

Effectiveness of school- and family-based interventions to prevent gaming addiction among grades 4–5 students in Bangkok, Thailand

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Purpose: This study aimed to assess the effectiveness of Participatory Learning School and Family Based Intervention Program for Preventing Game Addiction by Developing Self-Regulation of gaming addiction among students of grades 4 and 5 in Bangkok.

Methods: A quasi-experimental study was implemented among students of grades 4 and 5 at primary schools in Bangkok selected through multistage random sampling. Two comparable schools were randomly assigned to either the intervention or control group. Then, 310 students in the randomly selected classrooms were allocated to each group. The intervention group received the self-regulation program with school and family involvement to prevent gaming addiction. Master teachers attended in-house training on prevention of gaming addiction in children. Parents of these children received a gaming addiction prevention manual and guidelines. The program lasted 8 weeks. The control group received no intervention. Knowledge and Attitude About Gaming Questionnaire, Game Addiction Screening Test (GAST), and Game Addiction Protection Scale were utilized to assess subjects at baseline, immediately after, and 3 months post-intervention. Descriptive statistics, chi-square, and independent *t*-test were used to describe characteristics of the participants, and repeated measures ANOVA was analyzed to test the effectiveness of the intervention.

Results: The findings revealed that there were significant differences in knowledge, attitude, self-regulation, and gaming addiction behaviors ($p < 0.05$) immediately and 3 months post-intervention. Positive effects of the intervention included increase in knowledge, attitude, and self-regulation, whereas the GAST score was significantly decreased ($p < 0.05$) immediately and 3 months after the program.

Conclusion: The program based on self-regulation and school and family participation is effective for preventing gaming addiction in students of grades 4 and 5 in Bangkok, Thailand.

Keywords: game addiction, prevent, grade 4–5 students, self-regulation, school-based intervention, family-based intervention

Introduction

Currently, gaming has become a pervasive part of the lives of Thai youth. Data from the National Statistics Office¹ indicated that the average computer and Internet usage in Thailand was 3.1 hours per day – the highest of any country in Asia. The age groups most active online were 15- to 24-year-olds (51.9%) followed by 6- to 14-year-olds (38.3%). Adoption of digital technologies has been more prevalent among young people than adults, and this trend has been rising continuously. Ten- to 15-year-olds accounted for 54.5% of Internet users. Their primary reason for using the Internet was to play games (65.4%), with more than half (64.7%) reporting that they played games

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at Internet cafes. Most played games online (62.6%) and nearly half reported that they played games at home (46.6%). Almost all of them were using the Internet or computer at least 1–4 days a week (97%). Six percent of Thai Internet users met the criteria for Internet addiction. The percentage of users who were addicted ranged from 6% to 15%, accounting for three million people in 2012. In addition, it was estimated that one in eight children was addicted to gaming.²

In recent years, several studies have demonstrated that some gamers have trouble controlling how much time they spend playing games on a computer.^{3–5} Excessive use of online and video games has become a common habit that may result in adverse consequences.⁶ Although the positive effects of games and Internet use have a deep impact on human lives, especially their effect on education and learning,⁷ the possible negative effect of excessive gaming among children and adolescents has become the most concerning issue among psychologists, educators, parents, and researchers.

In Thailand, some studies on gaming addiction behavior attempted to develop interventions to solve gaming addiction among the youth. The National Institute on Drug Abuse⁸ reported that young children already face serious risk factors. If the intervention does not occur before adolescence, it is expected that there would be difficulties overcoming risks because adolescent attitudes and behaviors are well established and are not easily changed. Similarly, The Center of Game Addict Prevention at the Institute of Child and Adolescent, Ratchanakharin Mental Health, Department of Mental Health, Ministry of Public Health, Thailand, reported that the most significant factor leading to gaming addiction among children was caretakers' lack of knowledge and skill on the issue. This lack of knowledge can make children over seven times more likely to develop gaming addiction.² Therefore, evidence-based approaches to gaming addiction among school-age children should guide interventions that involve parents and teachers to improve awareness of the harmful effects of gaming addiction.

Learning to actively control emotions and behaviors begins in early childhood. The process of self-regulation continues when they develop the ability to think about what they are doing and react accordingly. In contrast, children and adolescents with poor self-regulation skills face a greater risk of peer rejection, social problems, delinquency, and obesity.⁹ Young children need to develop self-regulation skills because of the strong influence these skills have on school readiness and building relationships with peers.¹⁰ Parents and teachers play a critical role as guides and models teaching children to control themselves.

Self-regulation remains, perhaps, even more important in the teen years, which are often marked by an increased vulnerability to risks such as truancy,¹¹ peer victimization, and substance use.¹² Adolescents who do not regulate their emotions and behavior are more likely to engage in risk-taking and unhealthy behaviors.¹³ Being able to suppress impulsive behavior and to adjust behavior as appropriate has been linked to positive outcomes for children and adolescents. Self-regulation refers to both unconscious and conscious processes that affect the ability to control responses.¹⁴ It is a skill that has overarching effects on an individual's ability to tolerate unmet wants or needs, handle disappointments and failures, and work toward success. The ability to self-regulate is the foundation for compliance with accepted standards of conduct at home, school, and later, in the workplace. Self-regulation is often thought of as a dual process – cognitive and social-emotional.^{15,16} McClelland et al¹⁷ believed that parents and teachers play a crucial role in the development of their children's self-regulation skills at home and in the classroom. These could be significant predictors of children's self-regulation skills that can provide organization, consistency, and structure. For example, by following the rules provided, children can have the chance to practice controlling their actions. The combination of family participation and school programs – or a multicomponent program – can be more effective than using a single program.⁸

Accordingly, a systematic review in the areas of prevention, treatment, and policy measures relating to problematic Internet and video game use policy actions was implemented. The result found that, in the Western world, all age groups are a target, and the review was less focused on adolescents as compared to those implemented in Asian countries. In Asian countries, there exists a tendency to think that adolescents can be cured even if they do not recognize the problem themselves and/or are resistant to changing their behavior. The South Korean model, in particular, is an exemplar of a coordinated response to a public health threat, with extensive government initiatives and long-term strategic plans at all three levels of prevention (i.e., universal, selective, and indicated). Western regions, by comparison, are dominated by prevention approaches led by nonprofit organizations and private enterprise. The future of prevention of gaming and Internet problems ultimately relies upon all stakeholders working collaboratively in the public interest, confronting the reality of the evidence base and developing practical, ethical, and sustainable countermeasures.¹⁸ The future of prevention of gaming and Internet problems ultimately relies upon all stakeholders working collaboratively in the public interest,

confronting the reality of the evidence base and developing practical, ethical, and sustainable countermeasures.¹⁹ The reason for this may lie in the fact that the policies that have been outlined only addressed or influenced specific aspects of the problem instead of using a more integrative approach.

Presently, there are limitations to the universal preventive intervention program geared toward gaming addiction among primary schools. This age group cannot be overlooked as it poses additional challenges due to its vulnerability and need to protect the children's rights. This participatory-learning program sought to create a partnership between schools and families to foster sustainable intervention. Kumpfer and Alvarado²⁰ stated that parents were the most powerful factors involved in reducing negative behaviors among school-age children. Therefore, this study aimed to assess the effectiveness of the Participatory Learning School and Family Based Intervention Program for Preventing Game Addiction by Developing Self-Regulation of gaming addiction among students of grades 4 and 5 in Bangkok.

Subjects and methods

A quasi-experimental study was undertaken at primary schools in Bangkok, Thailand, between February and July 2015. The intervention group was imparted participatory learning in a school- and family-based intervention program for developing self-regulation skills against gaming addiction. The control group did not receive any intervention. The assessment was conducted at baseline, immediately post-intervention, and 3 months after completing the intervention. The study was ethically approved by the Ethics Review Committee for Research Involving Human Research Subjects, Chulalongkorn University. The certificate of approval number is COA No. 008/2558.

Study population

The participants in this study were students of grades 4 and 5 in Bangkok, Thailand. This study used G-Power version 3.1.5 (<http://www.gpower.hhu.de/en.html>), calculated by requisite power = 80% and $\alpha = 0.05$, with effect size $f = 0.1$. The total sample size comprised 270 students, after adding 10% for drop-outs and increasing the sample size to account for type II error.

The participating schools were recruited through multi-stage random sampling. Two comparable schools were randomly assigned as either experimental or control groups. The classrooms were also randomly selected, and all students in these selected classrooms were recruited – of the 310 cases, 151 students were in the intervention group and 159 in the control group, based on sample size calculation (Figure 1).

The students were recruited according to pre-specified inclusion and exclusion criteria. Inclusion criteria specified that students of grades 4 and 5 in primary schools under the jurisdiction of the Bangkok Primary Education Service Area, Thailand, willing to participate in this study, and whose parents signed the informed consent form were eligible for this study. Exclusion criteria were withdrawal from the study for any reason, failure to participate in the program for more than 2 weeks, and suffering from any condition that impaired communication, such as physical illness.

Research instruments

Self-administered questionnaires were adopted from the literature review and related studies in both Thai and English. The content captured in different sections of the questionnaires are described further.

Part I: Student characteristics

The questionnaires included both closed and open-ended questions addressing 12 items on the sociodemographic characteristics of the participants, including age, gender, grade point average (GPA), and level of education as well as characteristics of their parents, such as parenting style and family relationship.

Part II: Games

Knowledge about gaming and the problems of gaming addiction

This part of the evaluation comprised eight multiple-choice questions. This was modified from “Knowledge of computer games and the problem kids are addicted to the game today” questionnaire by Kajonboon.²¹ After testing the set of questions on 30 students at another school with similar characteristics to the sample population, the reliability coefficient was calculated by using the split-half method. The reliability coefficient was 0.708 and the index of consistency (IOC) from three experts was 0.92. The correct answer for each question received one point, and the total possible score was eight.

Attitude toward gaming and the effects of game addiction

This part of the assessment measured “attitude towards gaming” and was developed by Phosuwan.²² The reliability coefficient was tested, and the Cronbach's alpha coefficient was 0.749. The total possible score of the eight items in this section varied from 8 to 40 points. A higher score indicated a better attitude of the student toward gaming and gaming addiction.

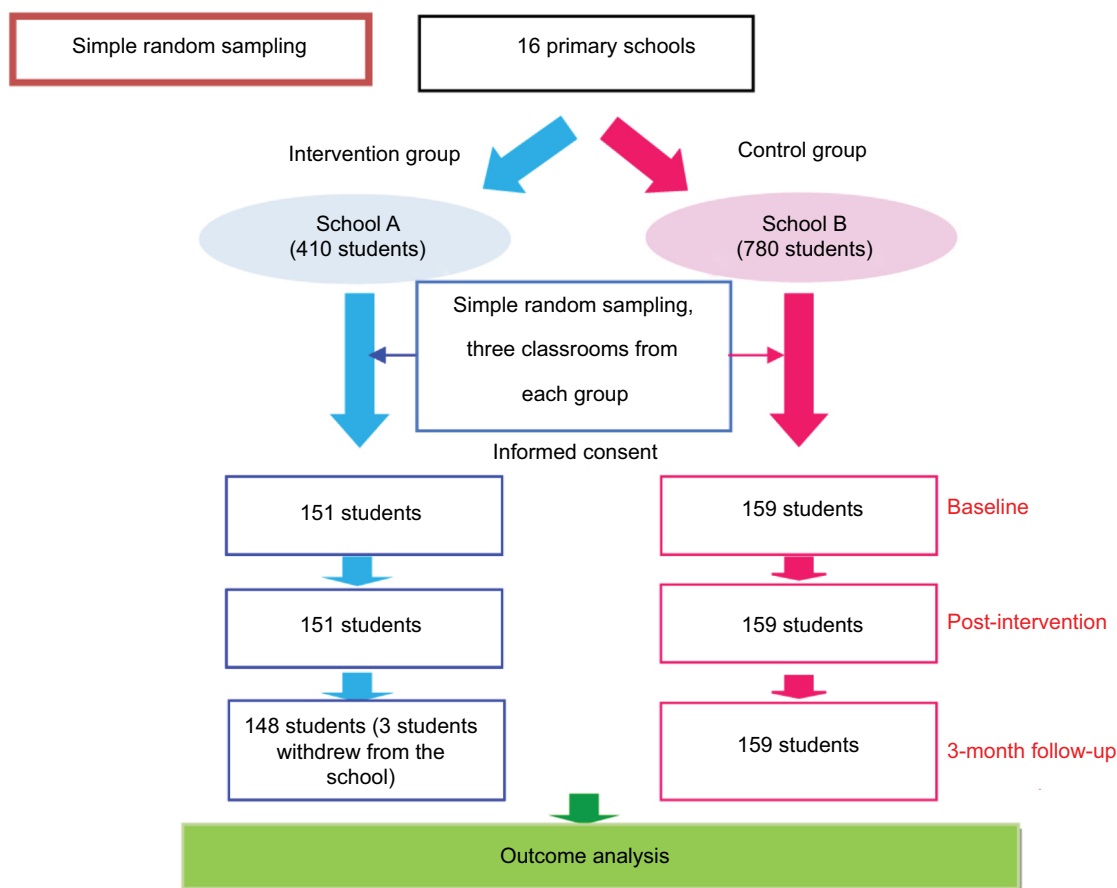


Figure 1 Study population at baseline, post-intervention, and 3 months follow-up.

Pattern of gaming

These questionnaires covered eight items through closed and open-ended questions about accessibility of games and gaming devices in participants' homes as well as the time and frequency at which games were played.

Gaming addiction behavior

This part used the standard tool known as the Game Addiction Screening Test (GAST) developed by Pornnoppadol et al.²³ Cronbach's alpha of child and adolescent GAST was 0.92, and the intra-class correlation coefficient was 0.90. For males, the cutoff point for classified gaming addiction was 24 or greater and 16 or greater for females. High scores meant students were more addicted to games.²³ This tool has 16 items. Each item had a 4-point rating scale from "not at all" to "yes" (0–3 points). Total scores varied from 0 to 48 points.

Self-regulation

Self-regulation was measured as the ability to control gaming addiction behaviors in children and adolescents by using the

Game Addiction Protection Scale (GAPS) developed by Pornnoppadol et al.²⁴ These questionnaires consisted of 30 items with a reliability of 0.78. Each item has a 4-point rating scale, from "not at all" or "never do" to "yes". With 30 items, the score could range from 0 to 90 points. Respondents were divided into two groups by a cutoff point: 0–64 represented low self-regulation, and 65 and greater represented high self-regulation.²⁴

Tools for parents

To ensure the reliability of the children's answers, the researcher monitored the effect of the program through a weekly checklist. Parents were told to supervise their child in the practice of gaming addiction behavior and self-regulation, and to provide feedback to teachers each week.

Interventional procedures

The study consisted of a Participatory Learning School and Family Based Intervention Program for Preventing Game Addiction by Developing Self-Regulation skills on gaming addiction among students of grades 4 and 5. This program was developed based on self-regulation theory and used

participatory learning by creating a partnership between school and family to develop a prevention program. The theory supporting this program was self-regulation (SR), developed by Bandura.²⁵ Self-regulation is part of the social-cognitive theory group, which involves three stages comprising self-monitoring, self-evaluation, and self-reinforcement. The four components of self-regulation comprise standards, monitoring, strength, and motivation.²⁶ Self-regulation is an important personality process by which people seek to exert control over their thoughts, feelings, impulses, appetites, and task performances.²⁷ An important process of self-regulation is monitoring information about one's existing state and comparing it with the desired goal.²⁸ This program does not change gaming addiction behavior directly; however, it can instead enhance self-regulation to promote confidence in refusing game playing, gain more knowledge about gaming addiction and its effects, as well as provide information about how to regulate themselves, the types of games they can play, suitable duration to play games, etc. All of these would help students prevent gaming addiction behavior.

The program required the involvement of teachers, to lead activities, and of parents, to help maintain consistency, during the program. "Master teachers", who underwent necessary training, took a leading role. They were the key actors educating the students and regulating gaming behavior. Families played a crucial role in maintaining program consistency. This program aimed to address knowledge, attitude, and self-regulation skills with regard to the ability to control and manage frequency of play and time spent gaming. The intervention contained 1 hour of activities a week during classes from weeks 1 to 8 (Table 1).

Data analysis

Descriptive statistics, chi-square test, and independent *t*-test were used to identify the significant differences between the intervention and control groups on the general characteristics of students at baseline measurement. Repeated measures ANOVA was used to test the effects of the interventional program. We considered 95% confidence intervals (CIs) and *P*-value less than 0.05 of all analysis as indicative of statistical significance.

Results

Baseline characteristics

Similarities were observed between the intervention and control school groups. Of the 310 students who enrolled at baseline, 307 (99.03%) were available for a follow-up of 3 months after the program. The three students who were unavailable were in the control group and had left school. Characteristics of the 310 students were collected at baseline in January 2015. Tables 2 and

3 show that baseline comparison of the general characteristics of students and their parents showed no statistically significant differences between the intervention and control groups.

However, only one variable – GPA – was significantly different between the two groups (Table 2). Students in the control-group school had a significantly higher GPA than those in the intervention school. In order to prevent GPA from affecting the findings of the study, the GPA was adjusted by using a covariate in repeated measures ANOVA when testing the effect of the intervention program.

Pattern of game playing

Of the 310 student participants, most (98.7% in the intervention group and 97.5% in the control group) played games. Moreover, there were no statistically significant differences in gaming behavior between the intervention and the control groups ($P = 0.447$, $P = 0.064$, $P = 0.585$, $P = 0.203$, and $P = 0.296$, respectively) as shown in Tables 4 and 5.

Effectiveness of the participatory-learning and family-based intervention program on developing self-regulation toward gaming addiction on changes over time between and within groups

After adjusting for GPA at post-intervention and at the 3-month follow-up, repeated measures ANOVA was used to analyze the effectiveness of the intervention program. There was a statistically significant difference between the intervention and control groups ($P < 0.001$). Between subjects, there was no statistically significant difference. However, within-subject testing showed that the participatory-learning and family-based intervention program resulted in changes to mean knowledge, attitude, GAST, and GAPS scores over the three time points, with statistical significance as shown in Table 6. The trends of GAST scores clearly showed that there was a significant difference between both groups from the post-intervention assessment and the 3-month follow-up as presented in Figure 2, and this was similar to the trends of GAPS scores presented in Figure 3.

Difference of knowledge, attitude, GAST, and GAPS score between the two groups at baseline, post-intervention, and at 3-month follow-up

There were statistically significant differences between the intervention and control groups in gaming knowledge at the post-intervention assessment and the 3-month follow-up

Table 1 Overview of the “Participatory Learning School and Family Based Intervention Program for Preventing Game Addiction by Developing Self-Regulation” modules and instructional activities

Instructional modules	Purpose	Core content	Activities/evaluation
Introduction (week 1)	<ul style="list-style-type: none"> To introduce an overview of the program To gain knowledge about gaming, type of game, consequence of gaming, and gaming addiction behavior To investigate problem situations for gaming addiction in schools 	<ol style="list-style-type: none"> 1. What is gaming? 2. Type of game 3. Rating games and their symbolism in Thailand 4. Consequence of gaming 5. Gaming addiction behavior 6. How to play games while avoiding addiction to gaming? 7. Time limit for playing games per day 8. Education on the healthy gamer 	<p>Activities:</p> <ul style="list-style-type: none"> Ice-breaking, introduction, test for baseline, VDO, group discussion Walk rally <p>Evaluation:</p> <ul style="list-style-type: none"> Question and answer, pre-test Participation in classroom
Self-regulation (week 2)	<ul style="list-style-type: none"> To gain knowledge about self-regulation 	<ol style="list-style-type: none"> 1. What is self-regulation? 2. Why self-regulation is necessary? 3. How can we develop self-regulation by ourselves? 	<p>Activities:</p> <ul style="list-style-type: none"> Build rapport and provide description of self-regulation VDO, group discussion <p>Evaluation:</p> <ul style="list-style-type: none"> Question and answer Participation in classroom
Self-determined, goal and standard (week 3)	<ul style="list-style-type: none"> Students determine goals to be achieved and standards for behavior Goal setting and target behavior 	<ol style="list-style-type: none"> 1. How to assess yourself? 2. Component of successful test performance 3. How to set goals in the short and long term? 4. Value of goal setting 	<p>Activities:</p> <ul style="list-style-type: none"> Test: are you addicted to gaming? Students analyze themselves Present result of self-assessment in group Goal setting by groups process Group presentation in class <p>Evaluation:</p> <ul style="list-style-type: none"> Question and answer Result of self-assessment and goal setting Participation in classroom
Strategic planning (week 4)	<ul style="list-style-type: none"> Searching for options and formulating a plan 	<ul style="list-style-type: none"> What is the option of planning? How to formulate a plan? How to search strategically to achieve their plan? 	<p>Activities:</p> <ul style="list-style-type: none"> Brainstorming – group discussion Group presentation in class <p>Evaluation:</p> <ul style="list-style-type: none"> Question and answer Participation in classroom
Self-monitoring (week 5)	<ul style="list-style-type: none"> Self-monitoring: students observe and monitor their own performance 	<ul style="list-style-type: none"> How to systemically develop strategic plans for attempting their own goals? Provide a model guideline to attempt their goals Option of self-monitoring 	<p>Activities:</p> <ul style="list-style-type: none"> Teach students about systemically developing strategic plans for attempting their goal Group discussion Group presentation in class <p>Evaluation:</p> <ul style="list-style-type: none"> Question and answer Participation in classroom
Self-instructions (week 6)	<ul style="list-style-type: none"> Self-instructions: students give selves instructions (either loudly or quietly) to help guide actions 	<ul style="list-style-type: none"> What is self-instruction? What are appropriate rewards and punishment? 	<p>Activities:</p> <ul style="list-style-type: none"> Teach about self-instructions Brainstorming Group discussion Group presentation in class <p>Evaluation:</p> <ul style="list-style-type: none"> Question and answer Participation in classroom

(Continued)

Table 1 (Continued)

Instructional modules	Purpose	Core content	Activities/evaluation
Self-reflection (week 7)	<ul style="list-style-type: none"> Students have to implement the plan and response 	<ul style="list-style-type: none"> How to implement the plan and response? 	Activities: <ul style="list-style-type: none"> Students share their experiences and show how to achieve their goal? Group discussion Group presentation in class Evaluation: <ul style="list-style-type: none"> Question and answer Participation in classroom
Self-imposed contingencies (week 8)	<ul style="list-style-type: none"> Self-imposed contingencies: students impose their own consequences for success or failure 	<ul style="list-style-type: none"> What is the benefit of self-regulation? Students response and feedback for their own consequences for success or failure 	Activities: <ul style="list-style-type: none"> Students share their experiences Group presentation about their action and evaluate plan in class Give rewards to all students enrolled in this study Awarding certificates Evaluation: <ul style="list-style-type: none"> Question and answer Participation in classroom

Note: Activities by Master teachers and RA.

Abbreviation: VDO, virtual data object; RA, research assistants.

Table 2 Baseline characteristics of students (N = 310)

Student characteristics	Intervention (n = 151) n (%)	Control (n = 159) n (%)	P-value
Gender			0.073 ^a
Boys	73 (48.3)	93 (58.5)	
Girls	78 (51.7)	66 (41.5)	
Age (years)			0.196 ^a
8 and 9	49 (32.5)	41 (25.8)	
≥10	102 (67.5)	118 (74.2)	
Mean (SD)	9.77 (0.79)	10.05 (0.67)	
Median (IQR)	10 (1)	10 (2)	
Min–max	8–12	8–12	
Level of education			0.634 ^a
Grade 4	81 (53.6)	81 (50.9)	
Grade 5	70 (46.4)	78 (49.1)	
Grade point average			<0.001 ^b
Mean (SD)	3.25 (0.56)	3.63 (0.38)	
Median (IQR)	3.31 (0.85)	3.76 (0.50)	
Min–max	1.56–4.00	2.45–4.00	

Notes: Significant at P-value < 0.05. ^aChi-square test. ^bindependent t-test.

Abbreviation: IQR, interquartile range.

($P < 0.001$). Attitude toward games at the post-intervention assessment and the 3-month follow-up showed statistically significant differences between the intervention and the control groups ($P < 0.001$ and $P = 0.013$, respectively). The GAST scores at the post-intervention assessment and the 3-month follow-up also showed statistically significant differences between the intervention and the control groups ($P < 0.001$). GAPS scores at post-intervention and at the

3-month follow-up were also found to have statistically significant differences between the intervention and the control groups ($P < 0.001$) as seen in Table 7.

Effect of the program on improving gaming addiction behavior

Practically, among the intervention group, the percentage of students who do not play games increased post-intervention, and had slightly decreased at the 3-month follow-up (1.3, 7.9, and 6.1%, respectively; Table 8). Moreover, we found that gaming behavior in the intervention group had lower average days spent on gaming than in the control group. The average time expended playing games during weekdays among the intervention and the control groups were 0.91 and 1.08 hours/day, respectively. On weekends, the average time spent on games were 1.73 and 1.93 hours/day in the intervention and control groups, respectively (Table 9). Moreover, in the 3-month follow-up, the researcher found that the intervention group still had a lower average number of days spent on gaming than the control group (3.57 and 4.03 days, respectively). The average time of playing games on weekdays among the intervention and the control groups were similar (1.21 and 1.41 hours, respectively). The intervention group spent lesser time per day on weekdays than the control group – at 2.15 and 2.44 hours – respectively. Nevertheless, there were statistically significant differences in the duration spent gaming between the intervention and the control groups in days per week ($P = 0.034$; Table 9).

Table 3 Baseline characteristics of parents (N = 310)

Parent characteristics	Intervention (n = 151) n (%)	Control (n = 159) n (%)	P-value
Parent's marital status			0.062 ^a
Married	134 (88.7)	129 (81.1)	
Widowed/separated/divorced/deceased	17 (11.3)	30 (18.9)	
Living arrangement of child			0.137 ^a
With parents, both father and mother	131 (86.8)	125 (78.6)	
With father or mother	13 (8.6)	25 (15.7)	
With relatives or others	7 (4.6)	9 (5.7)	
Father's education			
Primary, secondary, and vocational school	67 (44.4)	84 (49.4)	0.785 ^a
Bachelor's degree or higher	73 (54.9)	86 (50.6)	
Mother's education			0.072 ^a
Primary, secondary, and vocational school	56 (37.1)	75 (47.2)	
Bachelor's degree or higher	95 (62.9)	84 (52.8)	
Father's occupation			0.664 ^a
Government career	56 (37.1)	51 (32.1)	
Farmer, trader, or other	31 (20.5)	27 (17.0)	
Professional contractor	15 (9.9)	20 (12.6)	
Employee of private company	31 (20.5)	40 (25.2)	
Private owners	18 (11.9)	21 (13.2)	
Mother's occupation			0.322 ^a
Government career	59 (39.1)	53 (33.3)	
Farmer, trader, or other	38 (45.8)	45 (28.3)	
Professional contractor	11 (7.3)	5 (3.1)	
Employee of private company	28 (18.5)	37 (23.3)	
Private owner	15 (9.9)	19 (11.9)	
Family relationship			0.918 ^a
Good relationship	141 (93.4)	148 (93.1)	
Conflict	10 (6.6)	11 (6.9)	
Parenting style			0.093 ^a
Permissive	47 (29.6)	41 (27.2)	
Authoritarian	106 (66.6)	93 (61.6)	
Authoritative	3 (1.9)	10 (6.6)	
Uninvolved	3 (1.9)	7 (4.6)	

Note: ^aChi-square.

Discussion

Effectiveness of the intervention program on increasing knowledge

Results showed that the Participatory Learning School and Family Based Intervention Program for Preventing Game Addiction by Developing Self-Regulation toward gaming addiction was effective in increasing knowledge about gaming and its effects. Findings were related to those reported by Kajonboon²¹; her study revealed that knowledge of computer games was significantly higher after students completed the program. Meanwhile, the findings of Ferland et al²⁹ indicated that knowledge about gaming significantly improved subjects' knowledge. Furthermore, Williams et al³⁰ used school-based prevention programs to solve a gambling problem among students of grades 9–12 at 4 months after receiving the program; students in the intervention

group had significantly improved knowledge about gambling and demonstrated decreased gambling frequency.

Effectiveness of the intervention program in improving attitudes toward gaming and its effect

Results confirmed that the intervention program successfully improved attitudes toward gaming and its effects. Seenuan et al³¹ had pointed out that the mean score for attitude was significantly higher in the comparison group after completion of the family task program with participatory-learning methods for preventing computer gaming addiction among school-age children. Furthermore, Williams et al³⁰ also found that students in the intervention group had significantly more negative attitudes toward gambling following the use of

Table 4 Baseline characteristics of participants' gaming behavior (N = 310)

Variables	Intervention (n = 151) n (%)	Control (n = 159) n (%)	P-value
Play games			0.447 ^a
No	2 (1.3)	4 (2.5)	
Yes	149 (98.7)	155 (97.5)	
Have devices at home			0.064 ^a
Yes	137 (90.7)	153 (96.2)	
No	14 (9.3)	6 (3.8)	
Area allowed to use devices at home			0.585 ^a
Living room	73 (53.1)	95 (62.1)	
Work room	23 (16.8)	23 (15.0)	
Bedroom	22 (16.2)	16 (10.5)	
Everywhere	19 (13.9)	19 (12.4)	
Internet access at home			0.203 ^a
Yes	122 (89.1)	146 (94.3)	
No	15 (9.9)	7 (5.7)	

Notes: Significant at P-value < 0.05. ^aChi-square test.

Table 5 Baseline characteristics of participant gaming behavior among students who played games (N = 304)

Variables	Intervention (n = 149) n (%)	Control (n = 155) n (%)	P-value
Type of game usually played			0.296 ^a
Games online	80 (53.7)	96 (61.9)	
Games offline	26 (17.4)	19 (12.3)	
Both online and offline	43 (28.9)	40 (25.8)	
Place where games are played			
At home	143 (96.0)	155 (100.0)	
Outside the home (such as internet cafe, department stores, and school)	6 (4.0)	0 (0)	
Type of games played (ranks 1–3)			
Intervention group			
1. Line games	35 (23.2)		
2. Fighting games	24 (15.9)		
3. Adventure games	20 (13.2)		
Control group			
1. Line games		74 (46.5)	
2. Shooting games		17 (10.7)	
3. Adventure games		13 (8.2)	

Notes: Significant at P-value < 0.05. ^aChi-square test.

school-based prevention programs to solve gambling problems among students of grades 9–12. Moreover, the program brought about a statistically significant decrease in gambling frequency and rates of gambling problems.

Effectiveness of the intervention program in improving gaming addiction behavior

Although results from this study found that GAST scores at post-intervention in the intervention group radically

decreased from baseline scores and slightly increased at the 3-month follow-up, this was consistent with the results of Joo and Park³² who studied the effect of empowerment education programs on Internet gaming addiction among middle school students. Their results indicated that the experimental group had lower Internet game addiction scores than the control group. However, the trends clearly showed that there was a significant difference between GAST scores for both groups from post-intervention to the 3-month follow-up. GAST scores may have increased at the 3-month follow-up because of the time period in the study. The intervention program was completed in March 2015, after which schools went on a 3-month break in summer. Students might have had more free time to play games than during the school term. Kolkijkovin et al³³ found that the risk factors of gaming addiction included the frequency and length of time spent playing games. Nevertheless, after-school activities other than gaming helped improve child temperament and were, thus, protective factors. Therefore, teaching self-discipline in terms of self-regulation with regard to time used in to play games could solve and prevent gaming addiction among school-age children.

Effectiveness of the intervention program on increasing self-regulation on gaming addiction

The outcome of this study concurs with that of the study of Thongkambunjong et al,³⁴ who found that online gaming addiction behavior was negatively affected by self-control. A longitudinal study by Seay and Kraut³⁵ revealed that the player's reasons for playing influenced the development of problematic usage. These effects were overshadowed by the central importance of self-regulation in managing both timing and amount of playing. An individual's level of self-regulatory activity was shown to be very important in allowing them to avoid negative outcomes including problematic use. Billieux and Van der Linden³⁶ suggested that poor self-regulation capacities have been shown to play a critical role in problematic Internet use.

Self-regulation was an important factor toward gaming behavior in this study. The finding of the participatory-learning and family-based intervention program may be taken to suggest the importance of raising self-regulation with a small effect size of 0.254.³⁷ Similarly, in the study of Mun and Lee³⁸ who used interventions for empowerment and methods of behavioral modification and test its effects on the self-regulation and internet addiction, the effect size was 0.269. Whereas participants of their study were 28 persons

Table 6 Repeated measures ANOVA of knowledge, attitude toward gaming and its effect, GAST scores, and GAPS scores between the intervention and control groups (N = 307)

Variables	SS	df	MS	F-test	P-value
Knowledge					
Between subjects					
Intervention	324.674	1	324.674	102.720	<0.001
Error (between-group error)	960.868	304	3.161		
Within subjects					
Time	4.508	1.950	2.312	1.428	0.241
Intervention × time	47.042	1.950	24.123	14.897	<0.001
Error (within-group error)	959.977	592.831	1.619		
Attitude					
Between subjects					
Intervention	9461.265	1	9461.265	220.667	<0.001
Error (between-group error)	13034.246	304	42.876		
Within subjects					
Time	57.545	1.823	31.562	1.509	0.223
Intervention × time	297.134	1.823	162.973	7.792	0.001
Error (within-group error)	11593.120	554.256	20.917		
GAST scores					
Between subjects					
Intervention	9461.265	1	9461.265	220.667	<0.001
Error (between-group error)	13034.246	304	42.876		
Within subjects					
Time	57.545	1.823	31.562	1.509	0.223
Intervention × time	297.134	1.823	162.973	7.792	0.001
Error (within-group error)	11593.120	554.256	20.917		
GAPS scores					
Between subjects					
Intervention	43152.820	1	43152.820	223.271	<0.001
Error (between-group error)	58755.802	304	193.276		
Within subjects					
Time	101.718	2	50.859	0.430	0.649
Intervention × time	1871.226	2	935.613	7.914	<0.001
Error (within-group error)	71875.144	608	118.216		

Note: Bold values are significant at $p < 0.001$.

Abbreviations: GAST, Game Addiction Screening Test; GAPS, Game Addiction Protection Scale; SS, sum of squares; df, degrees of freedom; MS, mean squares.

Table 7 Pairwise comparisons of the different measurements of knowledge, attitude, GAST, and GAPS scores between the intervention group (n = 148) and control group (n = 159)

Time	Group		Mean difference	SE	P-value	95% confidence interval for difference ^a	
	i	j				Lower	Upper
Knowledge							
Baseline	Intervention	Control	0.425*	0.197	0.032	0.038	0.811
Post-intervention	Intervention	Control	0.745*	0.159	<0.001	0.432	1.058
3 months	Intervention	Control	1.576*	0.176	<0.001	1.230	1.923
Attitude							
Baseline	Intervention	Control	-0.390	0.643	0.544	-1.655	0.874
Post-intervention	Intervention	Control	2.507*	0.584	<0.001	1.358	3.656
3 months	Intervention	Control	1.692*	0.681	0.013	0.353	3.032
GAST							
Baseline	Intervention	Control	1.462	1.282	0.255	-1.061	3.984
Post-intervention	Intervention	Control	-7.758*	1.127	<0.001	-9.975	-5.541
3 months	Intervention	Control	-9.090*	1.148	<0.001	-11.349	-6.830
GAPS							
Baseline	Intervention	Control	1.462	1.282	0.255	-1.061	3.984
Post-intervention	Intervention	Control	-7.758*	1.127	<0.001	-9.975	-5.541
3 months	Intervention	Control	-9.090*	1.148	<0.001	-11.349	-6.830

Notes: Based on estimated marginal means. *The mean difference is significant at the 0.05 level. ^aAdjustment for multiple comparisons: Bonferroni. Bold values are significant at $p < 0.001$.

Abbreviations: GAST, Game Addiction Screening Test; GAPS, Game Addiction Protection Scale; SE, standard error.

Table 8 Differences among students who played games and did not play games among the intervention and the control groups at baseline, post-intervention, and the 3-month follow-up

Time	Intervention, n (%)		Control, n (%)		P-value
	Played games	Did not play games	Played games	Did not play games	
Baseline (n = 151, n = 159)	149 (98.7)	2 (1.3)	155 (97.5)	4 (2.5)	0.685
Post-intervention (n = 151, n = 159)	139 (92.1)	12 (7.9)	157 (98.7)	2 (1.3)	0.005*
3-month follow-up (n = 148**, n = 159)	139 (93.9)	9 (6.1)	157 (98.7)	2 (1.3)	0.030*

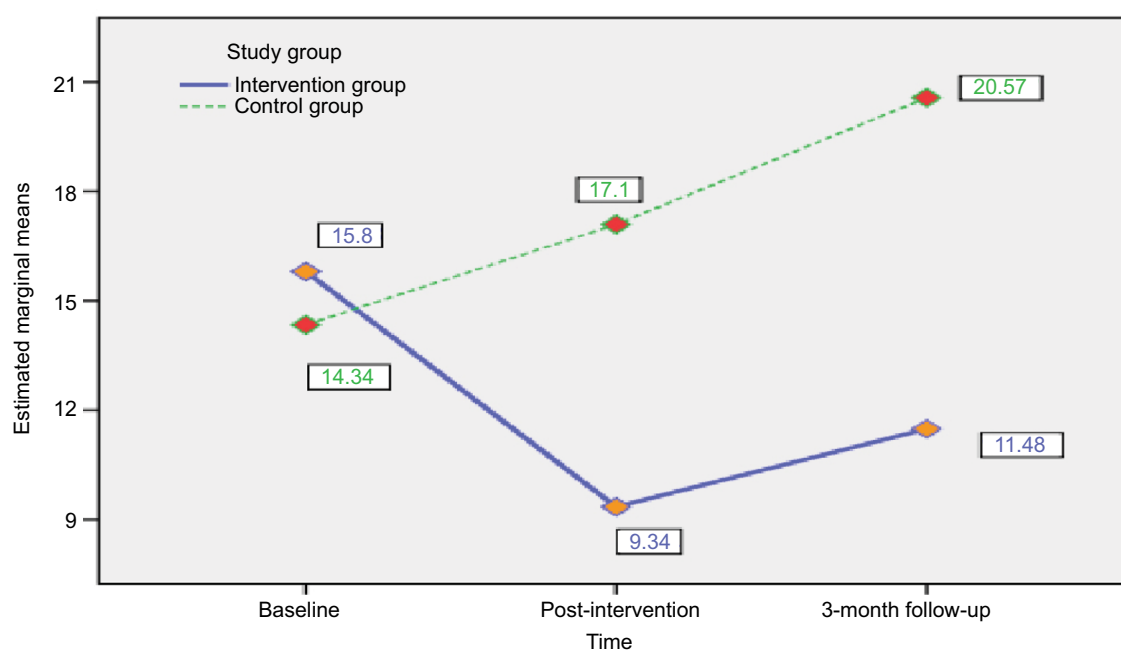
Notes: *Significant at P-value < 0.05. **Dropout, three cases. Analysis by Fisher's exact test.

Table 9 Comparison of frequency and amount of time spent on gaming at post-intervention and 3-month follow-up between the intervention group and the control group (n = 307)

Variables	Intervention (n = 148)		Control (n = 159)	
	Post-intervention	3-month follow-up	Post-intervention	3-month follow-up
Frequency of days used to play games per week				
Mean \pm SD	2.83 \pm 1.123**	3.57 \pm 1.674*	3.44 \pm 1.644	4.03 \pm 2.048
Median (IQR)	3.00 (1)	3.00 (3)	3.00 (3)	3.00 (5)
Min-max	0-7	0-7	1-7	1-7
Gaming time on weekdays (Monday-Friday) (hours/day)				
Mean \pm SD	0.91 \pm 0.698*	1.21 \pm 0.808	1.08 \pm 0.732	1.41 \pm 1.051
Median (IQR)	1.00 (0.50)	1.00 (1.00)	1.00 (1.00)	1.00 (1.50)
Min-max	0-5	0-4	0-4	0-6
Gaming time on weekends (Saturday and Sunday) (hours/day)				
Mean \pm SD	1.73 \pm 1.251	2.15 \pm 1.359	1.97 \pm 1.193	2.44 \pm 1.690
Median (IQR)	1.50 (1)	2.00 (2)	2.00 (2)	2.00 (2)
Min-max	0-7.50	0-7	0-5	0-10

Notes: *Significant at P-value < 0.05. **Significant at P-value < 0.001. Dropout, three cases.

Abbreviation: IQR, interquartile range.

**Figure 2** Changes over time of GAST scores between the intervention group and control group.

Abbreviation: GAST, Game Addiction Screening Test.

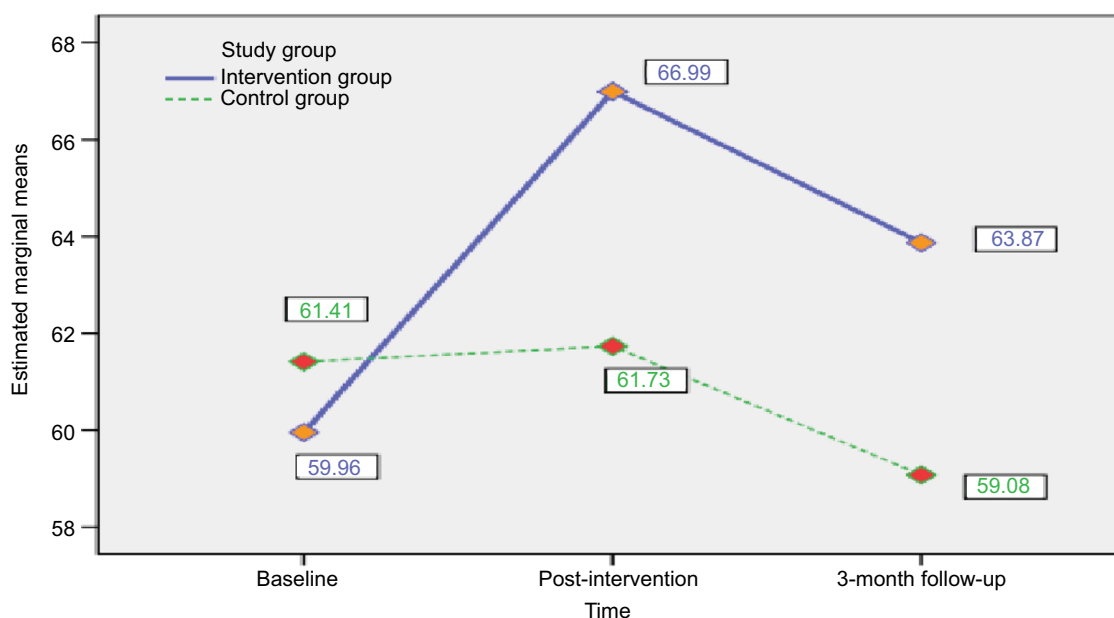


Figure 3 Change over time of GAPS scores between the intervention group and control group.
Abbreviation: GAPS, Game Addiction Protection Scale.

per group, the participants in this study were classified as 151 and 155 persons per group.

Strengths

The strengths of this study include a focus on younger youths who tend toward becoming addicted to gaming. There is a gap in the age group of participants; in this vulnerable group, is difficult to conduct research on data and protect their rights.

Limitations of the study

This study should be considered in light of its limitations. First, the study was carried out in only two primary schools in Bangkok, which are located in an urban area, being the capital city of Thailand. The study findings may not be representative of the other areas. Second, due to a limitation of time, this study lacked a long-term follow-up. Finally, the use of a weekly checklist from participant's parents to monitor changes could cause measurement error due to over- or under-reporting recall bias or social desirability bias.

Conclusion

The participatory-learning and family-based intervention program was effective in developing self-regulation toward gaming addiction in terms of improving knowledge and attitude about game and its effects and self-regulation on gaming addiction. In addition, it can show improvements in gaming addiction behavior over time. Research suggests that the intervention program should be considered to be

an appropriate intervention strategy to prevent and improve gaming addiction behavior among primary school students.

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Disclosure

The authors report no conflicts of interest in this work.

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