berpasangan dan uji t bebas. Hasil penelitian menunjukkan rata-rata skor pengetahuan sebelum intervensi adalah 5,76, sedangkan setelah intervensi meningkat menjadi 8,12. Rata-rata konsumsi buah dan sayur sebelum intervensi adalah 463,20 gram dan setelah intervensi meningkat menjadi 577,44 gram (P=0,000). Game PC Fruit and Veggie Story adalah inovasi teknologi dalam pendidikan untuk meningkatkan pengetahuan tentang buah dan sayuran secara efektif. Hal ini juga mampu mendorong anak untuk makan lebih banyak dari makanan tersebut.

Kata kunci : PC game, Fruit and Veggie Story

BACKGROUND

There are various nutrients contained in fruits and vegetables. Numerous vitamins and minerals in fruits as well as vegetables act as antioxidants or antidote to fight bad compounds in the body. Most vegetables consist of fiber which promote metabolism process in gastrointestinal system. Not only that, many types of fruits and certain vegetables also provide carbohydrates, especially in the form of fructose and glucose. The riper the fruit containing carbohydrates, the higher the fructose and glucose content, which is characterized by a sweeter taste (Kementrian Kesehatan, 2020). Moreover, certain fruits, such as avocados and red fruit, also provide unsaturated fats. With all the importance of nutrients contained by vegetables and fruits, all age groups specifically children, should consume them in sufficient quantities (Murni, 2017).

World Health Organization (2020) recommends children to consume adequate fruit and vegetable as it will support healthy grow. Generally, it is recommended that the consumption of vegetables and fruits for a healthy life is 400 grams per person per day, consisting of 250 grams of vegetables (equivalent to 2 servings or 2 glasses of vegetables after cooking and draining) and 150 grams fruit, (equivalent to 3 medium-sized Ambon bananas or 3 medium-sized oranges). Unfortunately, the amount of fruit and vegetable consumed by Indonesian children is still half than recommended which is between 100 – 200mg daily (Basic Health Research/Riskesdas, 2018). Fruit as well as vegetables are very easy to find and affordable for most Indonesians considering Indonesia as an agricultural country with abundant vegetables and local commodities. However, the amount of fruit and vegetable consumption in the community is still relatively low (Riskedas, 2018). The Ministry of Health (2017)

reported that fruit consumption in young kids was only 173 gr/day, while vegetable consumption was also only 01 g/day. Those were only about two-thirds of the total recommended consumption by the Ministry of Health (Kemenkes, 2017). Therefore, the consumption needs to be increased two times fold.

The important components needed by children aged between 6-12 years old for a maximum process of growth and development are calcium, phosphate, essential fatty acids, and iron. Moreover, zinc, magnesium, and vitamins essentially vitamin A, vitamin C, vitamin D, vitamin E, are also very much needed. All of those nutritious components can be found in fruits and vegetables. Lack of those nutrients could result in stunted grow, decline in intelligence and low of immune system (Noviyanti & Marfuah, 2017; Murni, 2017). Thus, it is very important that children consume adequate as well as various fruit and vegetable in their daily life (Kemenkes, 2017). Unfortunately, although school-age children need high nutritional needs, their appetite toward fruit and vegetable is quite low.

Most common problems which hinders children from consuming adequate fruit and vegetable are peer pattern consumption, availability of those food in their home, lack of knowledge of their parents regarding the food and introducing those food as early as possible ((Putri et al., 2019). A previous study found that providing fruit and vegetable during meal time would increase those food consumption. Furthermore, parents' knowledge, children's preference, information on social media(Dampang et al., 2017) and easy access or availability could support children's consumption over fruit and vegetable ((Dampang et al., 2017)(Tiara et al., 2019). A school-based intervention program which aimed to increase students' knowledge and consumption over fruit and vegetable using

story book with pictures and audio visual was conducted in Nganjuk, East Java (Tiara et al., 2019). The study reported that audio visual media is one effective tool for learning and teaching movement skills in addition to the school-based intervention strategy. The result of that study was supported by the experience of sight and memory storage in short-term memory can be used to improve movement caused by the influence of visualization received by the senses of sight and hearing (Sumarsono, 2019).

On our pilot study in Banyumas towards 8 parents who have children aged 6-12 years old it was found that only 2 parents who understood the importance of consuming vegetables and fruits in their families. Majority of children and parents (75%) knew very little about the importance of those food, thus they only give limited to vegetables and fruits that their children prefer. Moreover, during our observation for over one week of period, children rarely ate vegetables and fruit. Parents reported that only 2-3 times their children consume (1 portion of fruit and 1 portion of vegetables per week. Other than those time, children chose to eat fast food or junk food. Although the use of digital technology is very common in their family, parents said that they never used any particular means or digital technology to help their children know more about fruit and vegetable. They also seldom persuade their children to eat more of those food. Therefore, the application of the Fruit and Veggie Story: visual novel PC game was intended to inform both children and their parents in a pleasant way.

An educational game namely Fruit and Veggie story was created and developed in order to enhance both students and parents' knowledge over fruit and vegetable. The application platform development has undergone 4 steps based on Research and Development method. Based on the review, expert validity and reliability, the game was reported to be appropriate, feasible and

contented. It is very significant to introduce children towards fruit and vegetable as early as possible because, their early food choices can affect their appetite later in life until adulthood. Therefore, this study aims to measure the level of knowledge regarding fruit of vegetable among elementary students after playing the game. Furthermore, this study aims to measure the amount of fruit and vegetable consumption among elementary students one week after given the intervention.

METHODOLOGY

This study used a quasi-experimental design with pre-post tests for two groups: control and experiment. There were 50 students from SD Muhammadiyah Bumiayu who were physically healthy, had no distortion in their gastrointestinal system and were not in stunting condition enrolled into this study. They were divided into 2 groups based on their class, students in class 2A were chosen to play Visual Novel PC game: Fruit and Veggie Story media while students in class 2B used two educational videos containing nutrition daily consumption from the Ministry of Health which can be accessed freely via Youtube. Students in class B were informed to wait until the study was over before they were taught how to use Visual Novel Fruit and Veggie Story media. Before the study was conducted, the researchers requested the students' parents to accompany their children while they were playing the game. The application platform was developed according to R&D model from Borg and Gall (1983). The study adapted only four development steps: building the literature, designing the platform, assessing the validity reliability and reviewing back media development. The game had undergone both the media feasibility assessment and content validation, with the scores yielded 4.30 (appropriate) and 4.75 (very feasible) respectively. These results have reached the

indicators set out in this study. Those scores indicated that the game was considered suitable for both as an educational media and its contents/materials. The use of media for learning must meet the quality and feasibility of the media as a whole, so that learning can be effective and get optimal results. Data of knowledge among students were collected using a questionnaire consisting of 10 multiple choice questions depicting information about fruits and vegetables content in the Fruit and Veggie Story. Whereas the consumption of those food for over a week period was measured using a food diary recall form. The student parents were requested to assist their children to fill in the diary. This study had been reviewed by the Faculty of Health Sciences Ethics Board and obtained an Ethical Clearance form (no. KEPK/UMP/05/VI/2021). All of the respondents, both in the experiment and control groups, were asked for their consent. The parents of the students were informed about the respondent rights, asked to sign for the informed consent form.

RESULTS

Table 1 shows that among 25 students in the experiment group, majority of them (n=21, 84%) were aged 7 years old. More than half of the students (n=14) in the experiment group were male, whereas in the control group were female.

Table 1. Subject Characteristics (n=50)

Group	Variable	n	%	
Experiment	Age (years)	7	84	
		8	16	
	Gender	Male	14	56
		Female	11	44
		Control		
Control	Age (years)	7	60	
		8	40	
	Gender	Male	11	44
		Female	14	56

The mean of pre-test in the experiment group was 5.76, while the average of their post-test score was 8.12 (Table 2). Meanwhile, the average of pre-test score of the control group was 5.88 and the average of their post-test score was 8.24. Paired T-test analysis revealed that there was a significant increase of knowledge before and after students played the PC game and watched the Youtube video (p-value = 0.000) (Table 2).

Table 2. Level of Knowledge of the Experiment and Control Group (N=50)

Group	Knowledge	n	Min-Max	\bar{X} (SD)	P-value
Experiment	Pre	25	3-7	5,76 (1,45)	0,00
	Post	25	7-9	8,12 (1,56)	
Control	Pre	25	4-7	5,88 (1,35)	0,00
	Post	25	7-9	8,24 (1,40)	

Table 3 shows that the average consumption of fruit and vegetable among students in the experiment group per week was 463.20 grams. After one week period of this study, their average consumption increased significantly to 577.44 grams (p value=0.000).

Table 3. Fruit and Vegetable Consumption of Subjects in the Experiment Group (n=25)

Fruit and Vegetable Consumption	n	Min (gr)	Max (gr)	Mean (gr)	p-value
Before	25	320	625	463.20	0.000
After	25	435	699	577.44	

Data from table 4 shows that the difference of before and after average consumption among students in the control group was 201.72 grams. Students' average fruit and vegetable consumption after

watching the Youtube video increased from 401.80 grams to 603.52 grams ($p=0.000$).

Table 4. Fruit and Vegetable Consumptions of Subjects in the Control Group (n=25)

Level of fruit & vegetable consumption	Min (gr)	Max (gr)	Mean (gr)	p-value
Before	320	625	401,80	0.000
After	445	699	603.52	

DISCUSSION

Knowledge about nutrition can be conveyed through formal nutrition education in school or informal ways, for instance pamphlet, video sharing, and social media. One of innovative ways to deliver the knowledge for children is through gamified approach. Gamified approach was chosen for several reasons. Gamified approach was outweigh compared to conventional ways. It easily attracts children's attention and interest. Children could play while learning. Moreover, the game's visual would please and entertain them, hence it is hoped that they would easily understand the teaching material.

This study uses the mobile game Fruit and Veggie Story as a medium in providing nutritional knowledge about the importance of vegetables and fruits. This game is developed based on the visual novel telling story. Visual Novels are one type of game that is focused on the storytelling section, where players not only read and listen to the sound but can also choose options in the story to get a different storyline to proceed to the next storyline. The ultimate goal of nutrition education is a change in the respondents' knowledge and behaviour regarding fruit and vegetable consumption. that is carried out educatively based on the knowledge gained.

Children aged between 6-12 years old is in a crucial period of growth. To support their potential healthy growth, children need adequate nutritious food. Some nutrition needed by them are vitamin A,

vitamin C, vitamin B1, vitamin B12, zinc, calcium, and phosphate. According to previous studies' report, children with supportive parenting related to diet and nutritious food availability showed healthy growth compared to those who did not have such privileges (Fayasari et al., 2020)(Manumbalang et al., 2017).

The Effect of Fruit and Veggie Story Games on the Subjects' Knowledge

In the initial assessment, the level of knowledge regarding fruit and vegetable among students of SD Muhammadiyah Bumiayu was still very low. Only a few of them who understood the importance of consuming vegetables and fruit. After given a week learning period using Fruit and Veggie Story game application, their level of knowledge increased significantly. This can be seen from the average score of students' knowledge which increased for almost 3 points ($p=0.000$). Moreover, they also understood the importance of fruit and vegetable contents for their growth period. This is in concordance with a research conducted by Irnani and Sinaga (2017) which showed that educating elementary students could increase their level of knowledge related to fruit and vegetable (Irnani & Sinaga, 2017). The study reported that after the intervention, the students' level of knowledge changed to sufficient/adequate. However, this previous study conducted the education using a conventional strategy.

Although the excessive use of gadget could result in negative effect for children on physical, mental and social (Ariani et al., 2017)(Calorina et al., 2021), but using gadget for educational purpose is still strongly supported. The provision of education through a more innovative strategy, using a game application can be the basis of a modern and practical learning. Students at elementary school have been given an understanding of the use of gadgets. Therefore, the researchers did not find any difficulty in explaining how the educational game works in this

study. Providing education through this game application can provide deeper knowledge about the importance of vegetables and fruit in children with supervision by parents. Parents play a role in giving deeper explanation about the importance of vegetables and fruit as well as managing the time when the students playing with the game. This study showed that the use of this game application is very helpful and provided a significant increase in good knowledge in children about the importance of vegetables and fruit. However, the result from the experiment group was still a bit lower compared to the control group's level of knowledge.

Research conducted by Musfiqon et al. (2019) entitled "The Role of Paper Prototyping in Designing Visual Novel Games as Learning Media for children" shows that games have been used as learning media in education. In the development of educational media, it is necessary to have a match between the content and user interface with the target user and content that is in accordance with the objectives of the educational media (Çiftci, 2019). Researchers share experiences where paper prototypes are used to test the suitability of content and UI before entering the stage of making visual novel games (Musfiqon et al., 2019). This PC game also has some other positive strength, initiate interaction. The PC game was developed as the story line of two children who tell the player how to seek more information about fruit and vegetable in the game.

Furthermore, previous study conducted by Ring (2012), reported a significant effect of the type of intervention on increasing empowerment, but only for participants with gaming experience or who achieve a higher level of engagement high in the game. This study provides evidence that gaming may outperform certain types of health condition interventions.

The Effect of the YouTube video on the Subjects' Knowledge

The control group was instructed to use or watch YouTube video from the Ministry of Health channel for over a week. The study showed that after the intervention, the level of knowledge among those students in the control group increased significantly ($p=0.000$). Furthermore, their level of knowledge was higher than those in the experiment group. This condition could happen because of some reasons.

The students from the control group reported that YouTube educational video from the Ministry of Health is very interesting to watch. There are two videos released by the Ministry of Education: Fruit and Vegetable Education (3.5 minutes) and the Increase Consumption of Fruit and Vegetable (5 minutes). Moreover, the videos do not require students to click any button to choose which one they want to watch, thus it is considered very easy to use. Although the videos present a wide variety of colors which might attract children, the types of fruit and vegetable which were presented in the videos are fewer than the fruit and vegetable contained in the PC game. Furthermore, the PC game still has opportunity to be reviewed and developed to be more educative and interactive. Whereas when the students surfed over YouTube channel, they could watch other YouTube videos regarding fruit and vegetable from different creators. This could add greater knowledge for children about balanced nutrition or education on the importance of vegetables and fruit for children.

The Ministry of Health issued a regulation regarding the Recommended Nutritional Adequacy Rate (RDA) for the Indonesian nation based on age group as stated in PMK RI Number 75 of 2013 (Kementrian Kesehatan, 2020). This regulation recommends the RDA of vitamins and minerals consumed by the age group 7-9 years daily. Each of them is 500 mcg vitamin A, 45 mg vitamin C, 0.9 mg

vitamin B1, 1.0 mg vitamin B6, 10 mg iron, 1,000 mg calcium and 500 mg phosphorus. Moreover, children aged 10-12 years need to consume vitamin A 600 mcg, vitamin C 50 mg, vitamin B1 1.1 mg, vitamin B6 1.3 mg, iron 13 mg, calcium 1,200 mg and phosphorus 1,200 mg. Whereas male with age group of 13-15 years need to have 600 mcg vitamin A, 75 mg vitamin C, 1.2 mg vitamin B1, 1.3 mg vitamin B6, 19 mg iron, 1,200 mg calcium and 1,200 mg phosphorus daily (Kemenkes, 2013). Both the PC game and the YouTube videos give quite detail about the nutritious contents of fruit and vegetable which need to be consumed by school aged children in this study.

The Effect of the Fruit and Veggie Story PC game on the Subjects' amount of Consumption

There are several influencing factors for school aged children in consuming adequate fruit and vegetable in their daily diet menu. One of the supporting factors can be in the form of nutrition education provided (Putri et al., 2019)(Tiara et al., 2019). At this time, many children are familiar with gadgets and the internet. One of them is a mobile game that is much liked by children. One of the places to get information or knowledge about vegetable and fruit nutrition education is through vegetable and fruit nutrition education games (Çiftci, 2019). The students who played the game for one week period experienced an increase in the amount consumption of fruit and vegetable. Parents of the students played a significant role in this food consumption recall, because they helped their children to measure the amount of fruit and vegetable that they consume every day. This can be seen from the results of calculations where the average vegetable and fruit consumption of the respondents has increased for approximately 100grams.

However, the increase in consumption of vegetables and fruit that occurs is not so large and has not reached the existing

recommendations. The increase in consumption of vegetables and fruit that occurred only ranged between 115 – 379 grams of vegetables and fruit. With a minimum score after being given nutrition education, which is 435 grams and a maximum score of 699 grams in one week. According to the Ministry of Health (2017) that the recommendation to consume vegetables and fruit for school-age children is 2,100 – 2,800 grams in one week.

The pattern of consumption of vegetables and fruits in the community is influenced by several factors. According to states that when children enter school age, children begin to get influence from the outside environment, such as teachers, peers and a group, other people at school, and also the influence of the media (Murni, 2017)(Putri et al., 2019). These influences can be grouped into internal and external factors. Internal factors consist of factors that have positive and negative effects on the consumption of vegetables and fruits that come from outside, such as the availability of vegetable and fruit food, mother's education (parents), family income, and socialization media.

The Effect of the Youtube Video on the Subjects' Consumption

Consumption of vegetables and fruit is very crucial for children who are in the growth process. Both fruit and vegetable support metabolic health among children in this essential period. Nowadays, many children have been introduced to digital learning media, one of which is Youtube, which contains a lot of health information for children, especially regarding vegetables and fruit. This research showed that the students in the control group also experienced changes in consumption of vegetables and fruit after receiving information about vegetables and fruits through both Youtube videos. The control group's consumption increased roughly 200gram for a week. That amount of increase is quite significant to be continued.

The students could reach the optimum amount weekly consumption recommended by the Ministry of Health. According to the Ministry of Health (2017) school-age children need to consume vegetables and fruit for is 2,100 – 2,800 grams in one week.

Eating a balanced nutritious diet is one way to keep the body's immune system primed. However, we also need to increase the consumption of foods that contain nutrients that play an active role in increasing the body's resistance, among others, namely Vitamins A, C, E and Zinc (Kementrian Kesehatan, 2020). This study shows that nutrition education for children needs special attention because it is different from nutrition education for teenagers or adults. Nutrition education for children should ideally be carried out in a pleasant atmosphere and using media that are easily accepted.

Both groups in this study showed an increase of the consumption, but the amount was still far from the recommended amount by the Indonesian Ministry of Health as well as WHO. There could be several factors related to that condition, for instance environmental factor, parents/family aspect and socio-economic factor. Environmental factors such as friendships are also the cause of the consumption patterns of school-age children. If the child is in a friendly environment who prefers snacks, then it is certain that the child will be very less in consuming vegetables and fruit because when he returns home, the child feels full and does not want to eat anymore (Noviyanti & Marfuah, 2017).

A study said that the lack of self-concept in children in motivating themselves to want to eat vegetables and fruit, so this needs to be a concern for parents (Yulianti et al., 2021). In addition, the ease of getting fruit compared to vegetables is a trigger for higher consumption of fruit than vegetables such as fruit sellers around schools or homes that

are easily accessible by children. Another reason is that fruit is easier to consume without having to be cooked first so it is easier to eat than vegetables. And the sweet and refreshing taste of fruit is more in demand by children than vegetables (Putri et al., 2019). Often offering fruit and vegetables at home at breakfast or by bringing fruit as a lunch can be one of the recommended ways to increase the consumption of vegetables and fruit as a school-based intervention program for elementary school age children. Availability of fruits and vegetables, preferences, parental knowledge, exposure to television advertisements and the number of snacks available are the determining factors in choosing children to consume vegetables and fruit (Dampang et al., 2017).

The limitation in this study were the selection bias and the possibility communication between the respondents in class 2A and class 2B regarding the media. The selection of class 1A to become the experimental group was based on the consideration that all the students' parents have a personal computer/laptop while those in class B only a half number who possess a laptop. Moreover, during one week of treatment, there was a big possibility that either the students or the parents had some communication regarding the media that being used. It might affect the knowledge of the students from the control group. In the beginning of the study, the researchers only instructed the students in the classes as well as the student parents (via WhatsApp group) to follow the study guideline, asked the school principal and the class teachers to encourage their students to follow the researcher instructions. Moreover, the researcher informed the control group to wait for a week to get the information about the media. The researchers then explained and gave the students in class 2B how to play the game after the study was over. This study also has relatively small number of

samples, hence further research would be suggested to involve a larger number of students from elementary school.

CONLUSSION

The level of knowledge on fruit and vegetable of the study subjects who watched the PC game increased significantly, and there is a significant difference between the experimental group and the control group. Moreover, the amount of fruit and vegetable consumption also increased in the experimental group. In terms of the fruit and vegetable consumption, there is a significant difference between the experimental group and the control group. The media can be utilized as a sort of alternative to educate in an entertaining way for children to learn about fruit and vegetable.

There are several nursing implications which could be drawn from this study. Nurses in the community setting could use either PC game: fruit and veggie story or nutrition education videos from the Ministry of Health, easily access from YouTube to encourage children and their family in consuming more fruit and vegetable. Nurses could also use this media to introduce to both children and their parents regarding educational content of gadget. Digital gadget also offers educational content in a fun way.

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