ผลของโปรแกรมที่ประยุกต์ทฤษฎีปัญญาทางสังคมต่อการป้องกันการสูบบุหรี่ไฟฟ้าในนักเรียนมัธยมศึกษาตอนต้น
Effects of Social Cognitive Theory Applied Program on E-cigarette Smoking Prevention Among Junior High School Students

นิพนธ์ต้นฉบับ

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Original Article

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาผลของโปรแกรมที่ประยุกต์ทฤษฎีปัญญาทางสังคมต่อปัจจัยที่สัมพันธ์กับการป้องกันการสูบบุหรี่ไฟฟ้าในนักเรียนมัธยมศึกษาตอนต้น **วิธีการศึกษา:** การศึกษาแบบกึ่งทดลองมีตัวอย่างเป็นนักเรียนชายและหญิงในชั้นมัธยมศึกษาปีที่ 2 ในโรงเรียนใน จ.จันทบุรี แบ่งเป็นกลุ่มทดลองและกลุ่มควบคุม กลุ่มละ 37 คน กลุ่มทดลองได้รับโปรแกรมซึ่งพัฒนาจากกรอบแนวคิดทฤษฎีปัญญาทางสังคมซึ่งมีกิจกรรม 4 ชุด นาน 4 สัปดาห์ ส่วนกลุ่มควบคุมได้รับการเรียนการสอนปกติ ปัจจัยที่ศึกษา คือ ความรู้เกี่ยวกับบุหรี่ไฟฟ้า ความคาดหวังต่อผลลัพธ์ของการสูบบุหรี่ไฟฟ้า การรับรู้ความสามารถของตนเองในการปฏิเสธการสูบบุหรี่ไฟฟ้า และความตั้งใจในการไม่สูบบุหรี่ไฟฟ้า วัดผล 3 ครั้ง คือ ก่อนการทดลอง หลังการทดลองทันที และระยะติดตามผล 4 สัปดาห์ (สัปดาห์ที่ 8) เก็บข้อมูลโดยใช้แบบสอบถามทาง Google Form™ ทดสอบการเปลี่ยนแปลงคะแนนของปัจจัยดังกล่าวด้วยการวิเคราะห์ความแปรปรวนแบบวัดซ้ำ **ผลการศึกษา:** หลังการทดลองทันทีและระยะติดตามผล กลุ่มทดลองมีคะแนนเฉลี่ยความรู้ ความคาดหวังต่อผลลัพธ์ การรับรู้ความสามารถของตนเองในการปฏิเสธ และความตั้งใจไม่สูบบุหรี่ไฟฟ้า สูงกว่าก่อนการทดลองอย่างมีนัยสำคัญทางสถิติ (*P*-value < 0.001, 0.002, 0.009 และ < 0.001 ตามลำดับ) และสูงกว่ากลุ่มเปรียบเทียบอย่างมีนัยสำคัญทางสถิติ **สรุป:** โปรแกรมที่ประยุกต์ทฤษฎีปัญญาทางสังคมสามารถเพิ่มคะแนนปัจจัยที่สัมพันธ์กับการป้องกันการสูบบุหรี่ไฟฟ้าได้ คือ ความรู้เกี่ยวกับบุหรี่ไฟฟ้า ความคาดหวังต่อผลลัพธ์ของการสูบบุหรี่ไฟฟ้า การรับรู้ความสามารถของตนเองในการปฏิเสธการสูบบุหรี่ไฟ และความตั้งใจในการไม่สูบบุหรี่ไฟฟ้าในนักเรียนมัธยมศึกษาตอนต้น

คำสำคัญ: โปรแกรมที่ประยุกต์ทฤษฎีปัญญาทางสังคม, การป้องกันการสูบบุหรี่ไฟฟ้า, วัยรุ่นตอนต้น

Abstract

Objective: To examine effects of the social cognitive theory-based program factors associating with E-cigarette smoking prevention among junior high school students. **Method:** In this quasi-experiment study, participants were male and female students in the 8th grade at a high school in Chanthaburi province. They were assigned to the test and control groups, 37 each. Participants in the test group received 4 weekly training sessions while those in the control group attended regular classes. Through the online Google Form™, the study factors of knowledge about, outcome expectation of, self-efficacy in and the intention not smoke E-cigarette were measured using a questionnaire. These factors were measured at three times points (i.e., before and after the program, and at 4-week follow-up). Changes in scores of each of the four factors over time between the two groups were tested using repeated measure ANOVA. **Results:** At post-test and follow-up, scores of knowledge about, outcome expectation of, self-efficacy in refusing, and the intention not to smoke E-cigarette were significantly higher than those before the program (P-value < 0.001, 0.002, 0.009 and < 0.001, respectively), and significantly higher than those in the control group. **Conclusion:** The social cognitive theory-based program improved scores of factors associating with E-cigarette smoking prevention including knowledge about, outcome expectation of, self-efficacy in refusing, and the intention not to smoke E-cigarette among early adolescents

Keywords: social cognitive theory-based program, E- cigarette smoking prevention, early adolescents

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Introduction

E-cigarette smoking has been rising among adolescents which could pose a growing health problem worldwide. Based on the Global Youth Tobacco Surveys in adolescents aged 13 – 15 years old in 75 countries, more than 80% knew about E-cigarette, 30 – 50% smoked E-cigarette at least once, and more than 10% smoked E-cigarette at the time.[1] According to the World Health Organization, E-cigarette smoking has been more prevalent especially among teenagers from 2011 to 2019. The 2011 – 2018 national survey of the US revealed that E-cigarette smoking among senior high school students had been increasing by 1.5% in 2011 to 20.8%. In Ireland, in 2018 survey on health behavior among students, 22% of students aged 12 – 17 years old smoked E-cigarette 30 days before the survey.[2] In Thailand, E-cigarette smoking among

adolescents has not been different from other countries. In 2015, a survey in 1,721 junior high school students aged 13 – 15 years old revealed that 4.7% and 1.9% of male and female adolescents smoked E-cigarette, respectively.[3] The problem was prominent especially the prevalence of E-cigarette smoking among female teenagers which had been increasing from 2% in 2008 to 5% in 2015; while it had remained at 21% among male counterparts.[4] A study in private and public university students in Bangkok in 2019 revealed that most students knew about E-cigarette, and about one-third would like to try.[5] In addition, almost half of the students viewed the E-cigarette as positive when compared with the traditional one including less harm, less risk of lung cancer, facilitating smoking cessation, and no risk of dependence with no nicotine. Alarmingly, one-sixth believed that E-cigarette causes no harm.[5]

It has been obvious that most adolescents lack knowledge and understanding and had inappropriate belief about E-cigarette which could pose a fast upward trend of its use in the group. Despite its illegal status[6], popularity of E-cigarette has been at its peak among adolescents.[7] Based on the report of Thailand Youth Institute (TYI), E-cigarette was mostly distributed through online media (80.8%), followed by night market (39.2%) and peers or close individuals (31.3%).[3]

Previous research suggests that psychosocial factors influencing cigarette and E-cigarette smoking include knowledge about E-cigarette, expected outcomes of E-cigarette smoking, self-efficacy in refusing E-cigarette smoking, and the intention not to smoke E-cigarette.[2, 8-10] Based on previous research, E-cigarette smoking could also be influenced by socioenvironmental factors including influence of family members, friends, schools, and media.[8, 9, 11] Among adolescents, a good number of research on programs to prevent smoking suggest the tangible influence psychosocial factors on their smoking. These studies evaluated the outcomes of promoting knowledge about smoking[12-14], knowledge about law and regulations on and attitude toward smoking.[15,16] Some studies proved certain programs could improve knowledge about law and regulations on and attitude toward smoking, self-efficacy to refuse smoking, and the intention not to smoke.[17-20] For E-cigarette smoking prevention program, similar psychosocial factors influencing the behavior among adolescents were found. These factors include knowledge about smoking and health impact[21], attitude toward smoking[22], knowledge about harms of smoking, negative attitude toward smoking, expected outcomes of not smoking, self-efficacy in not smoking, and the intention not to smoke.[23] Findings from previous studies suggest that these factors could also influence the decision to smoke E-cigarette among junior high school students.

Previous studies in smoking among adolescents largely focused on the traditional cigarette smoking with a very limited number of studies on E-cigarette. With the upward trend of E-cigarette smoking among adolescents[3], studies on the matter is much needed more than ever. Adolescents could be influenced to smoke E-cigarette by a lack of experience, inaccurate or incomplete information given, easy access to E-cigarette through online social media, and heightened popularity and availability of E-cigarette products in the online world.[24] Most adolescents have lacked complete and accurate knowledge, understanding and belief about E-cigarette. Programs to prevent E-cigarette smoking were needed.

As one of many various concepts proved to be beneficial for behavior modification, social cognitive theory with its distinctly categorized factors was chosen as the framework for the program to prevent E-cigarette smoking.[25] Based on social cognitive theory, human behavior cultivated and modified as an influence of interactions of the three groups of factors namely cognitive, socioenvironmental and behavioral support domains. For cognitive domain, individuals' behavior could be influenced by their self-efficacy in, outcome expectation, and understanding on the target behavior. For socioenvironmental domain, learning from observation or vicarious experience, normative belief and social support could mold the behavior. For behavioral support domain, the actual behavior is supported by behavioral skills, intentions, and reinforcements.

Like traditional cigarette, smoking E-cigarette, among adolescents has been widely known to be largely influenced by cognitive and socioenvironmental factors. For cognitive factors, knowledge about E-cigarette, expectations on E-cigarette smoking, self-efficacy in refusing E-cigarette, and intention not to smoke E-cigarette. These factors could affect the cognitive process of junior high school students in their decision making on E-cigarette smoking. Steps and strategies to use in this study were applied from the "CATCH My Breath" program used in high school students in Texas, USA, which

was proved to be effective in preventing E-cigarette smoking.[21] The modified program in this study used healthcare providers as the educator. Each session was one-hour long and held off the regularly scheduled classes weekly for four consecutive weeks. After the 4-week program, a 4-week follow-up was placed. Materials were learned through self-study, review, and online learning through Link™ with e-book and videos. Contents were about harms of E-cigarette, laws and regulations, refusal skill and online activity for commitment keeping. Findings could be useful in guiding healthcare providers, teachers and other responsible agencies to promote prevention and cessation of E-cigarette smoking among junior high school adolescents.[26]

The current study aimed to test the effectiveness of a program based on the social cognitive theory on knowledge about, outcome expectancy of, self-efficacy in and intention not to use E-cigarette among junior high school Thai students. Specifically, the study compared scores of knowledge about, outcome expectancy of, self-efficacy in and intention not to smoke E-cigarette among students attending the program (test group) before and after the 4-week program and at follow-up. In addition, scores of knowledge about, outcome expectancy of, self-efficacy in and intention not to smoke E-cigarette between the test and control groups over time were compared. Accordingly, within each group, scores of knowledge about, outcome expectancy of, self-efficacy in and intention not to smoke E-cigarette at the end of the program and follow-up were higher than those before the program. Scores of knowledge about, outcome expectancy of, self-efficacy in and intention not to smoke E-cigarette in the test group were higher than those in the control group.

Based on social cognitive theory, human behavior cultivated and modified as an influence of interactions of the **three** groups of factors namely cognitive, socioenvironmental and behavioral support domains. For **cognitive** domain, individuals' behavior could be influenced by their self-efficacy in, outcome expectation, and understanding on the target behavior. For **socioenvironmental domain**, learning from observation or vicarious experience, normative belief and social support could mold the behavior. **For behavioral support domain**, the actual behavior is supported by behavioral skills, intentions, and reinforcements.

The training program in the current study was conceptually framed based on the social cognitive theory (SCT).[25] Based on the SCT, cognitive domain and socioenvironmental domain are associated with the target behavior. On the other hand, the behavior itself reciprocate the two domains. Cognitive domain as an internal domain, factors including expectation, belief, perception, emotion and intention, mold the pattern and direction of the behavior; while the pattern and experience of the behavior modify the perception and brain structure which could in turn further affect cognitive function of the individual. While socioenvironmental domain which is external factors including being taught, being persuaded by social role model, and laws and regulations could mold, polish, and stimulate the individual's expected behavior. On the other hand, the responsive behavior could in turn affect the structure and socioenvironmental domain. This concept guided developing the program activities.

Based on the SCT, the program activities to prevent E-cigarette smoking were as follows. For activities to promote knowledge and understanding, harms of E-cigarette smoking and laws and regulations pertaining to E-cigarette were taught through video, small group discussion, and class presentation. Participants were also guided in online searching and sharing indirect experience and outcomes of patients with and without E-cigarette smoking. Self-efficacy in refusing E-cigarette smoking was developed by watching role model of refusing the smoking, and training in refusal skills in everyday situations. The self-study was held through online Link™ presenting a video on harms of, laws and regulations, and refusal skill for E-cigarette smoking. Activities based on socioenvironmental factors to promote behavior change included competition on exhibition and campaign motto to promote cigarette smoking inhibition. Signs prohibiting smoking were placed in various spots in the school. Smokers were notified by student peers to the teacher for proper help. For supporting strategy, students pledged their commitment online not to smoke E-cigarette. The winner of exhibition competition was rewarded. All of these activities based on the SCT were hypothesized to promote knowledge of, outcome expectation on, self-efficacy in, and intention not to smoke E-cigarette.

Methods

In this quasi- experimental research, outcomes in the test and control groups were compared at the end of the 4-week program and the 4-week follow-up. For psychosocial

outcomes, it was recommended that not only immediate effects (i.e., outcomes measured at the end of the 4-week program), but extended immediate effects (i.e., outcomes measured at 8 weeks) should be obtained.[13,23]

Study population was 8th grade male and female students in junior high schools in Pongnamron district, Chantaburi province. Study sample was 80 students in two selected schools (i.e., 40 students each in test and control groups) with comparable socioeconomic status. These students were in their academic year of 2022.

The sample size wad calculated using the software program G * POWER 3.1.9.4. With an effect size of 0.99[12], a power of 0.99, and a type I error of 5%, a sample size of 33 participants per group were needed. To compensate for a 20% attrition rate[23], a total of 40 participants in each were required. Participants in the two groups were matched with academic achievement and gender since the two factors could affect the outcomes.

To be eligible, students had to be 13 – 15 years old, have Thai nationality, have Internet-based devices, have no illnesses contraindicated for smoking including asthma and allergy, have normal learning ability, and be consented by the parents and willing to participate in the study. Students with E-cigarette smoking experience were excluded. Participants in the test group attending less than 4 sessions were terminated from the study.

Research instruments

The instruments were the social cognitive theory-based program to prevent E-cigarette smoking for junior high school students and questionnaires on the study factors as follows.

The social cognitive theory-based program to prevent E-cigarette smoking for junior high school students consisted of four weekly one-hour sessions. The sessions were held off the regular scheduled classes. In the first session of “Inhaling to the dark lung,” the harm of E-cigarette and laws and regulations on E-cigarette were provided. A video on smoking effects between smokers and non-smokers was viewed. In each of the three groups, students discussed about and presented benefits and harms of E-cigarette. They also were trained to online search and self-study materials through Link™ which included e-books and videos on harms of E-cigarette, laws and regulations, and refusal skills. In the second session of “staying away from E-cigarette,” self-efficacy in refusing E-cigarette was trained using video of role model and role playing with simulated scenarios. Students in the three groups discussed and concluded the learned matters. In the third session of “smoking-free school,” students competed in creating an exhibition fair on effects of E-cigarette smoking in the school, campaigning on no smoking, placing signs of smoking-free area, and informing teachers for helps when spotting students smoking. In the fourth session of “commitment,” students wrote their commitment of not smoking through Link™. The winner of the competition in the third session was awarded.

The questionnaire consisted of five parts namely demographic characteristics, knowledge about E-cigarette, outcome expectation on E-cigarette, self-efficacy in refusing E-cigarette, and the intention not to smoke E-cigarette. The questionnaire was tested for content validity by five experts, specifically, two nursing instructors in community nurse practitioner, two public health instructors, and one nursing instructor in health education. Internal consistency reliability was tested in 30 students with characteristics comparable to the participants.

The **first part** collected demographic characteristics of the participants including gender, age, cumulative grade point average (GPA), living arrangement, daily allowance, parents’ marital status, number of family members who smoked, and number of close friends who smoked.

The **second part** asked participants about knowledge about E-cigarette, harms of E-cigarette, and laws and regulations regarding E-cigarette. The questions were developed by the researcher. This 17-question questionnaire had a response of “true,” “false,” and “not sure” with a score of 1 point for a correct answer and 0 points otherwise. With the possible total score of 0 – 17 points, knowledge was categorized as low, moderate and high (0 – 10, 11 – 13, and 14 – 17 points, respectively).[27] In this current study, content validity was at an acceptable level with content validity index (CVI) of 0.81. Internal consistency reliability was acceptable (Kuder-Richardson-20 coefficient of 0.84.

The **third part** asked participants about outcome expectation on E-cigarette smoking. The researchers developed the questions as guided by literature. Nineteen questions assessed the individual’s thought and belief about deceptive and non-deceptive outcomes of E-cigarette smoking based on the social cognitive theory including three components namely physical outcome expectation (5 items), social outcome expectation (7 items), and self-evaluation

outcome expectation (7 items). An example of deceptive statement in social outcome expectation was “E-cigarette smoking brings me social acceptance and style’ while the only non-deceptive statement was “E-cigarette smoking is illegal regarding tobacco control laws.” Of the 19 questions, 18 were deceptive and only one was non-deceptive.

The response was a 4-point Likert-type rating scale ranging from 4-highly disagree, to 3-disagree, 2-agree and 1-highly agree for negative/deceptive statements and in the reverse order for the non-deceptive statement. With the possible total score of 1 9 – 76 points, higher scores indicated higher expectation on positive statements. Outcome expectation was categorized as highest, high, moderate, and low (64 – 76, 49 – 63, 34 – 48, and 19 – 33, respectively). In this current study, content validity was at a high level with CVI of 1.00. Internal consistency reliability was high (Cronbach’s alpha coefficient of 0.92).

The **fourth part** evaluated self-efficacy in refusing E-cigarette smoking. The confidence in avoiding or refusing E-cigarette smoking influenced by peers and online media in various situations or circumstances was assessed. The questions were originally in English language[28] and translated and modified into Thai language.[23] In this present study, 15 questions were used with a response of a 4-pointrating scale ranging from 1-not at all confident, to 2-somewhat not confident, 3-somewhat confident, and 4-highly confident. With the possible total score of 15 – 60 points, higher scores indicated higher self-efficacy. Self-efficacy was categorized as low, moderate, high, and highest (15 – 26, 27 – 38, 39 -50, and 51 – 60 points, respectively). In this current study, content validity was at an acceptable level with CVI of 0.87. Internal consistency reliability was high (Cronbach’s alpha coefficient of 0.92).

In the fifth part, the questions assessed the intention not to smoke E-cigarette in the next year, the next five years, and in the future. The four questions were modified from those assessing the intention not to smoke cigarette.[29] The response was a 4-point rating scale ranging from 1-definitely not smoking, to 2-possible to smoke, 3-possible to smoke, and definitely smoking. With the possible total score of 4 – 16 points, the intention to smoke E-cigarette was categorized as low, moderate, high, and highest (4 – 6, 7 – 9, 10 – 12, and 13 – 16 points, respectively). In this study, 2-week test-retest reliability was acceptable (coefficient of 0.89).

Participant ethical protection

The study was approved by the Ethics Committee for Human Study, Graduate School, Burapha University (approval number: G-HS012/2565; approval date: May 11, 2022). The participants were informed about voluntary and anonymity nature of the study. Written informed consent was obtained from participants and their parents. Students could refuse participation and participants could stop participating at any time with no impacts on their rights and no reasons were needed.

Data collection procedure

The researcher requested the director of selected schools for study permission. Objectives and details of the study were provided. The researcher trained a nurse with more than 10 years experiences and a health educator to be research assistants. They assisted the researcher in training participants in refusal skill and all other activities.

Before the training sessions, participants in both groups were asked to complete the online questionnaire through Google Form™. In the **test group**, four weekly one-hour sessions were held off the regular scheduled classes in the large meeting room. At the end of the last session of the 4-week program and at the next 4-week follow-up, participants were asked to complete the questionnaire through Google Form™.

In the **control group**, the were approached for questionnaire completion at the time close to those of the test group. They were no intervention in addition to their regular scheduled classes. However, after the time of the 4-week follow-up, the training program identical to the one provided to the test group was provided to participants in the control group.

Data analysis

Descriptive statistics including mean with standard deviation (SD) and frequency with percentage were used to summarize demographic characteristics and study factors. Differences in demographic characteristics between the two groups were tested using chi-square test and independent t test. Differences between scores of each of study factors between the two group over time, i.e., between-group and within-group differences, were tested using repeated measure analysis of variance (ANOVA). Greenhouse-Geisser

correction was user to reduce type I error since compound symmetry of variance of study factors was not met. Statistical significance was set at a type I error of 5%. All statistical analyses were performed using the software program SPSS version 26.

Results

At the end of the study, 74 participants, 37 in each group, remained in the study (Table 1). In each group, there were about half of male students; they were in their 13 to 14 years old; slightly more than two-thirds had cumulative GPA of 3.5 or higher; slightly higher than 80% lived with their parents; about 70% of their parents living together; about half had smoker in their family; and about half had no close friends who smoked. These comparable characteristics resulted in non-significant differences. Only daily allowance between the two groups were significantly different (*P*-value = 0.002); where 91.9% and 67.6% of participants in the test and control groups, respectively, had an allowance of 51 Baht or higher per day (Table 1).

Table 1 Demographic characteristics of the participants (N = 74).

Characteristics	Test group (*n* = 37)		Control group (*n* = 37)		*P*-value
	N	%	N	%	
Gender					
Male	18	48.6	20	54.1	0.642 [a]
Female	19	51.4	17	45.9	
Age (years)					
mean ± SD	13.62 ± 03492		13.86 ± 0.585		0.057[b]
min, max	13, 14		13, 15		
Cumulative GPA					
< 3.00	12	32.4	11	29.7	0.865[b]
≥ 3.00	25	67.6	26	70.3	
mean ± SD	3.132 ± 0.615		3.111 ± 0.445		
min, max	2.00, 4.00		2.10, 4.00		
Living arrangement					
Living with parents	31	83.8	30	81.1	0.760[a]
Living with relatives	6	16.2	7	18.9	
Daily allowance (Baht/day)					
≤ 50	3	8.1	12	32.4	0.002[b]
≥ 51	34	91.9	25	67.6	
mean ± SD	95.68 ± 34.524		72.97 ± 24.480		
min, max	50, 200		30, 100		
Parents' marital status					
Living together	25	67.6	26	70.3	0.802[a]
Separated/ divorced/ widowed	12	32.4	11	29.7	
Having smoker in the family					
No	22	59.5	17	45.9	0.244[a]
Yes	15	40.5	20	54.1	
Having close friends who smoke					
0	20	54.1	16	43.2	0.682[b]
≤ 3	10	27.0	16	43.2	
≥ 4	7	18.9	5	13.5	

[a] Chi-square test.

[b] Independent t-test.

At pre-test (i.e., before the training program), most participants in the test group were at a low level of knowledge about E-cigarette smoking (86.5%) (Table 2). At post-test (i.e., after the program) and follow-up, most were at a high level (83.8% for both). For outcome expectation of E-cigarette smoking, proportions of participants at the highest level increased from 8.1% at pre-test to 35.1% at post-test and 40.5% at follow-up. For self-efficacy in refusing E-cigarette smoking, a number of participants at the highest level at increased from 48.6% at pre-test, to 48.6% at post-test and 67.6% at follow-up. For intention not to smoke E-cigarette, the proportion of participants at the highest level increased from 70.3% at baseline to 100.0% at post-test and follow-up. On the other hand, in the control group, proportions of participants at the highest level for each of these four study factors at each of the three time points were relatively comparable (Table 2).

For between-group differences, scores knowledge about, outcome expectation of, self-efficacy in, and intention not to smoke E-cigarette between test and control groups not adjusted for time of measurement were statistically significant (*P*-value < 0.001, < 0.001, 0.016, and < 0.001, respectively). For within-group differences, scores of knowledge about, outcome expectation of, self-efficacy in, and intention not to smoke E-cigarette in the test group increased while those in the control group decreased or remained the same with statistical significance (*P*-value < 0.001, 0.002, 0.009, and < 0.001, respectively) (Table 3).

Discussions and Conclusion

In this quasi-experimental study, four weekly one-hour sessions of activities based on social cognitive theory were able to improve scores of knowledge about, outcome expectation of, self-efficacy in, and intention not to smoke E-cigarette among Thai adolescent students aged 13 – 15 years old. Majority of students had good academic achievement, lived with their parents, had parents living together. About half of them had smoker in their family and had no close friends who smoked. These characteristics were not significantly different between the two group. Only daily allowance between the two groups were significantly different (*P*-value = 0.002); where 91.9% and 67.6% of participants in the test and control groups, respectively, had an allowance of 51 Baht or higher per day. However, difference in daily allowance might not suggest E-cigarette smoking since adolescents could

Table 2 Level of study factors (N = 74).

	Level of the factor, N (%)							
	Test group				Control group			
Knowledge about E-cigarette smoking	**Low**	**Moderate**	**High**		**Low**	**Moderate**	**High**	
Pre-test	32 (86.5%)	5 (13.5%)	0 (0%)		33 (89.2%)	4 (10.8%)	0 (0%)	
Post-test	0 (0%)	6 (16.2%)	31 (83.8%)		27 (73.0%)	7 (18.9%)	3 (8.1%)	
Follow-up	0 (0%)	6 (16.2%)	31 (83.8%)		28 (75.7%)	7 (18.9%)	2 (5.4%)	
Outcome expectation	**Low**	**Moderate**	**High**	**Highest**	**Low**	**Moderate**	**High**	**Highest**
Pre-test	0 (0%)	6 (16.2%)	28 (75.7%)	3 (8.1%)	0 (0%)	5 (13.5%)	24 (64.9%)	8 (21.6%)
Post-test	0 (0%)	0 (0%)	24 (64.9%)	13 (35.1%)	1 (2.7%)	7 (18.9%)	20 (54.1%)	9 (24.3%)
Follow-up	0 (0%)	1 (2.7%)	21 (56.8%)	15 (40.5%)	5 (13.5%)	8 (21.6%)	19 (51.4%)	5 (13.5%)
Self-efficacy in refusing E-cigarette smoking	**Low**	**Moderate**	**High**	**Highest**	**Low**	**Moderate**	**High**	**Highest**
Pre-test	1 (2.7%)	3 (8.1%)	15 (40.5%)	18 (48.6%)	0 (0%)	7 (18.9%)	12 (32.4%)	18 (48.6%)
Post-test	0 (0%)	1 (2.7%)	13 (35.1%)	23 (62.2%)	0 (0%)	8 (21.6%)	12 (32.4%)	17 (45.9%)
Follow-up	0 (0%)	0 (0%)	12 (32.4%)	25 (67.6%)	0 (0%)	8 (21.6%)	10 (27.0%)	19 (51.4%)
Intention not to smoke E-cigarette	**Low**	**Moderate**	**High**	**Highest**	**Low**	**Moderate**	**High**	**Highest**
Pre-test	0 (0%)	0 (0%)	11 (29.7%)	26 (70.3%)	0 (0%)	0 (0%)	8 (21.6%)	29 (78.4%)
Post-test	0 (0%)	0 (0%)	0 (0%)	37 (100%)	0 (0%)	11 (29.7%)	15 (40.5%)	11 (29.7%)
Follow-up	0 (0%)	0 (0%)	0 (0%)	37 (100%)	0 (0%)	18 (48.6%)	11 (29.7%)	8 (21.6%)

Table 3 Scores of study factors between the test and control groups over time (N = 74)*.

Factors	Mean score (±SD)		*P*-value for within-group comparison	
	Test group	Control group	time	group x time
Knowledge about E-cigarette smoking				
Pre-test	6.24 ± 3.91	6.38 ± 3.24		
Post-test	15.41 ± 1.64	5.70 ± 5.09	< 0.001	< 0.001
Follow-up	15.43 ± 1.43	5.92 ± 5.08		
P-value for between-group comparison	< 0.001			
Outcome expectation				
Pre-test	54.81 ± 6.29	55.08 ± 9.10		
Post-test	61.76 ± 8.11	55.51 ± 10.88	0.048	0.002
Follow-up	61.68 ± 8.12	51.19 ± 14.13		
P-value for between-group comparison	< 0.001			
Self-efficacy in refusing E-cigarette smoking				
Pre-test	48.70 ± 8.62	49.49 ± 9.44		
Post-test	53.30 ± 6.68	47.57 ± 9.45	0.031	0.009
Follow-up	54.95 ± 5.64	49.54 ± 9.81		
P-value for between-group comparison	0.016			
Intention not to smoke E-cigarette				
Pre-test	13.89 ± 2.25	13.97 ± 1.92		
Post-test	15.00 ± 1.35	11.41 ± 2.72	< 0.001	< 0.001
Follow-up	15.03 ± 1.32	10.11 ± 2.30		
P-value for between-group comparison	< 0.001			

* Comparisons using repeated measure ANOVA.

access or acquire cigarette with no money needed.[30,31] As a result, this difference was not taken into account in the analysis comparing scores between the two groups.

Social cognitive theory based program was beneficial in improving knowledge about, outcome expectation of, self-efficacy in, and intention not to smoke E-cigarette. For knowledge about E-cigarette smoking, the activity of “Inhaling to the dark lung” aimed to promoting cognition necessary for behavioral change by primarily boosting basic knowledge and understanding on harms of E-cigarette smoking and benefits of not smoking. Searching skill on online sources about E-cigarette such as the Tobacco Control Research and Knowledge Management Center (TRC), Action on Smoking and Health Foundation Thailand, and the Thai Health Promotion Foundation. The learning was fun with quiz and prizes. Manual on brief knowledge about E-cigarette was provided for self-study. E-books and videos about harms of E-cigarette, laws and regulations and refusal skill were provided for online viewing through Link™ application as many times as they wanted.

Before the program, most participants in the test group were at a low level of knowledge (86.5%); while at the end of the program and follow-up, most were at a high level (83.8% for both). Educating people could allow for thinking process and belief which could ultimately modify the behavior.[25] This finding is consistent with previous studies revealing that the program improve knowledge about E-cigarette smoking among high school students.[21-23] This finding is also consistent with traditional cigarette smoking.[12-20,32,33]

In terms of **outcome expectation**, activities such as brainstorming, group discussion on pros and cons of E-cigarette smoking and legal punishment when for breaking the law enforcement, and class presentation could improve students’ expectation on outcomes of smoking and refusing

smoking. The more positive outcome expectation, the more behavioral modification. In our study, more participants in the test group were at the highest level at the end of the program and follow-up (35.1% and 41.5%, respectively). At baseline, certain negative aspects of outcomes were viewed inappropriately by certain proportions of participants. For example, more than 10% of them believed that E-cigarette is less dangerous than the conventional cigarette, does not cause stain in the teeth, does not cause body or mouth odor, is available with more flavors than the traditional cigarette, and is convenient for carrying since no lighter is needed (data not shown). The improved outcome expectation in the test group could be attributable to symbolic modeling based on the social cognitive theory of Bandura.[25] Knowledge, as a conditional factor for behavioral change, affects thinking process when integrated with self-efficacy and outcome expectation. Our finding is consistent with previous studies in E-cigarette[22,23] and traditional cigarette.[15-20,33-35]

For self-efficacy in refusing E-cigarette smoking, the activity of "staying away from E-cigarette" was meant to enhance the disposition. Skills were developed by video of refusal technique, refusal skill training, role-play on smoking pressured scenarios, and feedback sharing. Participants were encouraged to use the skill in their daily life and bring such experience to share in week 4. More participants with the highest level of self-efficacy were found at the end of program and follow-up (62.2% and 67.6%, respectively). The scores of self-efficacy increased from 48.70 points at baseline to 53.30 and 54.95 points at post-test and follow-up, respectively. The increase was slight but with statistical significance. The social cognitive theory proposes that individuals trained for life skill would perceive their self-efficacy higher than those who are not.[25] Individuals with self-efficacy have a high outcome expectation which could further carry out the actual behavior. Self-efficacy among students could be enriched through influence of peer and friendship. They perceive their capability through social learning, skill developing off training and actual experience. With this previous mastery experience, with success and failure repeated, individuals perceived their capability. In addition, observational learning through vicarious experience using video would allow individuals to realize about their self-efficacy. Adolescents learn through their peers' experiences. They compare their information with peers' in decision making and judging their own capability. Adolescents choose friends with shared interest and value which could help enhance their self-efficacy. Our fining is consistent with previous studies on programs to prevent smoking of E-cigarette[23] and traditional cigarette.[19,32]

For the intention not to smoke E-cigarette, it was promoted by the activity called "commitment." The activity included knowledge review, realization on harms and impacts of E-cigarette on self and family through videos. Their commitment posted online media included "I will never do E-cigarette," "I will not make my parents regret smoking E-cigarette," "E-cigarette is not cool," "Not smoking E-cigarette for our loved ones and ourselves," "I won't do any kinds of cigarette" "I will never smoke E-cigarette for my entire life." Students shared skills for refusing smoking in daily living. Students winning the competition on exhibition were rewarded with prizes. All participating the program were given certificate for their portfolio.

The intention not to smoke E-cigarette was at the highest level as high as in 70.3% of the participants. Despite no experience of smoking E-cigarette, the participants might have been relatively familiar with smoking in general. At the end of the program and follow-up, all participants had the highest intention not to smoke E-cigarette. The intention could be affected by direct experience, vicarious learning on those successfully achieving the target behavior and outcome.[25] Based on social cognitive theory, proper supportive behaviors are needed for achieving the target behavior. These included skills related to the behavior, self-control and self-management, the intention to perform the behavior, and enforcement.[25] Our fining is consistent with previous studies on programs to prevent smoking of E-cigarette[2 3] and traditional cigarette.[17,18,20,34,35]

In this present study, socioenvironmental factors for E-cigarette smoking were not examined. However, the activities of vicarious learning and social norms toward the behavior, and social support were the components of socioenvironmental factors. With the activity of "smoking-free school," the exhibition demonstrated the impacts of smoking E-cigarette and traditional cigarette, skill to refuse smoking, and laws and regulations about smoking. Mottos were judged for rewarding and displayed. Student were provided with decorating materials. Signs for smoking-free school were placed in various spots in the school. Students held meeting to set measures for promoting smoking-free school. For example, if any smoking was spotted, teachers were notified so the smoker could be helped and referred to substance

abuse clinic of the school. Teachers also were asked to be their role model for not smoking.

The program enriched the main factors of the social cognitive theory.[25] For psychosocial and behavioral factors, knowledge about, outcome expectation of, self-efficacy in and the intention not to smoke E-cigarette are factors determining the actual behavior of smoking. Our program offered results similar to a study in Thai junior high school students (grade 8) with eight 60-minute sessions and measurements done at the end of the 4-week program.[23] However, our program is different from another study with six 25-minute session using teachers and students as group leaders and the outcomes measured as 6 and 16 months.[21] Intervention in our study lasted only 4 weeks with another 4 weeks for follow-up. Our study could offer only the immediate effect of the intervention. Our program was carried out by healthcare providers. The behavior was measured using the intention not to smoke E-cigarette which is an indirect measure. Our program had a strength where students could conveniently self-study or review the learning materials through online media, i.e., Link™ offering e- books and videos about harms of, laws and regulations about and skill to refuse E-cigarette smoking. The weakness was that we studied only the intention not to smoke which was an immediate or short-term effect of the program. We could not determine the actual smoking behavior which is a long-term benefit. In addition, the study on the actual smoking behavior was almost impossible since such behavior could have students who smoked expulsed or transferred.

Based on our findings, school nurses and community healthcare providers could apply the activities employed in our study for onsite and online self-study and training. In addition, these activities could be used in training the prospective leaders in schools and communities. These leaders could be students, community health volunteers, parents, and youth group members. Network partners with shared interest should be sought for cooperation and financial support. These include local administrative offices, To be Number One Foundation, and laws and regulations related offices. Activities could also be applied for other behaviors similar to smoking such as alcohol and other substances. Groups other than high school students, for example, extended school students, could be applied with these activities too. For future studies, longer follow-up duration should be tested. Stimulating activities should be conducted in every semester and tested in the future studies.

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