



A model proposal explaining the influence of smartphone addiction related factors on high school students' academic success

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Abstract

An exploratory sequential mixed-method study is designed to develop and test a comprehensive model explaining the relationships between factors associated with smartphone addiction and high school students' academic achievement. Involving two main phases of qualitative and quantitative, focus group discussions with high school students and interviews with teachers were conducted in the first phase, both to decide on the factors and to reveal the relationships between the factors in the model. According to the qualitative results, the most important factors were found as social media usage, cyberloafing, academic procrastination, external and internal academic locus of control. Then, a hypothesis model involving these factors was developed to explain high school students' academic achievement. Obtained from 410 high school students, quantitative data are collected online by the use of some scales measuring the factors included in the model. Using the path analysis method, the hypothesis model was tested, and it was observed that the model fit the data well. As a result, the factors that most influence academic achievement were found as duration of social media usage, external academic locus of control, smartphone addiction, internal academic locus of control, academic procrastination, and cyberloafing respectively. The uniqueness of the presented model in this research is believed to lie in its holistic perspective on the relationships between smartphone addiction and related factors, and their effects on academic achievement. Looking from a big picture, this model is expected to provide a roadmap for practitioners and decision-makers in terms of how to improve students' academic achievement.

Keywords Academic achievement · Smartphone addiction · Duration of social media use · Academic procrastination · Academic locus of control · Path analysis

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1 Introduction

Smartphones have become an indispensable part of daily life due to their various functionalities for information gathering, communication, education, and entertainment (Al-Khlaiwi et al., 2020; Haug et al., 2015). These functionalities have made smartphones increasingly popular, with new features being added (Altundağ & Bulut, 2017; Suresh et al., 2021; Yang et al., 2021). Recent developments suggest that these technologies can affect information exchange, social relationships, and the learning process (Shtepura, 2018) and may pose a potential risk factor, particularly for adolescents prone to excessive use and addiction to smartphones (Huang et al., 2021). Furthermore, potential risk factors associated with smartphone use and/or addiction, such as fatigue, stress, headaches, concentration issues (Ikeda & Nakamura, 2014; Khan, 2008), depression (Zhang et al., 2023), difficulties in concentration (Prasad et al., 2017), loneliness and weak social relationships (Yayan et al., 2019), poor sleep quality (Jniene et al., 2019), and low academic achievement (Baert et al., 2020; Felisoni & Godoi, 2018; Han & Yi, 2019; Kates et al., 2018; Kibona & Mgaya, 2015; Yang et al., 2019) are of concern. In fact, the adverse effects of smartphone use on educational performance may lead to broader societal consequences (Baert et al., 2020). Moreover, it has been reported that adolescents may be more vulnerable and susceptible to the excessive use of technology and smartphones (Ding, 2016). In this context, it is considered important to conduct studies that comprehensively examine the effects of smartphone addiction on the academic achievement of high school students.

While various studies have been conducted on factors influencing academic achievement (Ismail et al., 2018; Pérez et al., 2012; Sarier, 2016; Széll, 2013), more research is needed to understand how and to what extent factors related to smartphone addiction, which has come to the forefront with technological development, affect academic achievement. Academic achievement is considered an essential criterion in determining the quality of human resources (Ali et al., 2009), making it crucial to identify the factors that predict it (Becerra et al., 2019). In the relevant field, various factors that can affect students' academic performance are discussed, including internal and external factors (Cachia et al., 2018), social, psychological, economic, environmental, and personal factors (Mushtaq & Khan, 2012), motivation, self-efficacy, parental attitudes, behaviors, and socioeconomic levels (Sarier, 2016), technology usage, interaction processes, student characteristics, and class characteristics (Ismail et al., 2018). Correlational studies among various factors, such as academic achievement and smartphone usage (Baert et al., 2020; Kibona & Mgaya, 2015), smartphone addiction (Chaudhury & Tripathy, 2018; Khan et al., 2019; Oswal et al., 2020; Ozer, 2020; Rathakrishnan et al., 2021; Sunday et al., 2021), social media usage (Alamri et al., 2020; Giunchiglia et al., 2018; Lau, 2017), academic procrastination (Batool, 2020; Goroshit, 2018; Kim & Seo, 2015), academic locus of control (Anderson et al., 2005; Arslan & Akın, 2014; Bahçekapılı & Karaman, 2020; Uguak et al., 2007), and cyberloafing (Ravizza et al., 2017; Şenel et al., 2019; Wu et al., 2018) are all noteworthy. The following section includes a literature review that explains the relationships among the factors mentioned here.

2 Theoretical background

With the widespread use of smartphones, excessive usage and even addiction have become significant global issues (Sunday et al., 2021). Smartphone addiction can be characterized by the frequent use of smartphones for social networking and entertainment purposes, short periods of time between the last use before sleep and the first use after waking up, and excessive usage throughout the day (Haug et al., 2015; Lin et al., 2014). When smartphone usage interferes with daily life activities, it can lead to problematic or addictive behavior (Samaha & Hawi, 2016). In light of research in this field, uncontrolled, excessive, problematic, or compulsive smartphone usage can be considered among addictive behaviors (Bian & Leung, 2015; Cha & Seo, 2018; Haug et al., 2015; Marciano et al., 2021; Sunday et al., 2021; van Deursen et al., 2015).

Excessive smartphone usage can affect individuals' physical, mental, and social well-being, as well as their educational and professional lives (Amez & Baert, 2020). Indeed, findings from various studies in the literature have shown that academic achievement is affected by problematic smartphone use and/or smartphone addiction (Ahmed et al., 2020; Amez & Baert, 2020; Baert et al., 2020; Chaudhury & Tripathy, 2018; Grant et al., 2019; Khan et al., 2019; Kibona & Mgaya, 2015; Rathakrishnan et al., 2021; Sunday et al., 2021). When examining the literature, various studies have shown that the relationship between smartphone addiction and academic achievement can be negative (Amez & Baert, 2020; Kates et al., 2018; Sunday et al., 2021).

One of the most common purposes of students' smartphone usage is social media use (Dos, 2014). Social media platforms, which are used for building social relationships and sharing text, image, and audio content, also include instant messaging applications (Giunchiglia et al., 2018). Similar to smartphone usage, social media use is widespread among students (Lau, 2017). Especially, adolescents with a need for socialization tend to access their social media accounts via smartphones frequently (Enez Darcin et al., 2016; Minaz & Çetinkaya Bozkurt, 2017). Indeed, in the relevant literature, it has been emphasized that social media use can increase smartphone addiction (Alkın et al., 2020; Işık & Kaptangil, 2018; Roberts et al., 2014; Sözbilir & Dursun, 2018). Furthermore, it has been reported that social media use is among the determinants of smartphone addiction (Yanık & Özçiçek, 2021). Additionally, duration of social media usage classes has been found to be related to problematic phone usage (Rozgonjuk et al., 2018). Several studies have shown that using social media on mobile phones can negatively impact academic performance (Domoff et al., 2020; Giunchiglia et al., 2018). In this field, negative and significant relationships have been found between students' academic achievements and their general use of social networks (Abu-Snieneh et al., 2020; Azizi et al., 2019; Kumcağız et al., 2019; Paul et al., 2012).

One of the factors related to smartphone addiction is cyberloafing, defined as the unintended use of the internet at work or in a school setting (Wu et al., 2018). Moreover, the use of the internet, social media, and/or smartphones for non-academic purposes in learning environments (such as classrooms or study spaces)

can be seen as a cyberloafing behavior (Gezgin & Sarsar, 2020; Junco & Cotten, 2012; Şenel et al., 2019; Şumuer et al., 2018; Yaşar & Yurdugül, 2013). The use of smartphones during class, as well as non-task-related technology use, has been shown to distract students' attention, which results in hindering their learning (Heflin et al., 2017). Additionally, cyberloafing behaviors in the classroom can reduce the time spent on learning and negatively impact performance (Ravizza et al., 2017). In fact, a study with university students have shown a negative relationship between cyberloafing behaviors in the classroom and academic performance (Wu et al., 2018). In another study with university students, it was found that students with low academic achievement may be more inclined to engage in cyberloafing behavior (Şumuer et al., 2018). Furthermore, the results of a meta-analysis showed that using the phone more during studying have more detrimental effects to learning and academic performance (Sunday et al., 2021).

Another factor related to smartphone addiction is academic procrastination, which refers to delaying or not completing academic tasks (Gafni & Geri, 2010; Steel, 2007). For today's students, when academic tasks are performed on smartphones, unwanted behaviors such as browsing the internet, engaging in social media, and watching videos can often lead to time wasting, problematic internet use, and procrastination of academic tasks (Aznar-Díaz et al., 2020). Therefore, academic procrastination is not a desirable behavior in terms of academic performance since it can reduce the time and effort students allocate to academic tasks (Gareau et al., 2019; Kim & Seo, 2015). Indeed, the results of various studies in the literature have shown that academic procrastination can have a negative impact on students' academic performance (Batool, 2020; Gareau et al., 2019; Goroshit, 2018; Kim & Seo, 2015; Kutlu & Demir, 2017; Sop, 2020; Üztemur, 2020).

Another factor related to smartphone addiction is academic locus of control. Locus of control represents an individual's belief in the accomplishment of a task (Arslan & Akin, 2014). Academic locus of control is related to how students attribute their successes or failures to certain factors (internal or external) (Hasan & Khalid, 2014). In other words, the tendency to associate success and/or failure with oneself, efforts, personal characteristics, and responsibilities indicates an internal academic locus of control, while explaining success and failure with external factors suggests a dominant external academic locus of control (Akin, 2007; Jain et al., 2018).

In the relevant field, positive relationships between external locus of control and smartphone addiction (Meena et al., 2021), cyberloafing (Blanchard & Henle, 2008), or internet addiction (İskender & Akin, 2010) have been found. However, one study found that individuals with a high internal locus of control may better control inappropriate smartphone use at inappropriate times, while those with a high external locus of control may struggle to control smartphone use at inappropriate times (Li et al., 2015). In a study with Chinese university students, excessive use of the WeChat social network application was shown to be associated with a higher external locus of control (Hou et al., 2017). On the other hand, university students with a high internal locus of control may have fewer online interactions, be less dependent on the internet, and take less risk in sharing information on social networks (Ahadzadeh et al., 2021). In light of all these studies,

it can be suggested that an external locus of control may be related to addictive behaviors (smartphone addiction, social media addiction, internet addiction, cyberloafing, game addiction), and an internal locus of control may mitigate the risk of addiction (Hou et al., 2017; Lloyd et al., 2019; Meena et al., 2021; Ye & Lin, 2015).

In the literature, it has been shown that locus of control can affect academic procrastination (Batubara, 2017), and an external academic locus of control has been positively related to academic procrastination (Albayrak et al., 2016; Özer & Altun, 2011). However, the locus of control has been identified as one of the factors affecting the time students spend studying (Bodill & Roberts, 2013). Bahçekapılı & Karaman (2020) found that an external academic locus of control had a direct negative effect on university students' academic achievements. On the other hand, Abid et al. (2016) found that university students with an internal locus of control had higher learning performance than those with an external locus of control. Furthermore, Jain et al. (2018) found that participants with an internal academic locus of control were more advantageous in terms of academic performance compared to participants with an external academic locus of control.

In conclusion, although various studies have been conducted on factors related to smartphone addiction, the number of studies that examine the relationships between these factors and their effects on academic achievement is quite limited. Moreover, research explaining the relationships between smartphone addiction and academic achievement in a comprehensive model is rare, with most studies focusing on university students (Oswal et al., 2020; Rathakrishnan et al., 2021; Sunday et al., 2021), while the number of studies with high school students who use smartphones intensively is relatively limited. Nevertheless, Haug et al. (2015) found that smartphone addiction in adolescents is higher compared to young adults aged 19 and above. In fact, even a short period without smartphone use may be intolerable for adolescents (Thomé, 2018). Additionally, it has been reported that adolescents are more attracted to smartphones, and they are considered a high-risk group for smartphone addiction (Cha & Seo, 2018). As a result, smartphone addiction is a risk factor that can negatively affect academic performance in adolescents (Domoff et al., 2020). Therefore, more research is needed to examine the effects of smartphone addiction on the academic achievements of high school students (Ng et al., 2017; Zou et al., 2019). This research, being a mixed-methods study and explaining the relationships between smartphone addiction and academic achievement in a comprehensive model, is expected to shed light on studies in the field. Furthermore, it provides a holistic view of the factors related to smartphone addiction that can affect students' academic performance. The model developed in this study, with both qualitative and quantitative stages, can provide a more comprehensive framework. This model is expected to provide a roadmap for practitioners and decision-makers in terms of the relationship between smartphone addiction and academic achievement. Therefore, the development of a model that can offer a comprehensive perspective on the factors related to smartphone addiction that affect the academic achievements of high school students is believed to make a significant contribution to the literature.

3 Research objectives

The primary aim of this research is to develop a model that explains the impact of factors related to smartphone addiction on the academic performance of high school students. To achieve this objective, the following research questions will be addressed:

1. What are the opinions of high school students and teachers regarding the factors that affect academic success in relation to smartphone addiction?
2. What are the factors that affect the academic performance of high school students in relation to smartphone addiction?
3. To what extent does the model encompassing the direct and indirect relationships between factors related to smartphone addiction and the academic performance of high school students explain academic success and other internal factors?

4 Method

Employing a mixed-methods approach, this study was designed in the form of an exploratory sequential design consisting of successive qualitative and quantitative phases (Creswell & Creswell, 2018). Thus, this study consists of consecutive qualitative and quantitative phases. In the first phase, factors affecting academic achievement related to smartphone addiction were identified, along with the relationships among these factors, using qualitative data. As shown in Fig. 1, the initial phase of the research involved a literature review, followed by one-on-one interviews with teachers and focus group interviews with students, aiming to identify the factors related to smartphone addiction that explain academic success and to reveal the relationships between these factors. Following the analysis of qualitative data, factors related to smartphone addiction were identified. Both qualitative findings and models from the literature were used to determine interrelationships among factors.

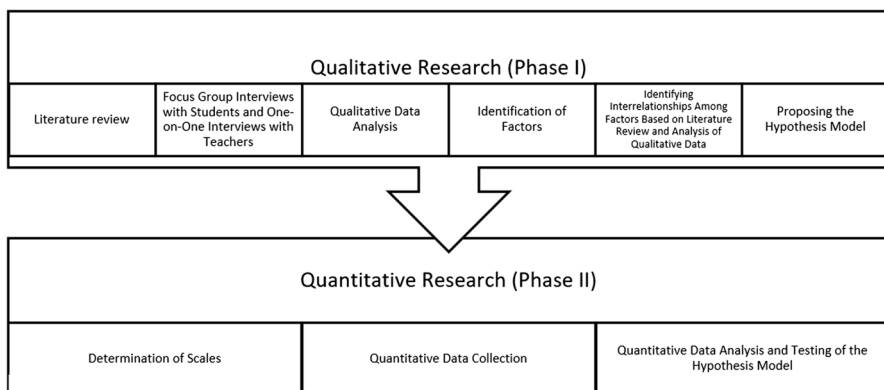


Fig. 1 Research design

Consequently, based on the identified factors and their interrelationships, a hypothesis model was proposed. In the second phase of the study, scales were decided for the factors included in the model. Subsequently, quantitative data were collected and this hypothesis model was tested.

Before starting to conduct this research, an approval was taken from the Research Ethics Board of the Institute of Educational Sciences at Marmara University. Furthermore, ethical consideration were taken into account by informing participants about confidentiality, respect for privacy, and the purpose of the research. Additionally, the researchers get permissions from the participants for recording the interviews.

4.1 Phase I: Qualitative research

In this phase, it was aimed to identify the factors related to smartphone addiction that affect high school students' academic achievement, and to propose a hypothesis model including these factors. To achieve this aim, focus group interviews were conducted with 20 high school students from a state school in Istanbul, and interviews were conducted with 15 teachers working at the same school. In the initial stage of the qualitative study, the school was selected using the convenient sampling method which is one of the preferred methods when limited time and resources are available (Dawson, 2009).

The students to be involved in focus group interviews were selected using maximum variation sampling method, which allows to select individuals with different perspectives (Creswell & Creswell, 2018). The students' academic performance was taken into consideration to decide on the participants to be involved in focus group interviews. To determine common and divergent aspects in terms of smartphone addiction and related factors, separate focus groups were held for students with a general grade point average (GPA) below 50 and those with a GPA above 50. Similarly, in the selection of teachers, the maximum variation sampling method was used to ensure that teachers from different subject areas in the chosen school were included. The interviews lasted approximately 40 min.

In the analysis of qualitative data, common patterns and relationships among prevalent factors were considered, and content analysis was employed to uncover concepts and relationships that could explain the collected data (Yıldırım & Şimşek, 2016). Content analysis included the stages of description, coding, categorization, and labeling (Patton, 2015). Additionally, an independent coding was conducted by a different field expert, and after a collaborative process, an agreement criterion of 94.25% was reached among the coders (Miles et al., 2014).

As a result of analyzing the content of the interviews, considering both the number of opinions and the number of individuals, five factors with the potential to have a significant impact were identified. These factors include "Duration of Social media usage", "Smartphone addiction", "Academic procrastination", "Cyberloafing" and "Academic locus of control". Subsequently, both qualitative findings and literature review were used to examine the relationships between these factors. Ultimately, as shown in in Fig. 2, a comprehensive hypothesis model encompassing these factors and their relationships was proposed.

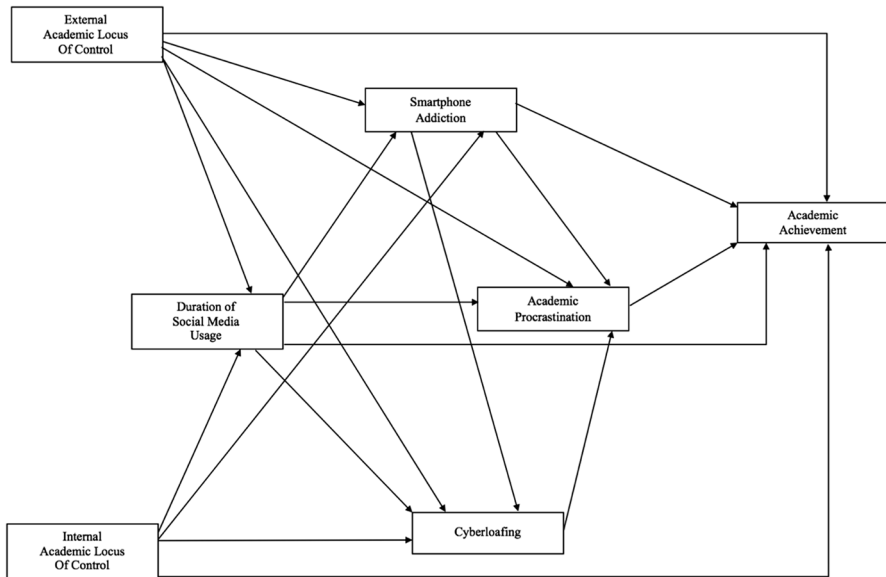


Fig. 2 Hypothesized model

4.2 Phase II: Quantitative research

4.2.1 Determination of scales

In the quantitative phase of the study, the aim was to test the hypothetical path model proposed in the previous phase of the study. To achieve this goal, a questionnaire containing questions and scales related to all variables in the hypothetical model was used in this phase. This questionnaire consisted of five main sections.

First, a personal information form containing questions about the students' self-reported duration of social media usage and academic achievement scores (GPA) was utilized. This form also included 14 questions, such as students' gender, age, grade level, department, and duration of daily phone usage. Second, the "Smartphone Addiction Scale—Turkish Version", developed by Kwon et al. (2013) and adapted to Turkish by Demirci et al. (2014), was employed to measure smartphone addiction levels. Involving 33 items, this scale is based on a six-point Likert scale (1: Definitely not, 6: Definitely yes). Third, participants' cyberloafing levels were measured using the "Cyberloafing Activities Scale," developed by Blau et al. (2006) and adapted to Turkish by Polat (2018). This scale comprises 16 items and uses a six-point Likert scale (1: Never, 6: Always). Fourth, to measure academic locus of control, the "Academic Locus of Control Scale," developed by Akın (2007), was used. The scale consists of 17 items and uses a five-point Likert scale (1: Strongly disagree, 5: Strongly agree).

Finally, the short Turkish version of the "Academic Procrastination Scale," developed by McCloskey (2011) was adapted to Turkish for this study and it was

employed to assess academic procrastination levels. This short form contains 5 items and uses a five-point Likert scale (1: Strongly disagree, 5: Strongly agree). The procedure recommended by Hambleton et al. (2005) was followed to adopt this scale to Turkish. The English version of the scale was translated into Turkish by three language experts fluent in both English and Turkish. The translations of the three experts were consolidated into a single form and sent to three experts in the Computer Education and Instructional Technologies department. Based on the feedback received from these experts, the final version of the scale was developed. Subsequently, the final version of the scale was sent to an academician in Turkish Language and Literature, and it was determined that there were no language-related issues in the Turkish version. As a result, it was found that the language equivalence of the items in the Turkish form was established. Then, a pilot study was conducted with 131 high school students enrolled in a private educational institution to determine that the Turkish version of the form structurally similar to the original short form. In the pilot study, the Kaiser–Meyer–Olkin (KMO) value, determined as 0.77, indicated that the data matrix was suitable for factor analysis (Büyüköztürk, 2010). Additionally, the factor analysis revealed a unifactorial structure with eigenvalues greater than 1, explaining 53% of the total variance (Büyüköztürk, 2010). It has been reported that for single-factor scales, it may be sufficient for the explained variance to be 30% or more (Büyüköztürk, 2010). Therefore, the Turkish version's factor structure was found to be similar to the original short form. A Cronbach's alpha coefficient of 0.78 was determined, and it was concluded that no items needed to be removed.

4.2.2 Data collection and testing the model

Schools participating in the study were selected using the convenient sampling method (Dawson, 2009). In this context, two “Science High Schools,” two “Anatolian High Schools,” and two “Vocational and Technical Anatolian High Schools” were selected as the researchers have access to six teachers in these schools. These teachers sent the relevant online form links to the class advisors in their schools through a social media application. As a result, a total of 461 students were sent the questionnaires, and 421 students returned them, resulting in a 91.3% response rate. After removing missing and erroneous data, the number of participants in the quantitative part of the study was determined as 410.

In conclusion, in this research, the path analysis method was used to test the hypothetical model, examine direct and indirect effects, and determine which independent variable is the most influential or important factor, as it can demonstrate all kinds of effects of each independent variable on the dependent variable (Agesti, 2018). This method was especially preferred as it allowed to understand the effects of each independent variable on the dependent variable in a comprehensive way (Nayebi, 2020). In this study, SPSS Statistics 22.0 was used for missing value analysis, data normality, linearity, multicollinearity, and singularity analyses, while AMOS 23.0 was used for model fit via path analysis.

5 Findings

5.1 Phase I: Qualitative research findings

5.1.1 Findings on smartphone addiction

All students who participated in the focus group discussion were smartphone users, and it was determined that excessive usage was more common in the focus group with a general grade average below 50 compared to the other group. It was understood that when these students' smartphone usage infiltrated their daily lives or became uncontrolled, they exhibited behavior resembling addiction symptoms. For example, some students reported experiencing problems such as impatience, irritability, and restlessness in the absence of their smartphones. Especially in the focus group with a general grade average below 50, students were observed to constantly think about their smartphones, wanting to use them without interruption, and getting angry when disturbed while using them. Furthermore, in the group with a general grade average above 50, it was found that addiction-like behaviors were less common. Some used their phones to relieve stress, while others could use them excessively for study preparation.

Most of the students in both focus groups expressed that smartphone usage negatively affected their academic performance. Those with negative opinions were mainly focused on the idea that they used their phones excessively and in an uncontrolled manner. From the students' statements, it was understood that smartphone usage may not necessarily affect academic performance if used in moderation, but it could have a negative impact when used excessively or when addiction-like behaviors towards smartphones were developed. For example, in the focus group with a general grade average below 50, the following statements stand out:

"I can't sleep at night because of using the smartphone all the time, and I sleep in the first four classes at school. As a result, it can't be said that I really pay attention to the lessons." (S7).

"I don't have much time to study because I can't stop using it most of the time, and my performance is inevitably dropping, but even if using the phone is banned at school, I still don't think I will be successful because it's not prohibited at home." (S2).

On the other hand, some students in the focus group with a general grade average above 50 stated that smartphone usage had a positive impact on their academic success, while others expressed that smartphone usage would not affect their success when used in a controlled manner. For example, some students used the following statements regarding this issue:

"I don't use it too much if I don't need to study, but when I have classes or can't learn some topics well, the usage can go up to 5-6 hours while watching educational videos. But if I don't have classes, I use it for 1-2 hours." (S5).

"I think it will definitely reduce success if you use a smartphone to play games or hang out on social media." (S5).

“After using it as much as needed, there is no problem. That is, if it is used without interrupting the lessons. For example, when I get tired of studying, I watch an entertaining video for 5-10 minutes to relax and feel better.” (S8).

Teachers who participated in the research believe that high school students excessively use smartphones, have a strong desire for smartphone usage, and think that this desire leads to uncontrolled use and addiction. However, most teachers believe that students’ smartphone usage is at an addictive level and negatively affects academic success. For example:

“In our school, this situation is more pronounced; they don’t have a minute without their phones. I definitely think they are addicted, so failure is inevitable.” (T11).

“In some classes, when I try to teach, I see that more than half of the students are asleep. When I ask them the reason, I get answers like ‘I couldn’t sleep at night,’ ‘I stayed up too late, sorry.’ When I ask why they stayed up late, they say they were watching movies or playing games on their phones. I really think the situation is quite serious.” (T7).

“While trying to teach, I observe that many students constantly have their hands on their phones and try to place them on the desk to read incoming messages deliberately. Our warnings lose their effect after a certain period, and they try to make it a natural habit because some teachers allow them to use their phones during class.” (T13).

5.1.2 Findings on social media usage

Content analysis revealed that the majority of students in the focus group with a general grade average below 50 had a high daily duration of social media usage that significantly interfered with their daily activities, and their usage was predominantly interactive. In contrast, although the focus group with a general grade average above 50 had lower social media usage times, the use of social media for study preparation was significantly higher compared to the other group. However, students in the focus group with a general grade average below 50 generally believed that their social media usage could negatively impact their academic performance. For example:

“It affects me a lot, especially because of social network usage. Even during exam times, I continue to use unnecessary social networks. I realized it had a bad effect on my academic success when the exam results were announced. I use my phone for 7 hours a day, and 5 of those hours are spent on social media.” (S2).

“It has a negative impact, but phones can also have a positive effect on studying. Some of my friends can enhance their academic success by watching educational videos. But because I always find myself watching funny videos, it negatively affects my performance.” (S3).

Students in the focus group with a general grade average above 50 stated that their academic success could be negatively affected if they used smartphones

uncontrollably, but it could positively impact their success if used in a controlled and purposeful manner. For example:

“If my smartphone is in the same room while I’m studying, messages from WhatsApp or Instagram can distract me, which negatively affects my performance. However, sometimes there are very useful educational content and posts on social media. I usually watch those videos, so I think it positively affects my academic performance.” (S7).

According to teachers, the majority of high school students use social media on their smartphones for interaction purposes. Therefore, teachers believe that high school students do not allocate time for studying, spend most of their time on social media, and that parents complain about this situation. In individual interviews, all teachers explained that students spend too much time on social media. According to teachers, the majority of high school students use social media for interaction purposes, including chat, comments, messaging, photo, and video sharing. For example, most teachers expressed the opinion that the relationship between social media usage and academic success was negative:

“It has a clear negative effect. They use it excessively, and they spend all their time on social media, and they don’t care about studying. They don’t do homework, and they don’t care about failing.” (T12).

“It doesn’t matter whether students are male or female; they use their phones even during classes, which shows their dependence. For example, when I catch students playing with their phones during class, WhatsApp, Instagram, or YouTube are usually open on their phones.” (T3).

“They never study efficiently; when I allow them some freedom, very few of them focus on the lesson, and most of them either start messaging someone or look at pictures on Instagram.” (T14).

“It definitely has a negative effect because they see themselves as someone different on social media. For them, it’s like a sanctuary. They are happier on social media platforms than in real life. That’s why they want to use it constantly.” (T14).

5.1.3 Findings on cyberloafing

Another factor that explains academic success in relation to smartphone addiction and is frequently mentioned in focus group discussions is cyberloafing. According to focus group discussions, students with a general grade average below 50 tend to engage more in recreational and interactive cyberloafing. A significant portion of the students admitted to engaging in recreational cyberloafing during class, such as playing games or other entertaining activities. On the other hand, a significant portion of the students also acknowledged engaging in interactive cyberloafing, such as sending instant messages, sending emails, or checking emails. However, students in the focus group with a general grade average below 50 generally believed that their cyberloafing behaviors were negatively related to academic success. For example:

“Especially because I don’t understand anything in math, I play with my phone during the class without the teacher noticing, so I don’t really pay attention to what’s being taught or what assignments are given. That’s why I get very low grades.” (S7).

“Classes are generally boring; I only come to school to not upset my mom and to get a diploma. Maybe if I didn’t play with my phone during class, I could get better grades, but especially for subjects like math, even if I study, it doesn’t work, so I prefer to play with my phone, and I generally get low grades.” (S5).

Some students in the focus group with a general grade average above 50 mentioned that they engaged in cyberloafing because they found the classes boring. For example:

“I really don’t like math, so when the teacher is explaining something, I don’t understand it even if I listen. So, at that time, I chat with friends, but when I listen to the lesson, I get really bored.” (S8).

Teachers’ opinions on students’ social media usage are mostly related to the recurring themes of entertainment and interactive subthemes. The entertainment subtheme of cyberloafing refers to students playing online games, using their phones, or spending time on entertainment activities during class. The interactive subtheme, on the other hand, pertains to students engaging in activities such as sending instant messages during class. According to individual interviews with teachers, the majority of teachers revealed that cyberloafing behaviors were negatively related to students’ academic success:

“Of course, it has a negative effect. Even during class, they are constantly trying to hang out on social media. It seems like their goal is not to study, but they come to school just because their parents want them to.” (T6).

“Yes, it happens, especially male students try to sleep by putting their heads on their desks during class. In fact, they are watching videos under the desk or visiting sports websites. That’s why their grades are generally low. Sometimes, when I warn them, and if they don’t pay attention, I have to take their phones away.” (T14).

5.1.4 Findings on academic procrastination

Another factor explaining academic achievement in relation to smartphone addiction is academic procrastination. According to student expressions, academic procrastination is a situation where they find it challenging to start studying, tend to delay tasks, and often submit assignments at the last minute. When examining the study results, it is evident that the majority of students in the focus group with a general grade point average below 50 indicated a negative relationship between academic procrastination and academic success, stating that they cannot find time to study. For instance:

“The main reason for my low performance is the inability to start studying. Whenever I try to study, a notification from my phone distracts me, and I find myself dealing with the phone instead.” (S2).

“I don’t have time to study, and the assignments given are really tough. Sometimes I open entertaining educational videos on YouTube, but while watching them, I come across more interesting videos and end up watching those instead.” (S10).

A significant majority of teachers believe that academic procrastination in high school students is associated with irresponsibility. Irresponsibility implies that students allocate more time to activities they enjoy and are unable to initiate studying. In fact, most teachers participating in this study expressed that students engage in academic procrastination due to excessive use of smartphones and social media, negatively impacting academic success. For example:

“Very few students submit performance tasks and project assignments. Most students don’t care about their grades or whether they will pass the class. They don’t study or do their assignments because their minds are constantly on their phones. Based on complaints from parents, it is understood that students excessively use their phones not only at school but also at home.” (TCH 1).

“It wouldn’t make a difference even if it were completely banned. They have lost control; as far as I have observed, they are excessively attached to their phones. For instance, on exam days, they ask for permission to study, and sometimes I allow it, but they never start studying; they are busy with their phones most of the time.” (TCH 2).

“Based on what we observe in classes and learn from parents, the most negative factor affecting students’ success is their excessive use of social media and smartphones. In short, they do not use social media consciously. Some students are so addicted that they want to use their phones even during classes, to find out what’s happening on Instagram or to play games. In fact, when I open the internet from the smartboard to teach, some students request, ‘Could you open YouTube, and we watch funny videos?’ They have no intention of studying at all. If they submit assignments, at least their performance grades would be high, but they don’t care. I am sure that ten years ago, only a small percentage of students did not submit assignments, but now this ratio has significantly increased.” (TCH 3).

“When I assign a project, I constantly have to remind students to start. Even if I remind them of the deadline, the number of those who actually start the project is quite low. Those who do usually copy content unrelated to the assignment just to submit it and get it over with.” (TCH 8).

This is already one of the most significant problems. You asked about studying during the question, but they can’t start studying because of the phone. When I ask them the reason for not submitting assignments, one response I get is that they struggle while doing assignments, and I think it’s because they find assignments difficult due to not studying at all (TCH 4).

5.1.5 Findings on academic locus of control

In this study, another factor explaining academic achievement in relation to smart-phone addiction is identified as academic locus of control ($f=62$). Among the opinions of the students participating in the focus group interviews, the internal locus of control subtheme was reiterated 33 times by 9 students ($f=33$, $n=9$), while the external locus of control subtheme was reiterated 29 times by 7 different students ($f=29$, $n=7$). It was observed that students with a general grade point average below 50 tended to attribute their failure more to external factors. External academic locus of control refers to attributing one's success or failure to factors beyond oneself. For instance, one student (S5) explained studying to avoid disappointing parents: *"I don't like studying; I haven't liked it since childhood. Actually, it would be more accurate to say since I started middle school. But when I fail, my mom gets very upset, so I try to study so she won't be sad."* Another student (S6) expressed reluctance to study due to the perceived easiness of exam questions: *"I don't think I need to study. After all, the questions are very easy, and I usually get lucky, so I don't feel the need to study or start studying."* Another student (S8) attributed not studying to a disagreement with the teacher and explained, *"But I don't want to do the assignments given by some teachers because I don't get along with them, but I know it harms me."* Yet another student (S4) attributed not studying to lack of time caused by social media:

"I don't have big goals for myself; I just want to get my high school diploma, that's enough. So, I don't need to work too hard. If you have a good relationship with the teacher in vocational courses and show respect, you'll pass with an average above fifty. I try to focus on those courses, but it's limited. Most of my time is spent on the phone anyway. Watching YouTube videos takes up most of my time, so there's hardly any time left for studying."

Internal academic locus of control refers to attributing success or failure situations to personal efforts. It was found that students with a general grade point average above 50 tended to attribute their success or failure more to their own efforts. For example, one student (S3) attributed his success to his own efforts and stated, *"I don't think the smartphone has a very negative impact on my success. Because even if I mess around with my phone a bit after studying effectively for an exam, it doesn't affect me in the end. I get bored of studying too much sometimes, but the phone is a bit of a distraction."* Another student (S7) saw his failure as his own fault and said, *"Dealing with the phone sometimes negatively affects starting to study. But my family and I made a decision. When I have an exam, I put the phone in another room. I don't get distracted while studying because I took this precaution. But when I first got the phone, I used it excessively, and that's why I couldn't study well for the chemistry exam. So, it was my fault."*

A student (S4), who believed that excessive use of the phone negatively affects success, mentioned, *"If I mess around too much with the smartphone, of course, my performance will drop, but I use the phone not to play games but to watch videos of topics I don't understand. So, I think the smartphone increases my success."* Similarly, another student (S9) who believed that his success was not affected because he

did not use it excessively stated, *“It doesn’t affect me because I don’t use the smart-phone too much. When I use it, I ask my friends about the parts I don’t understand. So, it can positively affect my success in that regard.”* Other example opinions supporting the internal locus of control theme are as follows:

“Some of the low scores I get in exams are not solely because of the smart-phone; it’s also because I don’t want to start studying. When I study, I can get high grades. But the truth is that sometimes I can’t sleep because of the phone. It makes me tired too.” (S2).

“After becoming a responsible student, the smartphone doesn’t negatively affect success. I think I’m doing my best to be successful. I make an effort. Sometimes I may not have worked enough for exams where I got low grades because I didn’t have time.” (S1).

In conclusion, according to student views, the relationship between academic locus of control and academic success varied depending on the type of locus of control. For example, in the low-achieving group, the frequency of reiteration of the external locus of control theme ($f=24$) was much higher than the frequency of reiteration of the internal locus of control theme ($f=3$).

According to teacher views, the frequencies of reiteration of factors affecting students’ academic locus of control were external locus of control ($f=42$, $n=11$) and internal locus of control ($f=10$, $n=3$), respectively. When teacher views were analyzed, it was observed that the opinion that students mostly have an external locus of control was reiterated more frequently than the opinion that they have an internal locus of control. Some teachers also believed that students with specific goals use smartphones in a more controlled way and make an effort to be successful. For example, one teacher (TCH9) stated the following about students having an external locus of control:

“Most students are addicted to their phones; it’s really worrying that their minds are constantly on their phones. We need to know the underlying reasons for this. According to my observations, most students think the subjects are unnecessary. When I ask them why they don’t listen, they can ask why learning the subject will be useful for them. Those who listen can be affected by the smallest things and experience concentration problems, becoming students who do everything they can not to listen to the lesson.”

Similarly, another teacher (TCH14) explained that students attribute their failures to factors outside themselves:

“When students get high grades, it’s always their success, but when they get low grades, they can say, ‘Teacher, you gave a very low grade.’ Although most students mess around with their phones during class and don’t listen to the lesson properly, parents also complain that students are constantly playing with their phones.”

Some teachers also believed that students with specific goals use smartphones in a more controlled way and make an effort to be successful. For example, one teacher

(TCH7) indirectly expressed that when students have an internal locus of control, smartphones do not negatively affect their successes:

“The use of smartphones negatively affects students who already have no sense of work. In our school, there are project classes where hardworking students are the majority and classes where non-hardworking students study. Since I enter both types of classes, I can say comfortably that students in classes with hardworking students know that if they play with their phones and don’t listen to the lesson, they will fail, so they don’t usually need to be warned about this. Sometimes I have to ask them to do research with their phones in those classes. They can immediately put their phones down when the task is done. However, in the other classes, I have to remind them constantly. They have no sense of responsibility.”

Another teacher (TCH15) stated that students who attribute their failures to factors outside themselves use social media more, try to use their phones during class, do not complete the given assignments, and ultimately have very low academic achievements:

“Since I teach vocational courses, some classes have a considerable number of weekly hours. Students passing the class depends on the grades they get from these courses. So, I don’t have much smartphone use in my own class because I share the rules with the students from the beginning. But if a child’s only goal is to get a diploma, if he has no future goal, if he doesn’t like his department, if he only comes to school under the pressure of his family, such children try to use their phones during class, do their assignments either superficially at the last minute or not at all. Naturally, they can’t pass the class because they can’t meet the average. But I receive many complaints about smartphone use, especially from cultural teachers and parents. Students who cause problems are generally students who have no purpose in life, I think. As far as I have learned from parents, students who want to achieve something, have the goal of getting a good job, and are responsible, use the phone and social media more than usual, but at least they try to comply with the rules during class and do not delay their assignments to the point of becoming a problem.”

6 Summary of qualitative research findings

Statistical information regarding themes derived from teacher and student perspectives is summarized in Table 1. As a result of the interviews, five factors potentially influencing academic achievement in relation to smartphone dependency have been identified: “duration of social media usage,” “cyberloafing,” “academic procrastination,” “academic locus of control,” and “gaming addiction.” However, considering that the sub-dimensions of academic locus of control, namely internal and external academic locus of control, may have different effects on smartphone dependency, duration of social media usage, cyberloafing, academic procrastination, and

Table 1 The frequency of theme repetitions and the number of individuals

Factors	Focus Group Interviews (Students)		One-on-One Interviews (Teachers)	
	Interviews (f)	Participants (n)	Interviews (f)	Participants (n)
Smartphone Addiction	79	15	71	15
Duration of social media usage	82	19	63	14
Cyberloafing	68	16	59	13
Academic Procrastination	63	16	54	15
Academic Locus of Control	62	16	52	14
Gaming Addiction	17	9	10	4

academic achievement, and due to the common practice of separately addressing these sub-dimensions in the literature, it was decided in this study to add the dimensions of academic locus of control as two separate factors to the proposed model.

In determining the prevalent factors to be involved in the model, four criteria were taken into account: context in which the response is given, consistency of the response, frequency of themes, and the number of individuals making similar comments (Baş & Akturan, 2017). As seen in Table 1, both the frequency of theme repetitions and the number of individuals indicate that values related to the gaming addiction theme are dramatically lower compared to other themes. Therefore, it was decided to include all factors except gaming addiction in the model. Consequently, the model proposed in this study includes five prevalent factors: smartphone dependency, duration of social media usage, cyberloafing, academic procrastination, and academic locus of control. Once the factors to be included in the model were determined, a path model was developed based on both qualitative findings and relevant literature, elucidating the relationships between these factors (see Fig. 2).

6.1 Phase II: Quantitative research findings

6.1.1 Preliminary analyses

Considering that the sample size for the data collected from 410 high school students is over 200, it was found sufficient for path analysis (Kline, 2016). As the missing value analysis results indicated that four participants did not respond to more than 90% of the items, their data were excluded from the study (Çokluk et al., 2018). Additionally, data from seven participants were excluded from the study as discrepancies were detected in their responses to control-purpose fake items in the survey (Berry et al., 2019). Consequently, data for a total of 11 participants were not included in the path analysis, and quantitative data analyses were conducted with the remaining 410 individuals.

The existence of outliers that could complicate the fulfillment of normality assumptions was examined through Mahalanobis distance values in this study

(Aksu et al., 2017). As a result, no outliers were detected based on the calculated Mahalanobis distances in this study (Kline, 2016; Stevens, 2009). Furthermore, since the Cook's distance assumption was satisfied due to being less than 1, and Cook's distances were smaller than $4/410 = 0.00975$, it was determined that there were no outliers (Karagöz, 2016).

Since skewness and kurtosis coefficients are reported to be excellent within ± 1.0 for most psychometric purposes and acceptable within ± 2.0 , the distribution is assumed to be normal in this study (George & Mallery, 2020). Furthermore, as shown in Table 2, all correlation values between the factors were less than 0.90, so the assumption of multicollinearity is satisfied (Kline, 2016). In addition, since all VIF values are less than 5, all CI values are less than 30, and all tolerance values are greater than 0.01, multicollinearity assumption was also met (Aksu et al., 2017). The normality of residuals was checked with a histogram and P-P plot, and it was observed that the residuals were normally distributed, and the linearity assumption was satisfied. However, since Durbin-Watson values are desired to be between 1.5–2.5, and in this research, according to the analysis conducted, $d = 2.02$, the assumption of independence of errors was satisfied (Karagöz, 2016). Ultimately, it was concluded that all assumptions of path analysis were met for the data obtained in the research.

6.1.2 Path analysis

The hypothesized model proposed in the study (see Fig. 2) was tested using path analysis. When examining the values of the multiple fit indices; $\chi^2/df = 3.09$ ($n = 410$), $RMSEA = 0.072$, $SRMR = 0.008$, $NFI = 0.997$, $TLI = 0.981$, $CFI = 0.998$, $GFI = 0.999$, it is observed that the model has an acceptable level of fit (Karagöz, 2016; Kline, 2016; Sümer, 2000). Direct, indirect, and total effects on each dependent factor in the model are presented in Table 3. In this study, a path coefficient of $+0.1$ is considered a small effect, $+0.3$ a moderate effect, and $+0.5$ a large effect (Field, 2009; Kline, 2016). The default model and the related standardized path coefficients resulting from the path analysis are shown in Fig. 3. Six factors in the

Table 2 Pearson product-moment correlation coefficients

Factors	1	2	3	4	5	6	7
Academic Achievement (1)	1						
Duration of Social Media Usage (2)	-0.819**	1					
Smartphone Addiction (3)	-0.801**	0.822**	1				
Cyberloafing (4)	-0.717**	0.730**	0.755**	1			
Academic Procrastination (5)	-0.716**	0.727**	0.743**	0.755**	1		
External Academic Locus of Control (6)	-0.615**	0.617**	0.640**	0.641**	0.643**	1	
Internal Academic Locus of Control (7)	0.493**	-0.488**	-0.503**	-0.478**	-0.501**	-0.632**	1

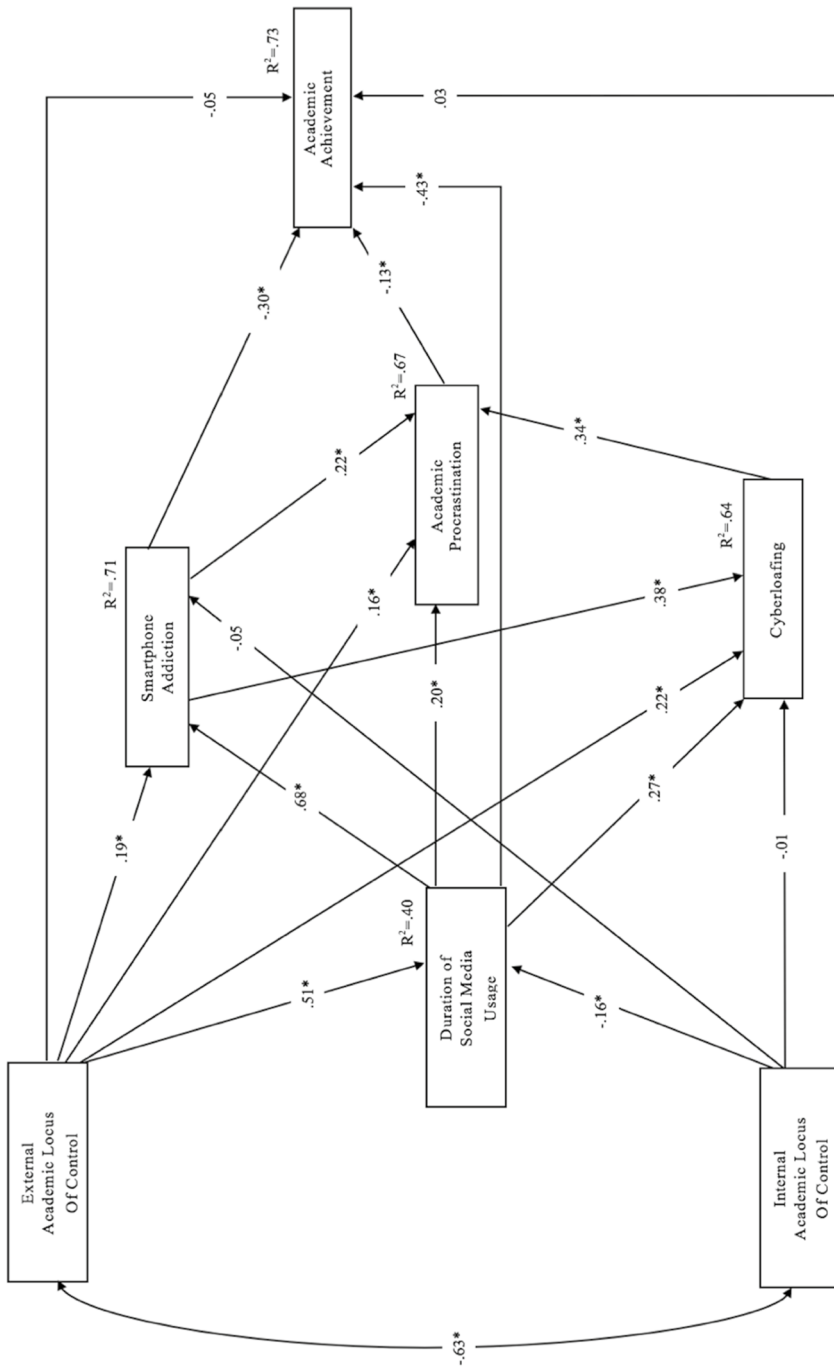
** $p < .01$

Table 3 Direct, indirect, and total effects

Dependent Variables	Independent Variables	Direct	Indirect	Total
Academic Achievement $R^2=0.73$	Duration of social media usage	-0.425*	-0.276*	-0.701*
	External Academic Locus of Control	-0.054	-0.455*	-0.509*
	Smartphone Addiction	-0.305*	-0.045*	-0.350*
	Internal Academic Locus of Control	0.034	0.134*	0.168*
	Academic Procrastination	-0.129*	–	-0.129*
	Cyberloafing	–	-0.044*	-0.044*
Smartphone Addiction $R^2=0.71$	Duration of social media usage	0.680*	–	0.680*
	External Academic Locus of Control	.187*	0.349*	0.536*
	Internal Academic Locus of Control	-0.052	-0.112*	-0.164*
Social Media Usage Duration $R^2=0.40$	External Academic Locus of Control	0.513*	0.000	0.513*
	Internal Academic Locus of Control	-0.164*	0.000	-0.164*
Cyberloafing $R^2=0.64$	External Academic Locus of Control	0.217*	0.346*	0.564*
	Duration of social media usage	0.274*	0.261*	0.535*
	Smartphone Addiction	0.384*	–	0.384*
	Internal Academic Locus of Control	-0.014	-0.108*	-0.122*
Academic Procrastination $R^2=0.67$	External Academic Locus of Control	0.159*	0.413*	0.572*
	Duration of social media usage	0.200*	0.331*	0.531*
	Smartphone Addiction	0.218*	0.132*	0.350*
	Cyberloafing	0.343*	–	0.343*
	Internal Academic Locus of Control	–	-0.111*	-0.111*

* $p < 0.05$

model, namely duration of social media usage, smartphone addiction, cyberloafing, academic procrastination, external academic locus of control, and internal academic locus of control, explained 73% of the variance in academic achievement. All six factors in the model showed a significant total effect on academic achievement. Duration of social media usage ($\beta = -0.701$, $p < 0.05$) and external academic locus of control ($\beta = -0.509$, $p < 0.05$) have a strong total effect on academic achievement, while smartphone addiction ($\beta = -0.350$, $p < 0.05$) has a moderate total effect. However, internal academic locus of control ($\beta = 0.168$, $p < 0.05$), academic procrastination ($\beta = -0.129$, $p < 0.05$), and cyberloafing ($\beta = -0.044$, $p < 0.05$) have a small total effect. Duration of social media usage, smartphone addiction, and academic procrastination showed significant direct effects on academic achievement. Duration of social media usage ($\beta = -0.425$, $p < 0.05$) has the strongest direct effect on academic achievement among high school students. In addition, smartphone addiction ($\beta = -0.305$, $p < 0.05$) has a moderate direct effect, while academic procrastination ($\beta = -0.129$, $p < 0.05$) has a low direct effect on academic achievement. Although the direct effect of external academic locus of control on academic achievement is not significant, its indirect ($\beta = -0.455$, $p < 0.05$) and total effects are high ($\beta = -0.509$, $p < 0.05$). Similarly, internal academic locus of control does not have a direct effect on academic achievement, but its indirect ($\beta = 0.134$, $p < 0.05$) and total effects ($\beta = 0.168$, $p < 0.05$) are considered low. Despite its weak direct effect,



* p < .05

Fig. 3 Path model and standardized path coefficients

external academic locus of control has shown the strongest indirect effect on academic achievement because it partially mediated the relationship between external academic locus of control and academic achievement, including duration of social media usage, smartphone addiction, cyberloafing, and academic procrastination. Additionally, duration of social media usage ($\beta = -0.276$, $p < 0.05$), smartphone addiction ($\beta = -0.045$, $p < 0.05$), cyberloafing ($\beta = -0.044$, $p < 0.05$), and internal academic locus of control ($\beta = 0.134$, $p < 0.05$) have significant indirect effects on academic achievement.

Three factors in the model, namely duration of social media usage, external academic locus of control, and internal academic locus of control, explained 71% of the variance in smartphone addiction. The total effect of all three factors on smartphone addiction is significant. Duration of social media usage ($\beta = 0.680$, $p < 0.05$) has the greatest total effect on smartphone addiction among high school students. Additionally, external academic locus of control ($\beta = 0.536$, $p < 0.05$) has a large total effect, while internal academic locus of control ($\beta = -0.164$, $p < 0.05$) has a low negative total effect.

Two factors in the model, namely external academic locus of control and internal academic locus of control, explained 40% of the variance in social media usage. Both of these factors have significant direct and total effects. External academic locus of control ($\beta = 0.513$, $p < 0.05$) has a strong direct and total effect on duration of social media usage, while internal academic locus of control ($\beta = -0.164$, $p < 0.05$) has a low direct and negative total effect.

Four factors in the model, namely duration of social media usage, smartphone addiction, external academic locus of control, and internal academic locus of control, explained 64% of the variance in cyberloafing. All four factors in the model showed a significant total effect on cyberloafing. External academic locus of control ($\beta = 0.564$, $p < 0.05$) and duration of social media usage ($\beta = 0.535$, $p < 0.05$) have a large total effect on cyberloafing, while smartphone addiction ($\beta = 0.384$, $p < 0.05$) has a moderate total effect. However, internal academic locus of control ($\beta = -0.122$, $p < 0.05$) has a low total effect. Except for internal academic locus of control, all other factors have significant direct effects on cyberloafing. Smartphone addiction ($\beta = 0.384$, $p < 0.05$) has the strongest direct effect on cyberloafing among high school students. Additionally, duration of social media usage ($\beta = 0.274$, $p < 0.05$) and external academic locus of control ($\beta = 0.217$, $p < 0.05$) have low direct effects on cyberloafing. The direct effect of internal academic locus of control on cyberloafing is not significant. However, despite its weak direct effect, internal academic locus of control has a significant small negative indirect effect on cyberloafing ($\beta = -0.108$, $p < 0.05$). Duration of social media usage and external academic locus of control factors have significant indirect effects on cyberloafing. External academic locus of control ($\beta = 0.346$, $p < 0.05$) has a moderate indirect effect, while duration of social media usage ($\beta = 0.261$, $p < 0.05$) has a small indirect effect on cyberloafing.

Five factors in the model, namely duration of social media usage, smartphone addiction, cyberloafing, external academic locus of control, and internal academic locus of control, explained 67% of the variance in academic procrastination. All five factors in the model showed a significant total effect on academic procrastination. External academic locus of control ($\beta = 0.572$, $p < 0.05$) and duration of social

media usage ($\beta=0.531$, $p<0.05$) have a large total effect on academic procrastination, while smartphone addiction ($\beta=0.350$, $p<0.05$) and cyberloafing ($\beta=0.343$, $p<0.05$) have a moderate total effect. However, internal academic locus of control ($\beta=-0.111$, $p<0.05$) has a small negative total effect. Except for internal academic locus of control, all other factors have significant direct effects on academic procrastination. Cyberloafing ($\beta=0.343$, $p<0.05$) has a moderate direct effect on academic procrastination, while smartphone addiction ($\beta=0.218$, $p<0.05$), duration of social media usage ($\beta=0.200$, $p<0.05$), and external academic locus of control ($\beta=0.159$, $p<0.05$) have low direct effects. Except for internal academic locus of control, the other four factors have significant indirect effects on academic procrastination. External academic locus of control ($\beta=0.413$, $p<0.05$) has a large indirect effect, duration of social media usage ($\beta=0.331$, $p<0.05$) has a moderate indirect effect, and smartphone addiction ($\beta=0.132$, $p<0.05$) and internal academic locus of control ($\beta=-0.111$, $p<0.05$) have small indirect effects on academic procrastination.

7 Discussion

This study, utilizing a two-stage exploratory sequential mixed-methods design, aims to propose and test a path model that comprehensively examines the relationships between high school students' academic achievements, smartphone addiction, and associated factors. According to the qualitative findings of the study, the most common factors influencing high school students' academic achievements in relation to smartphone addiction were found to be social media usage, academic locus of control, academic procrastination, and cyberloafing. Based on these qualitative findings and relevant literature, a hypothesis model illustrating the relationships between academic achievement, smartphone addiction, associated factors have been developed. Subsequently, in the quantitative phase of the study, this model has been tested using the path analysis method. This model, which fitted well with the data, explained academic achievement with a high variance (73%). It was observed that all factors included in the model significantly influence high school students' academic achievements in terms of total effects. Additionally, although there was no direct impact on high school students' academic achievements, external academic locus of control, internal academic locus of control, and cyberloafing had indirect effects.

The most important factor explaining academic achievement in the model is identified as duration of social media usage. Findings from the qualitative phase of the study, based on interviews with students and teachers, support the notion that daily social media usage can adversely affect academic achievement. Indeed, negative and significant relationships have been found in the literature between the general use of social networks and students' academic achievements (Abu-Snieh et al., 2020; Azizi et al., 2019; Kumcağiz et al., 2019; Paul et al., 2012). Another study showed a strong and negative association between the time spent socializing on a social network service and the overall grade average (Junco, 2012). Moreover, excessive use of social media has been reported to reduce the time allocated for learning activities and negatively affect academic performance (Nwazor & Godwin-Maduiké, 2015). Similarly, the quantitative findings of this research also indicated that the duration of

social media usage negatively influences academic achievement. This result aligns with numerous research findings in the literature, indicating that an increase in daily social media usage may lead to a decrease in students' academic performance levels (Giunchiglia et al., 2018; Kumcağız et al., 2019; Paul et al., 2012; Yorulmaz & Yorulmaz, 2020). Additionally, the quantitative findings of this study suggest that the duration of social media usage has a moderate indirect impact on academic achievement through smartphone addiction. In other words, excessive use of social media may indirectly and negatively affect academic achievement by causing smartphone addiction. This inference is consistent with various research findings demonstrating that social media is most commonly used through smartphones and that this usage increases smartphone addiction (Alkın et al., 2020; Işık & Kaptangil, 2018; Roberts et al., 2014; Sözbilir & Dursun, 2018). Therefore, according to the model obtained in this study, controlled use of smartphones and social media is considered important for avoiding adverse effects on students' academic achievements.

According to the model, the second most important factor explaining academic achievement is external academic locus of control. Based on the analysis of opinions of student and teacher participants relying on qualitative data, it is understood that when the academic locus of control is externalized, students tend to use their smartphones more for social media and entertainment purposes. Moreover, students in this situation try to maintain these behaviors during classes, do not fulfill academic tasks, and/or postpone them, allocate less time to learning, and consequently face the risk of low academic achievement. This inference is consistent with various studies in the literature demonstrating that external academic locus of control has a negative impact on academic achievement (Abid et al., 2016; Bahçekapılı & Karaman, 2020; Jain et al., 2018). For example, Bahçekapılı and Karaman (2020) found that external academic locus of control has a negative effect on the academic achievements of university students. However, the model indicates that external academic locus of control does not directly affect academic achievement but indirectly influences it through duration of social media usage, smartphone addiction, academic procrastination, and cyberloafing. Indeed, Lee, Chang, et al. (2014) emphasized that individuals with an external locus of control may compulsively use their smartphones due to a decrease in self-control powers. Similarly, Kuo et al. (2019) found that individuals with external control personality traits tend to use social media for longer periods. Hou et al. (2017) also showed that excessive use of a smartphone-based social network application, WeChat, is associated with higher external control focus and more online social interaction skills. According to the model, being inclined toward external academic locus of control positively affects social media usage, smartphone addiction, academic procrastination, and cybersloafing among high school students. Indeed, in a study conducted with university students (undergraduate, graduate, and doctoral) by Meena et al. (2021), a positive relationship was found between external locus of control and smartphone addiction. Therefore, especially for students inclined toward external academic locus of control, psychoeducational studies on social media and smartphone use conducted by guidance services can prevent the risk of low academic achievement.

According to the model, the third most important factor explaining academic achievement is smartphone addiction. One of the results that can be inferred from

the qualitative research findings is that smartphone addiction can directly and indirectly and negatively affect academic achievement. Qualitative findings support the idea that excessive or problematic use of a smartphone can lead to concentration problems, cause academic tasks to be postponed, distract during classes when used, and hinder learning, ultimately negatively affecting academic achievement. Similarly, in a meta-analysis study including 44 different research studies, Sunday et al. (2021) concluded that smartphone addiction negatively affects students' learning and academic performance. Considering that smartphone addiction is characterized by excessive use of smartphones (Jin Jeong et al., 2020), Lepp et al. (2015) emphasized that it would not be surprising to associate increased mobile phone use with decreased academic achievement. In fact, it has been shown that mobile phone addiction has a negative impact on learning motivation and learning performance (Tian et al., 2021). Moreover, most of the teachers participating in our study think that the smartphone and social media use of high school students may be associated with addiction, students may use social media and smartphones generally in an uncontrolled manner, the time students allocate to learning may decrease due to social media and smartphone use, and this situation may negatively affect academic achievement. Indeed, the quantitative findings of this study in the path model show that smartphone addiction is one of the most significant factors affecting high school students' academic achievements negatively. Thus, the qualitative and quantitative findings of this study overlap with various research findings in the literature, indicating that negative influences of smartphone addiction on academic achievement (Baert et al., 2020; Chaudhury & Tripathy, 2018; Felisoni & Godoi, 2018; Khan et al., 2019; Ozer, 2020; Rathakrishnan et al., 2021; Samaha & Hawi, 2016). Therefore, it can be argued that uncontrolled use of smartphones, especially for high school students showing addictive characteristics, is an important risk factor for low academic performance (Amez & Baert, 2020; Domoff et al., 2020; Kates et al., 2018; Sunday et al., 2021). In this context, taking measures to ensure that students use their phones in a controlled manner is considered important. According to the regulations of the Ministry of National Education for secondary education institutions, the use of phones by students without the knowledge of the teacher during the lesson is not considered appropriate (MNE, 2023). Indeed, when considered as a tool for relaxation for students, it is deemed important to guide students in adopting a balanced approach to smartphone usage in order to reduce the prevalence of smartphone addiction (Zhang & Zeng, 2024).

According to the findings obtained in the study, the factor that most influences the levels of smartphone addiction among high school students is the use of social media. Qualitative findings directed towards students indicate that the majority of high school students use their smartphones more for social media purposes. Most teachers strongly believe that high school students are at risk of smartphone addiction due to excessive and uncontrolled use of smartphones for social media. The quantitative findings of this study have confirmed, in line with qualitative findings, a positive relationship between social media usage and smartphone addiction, supporting various studies in the literature that indicate social media usage contributes to increased smartphone addiction (Alkın et al., 2020; Basu et al., 2021; Mazhar et al., 2020; Sözbilir & Dursun, 2018). According to relevant literature, social media

usage is considered a strong predictor of smartphone addiction (Alkın et al., 2020; Jeong et al., 2016; Yanık & Özçiçek, 2021). Excessive social media usage, driven by addiction, has a distracting effect on academic performance (Sharma & Behl, 2022). Considering the risk of social media usage turning into social media addiction and/or smartphone addiction, it can be argued that it may reduce time allocated for learning activities, lead to the postponement of academic tasks, and negatively impact academic performance (Muslikah et al., 2018; Nwazor & Godwin-Maduiké, 2015). Therefore, understanding the purposes for which high school students use smartphones may be beneficial in preventing low academic achievement. For instance, parents and teachers can consult school guidance services, especially for students who use smartphones more for social media purposes. Additionally, an individual's personality traits play a significant role in analyzing the impact of social media on academic performance (Sharma & Behl, 2022). Although personality traits and locus of control are separate theoretical concepts, they share common features in terms of certain behavioral patterns (Filipiak & Łubianka, 2021). Thus, it can be suggested that students' academic locus of control, whether inclined towards internal or external, may influence their social media usage (Ye & Lin, 2015).

The study results also indicate that the risk of addiction and its negative impact on academic achievement increase when smartphones are used for social media purposes. This finding could also be interpreted as smartphones have a potential to enhance academic achievement when used for educational purposes rather than entertainment purposes via social media. This conclusion aligns with the study by Wang et al. (2023), which demonstrates that smartphone behavior (interpersonal communication, leisure and entertainment, information retrieval) serves as a mediating variable affecting academic performance. Thus, the kinds of smart phone applications and the ways how they are used may have an influence on the academic achievement (Salvation, 2017). According to the qualitative findings of this study, a small number of students believe that controlled and conscious use of smartphones for preparation or research purposes can positively impact academic achievement. Thus, the positive influences of effective smartphone use by students with high self-control, as found in the study by Troll et al. (2021), should not be overlooked in terms of academic success. Consequently, some future studies should be conducted to investigate how to use smartphones in a controlled and conscious way for educational purposes as the smartphones have a potential to motivate better academic performance when used appropriately (Lin et al., 2021).

According to the model, the fourth important factor influencing high school students' academic achievements is their internal academic locus of control levels. The qualitative findings related to students and teachers in the study indicate that internal academic locus of control can positively influence academic achievement. Therefore, it is believed that internal locus of control plays a significant role in the development of academic success (Kumaravelu, 2018). In line with this, Abid et al. (2016) found in their study that university students with internal locus of control had higher learning performances compared to students with external locus of control. Another study found a negative relationship between internal locus of control and academic procrastination (Sari & Fakhruddiana, 2019). Additionally, qualitative research findings suggest that high school students with an inclination towards internal academic

locus of control use their smartphones more controlled and spend less time on social media. Consistent with a previous study, students with a high internal locus of control were found to have fewer online interactions, be less dependent on the internet, and take fewer risks in sharing information on social networks (Ahadzadeh et al., 2021). Similarly, Li et al. (2015) found that individuals with a high internal locus of control could better control inappropriate use of mobile phones at inappropriate times (such as at night or during class). In the model, in terms of total effect size, the internal academic locus of control has a low positive impact on academic achievement. While its direct effect may not be significant, there is a negative relationship between internal academic locus of control and duration of social media usage. Therefore, internal academic locus of control indirectly affects academic achievement through duration of social media usage, academic procrastination, and smartphone addiction.

The fifth most important factor influencing students' academic achievements according to the model is the level of academic procrastination. According to both qualitative findings from students and teachers in our study, there is a negative relationship between academic procrastination and academic achievement. Considering models in the literature, smartphone use has been shown to negatively affect academic achievement (Lepp et al., 2014), and in cases of addiction or problematic use, it leads to academic anxiety and academic procrastination (Liu et al., 2018; Yang et al., 2019). A model study by Üztemur (2020) also indicated that academic procrastination mediated the relationship between social media addiction and academic achievement, negatively affecting academic success. Similarly, another model study found that academic procrastination was a mediating variable between internet addiction and academic achievement, showing that internet addiction negatively affected academic success through academic procrastination (Kutlu & Demir, 2017). The quantitative findings of the study confirmed that academic procrastination negatively affects academic achievement. According to the path model, in terms of total effect size, the academic procrastination factor has a low negative impact on academic achievement, and this effect is direct and not indirect. The qualitative and quantitative findings of the study parallel various research findings in the literature, demonstrating the negative relationship between academic procrastination and academic achievement (Batoöl, 2020; Gareau et al., 2019; Goroshit, 2018; Kutlu & Demir, 2017; Sop, 2020; Üztemur, 2020). Therefore, interventions aimed at encouraging students to use their phones in a controlled manner through the school counseling service can eliminate obstacles to students' learning and academic success by reducing both addiction and academic procrastination risks.

The study findings indicate that smartphone addiction significantly and meaningfully affects the academic procrastination levels of high school students, both directly and indirectly. According to the results of the path analysis, smartphone addiction has a direct medium positive effect on academic procrastination. These results are consistent with various research findings in the literature, indicating that smartphone addiction positively influences academic procrastination (Kutlu & Demir, 2017; Liu et al., 2018; Özçelik Bozkurt, 2020; Yang et al., 2019). For instance, Özçelik Bozkurt (2020) found a moderate relationship between social media addiction levels and academic procrastination in a study with tourism department undergraduate students. Similarly,

Kutlu and Demir (2017) showed in their study with adolescents that as internet addiction levels increased, academic procrastination behaviors also increased, and as academic procrastination increased, academic achievement decreased. However, Liu et al. (2018) concluded that the relationship between addictive behaviors and procrastination was more pronounced in males. Moreover, Yang et al. (2019) showed that students were more likely to procrastinate when they could not control their smartphone use or when they felt anxious about this situation. Şahin (2014) found in a study with students aged 14–25 that individuals who used social media (Facebook) in line with their social relationships had higher tendencies of academic procrastination than those who used it for daily purposes, and individuals who used it for academic purposes did not show tendencies of academic procrastination.

According to the model, the sixth important factor influencing high school students' academic achievements is their levels of cyberloafing. The qualitative findings of the study suggest that high school students' cyberloafing behaviors may negatively affect their academic achievements. The quantitative results of the study also confirm that cyberloafing has a low negative impact on academic achievement. In terms of total effect size according to the path model, the cyberloafing factor has a low negative impact on academic achievement. Although its direct effect may not be significant, cyberloafing indirectly affects academic achievement. These findings are consistent with a limited number of studies in the literature indicating a negative relationship between cyberloafing and academic achievement (Ravizza et al., 2017; Wu et al., 2018). However, as the qualitative findings of this study also suggest, using a mobile phone during class as a distractive behavior may not only affect the user but also negatively impact the academic performance of other students. Therefore, efforts to encourage students to use their phones in a controlled manner through school counseling services can not only reduce the risk of addiction but also minimize the risk of cyberloafing, contributing to a more productive learning environment.

According to the model, the variable that has the highest influences on high school students' cyberloafing behaviors is the external academic locus of control. The qualitative findings of the study indicate that students who associate their success or failure with factors beyond themselves tend to use social media or smartphones more during the class. Accordingly, it can be suggested that external academic locus of control may directly and indirectly positively affect cyberloafing. Indeed, the quantitative findings of this study also confirmed that the external academic locus of control may have a direct and indirect impact on the cyberloafing levels of high school students. This finding is consistent with the results of some previous studies (Blanchard & Henle, 2008; Yaşar, 2013). For example, Blanchard and Henle (2008) showed that the external academic locus of control was associated with cyberloafing behaviors in work environments. Yaşar (2013) found a positive relationship between external locus of control and cyberloafing in a study with undergraduate students. Therefore, interventions to make students more internally focused and to encourage them to use their phones in a controlled manner may not only reduce the risk of addiction but also minimize the risk of cyberloafing.

In conclusion, this study provides valuable insights into various factors influencing high school students' academic achievements. The findings highlight the importance of addressing the issues such as social media usage, internal academic locus

of control, academic procrastination, smartphone addiction, and cyberloafing to enhance students' academic performance. The study suggests the need for targeted interventions and educational programs to promote healthier technology use and study habits among high school students. Additionally, efforts to encourage students to develop internal academic locus of control can positively impact their academic performance. School counseling services can play a crucial role in providing guidance to students and parents on responsible smartphone usage and effective time management. Ultimately, understanding and addressing these factors can contribute to creating a more conducive learning environment for high school students.

8 Conclusion and implication

In conclusion, according to the model developed in this study, students with a tendency toward an external academic locus of control may have a higher likelihood of experiencing various learning-related problems, including smartphone addiction, excessive use of social media, cyberloafing behaviors, and academic procrastination. This situation could pose a significant risk for low academic achievement. However, since the direct impact of the external academic locus of control on academic achievement is not significant, this risk may be higher in students who use social media more, engage in cyberloafing during classes, exhibit smartphone addiction behavior, and procrastinate academically.

Contrary to these findings, students with high scores on the internal academic locus of control seem to be more advantageous in terms of risks such as excessive social media use, smartphone addiction, cyberloafing, academic procrastination, and low academic achievement compared to students with a tendency toward an external academic locus of control. However, as the internal academic locus of control does not directly affect academic achievement, having an internal academic locus of control may not be sufficient for high academic achievement. In this context, it is believed that examining factors such as general intelligence, academic self-efficacy, effort, and learning strategies in explaining the impact of the internal academic locus of control on academic achievement would contribute to the literature.

In future research, qualitative findings can be redesigned with larger groups, including students, teachers, and parents. Additionally, similar studies can be conducted with different types of schools and different age groups. Moreover, experimental studies with groups consisting of students with high levels of smartphone addiction, cyberloafing, and academic procrastination can be conducted to explore different methods and strategies that can be used to improve academic achievement. In other words, approaches that teachers can adopt to enhance the learning motivations and academic achievements of students exhibiting cyberloafing and academic procrastination behaviors and prone to smartphone addiction can be investigated. New models can be developed regarding the relationships between teacher behaviors, parental attitudes, teaching methods used by teachers, and the relationships between students' cyberloafing, smartphone addiction, and academic procrastination. Furthermore, applications similar to the "Smartphone Addiction Management

System (SAMS)" suggested by Lee, Ahn, et al. (2014) for students at high risk of smartphone addiction can be developed. Informing families, installing applications on students' phones with their consent, and assessing students can be effective in using the correct intervention technique. Additionally, seminars and psychoeducation programs can be planned by school administrations and guidance services to address students struggling with usage control. Evaluation of the effectiveness of programs may require measuring smartphone addiction, cyberloafing, academic procrastination, and academic achievement levels before and after the program.

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Data availability The data analyzed during the current study are not publicly available due to privacy reasons but can be obtained from the corresponding author upon reasonable request.

Declarations

Ethical approval The Research Ethics Board of the Institute of Educational Sciences at Marmara University approved this study.

Conflict of interest The authors declare no conflict of interest.

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