The influence of health education using game-based learning methods on improving smoking prevention behavior among school-age children

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ARTICLE INFO

A B S T R A C T

Cigarettes are still the most common cause of death worldwide. Today, the younger generation's smoking behaviour is expanding to children's ages. Therefore, attractive smoking prevention to children with media is necessary. The aim of this research is designing game-based learning health education media and analyzing the effect of health education on improving smoking prevention behaviour for school-age children. This study consists of 2 stages, designing Game-Based Learning with the Multimedia Development Life Cycle (MDLC) method and quasi-experimental research with control and intervention groups. Determination of the research location used proportionate stratified random sampling and simple random sampling. The study took place at three elementary schools (SDN) in Yogyakarta with a sample of children 10-12 years old for a month. Testing games took 54 children, and the sample size was 88 children; 44 children for the control group and 44 children for the intervention group. The analysis used the Wilcoxon, Mann-Whitney, and Cohen's Effect Size with the help of SPSS. Most respondents in testing game applications stated that the game function followed the objectives, increasing knowledge about smoking and its prevention. Respondents rated the game as easy to use, learn, and have a pleasant feeling when playing the game. All respondents also expressed their interest in distributing the game to their other friends. After one month of intervention, children's knowledge increased with a p-value of 0.001, attitudes with a p-value of 0.022, and behaviour with a p-value of 0.019. Health education using the Game-Based Learning method could improve school-age children's knowledge, attitudes, and behaviour.

A B S T R A K

Rokok masih merupakan penyebab paling sering terjadinya kematian di seluruh dunia. Perilaku merokok saat ini banyak dilakukan oleh generasi muda dan meluas ke usia anak-anak. Pencegahan inisiasi merokok pada anak penting untuk diimplementasikan dengan menggunakan media yang menarik untuk anak-anak. Tujuan penelitian ini adalah merancang media edukasi kesehatan dengan game based learning dan menganalisis pengaruh edukasi kesehatan terhadap peningkatan perilaku pencegahan merokok anak usia sekolah. Penelitian ini terdiri dari 2 tahapan yaitu perancangan media edukasi dengan metode Multimedia Development Life Cycle (MDLC) dan penelitian quasi eksperimental dengan kelompok kontrol dan intervensi. Penentuan tempat penelitian menggunakan proportionate stratified random sampling dan pengambilan sampel dengen simple random sampling. Penelitian dilakukan di 3 SDN di Kota Yogyakarta dengan

sampel anak usia 10-12 tahun. Pengujian media menggunakan responden sebanyak 54 anak, kelompok kontrol sebanyak 44 anak dan kelompok intervensi 44 anak. Intervensi game based learning dilakukan selama 1 bulan. Analisis menggunakan Uji Wilcoxon, Mann-Whitney test dan Cohen's Effect Size dengan bantuan SPSS. Responden dalam pengujian media menyatakan bahwa setuju game dapat meningkatkan pengetahuan tentang pencegahan merokok dan menilai game mudah untuk digunakan, dipelajari, serta menimbulkan perasaan menyenangkan saat memainkan game. Seluruh responden berminat untuk menyebarluaskan game kepada temannya. Setelah intervensi selama 1 bulan terjadi peningkatan pengetahuan anak dengan p-value 0,000, sikap dengan p-value 0,022 dan perilaku dengan p-value 0,019. Pendidikan kesehatan dengan menggunakan media game dapat meningkatkan pengetahuan, sikap dan perilaku anak usia sekolah

INTRODUCTION

Smoking causes more than 8 million people every year globally, more than seven million deaths due to active smoking, and around 1.2 million deaths due to exposure to passive smoking or secondhand smoke (Kemenppa RI, 2018)(WHO, 2020). The smokers mostly live in developing countries, including Indonesia (Sohn, 2018). Indonesia is the third country with the highest number of smokers worldwide, after China and India. The national smoking prevalence in Indonesia in 2013 was 29%, and the average daily cigarette consumption per person was 12.3 or 369 cigarettes per month. The younger generation is taking over the high smoking number and expanding to children ages (Ariani, Mulyono, & Widyatuti, 2019a).

Global data showed that between 2000 and 2017, about 7% or more than 24 million children 13-15 years old smoked (Commar A, Prasad VK, Tursan d'Espaignet E, 2018). This situation raises special attention because many Indonesian children have tried smoking. The smoking habit of school-age children is increasing and influences the dangers. Perceptions are formed based on children's experiences of exposure to cigarettes and the environment of smokers. Positive perceptions about the risks of smoking for children consider it natural to do (Ariani, Mulyono, & Widyatuti, 2019b). Prevention of smoking initiation programs at a young age is essential, and the main focus of programs for children is the prevention of early-onset smoking (Kim & Kim, 2019) (Hieftje et al., 2021).

The Health Promotion Model by Pender (1982; revised 1996) is a complementary part of health protection models. The three new variables added to the revised model are activity-related effects, commitment to the action plan, and personal priorities and desires. This model defines *health* as a positive, dynamic state, not just the absence of disease. Health promotion aims to improve client welfare. This theoretical model describes the multidimensional nature of humans when interacting in their environment to achieve health. The model focuses on three areas, (1) individual characteristics and experiences; (2) knowledge and attitudes towards certain behaviours; and (3) behavioural outcomes when the client commits to behaviour or changes behaviour (Potter et al., 2019).

The media providing information on smoking prevention in children is considered adequate via a smartphone. Active smartphone users in Indonesia in 2018 reached 177.9 million, with the most significant users being children and adolescents. Games are popular software among children, adolescents, and adults (Yunanto & Rochimah, 2017). The children under 13 were interested in video games seen from the most frequently viewed content on the Internet (St, n.d, 2020).

Games can attract realistic role-taking stimulation in dealing with problems, formulating strategies, making decisions, and getting quick feedback on actions taken (Abt, 1987). Games with an educational purpose and behaviour change other than entertainment are game-based learning or challenging game. This game is a software project used as a learning medium in providing education and health education to a community in society (Yunanto & Rochimah, 2017) (Eichenberg & Schott, 2017)(Plass, Jan L.; Mayer, Richard E.; Homer, 2020).

Cigarette Prevention Educational Game (CPEG) is educational media provided for school-age children in the form of online game applications about the dangers of cigarettes and smoking prevention. The game is designed to be interoperable on android devices and can be accessed online. Scratch is a web-based design application to creates games. The game's appearance is designed with an animation of a child chasing the symbol of the smoking dangers, followed by questions and explanations about the dangers of cigarettes and how to avoid them. This game-based learning design is supported by Duncan et al. (2018) and Hieftje et al. (2019) on the video game "SmokeScreen". The results of increasing students' knowledge related to cigarettes and marijuana and providing preliminary evidence that video games have the potential to affect the cognitive and motivation of smoking prevention and marijuana consumption. This study aims to design health education media with game-based learning and analyze the effect of health education on improving smoking prevention behaviours of school-age children.

METHOD

This study has two stages, designing educational media and quasi-experimental research using the press. The method used in educational media design was the Multimedia Development Life Cycle (MDLC), with six stages: Concept, Design, Material Collecting, Assembly, testing, and distribution (Mustika et al., 2017). The game content related to smoking prevention in school-age children consults with

cigarette prevention experts, pediatric specialist nurses and Muhammadiyah Tobacco Control Center (MTCC) team leaders. The second stage of experimental research used quantitative research methods with Quasi-Experimental Design and two groups, the control and intervention groups. The technique used in determining the school as a research location used proportionate stratified random sampling. The school criteria included a public elementary school with a minimum number of students according to the sample required. The results of the sample calculation in this study were 44 for the control group and 44 children for the intervention group. The student sampling technique used is simple random sampling. The population used in this study were elementary school-aged children who were students at public elementary schools in the Yogyakarta City area and aged 10-12 years. The inclusion criteria for this study are children who have never smoked, have gadgets at home, and are allowed to use them during the intervention. The media testing in this study used the opinions of media experts or judges experts and the assessment of elementary school-aged children. The expert tests involved in the validity of the game are one science technology expert and two public health practitioners. The research for media testing took place at two elementary schools in Yogyakarta. The respondents in media testing were 54 students.

This study also used questionnaires to measure children's knowledge, attitudes and actions with 41 questions. The validity test with Cronbach's Alpha showed a knowledge questionnaire of 0.730, an attitude questionnaire of 0.876 and an action questionnaire of 0.761. Interventions in students were carried out for one month and pretested at the beginning and post-test at the end of the study. Those who had filled in the link at the beginning of the pretest in the intervention group were 50 children. Still, the respondents who followed the study were 44 respondents. One person quit due to disagreement with informed consent, one did not participate in the intervention, two did a double filling on the link, and two stated that they had smoked.

Children's knowledge, attitudes, and behaviour about smoking prevention were measured using a validated questionnaire–the statistical test to measure before and after the intervention using the Wilcoxon test. The effectiveness test of Gamed Based Learning on improving smoking prevention behaviour using the Mann-Whitney test.

RESULT AND DISCUSSION

The research produced educational media to improve smoking prevention behaviour in school-age children with an educational game called Cigarette Prevention Educational Game for School Children. Media development used the Multimedia Development Life Cycle (MDLC) method tested on school-age children.

Health education media helps to convey health messages more transparently and precisely (Notoatmodjo, 2011). The results of media testing on 54 children showed that most testing game applications stated that the game function increased knowledge about smoking and its prevention. The majority of respondents rated the game as easy and fun. All respondents were interested in sharing the game with their other friends.

Game-based health education has outperformed traditional or lecture-based learning (Setiawan & Phillipson, 2019). Game-based cigarette prevention interventions are a fun alternative to interventions. The message about health

will be more solid using a game. Respondents' enjoyment of using GBL indicates that the intervention may be acceptable to children (Weser et al., 2021)(Raiff et al., 2018). Hieftje et al. (2019) supported results in media development. They found that games like e-cigarettes are effective as an approach to smoking prevention health education and can provide immediate short-term changes as a medium for tobacco-related educational interventions compared to non-web sites (Parisod et al., 2018).

Table 1. Game Testing Results on School-Age Children (n = 54)

Variable	Result	
	N	%
Game Functions		
Compatible	50	92,6
Incompatible	4	7,4
Game Practicality		
Easy	52	96,3
Difficult	2	3,7
Opinion to the Game		
Fun	51	94,4
Boring	3	5,6
Interest to Share		
Interested	54	100
Uninterested	-	-

Source: Primary Data, 2021

The results of game-based learning to improve smoking prevention behaviour for school-age children are shown in Table 2 below.

Table 2. Respondents Characteristics (n = 88)

Respondents Characteristics	Intervention Group (n = 44)		Control Group (n = 44)	
	F	%	F	%
Sex				
Male	21	47,7	21	47,7
Female	23	52,3	23	52,3
Age				
Ten years old	2	4,5	0	0
11 years old	26	59,1	29	65,9
12 t years old	16	36,4	15	34,1
Children Smoking Status				
Yes	-	-	-	-
No	44	100	44	100
Exposed to Information				
Yes	36	81,8	39	88,6
No	8	18,2	5	11,4
Smoking Families				
Yes	31	70,5	29	65,9
No	13	29,5	15	34,1
Smoking Friends				
Yes	3	6,8	7	15,9
No	41	93,2	37	84,1
Smoking School Environment				
Yes	6	13,6	7	15,9
No	38	86,4	37	84,1

Source: Primary Data, 2021

Most respondents in the control and intervention groups were 11-year-old females, did not smoke, had been exposed to cigarettes, had smoker families, and did not have smoking friends and school environment.

Table 3. Characteristics of Knowledge, Attitudes, and Behavior in the Control Group (n = 44)

Variable	Pre Test		Post Test		P value
	n	%	n	%	
Knowledge					
Inadequate	7	15,9	4	9,1	0,719
Average	9	20,5	13	29,5	
Good	28	63,6	27	61,4	
Attitude					
Inadequate	1	2,3	1	2,3	0,637
Average	12	27,2	10	22,7	
Good	31	70,5	33	75	
Behaviour					
Inadequate	2	4,5	3	6,8	1,000
Average	9	20,5	7	15,9	
Good	33	75	34	77,3	

*p<0,05 based on the Wilcoxon test

The results of the Wilcoxon test in the control group showed that the p-value of knowledge, attitude, and behaviour were more significant than the alpha value or p> 0.05, namely 0.719, 0.637, and 1,000. The test results found no difference in the control group's value of knowledge, attitudes, and behaviour before and after the intervention.

Table 4. Characteristics of Knowledge, Attitudes, and Behavior in the Intervention Group (n = 44)

Variable	Pre Test		Post Test		P Value
	n	%	n	%	
Knowledge					
Inadequate	8	18,2	-	-	0,000
Average	13	29,5	2	4,5	
Good	23	52,3	42	95,5	
Attitude					
Inadequate	2	4,5	-	-	0,022
Average	12	27,3	5	11,4	
Good	30	68,2	39	88,6	
Behaviour					
Inadequate	2	4,5	-	-	0,019
Average	8	18,2	2	4,5	
Good	34	77,3	42	95,5	

*p<0,05 based on the Wilcoxon test

The intervention group results using the Wilcoxon test showed that the p-value of knowledge, attitude, and behaviour were smaller than the alpha value or p <0.05, 0.000, 0.022, and 0.019. The test results discovered the intervention group's effect of health education with game-based learning methods on smoking prevention knowledge, attitudes, and behaviour. Duncan et al. (2018) supported the findings. The student knowledge increase regarding smoking provides preliminary evidence that games can affect cognition and motivation to prevent smoking in school-age students (Duncan et al., 2018). The smoking prevention approach focuses on providing accurate information to children about the impact of smoking on their lifestyle and developing the skills and strategies [22]. The games in this study convey knowledge about smoking, and that cigarettes contain nicotine and can cause addiction to help children avoid smoking initiation decisions. The potential dangers of smoking can also affect children's health behaviour (Raiff et al., 2018). Rath et al. also stated that anti-tobacco integration into mobile games could increase attitudes against tobacco products in adolescents (Rath et al., 2015). Attitude changes occur when individuals receive a stimulus and make an assessment of the trigger. Attitudes in everyday life are emotional reactions to social stimuli (Notoatmodjo, 2011).

Behaviour is the result of learning from the objects around it and can change according to the level of development and the child's ability to learn, understand, and adapt information from things. Behaviour change can occur through the learning process and takes a relatively long time (Harvey et al., 2016)(Matthew, 2019). Derksen et al. (2020) stated that the effect of games on preventing smoking initiation is still less intense if the time to evaluate behaviour change is only short (Derksen et al., 2020).

The pretest analysis of the two groups with the Mann-Whitney test showed no difference in the control and intervention groups. The post-test analysis of the two groups showed a difference in the post-test results of knowledge and behaviour in the two groups. In comparison, the post-test results for the attitudes of the two groups were similar. The results of the effect size calculation for knowledge, attitudes, and actions are in the following table.

Table 5. Effect Size Calculation

Variable	Intervention Group Mean	Control Group Mean	*Sd*	*d*	Category
Knowledge	52,0733	45,364	13,533	0,4957	Average
Attitude	107,545	60,9636	22,871	2,0367	High
Behaviour	47,0833	14,5349	10,0362	3,2430	High

* Effect Size based on Cohen's formula

Attitude and action variables influence size values above one and are categorized as significant effects, while the knowledge variables are in the average category. The effect size results discovered that "GEPRUAS" significantly impacted attitudes and actions and had a moderate effect on knowledge. The factor that influenced attitudes in the two groups was children exposed to cigarettes because the family smoked. The respondents' characteristics related to cigarette exposure show that 55.9% of the respondents' families smoke in the control group and 70.5% in the intervention group. One factor that influences behaviour change is social and environmental influences. Family smoking habits have

an impact on children's perceptions of the dangers of smoking. Positive perceptions about the dangers of smoking make children consider smoking a natural habit (Ariani, Mulyono, & Widyatuti, 2019a) (Huriah & Dwi Lestari, 2020).

LIMITATION OF STUDY

Implementing online data collection means that researchers cannot ensure that respondents fill in the data correctly, which impacts the study's results. Another

challenge when implementing game interventions for students is connection constraints because each student uses a different provider, so the smooth connection is also different.

CONCLUSION AND SUGGESTIONS

Developing game media using the game-based learning (GBL) method of smoking prevention is considered adequate for school-age children. A quasi-experimental study showed that game-based learning health education interventions increased school-age children's knowledge, attitudes, and behaviour about smoking prevention. Suggestions for schools to regularly socialise about smoking prevention to encourage students not to initiate smoking.

ETHICAL CONSIDERATION

This study was approved by the Health Research Ethics Committee Universitas 'Aisyiyah Yogyakarta No.1736/KEP-UNISA/XII/2020

Conflict of Interest Statement

This study has no conflicts of interest.

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