Predictors of Adolescents' Commitment to Preventing Smartphone Addiction: The Role of Cognitive Factors and Self-Determination

Abstract

Introduction: Smartphone addiction among adolescents has become a growing public health concern due to its association with poor academic performance, sleep disturbances, and mental health problems. This study applied the Health Promotion Model (HPM) and Self-Determination Theory (SDT) to identify cognitive and motivational factors associated with adolescents' commitment to preventing smartphone addiction. **Methods:** A cross-sectional study was conducted among 307 senior high school students from five public schools in Malang City, Indonesia, selected using cluster random sampling. Data were collected through validated questionnaires adapted from the HPM framework, the Basic Psychological Needs Scale, and the Smartphone Addiction Scale–Short Version. Structural Equation Modeling (SEM) using SmartPLS was employed to examine the relationships among perceived barriers, self-efficacy, competence, autonomy, relatedness, and commitment to prevent smartphone addiction. **Results:** Competence was the strongest positive predictor of commitment to prevent smartphone addiction ($\beta = 0.488$, $p < 0.001$), followed by relatedness ($\beta = 0.213$, $p < 0.001$). Self-efficacy showed a significant negative association with commitment ($\beta = -0.124$, $p = 0.020$). In contrast, autonomy ($\beta = 0.016$, $p > 0.05$) and perceived barriers ($\beta = -0.047$, $p > 0.05$) were not significant predictors. The measurement model demonstrated satisfactory validity and reliability, while the structural model showed acceptable fit (SRMR = 0.069) and explained 45.2% of the variance in commitment ($R^2 = 0.452$). **Conclusion:** Competence, relatedness, and self-efficacy significantly influence adolescents' commitment to preventing smartphone addiction. Strengthening psychological competence, social connectedness, and self-regulatory capacities may enhance the effectiveness of school-based smartphone addiction prevention programs.

Keywords: Smartphone addiction; adolescents; commitment to action; self-determination theory; self-efficacy; health promotion model

Introduction

Smartphone use among adolescents has grown exponentially over the past decade, transforming from a communication tool into an indispensable part of daily life. In 2023, approximately 78% of people aged 10 years and older worldwide owned a mobile phone, with smartphone ownership among adolescents aged 14–18 years reaching nearly 90% [1]. While smartphones offer substantial benefits for learning and social connectivity, excessive and uncontrolled use has increasingly been recognized as a form of behavioral addiction. Smartphone addiction is characterized by compulsive use, loss of control, withdrawal symptoms, and significant interference with daily functioning [2]. A meta-analysis of studies conducted between 2005 and 2021 estimated the global prevalence of smartphone addiction at 26.99%, with adolescents and young adults identified as the most vulnerable groups [3]. Furthermore, studies indicate that approximately 20–30% of adolescents and young adults across multiple countries exhibit signs of smartphone addiction [4]. In Indonesia, the situation is also concerning. According to the 2024 Indonesian Internet Penetration Survey released by APJII, the national internet penetration rate reached 79.5%. Among individuals born between 1997 and 2012, the proportion accounted for 34.40% of internet users. Studies among Indonesian high school students have reported smartphone addiction prevalence rates ranging from 48.8% to 76.0%, indicating that this phenomenon warrants urgent public health attention [5].

The consequences of smartphone addiction during adolescence are wide-ranging and multidimensional. A narrative review synthesizing evidence from 25 systematic reviews and meta-analyses confirmed that excessive smartphone use is consistently associated with psychosocial, behavioral, and academic challenges, as well as sleep disturbances and mental health symptoms [6]. From a physical health perspective, prolonged smartphone use has been significantly associated with sleep deprivation and poor sleep quality among adolescents [7]. Psychologically, smartphone addiction is linked to elevated levels of anxiety, depression, loneliness, and reduced self-esteem [4]. Academically, compulsive smartphone use disrupts concentration, reduces study time, and is consistently associated with declining academic achievement [8]. Moreover, during adolescence—a critical developmental stage characterized by identity formation, self-regulation, and social competence development—smartphone addiction may hinder healthy psychosocial growth [9]. These multifaceted impacts position smartphone addiction as a cross-cutting public health issue that requires preventive interventions rather than merely reactive responses.

Despite the growing body of literature on smartphone addiction, significant gaps remain in understanding its prevention. Previous studies have predominantly focused on identifying risk factors associated with addiction itself, such as age, gender, social media use patterns, and family dysfunction, rather than examining the psychological and motivational factors that influence adolescents' commitment to preventing addictive behavior [4]. Furthermore, existing prevention frameworks have largely been applied in isolation, drawing either on cognitive-behavioral approaches or motivational theories, without integrating both into a unified explanatory framework [10]. A rapid systematic review of digital well-being interventions for young people found that most existing programs lack a strong theoretical foundation and fail to address the motivational mechanisms underlying behavior change [11]. Critically, the construct of commitment to preventive action, a proximal determinant of health behavior in the Health Promotion Model (HPM), has rarely been operationalized as an outcome in smartphone addiction research. This gap limits the development of theoretically grounded and practically actionable prevention programs.

This study addresses these gaps by integrating two complementary theoretical frameworks: the Health Promotion Model (HPM), proposed by Pender et al., and Self-Determination Theory (SDT), developed by Deci and Ryan. The HPM posits that health-promoting behavior is shaped by individual cognitions, particularly perceived barriers and self-efficacy, which culminate in commitment to action as an immediate antecedent of behavioral change [12]. Previous research has demonstrated that self-efficacy plays a significant mediating role in interventions targeting mobile phone addiction, underscoring its importance as a modifiable cognitive factor [10]. In contrast, SDT proposes that fulfillment of the three basic psychological needs—competence, autonomy, and relatedness—is essential for sustaining intrinsic motivation toward health-protective behaviors [13]. Empirical evidence suggests that when these psychological needs remain unmet, adolescents may turn to smartphones as a compensatory mechanism, thereby increasing the risk of addiction [14]. A systematic scoping review further confirmed that adolescent digital media use can both support and thwart these three psychological needs, reinforcing the relevance of SDT in the context of digital

addiction [15]. The integration of HPM and SDT is theoretically compelling: HPM explains the cognitive pathways through which adolescents develop intentions to prevent addiction, whereas SDT explains the motivational mechanisms that sustain those intentions. To date, no published study has simultaneously examined HPM and SDT constructs as joint predictors of adolescents' commitment to preventing smartphone addiction, particularly within the Indonesian context.

Therefore, this study aimed to analyze the influence of perceived barriers, self-efficacy, competence, autonomy, and relatedness on adolescents' commitment to preventing smartphone addiction among senior high school students in Malang City, Indonesia. The findings are expected to provide an evidence-based theoretical foundation for developing an integrated smartphone addiction prevention model in subsequent phases of this research program, as well as practical guidance for school-based health promotion interventions targeting adolescent digital behavior.

Methods

Study Design and Setting

This study employed a cross-sectional analytical design to examine the relationships among cognitive factors, self-determination constructs, and adolescents' commitment to preventing smartphone addiction. A cross-sectional design was selected because it is appropriate for identifying predictors of health behavior at a single point in time and is widely used in public health and behavioral research. The study was conducted between October and December 2025 in five public senior high schools or *Sekolah Menengah Atas* (SMA) in Malang City, East Java, Indonesia. Malang City was selected as the study setting because it is a major educational center in East Java with high levels of smartphone use among adolescents.

Population, Sample, and Sampling Technique

The target population consisted of all students enrolled in Grades X–XII at public senior high schools in Malang City during the study period. The inclusion criteria were: (1) active enrollment in one of the participating schools; (2) ownership of a personal smartphone; and (3) willingness to participate by providing written informed consent. Students who were absent on the day of data collection or submitted incomplete questionnaires were excluded from the analysis.

Cluster sampling was employed because the sampling units were naturally occurring groups (school classes) rather than individual students. Five public senior high schools in Malang City were randomly selected from the list of schools registered with the Malang City Education Department. Within each school, classes were randomly selected, and all students present in the selected classes were invited to participate. This approach enhanced data collection efficiency while maintaining representativeness across school settings.

A total of 307 students participated in the study, satisfying the recommended sample size requirements for Structural Equation Modeling (SEM), which generally range from 100 to 300 participants depending on model complexity [16]. Specifically, the minimum required sample size was determined using the ten-times rule of thumb commonly applied in PLS-SEM, whereby the minimum sample size equals ten times the largest number of structural paths directed at a single endogenous construct in the model. In this study, the endogenous construct Commitment received the largest number of incoming paths (five, from perceived barriers, self-efficacy, competence, autonomy, and relatedness), yielding a minimum required sample size of 50 respondents. The achieved sample of 307 respondents therefore substantially exceeded this minimum threshold, providing adequate statistical power for the PLS-SEM analysis.

Study Constructs

The study included one outcome construct and five predictor constructs derived from the Health Promotion Model (HPM) and Self-Determination Theory (SDT). The operational definitions and measurements of all constructs are presented in Table 1.

Table 1. Operationalization of study constructs based on HPM and SDT frameworks

Construct	Theoretical Basis	Type	Definition / Operationalization	Scale
Commitment to prevent	HPM — Pender et al. (2015) [12]	Dependent	Adolescent's intention and resolve to undertake specific	Likert 1–5

smartphone addiction			preventive actions against smartphone addiction	
Perceived barriers	HPM — Pender et al. (2015) [12]	Independent	Perceived obstacles that hinder the adolescent from limiting or controlling smartphone use	Likert 1–5
Self-efficacy	HPM — Pender et al. (2015), Bandura (1997) [12,17]	Independent	Perceived confidence in one's ability to successfully control smartphone use and resist addictive behaviors	Likert 1–5
Competence	SDT — Deci & Ryan (2000) [13]	Independent	The sense of effectiveness and mastery in managing one's own digital behavior	Likert 1–5
Autonomy	SDT — Deci & Ryan (2000) [13]	Independent	The degree to which smartphone use is self-determined and internally motivated rather than externally pressured	Likert 1–5
Relatedness	SDT — Deci & Ryan (2000) [13]	Independent	The sense of meaningful connection with others in real-world settings that reduces compensatory smartphone dependence	Likert 1–5

Instruments and Measures

Data were collected using two categories of instruments: (1) a validated instrument for measuring smartphone addiction and (2) self-developed questionnaires for measuring HPM and SDT constructs that underwent validity and reliability testing prior to data collection.

Smartphone addiction

Smartphone addiction was assessed using the Indonesian version of the Smartphone Application-Based Addiction Scale (SABAS), which was validated by Nurmala et al. (2022) among Indonesian university students. The Indonesian version demonstrated satisfactory linguistic validity and preliminary reliability, supporting its use in the Indonesian context [18]. The scale consists of six items that assess problematic smartphone application use and is scored using a six-point Likert scale.

HPM constructs (perceived barriers, self-efficacy, and commitment)

Perceived barriers, self-efficacy, and commitment to preventing smartphone addiction were measured using self-developed questionnaires based on Pender's Health Promotion Model [12]. Instrument items were developed from the theoretical definitions of each construct, translated into Bahasa Indonesia, and evaluated through expert review for content validity prior to pilot testing. Responses were recorded using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The instruments demonstrated acceptable validity (item-total correlation > 0.30) and reliability (Cronbach's $\alpha > 0.70$) [19].

SDT constructs (competence, autonomy, and relatedness)

The three basic psychological needs—competence, autonomy, and relatedness—were measured using self-developed questionnaires grounded in Self-Determination Theory [13] and adapted to the context of adolescent smartphone use. Each subscale was independently evaluated prior to the main study, with items designed to capture the extent to which adolescents experienced satisfaction of these psychological needs in their daily digital behaviors. Responses were recorded using a five-point Likert scale. The instruments met the same validity and reliability criteria applied to the HPM constructs (item-total correlation > 0.30; Cronbach's $\alpha > 0.70$).

Data Collection Procedure

Data were collected using self-administered questionnaires distributed directly to participants in selected classrooms. Prior to data collection, permission was obtained from the

principals of each participating school, and data collection schedules were coordinated with classroom teachers. Participants received information regarding the study objectives, voluntary participation, confidentiality, and data protection procedures. Written informed consent was obtained before questionnaire administration. Questionnaires were completed and collected during the same session to maximize response rates and minimize missing data.

Data Analysis

Data were analyzed using a three-stage approach consisting of univariate, bivariate, and multivariate analyses. All analyses were conducted using SmartPLS 4 software.

Univariate analysis

Descriptive statistics were calculated for all study constructs, including frequencies, percentages, means, and standard deviations. The prevalence of smartphone addiction and the distribution of commitment levels were presented using frequency and percentage tables.

Bivariate analysis

Pearson correlation analysis was conducted to examine the relationships between the predictor constructs (perceived barriers, self-efficacy, competence, autonomy, and relatedness) and the outcome construct (commitment to preventing smartphone addiction). Statistical significance was determined using an alpha level of 0.05.

Multivariate analysis: PLS-SEM

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to evaluate both the measurement model and the structural model simultaneously. PLS-SEM was selected because it is suitable for exploratory and predictive research, performs well with relatively small sample sizes, and accommodates complex models involving latent constructs [16,20].

The measurement model was evaluated using outer loadings (>0.70), Average Variance Extracted (AVE >0.50), Composite Reliability (CR >0.70), and the Heterotrait–Monotrait ratio (HTMT <0.85). The structural model was assessed using path coefficients, coefficient of determination (R^2), predictive relevance (Q^2), and standardized root mean square residual (SRMR). Statistical significance was determined using a bootstrapping procedure with 5,000 resamples and a significance level of $p < 0.05$.

Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki and received ethical approval from the Health Research Ethics Committee, Faculty of Public Health, Universitas Airlangga (Ethical Clearance No. 181/EA/KEPK/2025). All participants and their parents or legal guardians (for participants younger than 18 years) provided written informed consent before participation. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without penalty. All data were anonymized and stored securely, with access restricted to the research team. No personal identifiers were included in the analysis or reporting of findings.

Results

Background Characteristics

The age distribution of respondents ranged from 15 to 18 years. The largest proportion of respondents was aged 16 years (38.1%), followed by 17 years (33.6%), 15 years (21.2%), and 18 years (7.2%). The mean age score was 2.27 (SD = 0.875) based on the coded age categories. Of the 307 respondents, 60.3% were female and 39.7% were male.

Regarding parental education, 57.7% of respondents reported that their parents had attained a college degree, while 36.2% reported a high school education, 3.9% a junior high school education, and 2.3% an elementary school education. The mean parental education score was 3.49 (SD = 0.683). For parental income, 59.3% of respondents reported a monthly family income above IDR 3,507,693, whereas 40.7% reported income below this threshold. The mean income score was 1.59 (SD = 0.492).

Measurement Model Assessment

Prior to testing the structural model, the measurement model was evaluated for convergent validity and discriminant validity following the two-step approach recommended by Hair et al. (2021) [16].

Convergent validity was assessed using outer loadings, Average Variance Extracted (AVE), and Composite Reliability (CR). As presented in Table 2, all outer loadings exceeded the threshold of 0.70, ranging from 0.735 (Possesses skills) to 0.905 (Autonomy in smartphone use). All AVE values were above 0.50 (range: 0.559–0.802), indicating that each construct explained more than half of the variance of its indicators. All CR values exceeded 0.79 (range: 0.792–0.893), surpassing the recommended threshold of 0.70 and demonstrating satisfactory construct reliability. Although Cronbach's alpha values for Relatedness (α = 0.607), Self-Efficacy (α = 0.693), and Perceived Barriers (α = 0.691) were slightly below 0.70, Composite Reliability was used as the primary reliability indicator, consistent with recommendations for PLS-SEM models containing a limited number of indicators per construct. Overall, convergent validity was established for all six constructs.

Table 2. Measurement model: outer loadings, reliability, and convergent validity

Construct / Indicator	Loading	T-stat	p-value	α	ρA	CR	AVE
Commitment to Prevention							
Activity focus	0.805	34.892	<0.001	0.850	0.854	0.893	0.625
Healthy habits	0.745	24.142	<0.001				
Self-control ability	0.771	26.140	<0.001				
Intention control	0.835	42.264	<0.001				
Wise time management	0.794	27.273	<0.001				
Autonomy — SDT1							
Full control	0.887	—a	—a	0.754	0.757	0.890	0.802
Autonomy in use	0.905	—a	—a				
Competence — SDT2							
Able to manage time	0.797	30.504	<0.001	0.810	0.820	0.875	0.637
Able to manage	0.808	27.097	<0.001				
Possesses skills	0.735	17.413	<0.001				
Self-confidence	0.849	43.454	<0.001				
Relatedness — SDT3							
Relationships with friends	0.737	15.005	<0.001	0.607b	0.607	0.792	0.559
Family relationships	0.747	15.429	<0.001				
Happier	0.758	18.406	<0.001				
Self-Efficacy							
Reorganize time	0.872	26.260	<0.001	0.693b	0.693	0.867	0.765
Able to self-manage	0.877	27.343	<0.001				
Perceived Barriers							
Distracted focus	0.896	—a	—a	0.691b	0.705	0.866	0.763
Learning disruptions	0.851	—a	—a				

Note. α = Cronbach's Alpha; ρA = rho_A; CR = Composite Reliability; AVE = Average Variance Extracted. All outer loadings ≥ 0.70; all AVE ≥ 0.50; all CR ≥ 0.79. Bootstrapping: 5,000 subsamples. [b] α slightly below 0.70; CR was used as the primary reliability indicator as recommended for PLS-SEM.

Discriminant validity was evaluated using the Fornell–Larcker criterion (Fornell & Larcker, 1981) and the Heterotrait–Monotrait Ratio of Correlations (HTMT; Henseler et al., 2015), as presented in Table 3. The square root of AVE for each construct exceeded the inter-construct correlations in the corresponding row and column. Additionally, all HTMT values were below the recommended threshold of 0.85, ranging from 0.070 to 0.752.

Table 3. Discriminant validity: Fornell-Larcker criterion (diagonal) and HTMT (above diagonal)

Construct	1	2	3	4	5	6
1. Commitment	0.791	0.352	0.752	0.653	0.438	0.338

2. Autonomy (SDT1)	0.283	0.896	0.531	0.527	0.086	0.070
3. Competence (SDT2)	0.632	0.409	0.798	0.681	0.456	0.415
4. Relatedness (SDT3)	0.470	0.352	0.471	0.747	0.327	0.230
5. Self-efficacy	−0.337	−0.021	−0.345	−0.211	0.875	0.381
6. Perceived barriers	−0.259	0.042	−0.319	−0.153	0.263	0.874

Note. Diagonal values represent the square root of AVE (Fornell–Larcker criterion). Values above the diagonal represent HTMT ratios. All HTMT values were below 0.85, supporting discriminant validity.

Structural Model Assessment

Collinearity among predictor constructs was assessed using the Variance Inflation Factor (VIF). All inner VIF values ranged from 1.187 to 1.696, indicating no multicollinearity concerns. The structural model explained 45.2% of the variance in adolescents' commitment to preventing smartphone addiction (R^2 = 0.452; adjusted R^2 = 0.443). Predictive relevance assessed through blindfolding (omission distance D = 7) yielded Q^2 = 0.276. Model fit assessment indicated an SRMR value of 0.069 and an NFI value of 0.673. Path coefficients, confidence intervals, and effect sizes are presented in Table 4.

Table 4. Structural model: path coefficients, effect sizes, and predictive relevance

Path	β	T-stat	p-value	CI 2.5%	CI 97.5%	f^2	Effect Size	Decision
H1: Autonomy (SDT1) → Commitment	0.016	n.s.	n.s.	—	—	0.000	None	Rejected
H2: Competence (SDT2) → Commitment	0.488	8.599	<0.001	0.370	0.590	0.238	Medium	Supported
H3: Relatedness (SDT3) → Commitment	0.213	3.910	<0.001	0.116	0.328	0.060	Small	Supported
H4: Self Efficacy → Commitment	−0.124	2.328	0.020	−0.241	−0.023	0.021	Small	Supported
H5: Perceived Barriers → Commitment	−0.047	n.s.	n.s.	—	—	0.003	None	Rejected

Note. β = standardized path coefficient; CI = percentile confidence interval; n.s. = not significant. Bootstrapping was performed using 5,000 subsamples. Effect size criteria: <0.02 = none, 0.02–0.15 = small, 0.15–0.35 = medium, >0.35 = large.

Path Analysis Results

Competence (SDT2) had a significant positive effect on commitment to preventing smartphone addiction (β = 0.488, T = 8.599, p < 0.001; 95% CI [0.370, 0.590]). Relatedness (SDT3) also demonstrated a significant positive effect (β = 0.213, T = 3.910, p < 0.001; 95% CI [0.116, 0.328]). Self-Efficacy showed a significant negative effect on commitment (β = −0.124, T = 2.328, p = 0.020; 95% CI [−0.241, −0.023]).

In contrast, Autonomy (SDT1) did not significantly predict commitment to preventing smartphone addiction (β = 0.016). Similarly, Perceived Barriers did not demonstrate a significant effect on commitment (β = −0.047). Overall, three predictors—Competence (SDT2), Relatedness (SDT3), and Self-Efficacy—were significantly associated with commitment to preventing smartphone addiction, whereas Autonomy (SDT1) and Perceived Barriers were not significantly associated with this outcome.

Discussion

This study examined predictors of adolescents' commitment to preventing smartphone addiction using an integrated framework based on the Health Promotion Model (HPM) and Self-Determination Theory (SDT). The model explained 45.2% of the variance in commitment, indicating that cognitive and motivational factors play an important role in shaping adolescents' preventive intentions. Among the five predictors examined, competence, relatedness, and self-efficacy were significantly associated with commitment to preventing smartphone addiction, whereas autonomy and perceived barriers were not.

Competence emerged as the strongest predictor of commitment to preventing smartphone addiction. This finding is consistent with Self-Determination Theory, which identifies competence as a fundamental psychological need that supports self-regulation and goal-directed behavior [21]. Adolescents who perceive themselves as capable of managing smartphone use, organizing their time, and controlling digital habits may be more willing to commit to preventive behaviors. Previous studies have similarly shown that competence satisfaction is associated with stronger behavioral regulation, lower impulsivity, and healthier technology-use patterns [22,23]. The relatively large effect of competence in the present study suggests that prevention programs should prioritize skill-building approaches, including time-management training, digital self-regulation strategies, and opportunities for adolescents to develop mastery in controlling smartphone use.

Relatedness was the second significant predictor of commitment. According to SDT, relatedness reflects the need to feel connected, valued, and supported by others [21]. Adolescents who reported stronger relationships with family members and peers demonstrated greater commitment to preventing smartphone addiction. This finding aligns with previous evidence showing that social connectedness and family support are protective factors against problematic smartphone use [24,25]. In Indonesia, where family relationships and collective values play an important role in adolescent development, supportive interpersonal relationships may reinforce healthy behavioral norms and encourage responsible smartphone use [5,26]. These findings suggest that family- and peer-based interventions may strengthen preventive commitment by fostering supportive social environments rather than focusing solely on individual behavior change.

A notable finding was the negative association between self-efficacy and commitment to preventing smartphone addiction. This result differs from the assumptions of the Health Promotion Model, which generally predicts a positive relationship between self-efficacy and health-promoting behavior [12]. One possible explanation is that adolescents with high confidence in their ability to manage smartphone use may perceive less need to formally commit to preventive actions. Such a pattern resembles overconfidence effects described in health behavior research, whereby individuals who believe they are capable of controlling a behavior may underestimate their vulnerability and therefore show reduced motivation to engage in preventive planning [17,27]. Given the widespread normalization of smartphone use among adolescents, confidence in self-management may not necessarily translate into commitment to prevention. This finding highlights the need for future studies to explore the interaction between self-efficacy, risk perception, and motivation in explaining digital health behaviors.

Contrary to expectations, autonomy did not significantly predict commitment to preventing smartphone addiction. Although SDT proposes that autonomy supports internalized motivation [21], autonomy alone may be insufficient to influence preventive commitment in the context of smartphone use. Smartphones often provide opportunities for self-expression, entertainment, and personal choice, allowing adolescents to satisfy autonomy needs through the technology itself [23]. Consequently, greater autonomy may not necessarily encourage adolescents to reduce or regulate smartphone use. Furthermore, autonomy among adolescents is shaped by family, school, and cultural influences. In collectivist societies such as Indonesia, behavioral decisions are often embedded within social relationships rather than being driven solely by individual preferences, which may explain the limited role of autonomy observed in this study.

Perceived barriers were also not significantly associated with commitment. Although the relationship was negative as anticipated, its effect was negligible. This finding may indicate that adolescents do not perceive the adverse consequences of smartphone addiction as sufficiently serious to influence preventive intentions. Previous research suggests that perceived barriers are more likely to affect health behavior when individuals also perceive a high level of susceptibility and severity regarding a health threat [12]. Given the widespread integration of smartphones into educational, social, and recreational activities, adolescents may view smartphone-related difficulties

as normal aspects of daily life rather than barriers requiring behavioral change. Future research should consider broader barriers, including fear of missing out (FoMO), peer expectations, and social pressures related to continuous connectivity.

Several limitations should be acknowledged. The cross-sectional design precludes causal inference, and all data were collected through self-report measures, which may be subject to reporting bias. The study was conducted in public senior high schools in Malang City, limiting generalizability to other regions and age groups. In addition, some constructs were measured using a limited number of indicators, which may have restricted construct breadth. Future longitudinal studies incorporating objective measures of smartphone use are recommended to further validate the proposed model.

Conclusion

This study demonstrated that competence, relatedness, and self-efficacy are significant predictors of adolescents' commitment to preventing smartphone addiction. Among these factors, competence emerged as the strongest predictor, highlighting the importance of adolescents' perceived ability to regulate and manage their smartphone use. Relatedness also contributed positively, emphasizing the role of supportive family and peer relationships in fostering preventive commitment. In contrast, autonomy and perceived barriers were not significant predictors in the present model.

These findings support the integration of the Health Promotion Model and Self-Determination Theory in understanding preventive commitment toward smartphone addiction among adolescents. School-based prevention programs should prioritize competence-building strategies, strengthen supportive social relationships, and promote realistic awareness of smartphone-related risks. Such approaches may enhance adolescents' motivation and commitment to engage in healthier digital behaviors. Future research should employ longitudinal designs and broader populations to further examine the causal pathways underlying smartphone addiction prevention.