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Application of Social Cognitive Theory as a Predictor of Quitting E-Cigarette Use among College Students

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ABSTRACT

Background: Social Cognitive Theory was selected as the framework of this study because it can be used to explain, prevent, or reduce risky behaviors such as e-cigarette use. This study aimed to analyze and predict the behavior of quitting e-cigarettes through social cognitive theory among students.
Subjects and Method: This study was conducted in October-November 2024 with a sample of 200 students. The study was a cross-sectional study with study subjects selected using the fixed disease sampling technique. The dependent variable was the behavior of quitting using e-cigarettes. And the independent variables were knowledge, self-regulation, outcome expectation, self-efficacy, and observational learning.
Results: Quitting e-cigarettes was directly influenced by self-efficacy (b= 1.63; CI 95%= 0.93 to 2.33; p< 0.001) and outcome expectation (b= 0.82; CI 95%= 0.15 to 1.50; p= 0.017). Self-efficacy was directly influenced by knowledge (b= 0.94; CI 95%= 0.32 to 1.57; p= 0.003). Likewise, the outcome expectation was influenced by knowledge (b= 0.90; CI 95%= 0.28 to 1.53; p= 0.004). Knowledge was influenced by observational learning (b= 1.28; CI 95%= 0.65 to 1.92; p< 0.001). And self-regulation was influenced by the decision to quit using e-cigarettes (b=0.94; CI 95%= 0.37 to 1.51; p=0.001).
Conclusion: This study concludes that constructs in Social Cognitive Theory can be used as a predictor of quitting e-cigarettes.

Keywords: electric smoking cessation, smoking cessation, social cognitive theory.

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BACKGROUND

Smoking is often encountered in the community. Not only in Indonesia, but all over the world, the fact is that the habit of smoking is difficult to eliminate and is rarely recognized as a bad habit (Kesehatan Masyarakat et al., 2014). An e-cigarette is a device that uses an electrically powered coil

to heat an e-liquid solution to produce an inhaled aerosol. Although the original device resembles a cigarette, many of today's models resemble tech gadgets, pens, and other items. E-liquids often contain flavorings and additives dissolved in a solution of propylene glycol or glycerin, the main carriers used, and usually, but not always, contain nicotine. Therefore, there are two types of electronic cigarettes used in addition to electronic cigarettes and electronic pipes, known as Electronic Nicotine Delivery Systems (ENDS) and sometimes Electronic Non-Nicotine Delivery Systems (ENNDS). Nevertheless, nicotine and other harmful compounds commonly found in e-cigarette emissions are also harmful to users and non-users who are directly exposed to aerosol (Jane Ling et al. 2023).

Based on the 2018 Basic Health Research (Riskesdas), the proportion of e-cigarettes smoked by people under the age of 10 years in Indonesia in 2018 is 2.8%, the most e-cigarette users are in the age group of 10-14 years old as much as 10.6%, the age group of 15-19 years old as 10.5%, and the age group of 20-24 years as much as 7%. According to Garindra Kartasasmita (2019), the Head of the Organization Division of the Personal Vaporizer Association (APVI) revealed that until 2018 alone, the number of e-cigarette users in Indonesia had reached 1.2 million people. And in 2019, it is estimated that vapor users will increase to more than 1 million users, including tobacco smokers who switch to be electric smokers (Nova Diana et al., 2020).

Several factors influence the use of e-cigarettes, including the social environment. Second, because of the assumption that *vapes* can be used as an alternative to eliminate addiction to cigarettes. Third, its uniqueness lies in the fact that it produces steam (resembling thick smoke) in a manner that can be formed in such a way. So, in addition to being used as an alternative for cigarette addicts, *vapes* have also begun to be used as a forum for expressing self-creativity. Fourth, there are a variety of flavors that give a different and new sensation to smokers who use this type of cigarette (Satria et al., 2021).

Currently, the most common use of vapes is among young people of productive age. Most of them are college students who have a high chance of trying vaping, they think that vaping is less addictive. However, a recent study using Electronic Cigarette Dependence Index (ECDI) method discovered that the presence of nicotine in electronic cigarettes or vapes can be addictive, along with the frequency of their use (Hayati et al., 2020). A study conducted at Alfaisal University, Saudi Arabia, showed that male students are more likely to use e-cigarettes than female students. Many college students who used e-cigarettes previously did not smoke, and only a small percentage of them reported that e-cigarettes helped to quit smoking. (Habib et al., 2020).

The short-term impact of e-cigarette exposure on healthy adults increases airway resistance and reduces nitric oxide in exhaled air (fractional exhaled nitric oxide, FeNO) E-cigarettes and tobacco cigarettes have similar particle deposition patterns in the lungs, and nicotine is quickly absorbed and delivered to the brain. Preliminary pharmacological reports discover that nicotine delivery is significantly slower in e-cigarettes compared to regular cigarettes. The use of combustible cigarettes among young adults is a concern because smoking is associated with lung, mouth, stomach, kidney, bladder, and cervical cancers, as well as an increased risk of heart and lung

diseases such as emphysema and chronic bronchitis (Thirion-Romero et al. 2019).

The WHO has been a pioneer in discussing e-cigarettes at the International Framework Convention on Tobacco Control (FCTC) meeting on September 6, 2014 by advising its member states in formulating policies to limit e-cigarettes, efforts to minimize health risks, and prohibiting claims that e-cigarettes can be healthy. At the meeting, it was also explained that e-cigarettes are a threat to health and can be a gateway to becoming smokers (Wirajaya et al.,2024).

Social cognitive theory is based on the concept of reciprocal determinism, that a person's behavior is influenced by personal and environmental factors (Greer et al. 2022). Theoretical constructions are considered to be aligned with the nuances of vaping behavior, and the framework incorporates the social and environmental context of the behavior. These factors can be illustrated in the context of vaping with cognitive constructions of self-efficacy, perceptions of e-cigarettes, and social norms. Personal factors include constructs such as outcome expectations, or individual perceptions of behavioral consequences. A person's environment includes the physical, social, and regulatory environment in which such behavior is likely to occur. Social cognitive theory was selected as the framework of this study because it can be used to explain, prevent, or reduce risky behaviors such as e-cigarette use (Rahman et al.,2023).

Based on the above background, this study aims to examine and analyze the behavior of quitting using e-cigarettes in students who use e-cigarettes using the perspective of knowledge factors, self-efficacy, self-regulation, outcome expectations, learning observation, and strengthening of social cognitive theory among students in the city of Surakarta. This topic has not been widely studied comprehensively in the theory of Social Cognitive Theory. This study aimed to analyze and predict the behavior of quitting e-cigarettes through social cognitive theory among students.

SUBJECTS AND METHOD

1. Study Design

This was a cross sectional sudy conducted in Surakarta, Central Java, Indonesie, in October-November 2024.

2. Population and Sample

The study population was college students. A sample of 200 college students was selected using a fixed disease sampling.

3. Study Variables

The dependent variable was quitting smoking of e-cigarettes. The independent variables were knowledge, self-regulation, outcome expectation, self-efficacy, and observational learning.

4. Operational Definition of Variables

Quitting e-cigarette behavior is an individual who intends to stop using e-cigarettes with cigalike, vape mode, vape pod, and iqos.

Knowledge is the result of interaction between individuals and their environment, especially through the process of observation and social learning.

Outcome expectation is a person's belief in the consequences of his/her actions.

Self-regulation is a person's ability to regulate, control, and adjust behavior to fit desired goals.

Self-efficacy is a person's belief or confidence in his or her ability to do something, achieve a goal, or overcome an obstacle.

Observational Learning is the process of learning by observing others and imitating their behavior or speech.

5. Study Instruments

The instrument used in this study was a questionnaire. The questionnaire was

designed by the researchers based on existing theories to measure variables, namely knowledge, self-regulation, self-efficacy, outcome expectations, and observational learning. The questionnaire had been tested for validity and reliability.

6. Data analysis

The researcher conducted univariate analysis to see the frequency distribution and characteristics of the study subjects, as well as bivariate and multivariate analyses to see the relationship between independent variables and dependent variables. The research data was analyzed using pathway analysis.

7. Research Ethics

The ethical aspects in this study include informed consent, anonymity, and data confidentiality. The ethical clearance was obtained from the Health Research Ethics Committee of Dr. Moewardi Hospital, with the number: 2.576/X/HREC/2024.

RESULTS

1. Sample Characteristics

Description of the characteristics of the study subject using univariate analysis. This univariate analysis aims to determine the number and percentage of the characteristics of the study subjects. The data on the sample characteristics were gender, age, educational institution, level of education, and status of e-cigarette use.

Table 1 Results of univariate analysis of categorical data

Sample Characteristics	Category	Frequency (n)	%
Gender	Male	112	56
	Female	88	44
Age	< 23 years	99	49.5
	≥ 23 years	101	50.5
Educational institutions	Public University	70	35
	Private University	130	65
Education	Associate's Degree	6	3
	Bachelor's Degree	166	83
	Master's/Doctor's Degree	28	14
Status of e-cigarette use	E-Cigarette User	100	50
	Former smoker	100	50

Table 1 shows that the study subjects consisted of 112 male university students (56%), and 88 female university students (44%). Furthermore, 99 students (49.5%) were < 23 years old and 101 students (50.5%) were ≥ 23 years old. A total of 70 students (35%) studied at public universities, and as many as 130 students (65%) studied at private universities. Based on the status of the education level, most of the study subjects were Bachelor's Degree students with a total of 166 students (83%), 28 study subjects were Master's and Doctor's Degree students (14%) and the least, 6 students (3%) were Associate's Degree students. Based on the status of e-cigarette use, 100 students (50%) were e-cigarette users and 100 students were former users (50%).

Table 2. Results of univariate analysis of continuous data

Variable	Mean	SD	Minimum	Maximum
Knowledge	7.59	0.12	0	8
Outcome expectation	6.85	0.10	0	7

Variable	Mean	SD	Minimum	Maximum
Self-Regulation	6.56	0.14	0	7
Self-Efficacy	5.35	0.77	0	6
Observational Learning	8.01	0.17	0	8

Table 2 showed that mean of knowledge was 7.59 (SD= 0.12), outcome expectation was 6.85 (SD= 0.10), self-regulation was 6.56 (SD= 0.14), self-efficacy was 5.35 (SD= 0.77), and observational learning was 8.01 (SD= 0.17).

2. Bivariate Analysis

Table 3 showed that the likelihood of quitting e-cigarettes increased with knowledge (b= 0.65; 95% CI= 0.36 to 1.20; p= 0.168), outcome expectation (b= 0.29; 95% CI= 0.15 to 0.53; p= 0.001), self-regulation (b= 0.40; 95% CI= 0.22 to 0.70; p= 0.001), self-efficacy (b= 0.15; 95% CI= 0.08 to 0.30; p= 0.001), and observational learning (b= 1.92; 95% CI= 1.10 to 3.40; p= 0.023).

Table 3. Results of bivariate analysis of variables influencing quitting e-cigarette

Variabel	Path Coefficient (b)	95%CI		p
		Lower Limit	Upper Limit	
Knowledge	0.65	0.36	1.20	0.168
Outcome expectation	0.29	0.15	0.53	0.001
Self-Regulation	0.40	0.22	0.70	0.001
Self-Eficacy	0.15	0.08	0.30	0.001
Observational Learning	1.92	1.10	3.40	0.023

3. Multivariate analysis

Path analysis was used to determine the variables that affect the behavior of quitting using e-cigarettes. The path analysis in this study used STATA 13 and obtained the following results

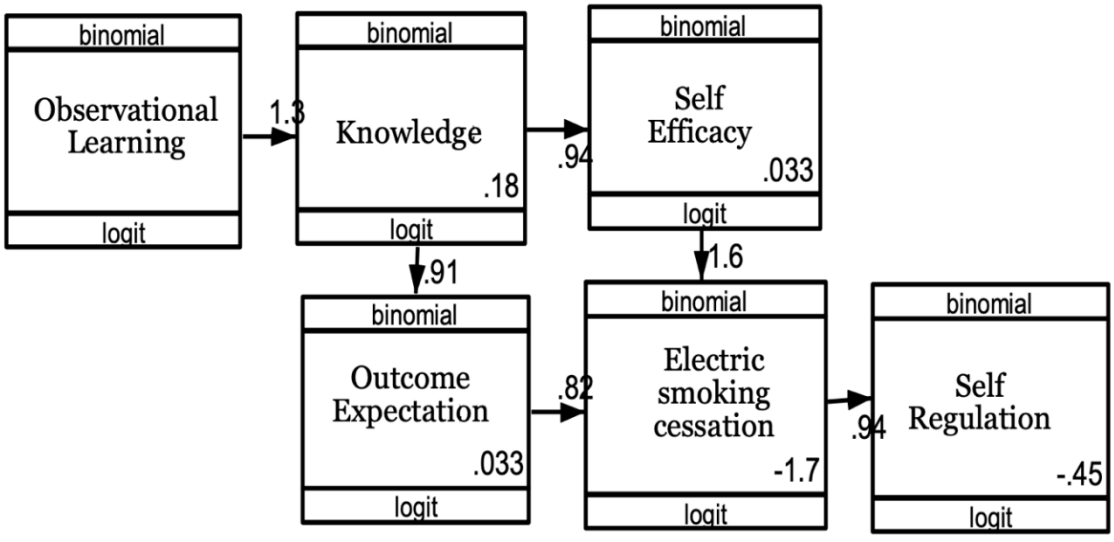

Figure 1. Path analysis of the application of Social Cognitive Theory in the decision to quit using e-cigarettes

Figure 1 shows that the decision to stop using e-cigarettes was directly influenced by outcome expectation and self-efficacy. The decision to quit using e-cigarettes was

indirectly influenced by observational learning and knowledge about the dangers of using e-cigarettes. The decision to stop using e-cigarettes was positively related to self-regulation to stop using e-cigarettes.

Table 4 shows that self-regulation was directly affected by decision to stop smoking using e-cigarretes (b= 0.94; 95% CI= 0.37 to 1.51; p=0.001). Decision to quit smoking using e-cigarretes directly increased by outcome expectation (b= 0.82; 95% CI= 0.15 to 1.50; p= 0.017) and self-efficacy (b= 1.63; 95% CI= 0.93 to 2.33; p <0.001).

Table 4 showed that knowledge increased outcome expectation (b= 0.90; 95% CI= 0.28 to 1.53; p= 0.004) and self-efficacy (b= 0.94; 95%CI= 0.32 to 1.57; p= 0.003). Observational learning increased knowledge (b= 1.28; 95% CI= 0.65 to 1.92; p< 0.001).

Table 4. Results of Path Analysis on the Application of Social Cognitive Theory in the Decision to Quit Using E-Cigarettes

Dependent variable	Independent variables	Path coefficient (b)	95%Cl		p
			Lower limit	Upper limit	
Direct effect					
Self-regulation	←Quitting e-cigarettes	0.94	0.37	1.51	0.001
Quitting smoking	←Self-efficacy	1.63	0.93	2.33	<0.001
using e-cigarettes	←Outcome expectation	0.82	0.15	1.50	0.017
Indirect effect					
Outcome expectation	←Knowledge	0.90	0.28	1.53	0.004
Self-efficacy	←Knowledge	0.94	0.32	1.57	0.003
Knowledge	←Observational learning	1.28	0.65	1.92	<0.001
N Observation =200					
Log likelihood = -615.50583 AIC=1253 BIC= 1289					

DISCUSSION

1. Decision to Quit Smoking and Self-Regulation

This study found that there was positive association between the decision to quit smoking using e-cigarretes and self-regulation. Self-regulation or self-control is a key mechanistic factor in addictive behaviors and is implicated in the inability to stop using cigarettes and other addictive substances (Bickel et al., 2017; Weinberger et al., 2021).

Individuals have a higher motivation to quit when their desire is lower than usual and when their will is stronger than usual. Greater motivation to quit will be associated with a higher perceived self-regulation, and discover that people report more motivation to quit at times when the urge was strong (Veilleux et al., 2023).

Self-regulation refers to a person's ability to manage cognitive, motivation, and emotional resources to act in accordance with their long-term goals. Self-regulation has been linked to many health-risking behaviors, such as smoking behavior. Contexts related to smoking were evaluated for their association with momentary self-regulation. Momentary difficulty in access-ing cigarettes, momentary caffeine intake, and momentary self-control in smoking are all positively associated with persistence, suggesting these external and internal contexts involve the persistence aspect of individual self-regulation (Scherer et al., 2022).

2. Self-Efficacy and Decision to Quit Smoking

This study showed that self-efficacy directly increased the likelihood of deciding to quit smoking using e-cigarettes. These findings are consistent with Rahman et al. (2023), who reported that self-efficacy was significantly associated with the intention to quit and should be a major component of vaping cessation support programs. Previous study has demonstrated that greater self-efficacy is linked to both quitting attempts and successful quitting outcomes. However, quitting vaping appears to be more likely among dual users who continue to smoke compared to exclusive vapers. In fact, vape users tend to have lower self-efficacy when their intention to quit is compared with that of smokers or dual users, suggesting that exclusive vapers may exhibit different cognitive processes related to quitting.

This study aligns with the findings of Kurnia (2020), which showed that individuals with high self-efficacy tend to have strong motivation to quit smoking, while those with moderate self-efficacy exhibit only sufficient motivation. Conversely, individuals with low self-efficacy were found to have low motivation to quit.

The study discovers that those who more strongly self-identify with other e-cigarette users are more likely to have more negative attitudes toward quitting smoking, lower self-efficacy, and lower intentions to quit smoking, compared to those who less strongly self-identify with other e-cigarette users. Positive subjective norms related to e-cigarettes, toward e-cigarettes, and social identification with other e-cigarette users can also interact with e-cigarette-related social media use to influence a person's self-efficacy and intention to quit (Phua, 2019).

3. Outcome Expectation and Decision to Quit Smoking

This study showed that outcome expectation increased the likelihood of deciding to quit using e-cigarettes. These findings are consistent with Greer (2022), who argued that higher outcome expectations can lead to greater recognition of the benefits of quitting vaping. However, higher scores on the Health Risk subscale are unfavorable, as they indicate lower outcome expectations regarding the negative health impacts of e-cigarretes.

4. Knowledge and Outcome Expectation

This study found that outcome expectations were positively associated with knowledge. These results are in line with Aslam (2014), who reported that outcome expectations are significantly related to knowledge sharing. Outcome expectation refers to the belief that specific actions or behaviors will lead to certain outcomes, and this belief serves as a key motivator for engaging in those actions or behaviors. Outcome expectation should be classified into two main dimensions, namely positive and negative outcomes expectations related to smoking. In this study, SOES is developed based on two construct dimensions. The EFA findings provide support for the two-factor structure and for the hypothesis behind the SOES construct of positive outcome expectations and negative outcome expectations (Chen et al., 2015)

5. Knowledge and Self-Efficacy

This study showed a positive association between knowledge and self-efficacy. Good knowledge can foster self-efficacy or strong confidence to engage in better behaviors. Overall, self-efficacy for items related to e-cigarettes is lower, but nearly half of physicians express confidence regarding their knowledge of e-cigarettes and their ability to answer patient questions. Pulmonologists and primary health care providers have similar abilities when it comes to

talking to patients about smoking, knowledge of medications to quit smoking, and the ability to help patients quit smoking (Nickels et al., 2017). Self-efficacy to refuse smoking may be an important mediator of quitting smoking. It targets theory-based mediators, especially self-efficacy for quitting smoking, may be important to influence smoking cessation rates in adolescents (Scheinfeld et al., 2019).

6. Observational Learning and Knowledge

This study found that observational learning increased alongside knowledge. Observational learning plays a crucial role in knowledge acquisition through social interaction. According to Bandura's Social Cognitive Theory, individuals can learn by observing others' behaviors and the consequences of those behaviors. This process involves four key components: attention, retention, reproduction, and motivation (Firmansyah et al., 2022).

Smoking hazard warning messages had a positive association with the level of knowledge about cigarettes, and the level of knowledge about cigarettes had a positive association with the interest in quitting smoking. Knowledge of e-cigarettes is associated with the current use of e-cigarettes and conventional cigarettes, and knowledge of the hazards and addiction of e-cigarettes among e-cigarette users is currently low (Al-Sawalha et al., 2021)

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CONFLICT OF INTEREST

There was no conflict of interest in this study.

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