



Effects of a Theory of Planned Behavior–Based Program on E-Cigarette Prevention among Female Students in Bangkok

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Abstract

This quasi-experimental study evaluated effects of program applying the Theory of Planned Behavior to preventive behavior from e-cigarette smoking among female junior high school students in Bangkok. Sixty Grade 8 students were equally assigned to an experimental group and a comparison group. The 6-week intervention comprised female peer-leader preparation and four participatory workshop sessions designed to improve attitudes, subjective norms, perceived behavioral control, and intention to abstain from e-cigarette use. Data were collected pre-intervention, post-intervention, and at two-week follow-up.

Research instruments included questionnaires assessing attitude, subjective norm, perceived behavioral control, intention, and prevention behaviors. Content validity was verified by three experts, yielding CVI values of 0.85–1.00. Reliability was high, with Cronbach's alpha ranging from 0.80 to 0.96. Data were analyzed using Chi-Square test, Fisher's Exact Test, Friedman Test, Wilcoxon Signed Rank Test, and Mann–Whitney U Test.

Results showed that, after the intervention and at follow-up, the experimental group had higher mean scores for attitude and subjective norm compared with baseline ($p < .05$). Perceived behavioral control and intention did not change. Prevention behavior increased post-intervention ($p < .05$) but was not maintained at follow-up. Between groups, the experimental group scored higher across variables ($p < .05$).

The findings indicate that the program improved attitudes, subjective norms, and short-term prevention behavior. Strategies are needed to strengthen perceived behavioral control, reinforce intention, and sustain change. Adapting the program for other adolescent female groups in non-formal education and working with families is recommended to support long-term outcomes.

Keywords: Theory of planned behavior, Female students, E-cigarette prevention program, Quasi-experimental study

What was Known

- E-cigarette use among adolescent girls is an increasing public health concern despite legal restrictions.
- Theory of Planned Behavior identifies attitude, subjective norm, and perceived behavioral control as key determinants of preventive behavior.
- Gender-specific, peer-led prevention programs for female junior high school students remain limited.

What's New and Next

- This study demonstrates that a TPB-based peer-led program improves attitudes, subjective norms, and e-cigarette preventive behaviors among female students.
- Findings support integrating gender-sensitive school interventions into adolescent tobacco prevention.
- Future programs should include booster sessions and family involvement to sustain long-term behavior change.

Introduction

Over the past decade, e-cigarette use among adolescents has increased sharply, emerging as a major public health concern. In the United States, more than 2.5 million middle and high school students reported e-cigarette use within the past 30 days, with over one-fourth being regular users⁽¹⁾. In the United Kingdom, prevalence among adolescents aged 16–19 years tripled from 5% to 15% in five years⁽²⁾. Despite Thailand's ban on importation and sales since 2015⁽³⁾, adolescents still have easy access to e-cigarettes, particularly via online platforms⁴. The National Statistical Office reported 78,742 e-cigarette users in 2021, including 24,050 individuals aged 15–24 years, mostly in Bangkok and the central region⁵. Notably, 8.9% of Thai female students aged 13–17 years were current users⁽⁶⁾. Females are also more susceptible to nicotine dependence and withdrawal^(7,8), while marketing strategies increasingly target young women through appealing colors, fragrances, and fashionable imagery^(9,10).

Although e-cigarettes do not involve combustion, they often deliver high nicotine concentrations equivalent to smoking about 15 conventional cigarettes per pod¹¹, alongside

harmful compounds such as formaldehyde and acrolein^(12,13). Severe health consequences include e-cigarette or vaping product use-associated lung injury (EVALI), which caused 2,807 hospitalizations and 68 deaths in the United States in 2023⁽¹⁴⁾.

Female adolescents are particularly vulnerable to e-cigarette use, influenced by attitudinal, social, and control-related factors. Positive perceptions of e-cigarettes as modern, fashionable, or less harmful behaviors^(15–17), combined with peer sharing, social media portrayal, and subtle normalization^(18–22), foster experimentation and sustained use. Misconceptions about low nicotine levels and controllability further reduce perceived risk^(23,24). These determinants align with the Theory of Planned Behavior (TPB), which posits that attitudes, subjective norms, and perceived behavioral control shape intention and behavior⁽²⁵⁾.

TPB provides a robust evidence-based framework for interpreting adolescent health behaviors and has demonstrated strong empirical validity in predicting health-related actions among youth populations^(26–29). Moreover, TPB serves as a practical foundation for designing theory-based interventions, especially participatory and peer-led programs that target cognitive, normative, and control components through structured group activities. For adolescent females, whose decision-making processes are highly influenced by peers, body image, and self-efficacy, TPB effectively captures these multidimensional determinants and supports the design of interactive prevention strategies.

Despite growing research on smoking-prevention programs, gender-focused interventions targeting e-cigarette use among female adolescents remain scarce. The present study aimed to examine attitudes, subjective norms, perceived behavioral control, intention not to use e-cigarettes, and preventive behaviors among female Grade 8 students. It also compared changes in these outcomes across pre-test, post-test, and follow-up assessments between participants of a TPB-based, peer-led prevention program and those receiving usual educational activities. The program, developed by a community nurse practitioner, utilized peer influence as a key mechanism in promoting e-cigarette-free behaviors, recognizing adolescence as a critical stage of social learning^(30, 34). Findings are expected to inform evidence-based school and public health initiatives that support gender-specific e-cigarette control strategies.

Materials and Methods

This quasi-experimental study employed an experimental and a comparison group. Outcome measures were assessed at three time points: baseline (pre-test), immediately post-

intervention, and at a two-week follow-up. The study was conducted between February 6 and March 20, 2025, over a six-week period.

1. Population

Female Grade 8 students attending schools under the Office of the Basic Education Commission (OBEC) in Bangkok during the 2024 academic year (n = 67 schools)

2. Sample

The sample consisted of female Grade 8 students aged 13–15 years from OBEC schools in Bangkok during the 2024 academic year who met the eligibility criteria and provided informed consent. Two schools were selected using simple random sampling, with one assigned to the experimental group (School A) and the other to the comparison group (School B). The schools were comparable in physical characteristics, school type, and instructional system, as shown in Figure 1.

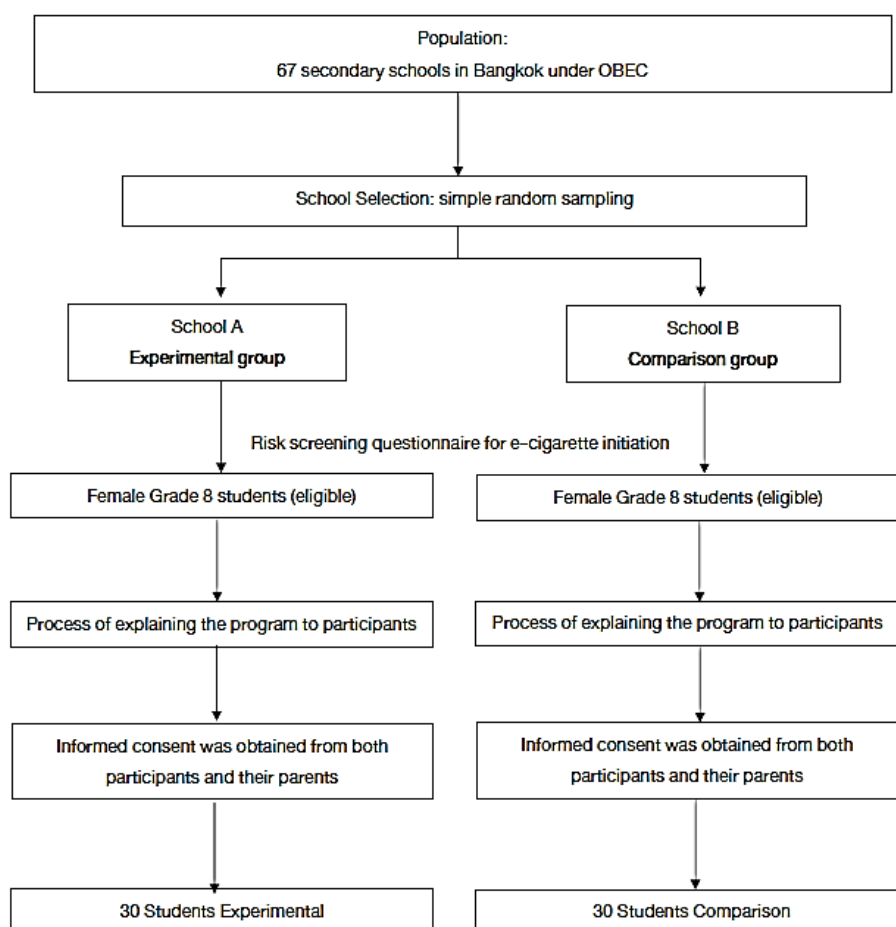


Figure 1 Sampling Procedure

3. Sample Size Calculation

The sample size was calculated using G*Power version 3.1.9.7, based on effect size estimates from a previous quasi-experimental study by Lopradit and Nusorn, which examined a smoking prevention program among secondary school students aged 13–15 years with exposure to smoking in family members or peers⁽³⁵⁾.

In the referenced study, the experimental and comparison groups reported mean post-intervention smoking-prevention behavior scores of 28.53 (SD = 2.46) and 10.27 (SD = 2.72), respectively, yielding a large effect size. For the present study, an effect size (d) of 0.80 was adopted, with a power of 0.80 and a significance level of .05. The minimum required sample size was 26 participants per group.

Allowing for a 10% attrition rate, the final sample size was increased to 29 participants per group. To enhance statistical robustness, 30 participants were ultimately recruited for each group, resulting in a total sample of 60 students.

In each selected school, female Grade 8 students were screened for eligibility using the risk screening questionnaire for e-cigarette initiation. Students who met the inclusion criteria and provided written informed consent from both themselves and their parents were recruited. Thirty eligible students were then enrolled from each school to meet the calculated sample size requirement and to ensure equal allocation between groups.

4. Inclusion Criteria

- 4.1. Female Grade 8 students aged 13–15 years during the 2024 academic year.
- 4.2. Students identified as at risk of initiating e-cigarette use, assessed using a risk-screening tool adapted from the New Smoker Risk Screening Questionnaire developed by Addjanagitti et al.⁽²⁹⁾, which evaluates prior experimentation with cigarettes or e-cigarettes, exposure to e-cigarette use by family members or peers, observation of vaping behaviors, and exposure to e-cigarette-related media or advertising that induces curiosity or intention to use.
- 4.3. Provided written informed consent from a parent or legal guardian.
- 4.4. Owned a mobile phone with adequate internet access to participate in program activities.
- 4.5. Voluntarily agreed to participate in the program.

5. Exclusion Criteria

Students were excluded if they were current users of any tobacco products or had used them within the past 30 days, did not complete all program activities, or transferred to another school during the study period.

6. Criteria for Selecting Student Leaders

Homeroom teachers nominated two female Grade 8 students from each of eight classrooms (n = 16) based on demonstrated leadership, responsibility, and peer influence. The nominated students were subsequently selected by peer voting via a Google Form. The five students receiving the highest votes and providing parental consent were appointed as student leaders for the program.

7. Research Instruments

The research instruments were developed based on the Theory of Planned Behavior and validated by three experts in health promotion and tobacco/e-cigarette control. The Content Validity Index (CVI) ranged from 0.85 to 1.00. Following expert review, the instruments were revised and pilot-tested among 30 students with characteristics similar to the target population, and subsequently finalized. The instruments comprised:

7.1 Intervention Instrument: The TPB-based intervention comprised four weekly 50-minute sessions delivered over four weeks. The program focused on peer leader preparation, enhancement of e-cigarette prevention behaviors, reinforcement of subjective norms, strengthening of perceived behavioral control, and promotion of intention to abstain from e-cigarette use. Outcomes were assessed immediately post-intervention and at a two-week follow-up.

7.2 Instrument for Screening Participants: Participant eligibility was assessed using a risk-screening questionnaire adapted from the New Smoker Risk Screening Questionnaire developed by Addjanagitti et al.²⁹ The instrument evaluated prior tobacco experimentation, exposure to e-cigarette use among family members and peers, and curiosity or intention to try e-cigarettes. Students with no current tobacco use or use within the past 30 days were eligible for inclusion.

7.3 Instruments for Data Collection: Data were collected using six questionnaire sections as follows:

7.3.1 Personal characteristics and school policies: Closed-ended (checklist) items.

7.3.2 Attitude toward e-cigarette prevention: A 10-item, four-point rating-scale questionnaire adapted from Addjanagitti et al.²⁹ Higher scores indicate more favorable attitudes toward e-cigarette prevention (reliability = 0.80).

7.3.3 Subjective norms regarding non-e-cigarette use: A five-item, four-point rating-scale questionnaire adapted from Addjanagitti et al.²⁹ Higher scores reflect stronger supportive subjective norms (reliability = 0.94).

7.3.4 Perceived behavioral control: A 10-item, four-point rating-scale questionnaire adapted from Addjanagitti et al.²⁹ Higher scores indicate greater perceived ability to refrain from e-cigarette use (reliability = 0.96).

7.3.5 Intention to abstain from e-cigarette use: A three-item, four-point rating-scale questionnaire developed by the researcher based on a literature review; higher scores indicate stronger intention (reliability = 0.81).

7.3.6 E-cigarette prevention behaviors: An eight-item, four-point rating-scale questionnaire adapted from Addjanagitti et al.²⁹ Higher scores indicate stronger prevention behaviors (reliability = 0.82).

8. Research Procedures

The study comprised four phases: preparation, implementation, data collection, and data analysis.

8.1 Preparation

8.1.1 A TPB-based intervention program and research instruments were developed, reviewed by experts, and pilot-tested.

8.1.2 Ethical approval was obtained from the Institutional Review Board, Faculty of Public Health, Mahidol University (MUPH 2024-113).

8.1.3 Institutional permission was obtained from the principals of the experimental and comparison schools.

8.1.4 Written informed consent was obtained from parents or legal guardians prior to study implementation.

8.1.5 Five female student leaders were selected through teacher nomination and peer voting via Google Form.

8.1.6 Program implementation schedules were coordinated with both schools.

8.2 Implementation: The study was conducted between 6 February and 20 March 2025. The experimental group participated in a four-week e-cigarette prevention program for female junior high school students, developed based on a literature review and the Theory of Planned Behavior. The program consisted of weekly 50-minute sessions.

Session 1 (Week 1): Five female student leaders were trained to support program implementation and participant engagement throughout the intervention. The training covered e-cigarette knowledge, health risks, relevant laws, and refusal skills, including role-play practice. During the same week, participants received lectures on e-cigarettes, associated harms, and regulatory laws to promote positive attitudes toward prevention. Small-group discussions were conducted following the viewing of five educational videos, facilitated by student leaders.

Session 2 (Week 2): Subjective norms were addressed through group viewing of five scenario-based videos, followed by discussions on the perceived advantages and disadvantages of modeled behaviors and strategies to avoid e-cigarette use, with facilitation by student leaders.

Session 3 (Week 3): Perceived behavioral control was enhanced through instruction on refusal skills using a PowerPoint presentation. Student leaders demonstrated refusal-skill role-plays, after which participants practiced responses in five simulated situations involving peer pressure, exposure, or promotional cues related to e-cigarette use.

Session 4 (Week 4): intention to abstain from e-cigarette use was reinforced through a creative group activity. Participants were divided into five groups to produce video entries for the “TikTok: Youth Against E-Cigarettes” contest. The winning team received a certificate and a 5,000-baht prize. Student leaders continued to provide support and motivation throughout the activity.

8.3 Data collection: Data were collected by self-administered questionnaires at baseline, post-intervention, and two-week follow-up.

8.4 Data analysis: Data were analyzed using descriptive statistics and nonparametric tests (Chi-square, Fisher’s exact, Mann–Whitney U, Friedman, and Wilcoxon signed rank). Analyses were performed with SPSS version 29 at $p < .05$.

Result

1. Demographic and School Characteristics of the Sample

Baseline demographic and school-related characteristics were comparable between the experimental ($n = 30$) and comparison ($n = 30$) groups, with no significant between-group

differences observed ($p > .05$). The only significant difference was exposure to e-cigarette-free signage, which was more frequently reported in the experimental group than in the comparison group (86.67% vs. 63.33%, $p = .037$). (Table 1)

Table 1 Demographic and School Characteristics of the Sample

Characteristics	Experimental (n = 30)	Comparison (n = 30)	p-value
Demographic characteristics			
Age (years), mean $\pm$ SD	13.80 $\pm$ 0.55	14.03 $\pm$ 0.49	.085 ^a
Grade point average, mean $\pm$ SD	3.46 (0.49)	3.45 (0.45)	.690 ^a
Daily income (THB/day), mean $\pm$ SD	97.23 $\pm$ 28.52	105.33 $\pm$ 25.15	.154 ^a
Adequacy of income, n (%)			
Adequate	23 (76.67)	26 (86.67)	.317 ^b
Inadequate	7 (23.33)	4 (13.33)	
Type of residence, n (%)			
House	19 (63.33)	26 (86.67)	.113 ^c
Dormitory	8 (26.67)	3 (10.00)	
Others	3 (10.00)	1 (3.33)	
Living arrangement			
Family or Relatives	29 (96.67)	29 (96.67)	1.000 ^c
Friends or Partner	1 (3.33)	1 (3.33)	
School-related characteristics			
Awareness of school e-cigarette-free policy			
Aware	25 (83.33)	24 (80.00)	.739 ^b
Unaware	5 (16.67)	6 (20.00)	
Awareness of school e-cigarette prevention activities			
Aware	23 (76.67)	20 (66.67)	.390 ^b
Unaware	7 (23.33)	10 (33.33)	
Awareness of school disciplinary measures			
Aware	26 (86.67)	27 (90.00)	1.000 ^c
Unaware	4 (13.33)	3 (10.00)	
Awareness of school promotion of student participation			
Aware	21 (70.00)	25 (83.33)	.222 ^b
Unaware	9 (30.00)	5 (16.67)	

Table 1 Demographic and School Characteristics of the Sample (cont.)

Characteristics	Experimental (n = 30)	Comparison (n = 30)	p-value
Awareness of school coordination with health agencies			
Aware	21 (70.00)	18 (60.00)	.417 ^b
Unaware	9 (30.00)	12 (40.00)	
Exposure to e-cigarette-free signage			
Ever seen	26 (86.67)	19 (63.33)	.037 ^{b*}
Never seen	4 (13.33)	11 (36.67)	
E-cigarette instruction in health curriculum			
Ever received	27 (90.00)	25 (83.33)	.706 ^c
Never received	3 (10.00)	5 (16.7)	

Notes. Values are presented as mean $\pm$ standard deviation or number (percentage).

^a Mann-Whitney U test; ^b Chi-square test; ^c Fisher's exact test.

Statistically significant at $p < .05$.

2. Research Variable Data

At baseline, no significant between-group differences were observed in any TPB construct or preventive behaviors ($p > .05$).

Attitude toward preventing e-cigarette smoking in the experimental group significantly increased at post-test and follow-up compared with baseline ($p < .001$), whereas no significant change was observed in the comparison group. Between-group differences were significant at both post-test and follow-up ($p < .001$).

Subjective norms toward e-cigarette prevention significantly improved over time in the experimental group ($p = .008$), while no significant changes were found in the comparison group. The experimental group had significantly higher scores than the comparison group at post-test ($p = .001$) and follow-up ($p < .001$).

Perceived behavioral control in preventing e-cigarette smoking was significantly higher in the experimental group than in the comparison group at post-test ($p = .003$) and follow-up ($p = .009$). No significant within-group changes over time were observed.

Intention not to smoke e-cigarettes was significantly higher in the experimental group than in the comparison group at post-test ($p = .001$) and follow-up ($p = .002$), with no significant within-group changes over time.

Preventive behaviors against e-cigarette use significantly increased in the experimental group at post-test and follow-up compared with baseline ($p < .001$), whereas no significant changes were observed in the comparison group. Between-group differences were significant at post-test ($p < .001$) and follow-up ($p = .009$).

Overall, the results indicate that the intervention significantly improved TPB constructs and preventive behaviors in the experimental group, as shown in Table 2.

Table 2 Comprehensive Results of TPB Constructs and Preventive Behaviors Against E-Cigarette Smoking (n=60)

Time point	Experimental (n=30) Mean (SD)	Comparison (n=30) Mean (SD)	<i>p-value</i> (Between-group)
Attitude toward preventing e-cigarette smoking			
Pre-test	31.90 (4.29)	29.50 (5.68)	.092
Post-test	35.87 (2.65) *	30.57 (5.26)	<.001*
Follow-up	36.53 (2.37) *	31.03 (5.73)	<.001*
<i>P-value</i> (Within-group)	<.001*	.925	-
Subjective norms toward e-cigarette prevention			
Pre-test	16.43 (2.57)	16.07 (2.21)	.665
Post-test	17.80 (1.88) *	15.90 (2.59)	.001*
Follow-up	18.87 (1.87) *	16.33 (2.73)	<.001*
<i>P-value</i> (Within-group)	.008*	.758	-
Perceived behavioral control in preventing e-cigarette smoking			
Pre-test	35.57 (4.97)	33.60 (6.22)	.187
Post-test	37.10 (4.46)	32.40 (6.62)	.003*
Follow-up	37.50 (4.07)	33.90 (5.45)	.009*
<i>P-value</i> (Within-group)	.267	.830	-
Intention not to smoke e-cigarettes			
Pre-test	10.37 (1.67)	9.77 (1.99)	.296
Post-test	11.07 (1.26)	9.83 (1.42)	.001*
Follow-up	11.07 (1.26)	9.90 (1.52)	.002*
<i>P-value</i> (Within-group)	.063	.830	-

Table 2 Comprehensive Results of TPB Constructs and Preventive Behaviors Against E-Cigarette Smoking (n=60) (cont.)

Time point	Experimental (n=30) Mean (SD)	Comparison (n=30) Mean (SD)	<i>p</i> -value (Between-group)
Preventive behaviors against e-cigarette use			
Pre-test	28.13 (4.76)	26.53 (4.77)	.107
Post-test	30.30 (2.41) *	26.50 (3.95)	<.001*
Follow-up	30.13 (2.62) *	27.27 (4.18)	.009*
<i>P</i> -value (Within-group)	.318	.812	-

Note. Values are presented as mean (standard deviation). Within-group comparisons were analyzed using the Friedman test. Between-group comparisons were analyzed using the Mann–Whitney U test. * $p < .05$

Discussion

1. Attitude toward preventing e-cigarette smoking

The program significantly improved attitudes toward preventing e-cigarette use in the experimental group, with a significant within-group increase ($p < .001$) and significantly higher scores than the comparison group at both post-test and follow-up ($p < .001$). These improvements were facilitated by educational activities that enhanced knowledge of e-cigarettes, associated health risks, and relevant control laws through video-based learning, group discussions, and presentations. Emphasis on appearance-related harms particularly salient for females—such as skin dullness, premature wrinkles, and lip discoloration—enhanced risk awareness and personal relevance⁽³⁶⁾. In addition, clarification of marketing strategies targeting adolescent girls, including appealing colors, toy-like designs, and flavored products, helped reduce misconceptions regarding the safety and image-enhancing effects of e-cigarettes^(9,15,24).

The involvement of female peer leaders further strengthened peer learning and positive social influence, reinforcing non-use as a socially desirable behavior. These findings are consistent with previous Thai studies demonstrating the effectiveness of knowledge-based and participatory learning approaches,^(28,29) and with international evidence showing that interactive school-based interventions reduce positive expectancies toward e-cigarette use^(37,38).

2. Subjective norms toward e-cigarette prevention

The program significantly enhanced subjective norms toward e-cigarette prevention in the experimental group, as reflected by a significant within-group increase ($p = .008$) and significantly higher scores than the comparison group at post-test ($p = .001$) and follow-up ($p < .001$). These

effects were supported by peer-led activities involving analysis of video-based behavioral models representing key reference groups. The active role of peer leaders reinforced positive social influence and promoted non-use as a socially desirable norm. Given that early-adolescent females are highly responsive to peer acceptance and role modeling,^(30,39) peer-leader advocacies played a critical role in shaping subjective norms. These findings are consistent with prior evidence showing that non-smoking role models effectively influence classroom norms and motivation^(29,34)

3. Perceived behavioral control in preventing e-cigarette smoking

Although refusal-skills training resulted in higher mean scores, no significant within-group change in perceived behavioral control was observed in the experimental group ($p = .267$). However, perceived behavioral control was significantly higher in the experimental group than in the comparison group at post-test ($p = .003$) and follow-up ($p = .009$), indicating a partial intervention effect. This pattern suggests that the relatively short program duration may have been insufficient to produce significant individual-level change, as perceived behavioral control typically requires repeated practice and reflection in real-life contexts⁽²⁰⁾. The observed between-group differences may reflect initial gains in self-efficacy,⁽²⁵⁾ consistent with evidence from Thai studies and international interventions highlighting experiential learning as essential for strengthening perceived behavioral control^(37,38,40,41).

4. Intention not to smoke e-cigarettes

The program included student-led campaign activities, such as a Creative TikTok “Youth Against E-Cigarettes” video contest and a school-wide e-cigarette-free campaign, which contributed to higher intention to abstain from e-cigarette use. Although within-group changes were not statistically significant ($p = .063$), this may reflect relatively high baseline intention in the experimental group. However, compared with the comparison group, the experimental group demonstrated significantly higher intention scores at post-test ($p = .001$) and follow-up ($p = .002$). This finding is consistent with the Theory of Planned Behavior, which identifies intention as a key determinant of behavior. External factors, including online access to e-cigarettes⁴ and peer influence⁽⁴²⁾, may have moderated the program’s impact. Similar results have been reported in multi-component school-based interventions that increased abstinence intention despite contextual challenges^(28,41,43).

5. Preventive behaviors against e-cigarette use

Preventive behaviors against e-cigarette use were significantly higher in the experimental group than in the comparison group at post-test ($p < .001$) and follow-up ($p = .009$), although within-

group changes were not statistically significant. The slight decline in mean scores at follow-up suggests attenuation of effects after the active intervention ended, consistent with Ajzen's theory that sustained behavior requires ongoing external support and supportive environments^(2,5). Exposure to real-life influences, such as peers, social media, and environments where e-cigarettes are accessible, together with adolescents' developmental susceptibility to contextual cues, may further weaken the maintenance of preventive behaviors⁽³¹⁾. These findings support evidence from Thai studies and international programs indicating that continuous, structured strategies—particularly peer-led activities and follow-up reinforcement—are essential for sustaining behavior change^(35, 37, 44).

Limitations

This study involved a limited sample and a short follow-up period, which may restrict generalizability. The use of self-reported questionnaires may also introduce bias. Future studies should include larger samples, longer follow-up durations, and the integration of family- or school-level factors.

Conclusion

This study demonstrates that a Theory of Planned Behavior-based, peer-led intervention effectively improved attitudes, subjective norms, and preventive behaviors toward e-cigarette use among female junior high school students, highlighting the role of peer influence and participatory learning. From a public health perspective, the findings support integrating theory-based, gender-sensitive, and peer-led strategies into school health promotion programs. Future research should examine longer intervention durations, booster activities, and family or community involvement to strengthen perceived behavioral control and sustain preventive behaviors over time.

Ethical Approval Statement

This research was approved by the Research Ethics Committee for Human Research, Faculty of Public Health, Mahidol University, on October 24, 2024, under project code MUPH 2024-113

Author Contributions

All of the authors have contributed significantly in the development of this work. NA, supervised the study and provided critical guidance and review. AP, and SK, served as co-supervisors, contributing methodological advice and manuscript revision.

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Conflicts of Interest

None of the authors report any conflicts of interest.

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