

# Integrating Health Literacy into a Theory-Based Drug-Use Prevention Program: A Quasi-Experimental Study Among Junior High Students in Taiwan.

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## Research

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# Abstract

## Background

In Taiwan, illegal drug use is a critical health problem during adolescence. Schools play a vital role in preventing students' illegal drug use. Accordingly, we developed and evaluated a school-based, drug-use prevention program integrating the theory of planned behavior (TPB) and health literacy for junior high school students.

## Methods

We recruited 648 junior high school students from 14 selected schools:  $N= 323$  in the experimental group,  $N= 325$  in the comparison group. The experimental group received ten 45-minute sessions of a theory-based drug-use prevention program. The comparison group received traditional didactic teaching and drug refusal skill training. We used a generalized estimating equation (GEE) to analyze data.

## Results

Results of paired  $t$ -tests indicated that drug-use health literacy and TPB-related variables improved in the experimental group. The GEE analyses indicated that participants in the experimental group also demonstrated significantly improved health literacy ( $p < 0.001$ ) compared to the comparison group, especially for functional ( $p < 0.001$ ) and critical health literacy ( $p = 0.017$ ). The experimental group also showed significant post-intervention improvement in terms of subjective norm scores ( $p = 0.024$ ).

## Conclusion

Study results demonstrated the effectiveness of a drug-use prevention program on health literacy and subjective norm by integrating the TPB and health literacy. These results could support the future implementation of drug-use prevention programs for junior high school students on a larger scale.

# Background

Drug use has been a critical health problem among students over the past decade. Prevalence rates for lifetime, past-year, and past-month illegal drug use were 2.79%, 1.91%, and 1.72%, respectively, for 15,754 senior and vocational high school students in Taiwan [1]. A national campus survey in 2017 showed drug-use prevalence at 0.23% for junior high school students and 0.73% for senior high school students [2]. From 1999 to 2006, the prevalence of drug abuse among junior high school students was approximately between 0.6% and 1.5% [3, 4]. However, prevalence rates were relatively higher for night class students in vocational high schools. A randomized sample was drawn from 33 vocational high school night classes, which included 1,079 students already employed outside the campus. Among them, 881 (81.7%) were non-drug users, 147 (13.6%) were experimental users, and 51 (4.7%) were regular users[5]. Initiating substance use at an early age is a significant predictor of later substance abuse, delinquency, and serious adverse health consequences [6, 7]. According to a national survey report in

Taiwan, the first-time drug use reason was "curiosity" (70.5%), and the first-time drug use location was most often a classmate's or friend's home (29.9%). The survey report also indicated that the use of new types of drugs such as poisoned coffee bags, milk tea bags, and rainbow cigarettes is found mainly in young populations, and there is no gender difference, which is an emerging problem. The survey revealed that the young populations are the most common users of new types of illegal drug. Moreover, approximately 90% of participants agreed that anti-drug education should be "integrated into the formal school curriculum"[8].

The theory of planned behavior (TPB) is a common theoretical framework for predicting behavior. It proposes that behavior is directly influenced by behavioral intention and perceived behavioral control (PBC), while attitude, subjective norm, and PBC can jointly influence the behavioral intention, and then indirectly influence behavior performance or maintenance [9]. In the constructs of TPB, attitude refers to the comprehensive evaluation of the target behavior, subjective norm refers to the behavior that significant others would like an individual to perform, and PBC refers to perceived difficulty and self-control in target behavior implementation. TPB was often used as a theoretical framework for illegal drug use in past studies [10]. TPB has shown satisfactory predictive power for behavior and behavioral intention [11], and TPB is suitable as the framework for illegal drug use prevention programs [12].

TPB could provide a framework for understanding students' drug-use behavior. However, it lacks specificity on how to make behavioral changes in the context of illegal drug use [13]. Life skills can act as critical tools to assist students in rejecting drugs. These skills enable students to translate knowledge and attitude into behavior, thereby improving self-confidence, self-efficacy, positive attitude, and behavior control. They also enhance students' ability to handle social influence [14]. A longitudinal study [15] found that life skills training was effective in reducing illegal drug use. A meta-analysis on a school-based drug-use prevention program indicated that life skills were a critical component of school-based adolescent drug prevention programs [16].

Health Literacy is defined in the Institute of Medicine report, as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions"[17]. Health literacy has received much attention in recent years. It is an important indicator of whether individuals can perform their health behaviors by obtaining, processing, and understanding basic health information and services [18]. The present study suggests that health literacy includes three components: basic/functional, communicative/interactive, and critical literacy [19]. According to Nutbeam, functional literacy refers to skills in reading and writing that enable students to function effectively in everyday situations. Interactive literacy refers to more advanced cognitive, social, and literacy skills that can be actively used to participate in everyday activities. It is also used to extract information and derive meaning from different communication forms, and apply new information to a changing environment [20]. Critical literacy refers to more advanced cognitive skills, which are used together with social skills to critically analyze information and acquire more control over life events and situations. A systematic review investigated the relationship between health literacy and health behaviors in adolescents. The results indicated that there is a meaningful relationship between health literacy and

adolescents' substance use behaviors [18]. It suggests that high health literacy potentially reduces substance use in adolescents.

The present study aimed to develop a drug-use prevention program incorporating health literacy to evaluate its effectiveness among junior high school students in Taiwan. We considered illegal drug-use intention as a proxy and direct variable to illegal drug-use behavior. Based on TPB, the drug-use intention could be strengthened by advancing students' attitudes, subjective norms, and perceived control. We hypothesized that their improved health literacy would contribute to a higher level of behavior intention to remain drug-free.

## **Methods**

### **Participants**

A quasi-experimental design was used to recruit participants. We invited 14 junior high schools to participate in the study through the local Department of Education in seven counties and cities. We recruited two schools in each county/city and randomly assigned them to experimental and comparison groups. We invited the health education teachers of the experimental schools to attend an orientation meeting and introduced the purpose and methods of the study. After obtaining the health education teacher's permission to participate, we invited students from two classes of these schools to enroll in the study. Students and their parents/guardians provided written consent forms. An identical procedure is carried out for the control school group. Students or parents who did not provide written consent were not included in the study. All students and parents/guardians were informed of their right to participate and were assured that students' health education grades were not contingent on participation. The final sample comprised 323 and 325 students in experimental and comparison groups, respectively.

### **Procedure and Program Delivery**

A flowchart outlining participant enrollment and assessments is presented in Figure 1. After selecting the seven experimental schools, the research team approached the principal and health education teacher of each school to explain the research purpose, method, and protocol. After obtaining permission to conduct the study, we delivered recruitment messages to invite students to participate in this study, and scheduled an orientation meeting to ensure that the health education teachers could fully understand the purpose of the study and the cooperation works. Subsequently, we provided a half-day workshop to introduce the drug-use prevention program (Table 1). The program was developed by a professional team including professionals in health promotion and health education, drug-use prevention professionals, nursing, and social workers. Teachers were strongly advised to use numerous interactive teaching methods including questions and answers, brain-storming, story-telling, case discussion, situational role-playing, game playing, watching an animated film, and to follow the discussion, value clarification, modeling, and skills practice exercises during the program implementation. To promote health literacy acquisition, we also provided program worksheets and a parent-child workbook to increase the potential practices of health

literacy in daily life. Animated films, E-games, case stories, worksheets, and role-playing were used to increase health literacy learning experiences.

Before program implementation, the relevant materials and worksheets were implemented in a junior high school as a pilot test to ensure their appropriateness. The program consisted of ten 45-minute sessions. The sessions were delivered in a health education class, morning study time, and during the class meeting time, which was arranged by the health education teacher and school administration. The 10 sessions were completed within six months. A structured self-reported questionnaire was administered to students at baseline and the end of the program by research staff blind to the students' group status. The principal investigator supervised the teachers during program implementation to ensure fidelity to program design. A regular monthly meeting was scheduled to support health education teachers' program delivery (Figure 2, 3).

## Instruments

The four TPB variables including attitude, subjective norm, PBC, and intention to not use illegal drugs were modified from the previous study with permission [15]. Demographic variables consisted of gender, parents'/guardians' education level, parenting style (authoritative vs. democratic), household status (living with both parents, living with a single parent, and others), and lifetime substance use (smoking, drinking, and betel nuts chewing).

Drug-use-related health literacy measures students' ability to access and understand information and resources of substance use prevention and apply them to make the right decisions to maintain and promote their health [20]. This scale consists of 14 Likert-type items, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Items appear as five groups based on the logic flow of five presented drug-use paragraphs, respectively.

A sample paragraph is "When the school had activities, Leo heard the discipline director say to all students: In recent years, Taiwan's illegal drug-use has escalated according to the news, and the average age of users has gradually decreased. Students should pay attention not to go to at-risk environments such as Internet cafes, billiards rooms, and home parties, to prevent exposure to illegal drugs in the community. If you have family and friends with a drug use problem who need help, please dial 0800-775-885." The three follow-up items after that paragraph are "If I were Leo, I would reduce my access to at-risk places;" "I know what kinds of places are 'at-risk environments' that may expose me to illegal drugs;" and "I know that the 'special line for successful detoxification' is 0800-770-885, and I will support my family and friends in need of those resources." The higher the score, the higher level of drug use-related literacy. The Cronbach's  $\alpha$  coefficient was 0.86 in this study. Exploratory factor analysis extracted only one factor, which could explain 53.86% of the variance.

Attitude was measured using four pairs of evaluative bipolar adjectives (pairs of opposite terms) to assess students' positive or negative evaluations and feelings regarding illegal drug use. Each item was scored on a Likert-type scale with a reversed score scale of 1–5, with higher scores indicating a higher

level of agreement on not using drugs. A sample item is “To me, drug use makes me feel joyless/joyful.” Exploratory factor analysis extracted only one factor and the factor could explain 75.47% of the variance. The Cronbach’s  $\alpha$  coefficient was 0.80 in this study.

Subjective norm was measured by five items using a five-point Likert-type scale. Each item was scored from 1 to 5 with higher scores indicating a higher level of significant others’ agreement on not using drugs. A sample item was “My teachers don't think I should use drugs.” Exploratory factor analysis extracted only one factor and the factor could explain 66.83% of the variance. The Cronbach’s  $\alpha$  coefficient was 0.93 in this study.

Perceived behavior control was measured using two items rated on a five-point Likert-type scale. Each item was scored from 1 to 5 with higher, scores indicating a higher level of students’ confidence in not using drugs. A sample item is “I am confident I won't use drugs.” Exploratory factor analysis extracted only one factor and the factor could explain 85.88% of the variance. Cronbach’s  $\alpha$  coefficient was 0.83 in this study.

We used the intention not to use drugs as a proxy measure for drug-free behavior because most students had not used any drugs before. The intention not to use drugs was measured using three items rated on a five-point Likert-type scale. Each item was scored from 1 to 5 with higher scores indicating a higher level of students’ agreement on not using drugs. A sample item is “I would not like to use drugs.” Exploratory factor analysis extracted only one factor, which could explain 86.48% of the variance. Cronbach’s  $\alpha$  coefficient was 0.93 in this study.

## **Statistical analysis**

SPSS version 22.0 was used for the Descriptive analyses of the demographic and outcome variables. Chi-square tests were used to compare percentages on the demographic status between the experimental and comparison groups. The group comparisons of outcome measures at baseline were determined by performing Hotelling’s  $T^2$  to avoid inflating type I error. A generalized estimating equation (GEE) was used to investigate the effects of time, groups, and their interactions on the outcome variables; GEEs enabled understanding the patterns of the time change and the effects at both the individual and group levels.

After the first-round analysis, we conducted further analysis to explore the intervention effects for the drug-use-related function, and communicative/interactive and critical health literacy. This further analysis is meaningful because we wanted to explore whether the life-skills training and 4 Fs (Facts, Feeling, Finding, and Future) teaching methods designed for health literacy were effective or not.

## **Results**

There were no statistically significant differences between groups in terms of participants’ gender, parents’/guardians’ education level, parenting style (authoritative, democratic, and others), household

status (living with both parents, living with a single parent and others), and substance lifetime use (smoking, drinking, and betel nuts chewing) (Table 2).

### **Improvements of outcome variables**

Results of paired *t*-tests indicated that drug-use health literacy and TPB-related variables improved after intervention for the experimental group. The paired *t*-tests and *p*-values of drug-use health literacy, attitude, subjective norm, perceived behavior control and behavioral intention were 7.03 ( $p < 0.001$ ), 2.43 ( $p = 0.015$ ), 2.16 ( $p = 0.032$ ), 2.46 ( $p = 0.014$ ), and 2.85 ( $p = 0.005$ ), respectively. Although the mean differences in health literacy and TPB-related variables between pre- and post-intervention slightly improved for the comparison group except for subjective norm (23.35 vs. 23.19), the results of the paired *t*-tests for the comparison group were all not significant.

Group differences in patterns of change over time are shown in Table 3. Results of GEE analyses indicated that the experimental group made significant improvements compared to the comparison group in health literacy and subjective norm scores but not for attitude, perceived behavior control, or behavioral intention. There was a significant group  $\times$  time interaction for health literacy and subjective norm. The experimental group showed an improvement in health literacy score (coefficient = 2.01, Wald  $\chi^2 = 20.39$ ,  $p < 0.001$ ) and subjective norm (coefficient = 0.61, Wald  $\chi^2 = 5.07$ ,  $p = 0.024$ ).

Group differences in patterns of change over time in Table 3 also indicated that the experimental group made significant improvements compared to the comparison group in term of the scores on functional (coefficient = 1.15, Wald  $\chi^2 = 27.39$ ,  $p < 0.001$ ) and critical literacy (coefficient = 0.63, Wald  $\chi^2 = 5.72$ ,  $p = 0.017$ ) but not for communication/interactive literacy (coefficient = 0.04, Wald  $\chi^2 = 0.27$ ,  $p = 0.602$ ).

## **Discussion**

Our findings supported the effectiveness of a school-based, drug-use prevention program integrating health literacy developed for and evaluated by junior high school students in Taiwan. Compared with a previous similar study [15], our study has better external generalizability because participants were recruited from seven counties/cities. The sampling method will enable researchers to make inferences about this population. Our findings provided evidence for combining a psychosocial construct and health literacy to prevent student drug use. A previous systematic review on health literacy in childhood and youth indicated health literacy in children and young people is described as comprising variable sets of key dimensions, each appearing as a cluster of related abilities, skills, commitments, and knowledge that enable an individual to approach health information competently and effectively and to make health-promoting decisions [21]. Our program content and teaching methods provided participants in the experimental group a cluster of drug-use-related knowledge, skills, beliefs, commitment norms not to use illegal drugs through interactive teaching methods. To the best of our knowledge, this is the first study to increase students' drug-use-related health literacy in Taiwan. The program was unique in its integration of the TPB and health literacy.

The participants in the experimental group made significant improvements compared to their counterparts of the comparison group after an intervention on functional and critical literacy, but not in communication/interactive literacy. The cultivation of communicative/interactive literacy takes time, and the duration of this program was limited. Therefore, it is not surprising that the communicative/interactive literacy improved, but it was not statistically significant. As long as the program duration is extended and the time devoted to peer interaction increased, the intervention effectiveness is promising. Drug-use-related health literacy is critical because it enabled students to acquire and understand information and resources regarding drug use prevention. Students can use this information and resources to make personal decisions to maintain and promote their drug-free status. Currently, the health literacy scales mainly focused on medical-related topics [22]. This program provided a new research direction to support the integration of health literacy into the drug-use prevention program and promote adolescent health. Recently, adolescents are more likely to be exposed to illegal drugs through internet access or social media. Adolescents may receive persuasive messages to convince them to initiate drug use when they interact with others on the Internet [23]. At this time, it is critical to have enough health literacy to teach students how to verify and assess a large amount of information available on the Internet or social media. It is also important to teach adolescents how to correctly and precisely discuss and communicate information about drug use, and make drug-free decisions, to reduce illegal drug use. Communication/interactive health literacy needs to be emphasized in future drug use prevention programs, and it needs a longer duration to avoid one-way indoctrination.

In addition to health literacy, this study also evaluated the effectiveness of students' attitudes, subjective norms, perceived behavior control, and behavioral intention. The results showed that the changes in attitude, subjective norms, perceived behavior control, and behavioral intention in the experimental group made significant improvements, which was in line with a previous study [24], especially the subjective norms, which showed significant improvement when compared to the comparison group. It suggested the study can successfully assist students to perceive significant others' norms that disapprove of illegal drug use. It is critical for junior high school students because most drug users initiate drug use during adolescence. A previous study explored the "Drugs-at-work" program designed for students' normative beliefs and found that it could effectively reduce students' intention to use drugs [25]. A positive normative belief in students can contribute to a positive climate of drug use rejection on campus.

There were also improvements in experimental students' attitude, perceived behavior control, and behavioral intention, but there was no significant difference when compared with the comparison group. The first possible reason was that students' baseline scores were surprisingly high, which led to limited room for improvement in the post-test, similar to a ceiling effect (a ceiling effect is said to occur when a high proportion of participants) in a study have maximum scores on the observed variable [26]. The second possible reason was that there was only one health education session per week for students in grades 1 to 9 in Taiwan, and drug use content was included as an essential component in the health education curriculum. The component emphasized increasing students' anti-drug knowledge, attitude, and refusal skills. Participants in the comparison group also benefited from learning in a regular health education class and revealed slight improvements on outcome variables. The third possible reason was

that more sessions were needed and the study design lacked a booster session. For example, the previous drug-use prevention program consisted of 12 sessions [27] and even implemented a booster intervention after the end of the program [15]. A booster intervention has proven to enhance intervention effectiveness, so it might merit implementation in future prevention program promotion. A booster intervention can make students review the critical components of the prevention program, and improve on an insufficient past drug education. Furthermore, some psychosocial variables, such as attitude, perceived behavior control, and behavior intention might require a long time to be improved. The previous study also revealed that the prevalence of illicit drug use among adolescents tended to increase with age [5], which indicated the necessity of continuing to promote drug-use prevention programs in junior high schools. If there is a booster intervention, it is very likely to prolong the intervention effect and prevent a student from using illegal drugs.

Integrating health literacy into a theory-based drug-use prevention program is effective. Program components delivered by digital animated files and E-games can increase students' interest in learning, strengthen interactions between teachers and students during the teaching process, and reduce the burden on teacher's preparation time. The study provides an evidence-based drug-use prevention program for junior high school students with a focus on health literacy. It is believed that increasing the students' anti-drug health literacy will benefit their future life and have a higher probability of reducing drug use.

## **Conclusion**

Study results demonstrated the effectiveness of a drug-use prevention program on health literacy and subjective norm by integrating the Theory of Planned Behavior and health literacy. These results can support the future implementation of similar programs for junior high school students on a larger scale.

## **Abbreviations**

TPB: theory of planned behavior; GEE: generalized estimating equation; PBC: perceived behavioral control

## **Declarations**

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## Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Authors' contributions

JLG & LCL were responsible for the study conception and design. JLG, LCL, HPH & CMH obtained funding. JLG supervised the study. HPH & JYL provided administrative and material support. HPH & CYL performed the statistical analyses. CMH & LCL made critical revisions to the paper for important intellectual content. All authors read and approved the final manuscript.

## Declarations

### Ethics approval and consent to participate

The study protocol was approved by the research ethics committee of National Taiwan University. All the participants signed informed consent before participating in the study.

### Consent for publication

Not applicable.

### Competing interests

The authors have no competing interests to declare.

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## Tables

**Table 1 Learning objectives, digital educational materials, and outcomes variables**

<b>Session</b>	<b>Learning objectives</b>	<b>Digital educational materials*</b>	<b>Outcome variables</b>
1	I Understand substance abuse and illegal drugs I Critical thinking skills	Critical thinking-do not harm	I Health literacy-critical literacy I Life skills – critical thinking
2	I Recognize the various effects of illegal drugs I Recognize common new types of drugs	Search illegal drug information	I Anti-drug attitude I Health literacy-interactive literacy
3	I Recognize common causes of illegal drug use I Decision-making skills	The temptation of beauty	I Health literacy-interactive literacy I Life skills-decision making
4	I Recognize risk factors and specific methods to reduce risk factors I Identify illegal drug users	Looking back on the initiation of drug use E-game: The human puzzle	I Perceived behavioral control I Anti-drug attitude
5	I Identify high-risk situations I Effective rejection techniques	Refusal skills- Stand up for your position E-game: Be careful! E-game: Refusal skill practices	I Perceived behavioral control I Life skills-refusal skills I Health literacy-critical literacy
6	I Liability for illegal drug use I Cultivate the spirit of the rule of law	Stop today	I Perceived behavioral control I Anti-drug attitude
7	I Recognize protective factors and specific methods to increase protective factors	Classmates can help!	I Perceived behavioral control
8	I Self-stress review I Relief skills	Stressful pot. E-game: A memory test	I Perceived behavioral control I Life skills-coping with stress
9	I Know the resources for assistance and abstinence I Learning advocacy skills	What we want to say in those years. E-game: Our new anti-drug proposition	I Subjective norms I Life skills-negotiation skills

Session	Learning objectives	Digital educational materials*	Outcome variables
10	I General review and strengthening of life skills  I Summary of required drug-use knowledge and skills	Drug Q&A Challenge	I Life skills  I Perceived behavior control

\*Each session has a PPT related to outcome variables

**Table 2 Participants of experimental and comparison groups at baseline**

	Experimental Group (N=323)		Comparison Group (N=325)		$\chi^2$	<i>p</i>
	N	%	N	%		
Gender <sup>a</sup>					0.97	0.325
Male	169	52.48	158	48.62		
Female	153	47.52	167	51.38		
Parents'/Guardians' Education Level <sup>a</sup>					1.16	0.560
9 Years	60	19.42	61	19.55		
12 Years	115	37.22	128	41.03		
College & Graduate School	134	43.36	123	39.42		
Parenting Style <sup>a</sup>					3.66	0.160
Authoritative	34	10.63	50	15.63		
Democratic	277	86.56	263	82.19		
Others	9	2.81	7	2.18		
Household status					0.76	0.684
Living with both parents	244	75.55	245	75.38		
Living with a single parent	63	19.50	68	20.92		
Others	16	4.95	12	3.70		
Substance lifetime use					2.76	0.097
Yes	79	24.46	62	19.08		
No	244	75.54	263	80.92		

<sup>a</sup> Some participants in the experimental and comparison group did not answer this question

**Table 3 Results of GEE <sup>a</sup> analyses for outcome variables**

	Coefficient	SE	Wald $\chi^2$	<i>P</i>
Drug-use related health literacy				
Group (Experimental group) <sup>b</sup>	-1.25	0.48	6.78	0.009
Time (Post-test) <sup>c</sup>	0.35	0.31	1.29	0.257
Group (Experimental) Time (Post-test) <sup>d</sup>	2.01	0.45	20.39	<b>&lt;0.001</b>
Drug use related functional literacy				
Group (Experimental) <sup>b</sup>	-0.69	0.22	9.84	0.002
Time (Post-test) <sup>c</sup>	0.30	0.14	4.50	0.034
Group (Experimental) Time (Post-test) <sup>d</sup>	1.15	0.22	27.39	<b>&lt;0.001</b>
Drug use related communicative/interactive literacy				
Group (Experimental) <sup>b</sup>	-0.02	0.08	0.05	0.821
Time (Post-test) <sup>c</sup>	0.06	0.06	0.86	0.353
Group (Experimental) Time (Post-test) <sup>d</sup>	0.04	0.08	0.27	0.602
Drug use related critical literacy				
Group (Experimental) <sup>b</sup>	-0.55	0.27	4.23	0.040
Time (Post-test) <sup>c</sup>	0.13	0.18	0.49	0.485
Group (Experimental) Time (Post-test) <sup>d</sup>	0.63	0.27	5.72	<b>0.017</b>
Attitude				
Group (Experimental) <sup>b</sup>	0.35	0.21	2.63	0.105
Time (Post-test) <sup>c</sup>	0.29	0.19	2.29	0.130
Group (Experimental) Time (Post-test) <sup>d</sup>	0.08	0.24	0.12	0.727
Subjective norm				
Group (Experimental) <sup>b</sup>	-0.90	0.24	14.52	<b>&lt;0.001</b>
Time (Post-test) <sup>c</sup>	-0.12	0.16	0.61	0.433
Group (Experimental) Time (Post-test) <sup>d</sup>	0.61	0.27	5.07	<b>0.024</b>
Perceived behavior control				

	Coefficient	SE	Wald $\chi^2$	<i>p</i>
Group (Experimental) <sup>b</sup>	-0.28	0.10	7.91	0.005
Time (Post-test) <sup>c</sup>	0.04	0.07	0.31	0.580
Group (Experimental) Time (Post-test) <sup>d</sup>	0.15	0.10	2.12	0.145
Behavioral intention				
Group (Experimental) <sup>b</sup>	-0.15	0.14	1.22	0.269
Time (Post-test) <sup>c</sup>	0.14	0.09	2.25	0.134
Group (Experimental) Time (Post-test) <sup>d</sup>	0.17	0.14	1.42	0.233

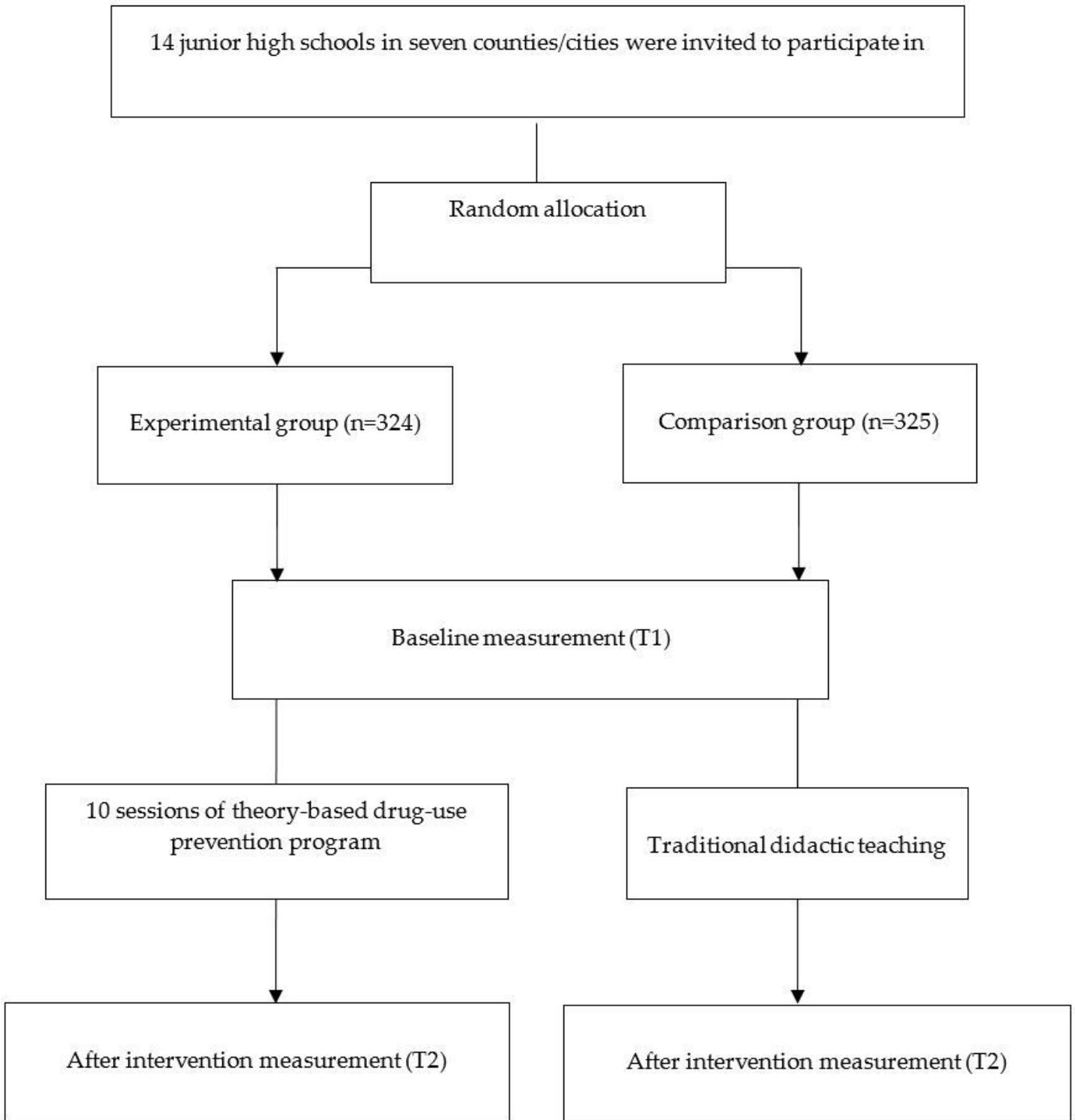
<sup>a</sup> GEE: generalized estimating equation.

<sup>b</sup> Reference group (group): comparison group.

<sup>c</sup> Reference group (time): pretest.

<sup>d</sup> Reference group (grouptime): comparison group pretest.

## Figures



**Figure 1**

Flowchart of Participant Enrollment and Assessment

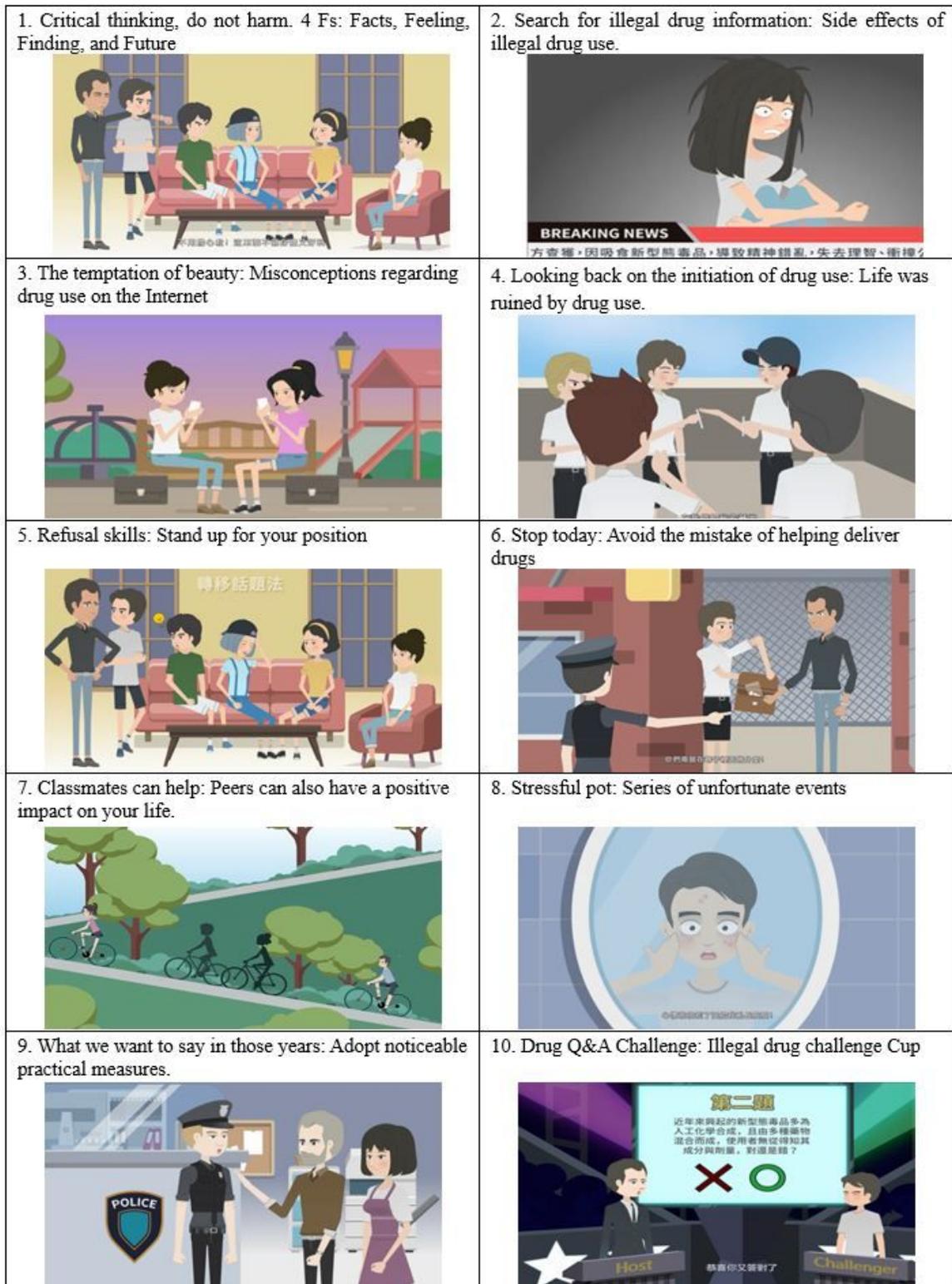


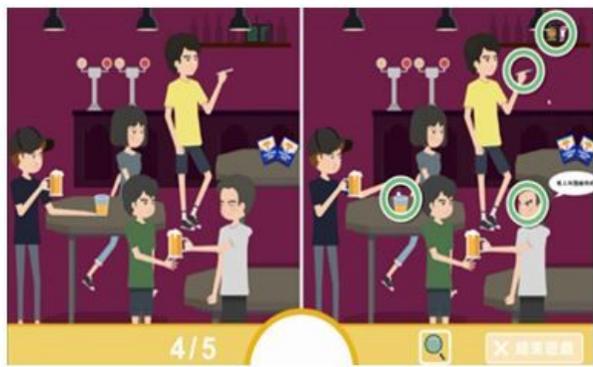
Figure 2

Digital educational materials: 10 animated E-games

1. The human puzzle: Illegal drugs can affect physical and psychological appearances.



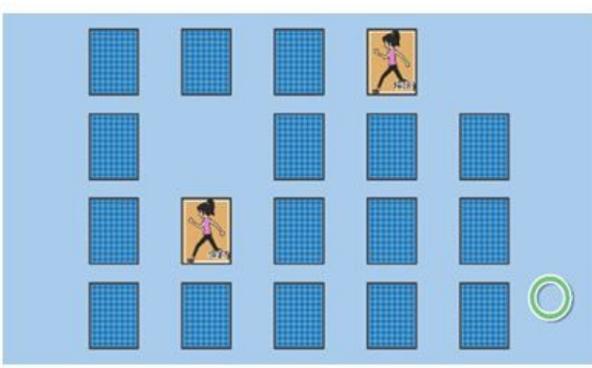
2. Be careful! Warnings: Hazard identification in the environment.



3. Refusal skill practice: Create your own story.



4. A memory test: Understand how to cope with stress



5. Our new anti-drug proposition: The advocacy statement



Figure 3

Digital educational materials: 5 E-games