
The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2015

Volume 2, Pages 153-158

ICEMST 2015: International Conference on Education in Mathematics, Science & Technology

THE EFFECTS OF USING SOMATOSENSORY VIDEOGAMES TO PROMOTE "LIFE-EFFECTIVENESS" OF CHILDREN IN ELEMENTARY SCHOOLS

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ABSTRACT: With dramatic advancement of technology, children in elementary schools have much more opportunities to immerse in technology environment. However, children nowadays are facing a variety of challenges in emotional control, peer pressure, and social interactions and relationships due to rapid changes of social environment on campus. In order to develop their social capacities, it is important to provide appropriate activities with technology to enhance their life-effectiveness. Therefore, there is a crucial need to understand how to improve the life-effectiveness of children in elementary school. The purpose of this study was to explore their life-effectiveness by using somatosensory video games, Xbox 360 Kinect. A total of 84 participants were recruited and divided into an experimental group ($n = 40$) and control group ($n = 44$). The experimental group voluntarily agreed to complete 30-minute Xbox 360 Kinect trainings one time a week for total of 4 weeks. The Life-Effectiveness questionnaire was used to measure and complete before and after the intervention in both groups. The Wilcoxon nonparametric test for each two independent samples was used to evaluate time-series training effects. Results showed that experiment group significantly improved their self-effectiveness between pre and post-test ($p < .05$). The study concluded that using somatosensory video games is a potential tool to enhance the life-effectiveness of children in the elementary school. Further studies are suggested to validate possible follow-up benefits of somatosensory video games and to develop the best intervention model.

Key words: Life effectiveness, somatosensory videogame, Xbox 360 kinect, educational technology, e-learning

INTRODUCTION

The Department of Statistics, Ministry of Education in Taiwan (2013) pointed out that the total number of public elementary school classes would decrease from 53, 574 to 49, 071, each class would have less than 30 students, and the number of teacher demand would fall from 92, 476 to 86,208 within following 5 years. Schools have begun to reduce the number of classes and teachers, and even school merging to reflect the trend of low birthrate and enrollment numbers. Having more educational resources than before, schools in Taiwan have to develop diverse interactive teaching and learning strategies, such as e-learning and game-based learning. Gros (2007) found that videogames are valuable tools to help students to learn specific teaching goals and knowledge with

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- Selection and peer-review under responsibility of the Organizing Committee of the conference

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long term outcomes. Toprac (2008) pointed out that students are able to be motivated by videogame-based courses which create enjoyable and fun learning experience.

“Morning hours” are very common informal period right before the official first period in elementary schools in Taiwan and are used to arrange diverse extra-curricular activities, such as parenting story telling and picture book reading. According to a recent investigation, most common activities are homeroom teacher’s time (25.64%), morning gathering (12.82%), and flag-raising ceremony (8.97%) and most of them are sedentary activities (Wang, 2008). Ratey and Hagerman (2009) published a book named “Spark: The Revolutionary New Science of Exercise and the Brain” and reported that Zero hour PE (refers to its scheduled time before first period) in Chicago helps students to have better performance in reading and comprehension and to acquire social-emotional development and behavior. Marashian and Khoraml (2012) also identified that children were able to improve their academic performance and decreased the sense of loneliness significantly. Buck, Hillman, and Castelli (2008) studied 74 children aged 7 to 12 and investigated their aerobic fitness, muscle strength and body composition. They found that children with better physical fitness got higher scores in Stoop effect test. Wang & Sugiyama (2014) stated that students with appropriate physical education program intervention could learn social skills effectively, interact with other appropriately, increase independence, and have better self-expression. Therefore, programs in morning hours are important to children’s physical and psychological development and academic performance.

With dramatic advances of technology, combining interactive game with education in the classroom was viewed as a viable way for promoting physical and mental health in elementary schools. In Fogel, Mittenberger, Graves and Koehler (2010) research, they evaluated the effects of somatosensory videogame (SVG) on physical activity among four inactive children in physical education (PE) classroom. Their results showed that the inactive children were willing to spend time in physical activities than the standard PE programs and SVG was socially acceptable to the children and PE teachers. Staiano and Calvert (2011) who conducted a literature review on effects of exergames for physical education courses mentioned that SVG, such as Wii and Xbox, have potential for improving young kids’ physical, social interactions and self-esteem. Several studies have suggested that the benefits of SVG are promoting children physical and mental health; however, few studies have been done on the effects of SVG in promoting life-effectiveness and group cohesion in elementary schools during morning hours at present. Thus, the purpose of the study is to examine the effect of using SVG in promoting life-effectiveness and group cohesion in elementary schools during morning hours.

METHODS

Participants

Eighty-four participants in Grades 5-6 for this research were enrolled in two northern and central elementary schools in Taiwan. In order to respect personal rights in making decision of their own, non-random purposive sampling were utilizing in this study and all experimental procedures were pre-approval and consented by their parents, instructors, and school authorities.

Intervention

A quasi-experimental design was designed in this study. Experimental group voluntarily agreed to participate in a 30-minute each session, SVG program one time per week for 4 weeks. Controls group did not receive any additional program. Comparing with traditional videogames, Xbox 360 Kinect that does not have to hold any remote controllers is friendlier to players. Thus, Xbox 360 Kinect was used to be the interventional tool in this study. After reviewing all game software of Xbox 360 Kinect, four games including Body clock, Balloon Buster, Car management exercise, and Mouse mayhem in “Dr. Kawashima’s Body and Brain Exercises” were chosen. Table 1 showed the SVG program in the study.

Table 1. Intervention Program

Time	SVG program
Week1	Body clock
Week2	Balloon Buster
Week3	Car management exercise
Week4	Mouse mayhem

Measurement

Data were collected in pre-SVG intervention and post-SVG intervention. The data sources used three questionnaires as measurement tools: (1) Life-Effectiveness questionnaire, (2) group cohesion questionnaire, and (3) game enjoyment questionnaire.



Figure 1. Body clock

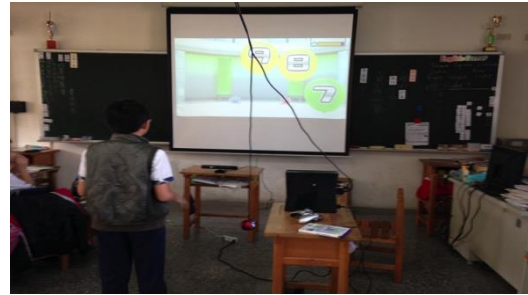


Figure 2. Balloon Buster



Figure 3. Car management exercise



Figure 4. Mouse mayhem

Life-Effectiveness questionnaire

Life-effectiveness is a person's ability to adjust their behavior through the targeted intervention programs. Life-effectiveness of children was assessed with six parts including time management, achievement motivation, task leadership, emotional control, active initiative and self-confidence based upon a measure developed by Wu and Hsieh (2008). The questionnaire was composed of 18 items on 1-5 Likert scales, ranging from "strongly disagree" to "strongly agree". The outcome of the questionnaire is the average of the scores in those items. Reliability of the Life-effectiveness were highly reliable (Cronbach's $\alpha=.93$) as well as each parts of the questionnaire (time management: Cronbach's $\alpha=.77$; achievement motivation: Cronbach's $\alpha=.71$; task leadership: Cronbach's $\alpha=.68$; emotional control: Cronbach's $\alpha=.78$; active initiative: Cronbach's $\alpha=.65$; self-confidence: Cronbach's $\alpha=.72$).

Group cohesion questionnaire

Group cohesion questionnaire was based upon a measure developed by Glass and Benshoff (2002). The test contained of 9 items on 1-5 Likert scales, ranging from "strongly disagree" to "strongly agree". Reliability analyses showed that this questionnaire has a high reliability (Cronbach's $\alpha=.96$).

Game enjoyment questionnaire

The level of game enjoyment was assessed using 8-item questionnaire developed by Ryan, Mims, and Koestner (1983) research to develop the assessment of game enjoyment. Participants were asked to indicate their attitudes toward the SVG (ie., Do you enjoy this game? Does this game draw your attention?). The participants responded on a 1-5 Likert scale, ranging from "strongly disagree" to "strongly agree".

Data Collection and Analysis

The analysis used SPSS 18.0 statistical software package. Descriptive statistics were computed to describe demographic background of participants. A Mann-Whitney nonparametric test for two independent samples was used to evaluate training differences in the SVG group and control group for changes in three measuring tools. The Wilcoxon nonparametric test for each two independent samples was used to evaluate their time-series effects in SVG program.

RESULTS AND FINDINGS

Demographic Background of the Participants

The results showed that 25 males and 15 females in the SVG group and 23 males and 26 females in the control group (Table 2).

Table 2. Participant Demographics (N = 84)

Gender	SVG group	Control group
Male	25 (62.5%)	21 (47.7%)
Female	15 (37.5%)	23 (52.3%)
TOTAL	40	44

Intervention Effect

Table 3 showed that there is no significant difference of three measuring tools between SVG group and control group before the SVG intervention. However, the data reveal significant differences between two groups in life-effectiveness ($z = -2.05, p < .05$), emotional control ($z = -2.21, p < .05$), self-confidence ($z = -2.33, p < .05$), and game enjoyment ($z = -3.08, p < .01$) after 4-week SVG intervention.

Table 3. Results of the Mann-Whitney analysis on pre-test and post-tests variance of SVG group (n = 40) and Control group (n = 44).

Measurement	Group	Pre-test		Post-test	
		Mean (SD)	z statistics	Mean (SD)	z statistics
Life-Effectiveness	SVG	3.78 (0.71)	-0.10	3.95 (0.80)	-2.05*
	Control	3.79 (0.56)		3.62 (0.72)	
Time management	SVG	3.63 (0.89)	-0.45	3.78 (0.89)	-1.34
	Control	3.58 (0.73)		3.52 (0.90)	
Emotional control	SVG	3.43 (1.01)	-0.33	3.82 (0.92)	-2.21*
	Control	3.59 (0.74)		3.33 (1.00)	
Achievement motivation	SVG	3.90 (0.77)	-0.86	4.13 (0.79)	-1.00
	Control	3.88 (0.90)		3.92 (0.88)	
Social leading	SVG	3.76 (0.93)	-0.15	3.79 (1.06)	-1.44
	Control	3.80 (0.71)		3.54 (0.88)	
Self-confidence	SVG	3.92 (0.78)	-0.42	4.10 (0.85)	-2.33*
	Control	3.95 (0.90)		3.64 (0.97)	
Aggressive	SVG	4.08 (0.79)	-0.41	4.08 (1.23)	-1.69
	Control	3.92 (0.98)		3.80 (0.97)	
Group cohesion	SVG	3.85 (1.05)	-0.02	3.87 (0.99)	-0.40
	Control	3.91 (0.80)		3.83 (0.83)	
Game enjoyment	SVG	4.00 (1.05)	-1.60	4.29 (0.81)	-3.08**
	Control	3.77 (0.91)		3.70 (0.99)	

* $p < 0.05$; ** $p < 0.01$.

In comparing with within-group analysis, Table 4 presents that after 4-week intervention, SVG group significantly increased in life-effectiveness ($z = -2.09, p < .05$) and emotional control ($z = -2.97, p < .01$). Control group significantly decreased in self-confidence ($z = -2.35, p < .05$)

Table 4. Results Of The Within-Group Variance On Pre-Test And Post-Tests Of Svc Groups (N = 40) And Control Group (n = 44).

	SVG group (n=40)			Control group (n=44)		
	Pre-test	Post-test	z statistics	Pre-test	Post-test	z statistics
	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
Life-Effectiveness	3.78 (0.71)	3.95 (0.80)	-2.09*	3.79 (0.56)	3.62 (0.72)	-0.89
Time management	3.63 (0.89)	3.78 (0.89)	-1.43	3.58 (0.73)	3.52 (0.90)	-0.67
Emotional control	3.43 (1.01)	3.82 (0.92)	-2.97**	3.59 (0.74)	3.33 (1.00)	-0.78
Achievement motivation	3.90 (0.77)	4.13 (0.79)	-1.76	3.88 (0.90)	3.92 (0.88)	-1.75
Social leading	3.76 (0.93)	3.79 (1.06)	-0.03	3.80 (0.71)	3.54 (0.88)	-1.14
Self-confidence	3.92 (0.78)	4.10 (0.85)	-1.77	3.95 (0.90)	3.64 (0.97)	-2.35*
Aggressive	4.08 (0.79)	4.08 (1.23)	-0.73	3.92 (0.98)	3.80 (0.97)	-0.85
Group cohesion	3.85 (1.03)	3.87 (0.99)	-0.76	3.91 (0.80)	3.83 (0.83)	-0.91
Game enjoyment	3.99 (1.04)	4.29 (0.81)	-1.92	3.77 (0.91)	3.70 (0.99)	-0.49

* $p < 0.05$; ** $p < 0.01$.

DISCUSSION

Life-Effectiveness questionnaire

Life-Effectiveness which contained of eight measurements including time management, social competence, achievement motivation, intellectual flexibility, task leadership, emotional control, active initiative and self-confidence have been developed by Neill, Marsh, & Richards (1997). In our studies, SVG group had significant improvements in life-effectiveness after 4-week intervention, especially in emotional control and self-confidence. These findings were in line with Whitaker and Bushman's (2012) research, which showed that playing a relax video game could make people have a good mood. Using SVG in the elementary schools not only could provide joyful stimulation to promote a positive mood for young children but also could enhance their self-confidence to deal with social relationship. Chiang, Lee, Frey, McCormick (2004) used "DDR" to train children with high-functioning autistic spectrum disorders (HFASDs) for 3-6 weeks and found that youth with HFASDs could have more confidence to teach peers without HFASDs. SVG program appears to offer children some opportunities to become a leader in a multiage team (Olson, 2010).

Group cohesion questionnaire

Results showed that there is no significant difference after 4-week intervention in within-group analysis and between-group analysis. The possible reason might be that children were single-players rather than multiply-players in participating SVG programs so that they are lacked of opportunities to collaborate with peers. The other reason might be the game settings of the SVG programs. All the games in this study were focused on their personal abilities so that some children who enjoyed competition tried to beat other down and gained their social status among the group. Peng and Hsieh (2012) mentioned that playing with friends caused a stronger commitment to cooperate goal structures in the group. In order to enhance group cohesion, examining the relationship types among the gaming context plays a key role in structuring social relationship when participating SVG.

Game enjoyment questionnaire

In this study, the participants' game enjoyment had significant difference between SVG group and control group after 4-week intervention. In other word, the SVG group felt joyful in virtual gaming and more likely to participate in SVG again. Game enjoyment plays an important role in influencing the children to participate physical activities (Dishman et al, 2005). Olson (2010) pointed out that feeling fun, exciting, challenge, compete are the top four reasons for playing videogame for young children. However, there is no significant improvement of game enjoyment in SVG group. One possible reason is the fact that their feeling about challenge and exploration were lower than initial perceptions when they played SVG at the first time (Sun, 2013). Thus, designing challenge and exploration in order to sustain young children's interest to participate are needed.

CONCLUSION

Findings suggest that elementary school children had better improvement in emotional control, self-confidence, and game enjoyment after 4-week SVG programs. This study illustrates that SVG programs have positive effects to enhance the life-effectiveness of children in the elementary schools during morning hours.

RECOMMENDATIONS

An area of future promoting that should be considered is providing a variety of SVG for elementary school children in order to sustain their interests in participating. According to our results and discussion, the SVG could enhance the children's self-confidence and emotional control. Thus, further incorporating SVG in school PE classes during morning hours are highly recommended to increase children's physical and mental health. Besides, further studies are suggested to validate possible follow-up benefits of SVG programs and to advance other possible intervention models.

ACKNOWLEDGMENT

This works was supported by the Ministry of Science and Technology (MOST), Taiwan, under Grant MOST 101-2511-S-018-009-MY2 and 103-2511-S-018 -009.

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