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Integration of Science Education in Physical Activity and Dietary Behavior for Elderly: An Intervention of Digital-Based Learning

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ABSTRACT

Unhealthy eating behavior and low physical activity are the main problems for teenagers, especially vocational education students. To develop an effective intervention program, more research is needed to understand how different types of learning contribute to knowledge and their behavior regarding physical activity and eating behavior. In this research, the use of technology in learning in the elderly community contributes to eating patterns and physical activity behavior. This research involved 80 elderly (mean age 17.2 ± 1.2 years) attending an intervention program. A paired sample t-test was used to investigate the effect of technology-based learning media interventions implemented through physical education learning. This research found that there is a significant influence on learning outcomes using animated videos on increasing physical activity and dietary behavior of the elderly.

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1. INTRODUCTION

Unhealthy dietary habits and decreased physical activity are major problems in adolescents and adults (McVeigh *et* al., 2016). Many reports regarding this diet have been well-developed, and they relate to the Sustainable Development Goals. This unhealthy behavior can pose a higher risk of disease in individuals. The disease that may occur is a type of non-communicable disease that may be very dangerous for their lives (Aune *et al*., 2017; Lee *et al*., 2012; Wahid *et* al., 2016). The prevalence of diseases caused by unhealthy lifestyles is not evenly distributed among various groups of adolescents (Piirtola *et al*., 2016; Shrewsbury *et* al., 2018). In several countries, many vocational school students are overweight, show less movement than recommended, do not do enough activity, and most do not meet fruit and vegetable consumption guidelines (Bonevski *et* al., 2013). Most vocational students are in their late teens, ranging from 16 to 20 years old. Late adolescence is characterized by many psychomotor, affective, and cognitive changes, including changes in body shape, behavior, lifestyle, and motivational processes (Reyna & Farley, 2006; Van Duijvenvoorde *et al*., 2016). This is also a transition period from adolescence to adulthood, where young people develop independence, adopting relatively persistent health behaviors. In this condition, eating patterns are closely related to the risk of developing obesity if unhealthy eating habits and physical activity practices are not carried out properly according to recommendations (Nelson *et* al., 2008). Therefore, it is very relevant to promote healthy eating habits and physical activity behavior among adolescents, especially among those who are vulnerable target.

Physical activity (PA) has many health benefits. In the short term, PA can improve well-being, prevent musculoskeletal injuries, and be a preventative tool for obesity (Janssen & LeBlanc, 2010). In the long term, regular PA can reduce the risk of premature morbidity and mortality, as well as prevent non-communicable diseases (Lee *et al*., 2012; Rahayu *et* al., 2023). Many reports regarding physical activity have been developed. Further, **Table 1** shows several papers recently published relating to physical activities. The World Health Organization (WHO) recommends that individuals aged 18–64 years engage in at least 150 minutes/week. Moderate-intensity physical activity or 75 minutes per week, vigorous-intensity physical activity (VPA), or an equivalent combination of moderate to vigorous physical activity (MVPA). However, in reality, around one in four people aged 18–64 years do not reach these minimum PA guidelines. In general, a greater proportion of adults meet these guidelines than older adults. When compared with those who do not do physical activity, there are still many who do not meet the WHO PA guidelines. In Denmark, 30% of students in vocational education and training (VET students) do not meet the WHO minimum PA guidelines (Rahayu *et* al., 2023). Meanwhile, in general, the percentage of upper secondary education is 12–16%. A similar pattern occurs in other Scandinavian countries, with students in upper secondary education generally being significantly more physically active than students in secondary vocational education. To develop an effective intervention program for students in vocational schools, research is needed to identify factors that predict engagement in physical activity behavior and their health, including using vocational students as the research population. Various theoretical explanations provide a basis for understanding the determinants of behavior and changes in lifestyle and health behavior (Conner & Norman, 2015). Several studies have reported the success of changing behavior related to motives, self-regulation, resources, habits, and social-environmental influences, as well as emphasizing that motivation is very important in supporting healthy eating and physical activity behavior (Cortis *et al*., 2017; Kwasnicka *et al*., 2016; Teixeira *et* al., 2012).

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The learning intervention program that is considered effective and effective and following current developments is learning that involves elements of technology and digitalization. Technological developments in learning focus on the use of computers and technological, information, and communication literacy (Van Laar *et al*., 2017). The development of digital technology in the learning process has grown so rapidly that it has an innovative role in education (Kryukov, 2017). This causes a shift in the learning process from traditional learning to digital-based learning. The concept of digitalization is in line with the development of the Industrial Revolution 4.0 era, which has now developed into an era of super-intelligent society, namely, entering society 5.0, the trend of digitalization in various fields has been utilized. One of which is in the field of education (Muktiarni *et* al., 2019). Digitalization in the world of education continues to experience developments that influence patterns and strategies in learning, learning systems are changing to electronic learning, such as audio and visual (Muktiarni *et al*., 2021; Pettersson, 2021). Various media can be used in the learning process, digital media, mobile learning, audio-visual media, etc. One of the media that is often used is mobile learning, which is a trend that continues to develop in the field of education. This research aims to intervene in learning by focusing on physical activity and dietary behavior in vocational education and training school students: an intervention of digital-based learning by utilizing digital video animation facilities that can be accessed via cellphone or computer. This is based on the idea that children and teenagers tend to spend more time using smartphones and computer devices. Therefore, researchers chose to develop mobile learning in the form of animated videos. This animated learning video will contain material about physical activity, dietary behavior, and its impact on health, which is expected to educate teenagers who are students at vocational schools in Indonesia. Thus, they can change their mindset and lifestyle for the better.

2. METHODS

In this quasi-experimental study, a pretest-posttest control group design was used. Data were collected before and after the intervention in both sample groups. Samples were taken randomly from 80 elderly people. The sample is carried out because it is adapted to the implementation of the curriculum structure that applies in an elderly community program. The intervention carried out was the implementation of physical education learning interventions in schools based on digital-based learning using animated videos regarding physical activity and dietary behavior material. The intervention was carried out on the treatment group for 16 sessions with a duration of 90 minutes. The instruments used for data collection were GPAQ, adapting the Adult Eating Behavior Questionnaire (AEBQ). Data analysis used a Paired sample t-test with the help of SPSS version 26 at a significance level of 0.05.

3. RESULTS AND DISCUSSION

3.1. Descriptive and Inferential Analysis

The results of this study have been analyzed descriptively and inferentially using statistical analysis. The results of this study analysis are shown in **Tables 1, 2, and 3**. The characteristics of the study population are shown in **Table 1**. The average age of the sample was 17.2 (±1.2) years. Mean BMI was 22.1 (2.9). The results of the descriptive analysis showed that the students' weight status was 20 people underweight, 30 people of normal weight, 15 people overweight, and 5 people obese.

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Table 2 is a pre-test of individual characteristics, the average water consumption is 1002 mL/day, the average soda consumption is 430 mL/day, and the average diet soda consumption is 95 mL/day. For fruit, the average consumption is 1.9 pieces a day, and the average number of high-calorie snacks is 0.6 portions per day. The average frequency of breakfast is 2.7 days per week. Engagement in student physical activity was. The average time for weekly MVPA was 643 minutes, 102 minutes for vigorous physical activity, and 541 minutes for moderate physical activity.

Table 3 shows the result of the posttest of individual characteristics. The average water consumption is 1562 mL/day, the average soda consumption is 370 mL/day, and the average diet soda consumption is 83 mL/day. For fruit, the average consumption is 1.9 pieces a day, and the average number of high-calorie snacks is 2.7 portions per day. The average frequency of breakfast is 3.4 days per week. Engagement in student physical activity was. The average time for weekly MVPA was 943 minutes, 272 minutes for vigorous physical activity, and 671 minutes for moderate physical activity. Based on statistical inference analysis using a paired sample t-test, it shows that there is a significant influence of digital-based learning interventions on increasing physical activity and dietary behavior in the elderly community (t 3.764, p 0.03).

Table 1. The characteristics of the study population.

Characteristic	Mean (SD)	Percentage
Age	17.2 (±1.2)	
BMI	21.1 (2.9)	
Weight Status		
Underweight		20
Normal Weight		30
Overweight		15
Obese		5
Gender		
Male		47
Female		33
Program Background Culinary		50 (40)
Digital Bussines		50 (40)

Table 2. Pretest of individual characteristic.

Item	Mean (SD)
Water (ml/day)	1002 (661)
Regular soda (ml/day)	430 (476)
Diet soda (ml/day)	95 (102)
Energy Drink (ml/day)	80 (173)
Fruits (pieces/day)	0.6 (0.9)
Breakfast (days/week)	2.7 (1.3)
MVPA (minutes/week)**	643 (603)
Moderate PA (minutes/week)**	541 (459)
Vigourous PA (minutes/week)**	102 (221)
High-calorie snacks (portions/day)	2.9 (3.9)
Water (ml/day)	1002 (661)
Regular soda (ml/day)	430 (476)

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Table 3. Posttest of individual characteristic.

Item	Mean (SD)
Water (ml/day)	1562 (961)
Regular soda (ml/day)	370 (416)
Diet soda (ml/day)	83 (92)
Energy Drink (ml/day)	75 (107)
Fruits (pieces/day)	1.9 (1.1)
Breakfast (days/week)	3.4 (1.8)
MVPA (minutes/week)**	943 (668)
Moderate PA (minutes/week)**	671 (459)
Vigourous PA (minutes/week)**	272 (235)
High-calorie snacks (portions/day)	2.7 (3.8)

3.2. Discussion

The increasing trend of using mobile phones and computer devices has greatly influenced almost all aspects of students' lives, wherever and whenever, everyone is very dependent on the use of these tools (Suherman *et* al., 2021). Two sides influence the use of digital means. On the positive side, all information will be obtained more quickly and easily, on the other hand, the tendency to become addicted to using these tools is increasing, especially for children and teenagers who are students and Even elderly people nowadays are very familiar with mobile phone technology (Muktiarni *et* al., 2023). Children and teenagers can spend hours using smartphones, which affects their lifestyle, which tends to be unhealthy due to a lack of physical activity (Suherman *et al*., 2021). This sedentary lifestyle occurs in someone too lazy to move due to convenience in various fields, namely technology, transportation, and household equipment. Therefore, you should be wise in using digital means and technology for good and positive things. One of them is the use of technology and digitalization for learning media. Learning through digital media can be done with animated videos as intervention material to increase student output related to their physical activity status and dietary behavior. This animated video is a medium that combines audio and visuals to attract students' attention, present objects in detail, and help them understand difficult lessons (Muktiarni *et* al., 2023).

Animated videos can comprehensively illustrate and explain the material to students. The animated video contains material on physical activity and dietary behavior, along with their benefits and bad effects. The videos developed aim to educate children and teenagers about physical activity and dietary behavior, and their impact on health. The use of digital video animation media is based on analytical studies that have been carried out; the results of literature reviews and research show that digital video animation media are effectively used for learning and improving health, especially among children and teenagers (Rahayu *et al*., 2023). Apart from being used as a learning medium, this intervention can also be used to promote and campaign for a healthy and active lifestyle. Because the trend of unhealthy behavior among students is a serious problem, this intervention functions to educate students while achieving learning goals at school. Recommended PA is measured as compliance with the minimum guidelines issued by WHO. One of the instruments used was the Nordic-short Physical Activity Questionnaire consists of two open-ended questions with weekly durations of MVPA and VPA. This measure was validated to monitor compliance with WHO guidelines. Gender and age were included as covariates that could potentially influence health, dietary patterns, and PA. Specific information regarding vocational schools in the two

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main educational programs was obtained from the survey and categorized according to research needs.

Although initially, the prevalence rate of non-compliance with the WHO-recommended PA among VET students was relatively high, as well as the proportion of students whose dietary patterns were considered poor. In the end, it changed after the intervention process was carried out systematically, programmed, and using appropriate learning media. The research results show a significant influence from the results of interventions using animated videos as digital-based learning to improve activity patterns and dietary behavior among vocational students (Murphy *et* al., 2018). This may reflect that the form of intervention implemented in learning is appropriate to the characteristics of the elderly. The results of this study are in line with previous findings regarding self-efficacy associated with PA. As well as research showing a composite measure of self-efficacy and perceived behavioral control correlates with MVPA among the elderly in a community program. The strength of this article is its examination of various aspects of health, such as physical activity and dietary patterns, as well as healthy lifestyle as a multidimensional measure of adherence to WHO guidelines. A further strength of this research is the analysis of the aspects that build physical activity and dietary patterns that lead to a lifelong healthy and active lifestyle in a representative sample of the elderly, as an understudied group. Apart from that, the use of digital media as a step to increase learning output and validated control due to demographic and educational factors is an advantage of this article.

4. CONCLUSION

This research concludes that interventions using animated videos as digital-based learning are effective in increasing elderly physical activity and dietary patterns in the community. The elderly in community programs are a promising place for the promotion of PA and good diet patterns. However, this research cannot identify the best intervention to produce the output, because it was not compared with other forms of intervention. This suggests the potential for developing other interventions to increase PA and health promotion for the elderly. Future longitudinal studies are needed to find the best interventions elderly with various characteristics to increase output and achieve optimal learning outcomes.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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