Determination of Predictive Relationships Between Problematic Smartphone use, Self-Regulation, Academic Procrastination and Academic Stress Through Modelling

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Abstract

In this study, the relationship between problematic smartphone use, self-regulation, academic procrastination and academic stress among university students was examined. The theoretical model constructed to explain the predictive relationships between variables was tested using path analysis. Research data was collected from a sample of 632 university students (68.2% male, 31.2% female) using scales for smartphone addiction, academic procrastination, academic self-regulation, and academic-expectations-related stress. Collected data was checked for suitability for path analysis, thereafter a valid model was constructed making appropriate data modifications in the process. Path analysis results showed that; (i) self-regulation is a significant negative predictor for problematic smartphone use, (ii) problematic smartphone use is a significant predictor for both academic procrastination and academic stress, while (iii) self-regulation is a significant negative predictor for academic procrastination and a significant positive predictor for academic stress. Therefore, it can be said that problematic smartphone use has a negative impact on academic development for university students.

Keywords: Academic Procrastination, Academic Stress, Problematic Smartphone Use, Self-Regulation

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INTRODUCTION

Increasing smartphone use brought with it a myriad of problems such as compulsive checking of messages, not being able to stop using it in inappropriate situations, and texting while driving (Billieux et al., 2015). The relationship between excessive smartphone use and dereliction of family/work/school responsibilities can be clearly observed. Seeing more and more distracted students passing time on their smartphones during classes, calls for a better examination into the issue.

Before framing problematic smartphone use, the meaning of addiction and behavioral addiction should be clarified. Addiction has been defined as "a compulsion to engage in a rewarding behavior despite any negative consequences to the person's physical, mental, social or financial well-being" (Stein, Hollander, Rothbaum and Olasov, 2009) and is listed under "mental disorders" (APA, 2013): In *The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5), published by the American Psychiatric Association (APA), —in which mental disorders are defined and classified,— addictive disorders are listed under two broad categories; substance-related and behavioral. Only gambling addiction was listed under the latter in DSM-5, published in 2013, while the only mention was made for internet gaming, exercise, shopping related addictions, to be considered for listing when/if there is insufficient peer-reviewed evidence. Behavioral addictions were listed under the same broad category with substance-related disorders, since activated reward systems and behavioral symptoms regarding both are similar (APA, 2013). Physical and psychological symptoms seen in substance-related disorders, can be observed in behavioral addictions. Anything that can induce excitement and impulsive reinforcement, be that substance-related or not, can be addictive (Bian and Leung, 2015). There is growing research into technology-related addictive behavior regarding television, the Internet, gaming, social media and mobile phones (Soror, Steelman and Limayem, 2012). Many technology-related addictions that have been defined to date (for the Internet, social media, online gambling, online gaming) can relate to smartphones, which is an object of addiction by itself and a conduit into the aforementioned (Haug, Castro, Kwon, Filler, Kowatsch and Schaub, 2015). However, disorders related to the Internet and gaming were prevalent way before smartphones came into use. Researchers prefer using terms like "problematic smartphone use" (Wang, Wang, Gaskin and Wang, 2015; Elhai, Dvorak, Levine and Hall, 2017), "excessive mobile phone use" (Khan, 2008; Domoff, Borgen, Foley and Maffett, 2019) for disorders related to smartphone usage and refrain from using the term "addiction", since no clear definition regarding the issue has yet been made by reference organizations. On the other hand, some indications for problematic smartphone use, —like compulsive checking of messages and failure to stop usage in inappropriate situations or while driving— have already been defined (Billieux et al., 2015). In this study, we prefer referring to the issue as "problematic smartphone use".

Considered to be a device of convenience and fun; smartphones are used for many purposes like information search and retrieval (Dorsey, McConnell, Shaw, Trister and Friend, 2017), reading news and magazines (Park and Kim, 2018), access to social media (Anderson and Jiang, 2018), education (Anshari, Almunawar, Shahrill, Wicaksono and Huda, 2017), social interaction, banking (Brodmann, Rayfield, Hassan and Mai, 2018), and gaming (Lopez-Fernandez, Männikkö, Kääriäinen, Griffiths and Kuss, 2018). Turkey is one of the leading countries in smartphone ownership, with 74% (Poushter, Bishop and Chwe, 2018). In addition, smartphone ownership among younger adults (aged 18 to 36) is much higher than that for older adults (Poushter et al., 2018). The number of mobile internet users in Turkey was reported to be 60,802,355 as of June 2019 (Information and Communication Technologies Authority , 2019), which translates into a mobile internet penetration figure exceeding 70%, way above the global average. A distinct culture has formed around smartphones, which became an indispensable part of everyday life. There is growing evidence for negative aspects of mobile phone use, and particularly smartphone use, despite the convenience they provide (Hussain, Griffiths and Sheffield, 2017; Lopez-Fernandez et al. 2017). Notwithstanding rising issues, school and academic institutions allowing smartphone use and multitasking during classes are growing in number. The portability, ease of access and range of applications that smartphones provide also open the door to new ways of problematic use. The flood of reminders and information flowing

through “always-on and connected” smartphones and their lustrous interfaces, may be among major reasons behind the rise in attention disorders and related irresponsible behavior we observe in our times.

Despite the convenience they bring, excessive and uncontrolled use of smartphones in a manner that conflicts with the roles and responsibilities of users can lead to addiction (Haug, et al., 2015). Individuals developing behavioral addiction to mobile phones, the Internet, social media and online gaming, get carried away neglecting other tasks and duties, and some may even stay up and hungry for long periods of time (as in the case of addicted online gamers) to keep on with the addictive behavior. Along with that, comes the deferral of family and academic duties. Problematic smartphone use does not typically cause economic loss as in the case of substance-related disorders and gambling addiction (APA, 2013). Behavioral addictions are characterised with overuse, withdrawal symptoms, tolerance and unwanted consequences. Craving for excessive use defines many behavioral addictions. In a typical student with mobile phone addiction, one can observe at least 5 hours of daily mobile phone use, nervousness when parted with the device, constant tendency to increase use time whenever possible along with physical and psychological problems (Kuss and Pontes, 2018). Lack of self-confidence and social skills, depression, extreme impulsivity, social anxiety, attention deficits, feelings of loneliness, and poor academic performance are observed among people with problematic smartphone use (Elhai et al., 2017). The aforementioned observations are similar with those related to Internet addiction, gambling addiction and other behavioral addictions (Kuss and Pontes, 2018). Problematic smartphone use has also been shown to be related to attention deficit disorder, concentration problems, sleep disorders, nutrition disorders, tobacco and substance abuse (Ezoe, Toda, Yoshimura, Naritomi, Den and Morimoto, 2009). Jumoke, Oloruntoba and Blessing (2015) showed a negative relationship between mobile phone use in students and their academic performance.

Academic Stress and Problematic Smartphone Use

Stress is described as ‘feelings of tension and pressure that the individual experiences due to physical and emotional distress’, and plays a major role in human life (Baltaş and Baltaş, 2008). While stress at certain levels motivates and helps the individual to succeed, excessive stress may lead to physical, emotional, social and psychological problems. Hardships in private life, work or school environments can be sources for stress (Braham, 2004). Sources for and sensitivity to stress-inducing factors and the level and modes of feeling stress may differ from individual to individual. Stress destabilizes the psychological and physical balance that an individual normally experiences in life. Efforts towards coping with stress are actually actions to regain those balances (Selye, 1983).

Problems at school environments are major sources of stress for university students. According to the Holmes-Rahe stress scale; getting bad grades, being expelled from school, switching schools, having problems with classmates and peers are important causes of stress (Pastorino and Doyle-Portillo, 2012). Factors like family pressure, financial problems, competition in class, hardships in grasping subjects, problems in communication with academic personnel (Cheng, Leong and Geist, 1993), exam anxiety, exam preparation issues, having too many subjects to cover (Misra and Castillo, 2004) can also cause stress. Stress that students experience related to issues in the academic environment is called “academic stress”. Stress at a certain level can be motivating for promptly delivering assignments, getting prepared for the exams and handling other academic tasks. However, stress above a certain level will probably put the student under debilitating pressure which can cause academic failure along with physical and psychological problems (Fisher, 1994).

Research done among university stıdents indicates that academic stress is a major factor affecting academic performance and overall health. Studies show that academic stress at school environments has negative effects on the learning and academic performance of students (Ahn, Park, Baek and Chung, 2007; Akgün and Ciarrochi, Siraj, Salam, Roslan, Hasan, Jin and Othman, 2014;

Struthers, Perry and Menec, 2000; Talib and Zia-ur-Rehman, 2012). According to Struthers et al. (2000), the effect might turn to positive as stress also elevates motivation at times. Academic stress is also closely related to health problems (Hystad, Eid, Laberg, Johnsen, and Bartone, 2009). An increase in academic stress results in an increase in complaints about physical health and in the prevalence of depression (MacGeorge, Samter and Gillihan, 2005).

Recent academic research points to relationships between smartphone addiction or problematic smartphone use and academic stress (Kim and Lee, 2019; Kim, 2019; Oh and Kim, 2019; Seo, 2018). Moreover, it was shown that phone addiction and general life stress levels of students are related (Kang and Park, 2018). Students who fall behind with academic work or exam preparation due to excessive phone use will probably have stress problems due to academic failure, delayed graduation and family problems (Yang, Asbury and Griffiths, 2019). There is no prior research exploring the relationship between student stress, academic stress and smartphone addiction in Turkey. On the other hand, the relationship between smartphone addiction and mental health of individuals have been studied. According to Özen and Topçu (2017), there is a positive relationship between smartphone addiction and the prevalence of depression, obsessive-compulsive disorders and difficulty in identifying feelings. Demirci, Akgönül and Akpınar (2015) also showed that smartphone addiction is related to depression and anxiety. In this study, the magnitude and direction of the relationship between smartphone use and academic stress among university students in Turkey, a topic widely researched in some other geographies, will be examined.

Academic Procrastination and Problematic Smartphone Use

Procrastination is a self-regulatory problem characterised with a tendency to refrain from starting to work on or deferring the completion of required and important tasks (Ferrari, 2010). Academic procrastination, on the other hand, is a deliberate deferral of the initiation or completion of tasks required to finish an academic activity. (Schouwenburg, 2004). Being a personal problem that is much more complicated compared to ineffective time management, and with its varied emotional, behavioral and cognitive aspects; academic procrastination is a complex issue that plays an important part in student life. Meta-analysis studies on the issue showed that males have a higher tendency to procrastinate (Steel, 2007; Van Eerde, 2000). It is reported that 80% to 95% of students live through some level of academic procrastination in their lives (O'Brien, 2002). The main difference between procrastination and the simple delaying of a task is the feeling of internal disturbances that the former causes (Lay and Schouwenburg, 1993). These disturbances can come out as anxiety, regret, loss of hope or self-accusation. There are other external consequences of chronic academic procrastination like low performance, missed opportunities, increasing health risks, problems in relationships to name a few (Moon and Illingworth, 2005).

Academic procrastination is essentially a conflict between intentions and actions resulting in unfavorable emotional responses. Şahin (2014) reported a relationship between the level of Facebook usage and academic procrastination among students. On the contrary, in a similar study, Odacı (2011) mentioned that data showed no significant relation between academic procrastination and problematic Internet use. As a result, we can say, evidence for such a relationship is not conclusive. To clarify the issue, in this study, the relationship between problematic smartphone use and academic procrastination is examined. In international studies among university students, relationships between excessive smartphone use and poor psychological well-being, anxiety, and feelings of loneliness have been reported (Bian and Leung, 2015), which points to the importance for an inquiry about the level of problematic smartphone use among Turkish university students and relationships of such use with prevalent physiological problems. This study aims to explore the relationship between problematic smartphone use and academic stress, academic procrastination, and self-regulation in university students, and reveal other possible relationships among these factors.

Self-regulation and Problematic Smartphone Use

Self-regulation refers to the processes, internal and/or transactional, enabling an individual to guide goal-directed activities over time and according to changing circumstances (Karoly, 1993). Impulsivity, that implies a lack of self-regulation, may cause problematic smartphone use. Some research shows low levels of self-regulation to be a good predictor for high internet or mobile phone use and the prevalence of unfavorable consequences like anxiety (Soror et al., 2012). In studies among samples from Europe, failure of self-regulation was found to be a good predictor for problematic smartphone use (VanDeursen et al., 2015). However, it is not clear if such relationships exist among university students in Turkey.

Emotion regulation is the process of an individual's modification of his/her emotions to cope with their changing environment (Cakir, 2017). Success of such adaptive rearrangement of emotions mainly depends on two factors: Improvement of cognitive reappraisal and avoidance of expressive suppression (Karoly, 1993).

It has been shown that there is a positive relationship between coping motives, mood alteration, level of perceived fun and problematic smartphone use. On the other hand, levels of empathy and life satisfaction are negatively linked to the predisposition towards disorders related to smartphone use (Bian and Leung 2015). University life may become pressing and stressful for some students, which makes smartphones attractive vehicles for a temporary escape from reality (Soror et al., 2012). Students who are into the habit of problematic smartphone use, generally find it hard to control the urge during lessons and study time, too, and more likely to suffer from poor academic performance.

Cognitive reappraisal is the reassessment of emotional stimulation to reduce negative emotional impact. Expressive suppression, on the other hand, involves avoiding emotional reevaluation and expression. Problematic smartphone users may not effectively organize their emotions, but rather prefer avoidance/distraction through smartphone use (Hoffner and Lee, 2015). In other words, rather than using adaptive emotion management strategies like problem-solving or social support, problematic smartphone users prefer distraction, avoidance or withdrawal through smartphone use. The relationship between problematic smartphone use and perceived level of anxiety builds up on maladaptive coping strategies involved (Elhai et al., 2017).

Aims and Hypotheses

The aim of this study is to explore the relationship between academic procrastination, self-regulation, academic stress and problematic smartphone use in university students. Research sub-problems are as follows:

1) Is self-regulation a predictor of problematic smartphone use among college students?

2) Does problematic smartphone use predict academic procrastination among college students?

3) Does problematic smartphone use predict academic stress among college students?

4) Is self-regulation a predictor of academic procrastination among college students?

5) Is self-regulation a predictor of academic stress among college students?

6) Does academic stress predict academic procrastination among college students?

METHOD

Research Model

In this study, the relational screening model, a quantitative research method, was used to explore the relationship between problematic smartphone use and academic procrastination, self-regulation, and academic stress. The relational screening model is mainly used to explore the relationship between two or more variables (Büyüköztürk, et al., 2012). The theoretical model constructed for this study was tested using path analysis, a special case of structural equation modelling. In this model, self-regulation was set as an exogenous variable, problematic smartphone use and academic stress as intermediate variables, and academic procrastination as an endogenous variable. Arrows and their directions show the explanatory relationship between variables in the model. Since self-regulation has been identified as an important predictor of problematic smartphone use in previous studies (VanDeursen et al., 2015; Soror et al., 2012), it is also defined as an exogenous variable in this study. Problematic smartphone use (Bian and Leung, 2015; Odacı, 2011), which has a high level of correlation with academic procrastination, is defined as an internal variable in this study. Finally, the relationship between problematic smartphone use and academic procrastination and its' mediating rolewas added to the model. (Ref. Figure 1).

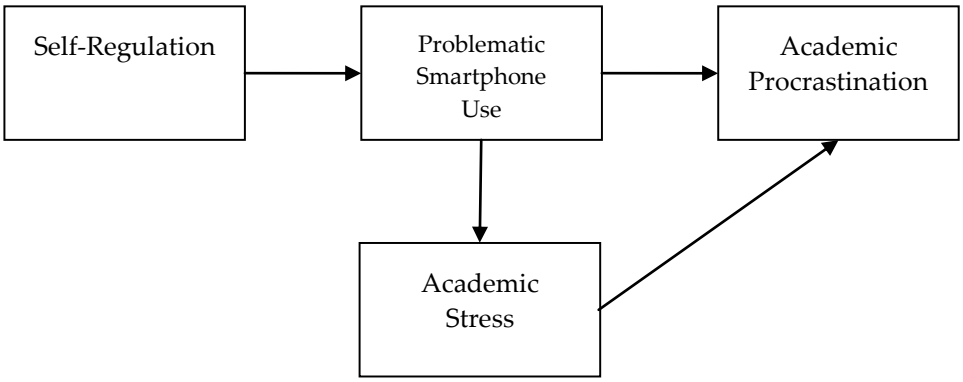

Figure 1. Assumed model

Participants

Data for the study were collected from 632 university students (68.8% female, 31.2% male) from 15 different teaching programs at Atatürk Faculty of Education, Marmara University. Of those; 43.8% were in their 1st year, 9.7% in their 2nd year, 20.9% in their 3rd year and 20.9% were in their 4th year or had spent more than 4 years at their departments. Participants' age distribution is as follows: 21.6% aged 19, %19 aged 20, %19.5 aged 21, %21.7 aged 22 and %19.6 aged 23 and over. Average age of participants is 21.3 (±3.2). For an effective path analysis, a large sample size(N>200) has been suggested (Kline, 2005). The sample size for this study (N=632) easily satisfies this requirement.

Table 1. Identity Attributes of Participating Students

Attributes		N	%
Gender	Female	435	68,8
	Male	197	31,2
Class Level	1	277	43,8
	2	61	9,7
	3	132	20,9
	4 and over	162	25,6

Age	19	128	21,6
	20	120	19,0
	21	123	19,5
	22	137	21,7
	23 and over	124	19,6
Department	Special Education Teacher Education	118	18,7
	Turkish Language and Literature Teaching	91	14,4
	Guidance and Psychological Counseling	55	8,7
	Science Teacher Education	45	7,1
	Art and Crafts Teacher Education	45	7,1
	Psychology	43	6,8
	Computer Education and Instructional Technology	41	6,5
	Primary Mathematics Teacher Education	31	4,9
	English Language Teaching	18	2,8
	Social Studies Teacher Education	18	2,8
	Others	127	20,2
Total		632	100

Data Collection Tools

Data for research variables were collected using four different measurement tools. The participants also filled a personal information form containing identity attributes like gender, age, class level and department.

Academic Expectations Stress Scale

To measure academic expectations stress levels of participants, the "Academic Expectations Stress Scale", developed by Ang and Huan (2006) and adapted to Turkish by Kelecioğlu and Bilge (2009) was used. The scale consists of nine 5-point Likert-type items grouped under two main categories: "Expectations of Parents/Teachers" and "Expectations of Self". Total scores were used in this study. The adapted version used has a factor structure similar to that of the original scale. The internal consistency coefficient for the whole scale is .90. The Cronbach alpha coefficient computed for this study is .86.

Academic Procrastination Scale

Data regarding academic procrastination were collected using the "Academic Procrastination Scale". The scale, developed by Çakıcı (2003) contains nineteen 5-point Likert-type items, grouped under "Procrastination" and "Regular Studying Habits" sub-sections. Higher scores translate into lower academic procrastination. Total scores were used in this study. The internal consistency coefficient for the whole scale is .92. The Cronbach alpha coefficient computed for this study is .83.

Smartphone Addiction Scale

To assess problematic smartphone usage of university students the "Smartphone Addiction Scale" was used. The scale, developed by Kwon, Kim, Cho and Yang (2013) consists of ten 6-point Likert-type items. The scale was adapted to Turkish, and contingent validity and consistency tests were run by Noyan, Enez Darçın, Nurmedov, Yılmaz and Dilbaz (2015). The adapted version used has a factor structure similar to that of the original scale. The Cronbach alpha internal consistency coefficient for the whole scale is .87. The Cronbach alpha coefficient computed for this study is .75. Higher scores point to stronger smartphone addiction.

Academic Self-Regulation Scale

Data regarding the self-regulation capabilities of university students were collected using the "Perceived Self-Regulation Scale".

The scale was developed by Martinez-Pons (2000) and adapted to Turkish by Kaplan (2014). The scale covers four factors and consists of 48 items: 15 items under "goal-setting", 4 items under "getting support", 14 items under "strategy implementation" and 15 items under "strategy monitoring". Total scores were taken into consideration in this study. The Cronbach alpha internal consistency coefficient for the whole scale is .97. The Cronbach alpha coefficient computed for this study is .86.. Higher scores translate into higher self-regulation capabilities.

Data Collection and Analysis

Data for this study were collected in November and December 2019. Prospective participants were informed about the study and told that participation would be on a voluntary basis. Analyses were conducted using SPSS and AMOS. For the identity data collected from participating university students, frequencies and percentages were calculated. Mean and standard deviation of research variables were computed to obtain descriptive statistics, and Pearson correlation test was used to investigate the relationship between variables. VIF and tolerance values were calculated to test for multicollinearity. Path Analysis was performed to test the assumed model. Path Analysis is one of many Structural Equation Modelling methods, used specifically for exploring complex dependencies among multiple variables. Only observed variables are used for path analysis (Kline, 2005; Byrne, 2015).

Path analysis starts with computing goodness-of-fit indices and checking if they are in acceptable range. Some of the indices frequently used for this purpose are; Chi-square/df, RMSEA (Root Mean Square Error of Approximation), NFI (Normed Fit Index), RFI (Relative Fit Index), CFI (Comparative Fit Index), TLI (Tucker Lewis Index). For a good fit, Chi-square/df must be below 3, RMSEA below .03 and NFI, RFI, CFI, TLI must all be above .95. If not, the model should be modified until so as to meet the conditions. That modification involves methods like adding/removing causal arrows and adding covariance arrows between exogenous variables. The next step after desired values for the goodness-of-fit indices is attained upon modification is the analysis of relationships between variables (Byrne, 2015; Hu and Bentler, 1999; Kline, 2005; Tabachnick and Fidell, 2007).

Measures of internal consistency, skewness and kurtosis are listed in Table 2.

Table 2: Internal consistency coefficients, skewness and kurtosis values for scales utilized

	Cronbach Alpha	Skewness	Kurtosis
Smartphone Addiction Scale	.75	.271	−.492
Academic Procrastination Scale	.83	.343	−.169
Academic Self-Regulation Scale	.86	−.062	−.032
Academic Expectations Stress Scale	.86	−.246	−.325

The Smartphone Addiction Scale, the Academic Procrastination Scale, the Academic Self-Regulation Scale, and the Academic Expectations Stress Scale used in this study to collect data have Cronbach alpha internal consistency coefficients of .75, .83, .86 and .86 respectively. Those values being above the minimum requirement of .70 indicates a high level of overall internal consistency. A normal distribution requires skewness and kurtosis values between −1 and +1. Skewness and kurtosis values for all four scales used in this study satisfy that condition, showing that data obtained is normally distributed.

FINDINGS

Path analysis was performed to examine the predictive relationship between problematic smartphone use, self-regulation, academic procrastination and academic stress among university students. The model tested in this study is shown in Figure 2. Mean and standard deviation values for problematic smartphone use, self-regulation, academic procrastination and academic stress along with correlation coefficients between these variables, the relationships between which were examined in this study, are listed in Table 2.

Table 3: Mean, Standard Deviation and Correlation Values for Variables Examined

	Mean	Std. Dev.	1	2	3
1. Problematic smartphone use	3.14	1.06			
2. Academic procrastination	2.65	.60	.396**		
3. Self-regulation	3.76	.56	−.157**	−.347**	
4. Academic stress	3.41	.83	.249**	.056	.072

** significant at p<.01

As shown in Table 3, mean values for problematic smartphone use, self-regulation, academic procrastination and academic stress are 3.14, 3.34, 3.76, and 3.41, respectively. Problematic smartphone use has a significant positive relationship with academic procrastination at .396 level, a significant negative relationship with self-regulation at −.157 level, and a significant positive relationship with academic stress at .249 level (p<.01). Self-regulation has a significant negative relationship with academic procrastination at, −.347 level, while it is not related to academic stress at a significant level (p>.05). Lastly, there occurs no statistically meaningful relationship between academic procrastination and academic stress (p>.01).

No multicollinearity between exogenous variables should exist for correct path analysis. The hypothesis regarding the existence of multicollinearity was tested using VIF and tolerance values. A VIF value below 10 and a tolerance value larger than 0.1 are required to confidently conclude that there is no multicollinearity (Hair, Anderson, Tatham and Black, 1995). VIF and tolerance values for variables are listed in Table 4.

Table 4: VIF and Tolerance values for variables

	Tolerance	VIF
Problematic smartphone use	.790	1.266
Academic procrastination	.760	1.316
Self-regulation	.869	1.151
Academic stress	.925	1.081

For all four variables in Table 4, VIF values are below 10 and tolerance values are above 0.1. Therefore, it can be said, there is no multicollinearity between variables. Upon that confirmation, a path analysis was conducted.

Path analysis consists of two main phases; evaluating goodness-of-fit using related indices, and hypothesis testing. Hypothesis testing starts when only if goodness-of-fit indices satisfy required conditions. If there are discrepancies in goodness-of-fit indices, modifications are made iteratively until all indices of concern satisfy required conditions; if that is not possible the analysis is terminated. The primary computation of goodness-of-fit indices for this study yielded following results: Chi-square/df = 36.416, RMSEA = .237, NFI = .694, RFI = .082, CFI = .69, TLI = .084. The initial results were way out of acceptable ranges (Byrne, 2015; Hu and Bentler, 1999; Kline, 2005; Tabachnick and Fidell, 2007). Therefore, some modifications were required to improve goodness-of-fit. Modifications help researchers improve the model and reveals undiscovered predictive relationships between variables. (Şimşek, 2007). In this study, causal arrows from self-regulation to academic stress and to academic procrastination were added at modification. In addition, the causal arrow from academic stress to academic procrastination was omitted. Şimşek (2007) suggests omitting causal arrows

depicting relationships that are found to be insignificant, during modelling. In line with those preliminary findings, Hypothesis 6 (H6) was rejected. Studies by Hj Ramli, Alavi, Mehrinezhad and Ahmadi (2018), Orem, Petrac and Bedwell (2008) revealed the existence of a relationship between self-regulation and academic stress. Similarly, Senecal, Koestner and Vallerand (1995); Bembenutty (2007), Bembenutty (2009) and Avcı (2013), in their research, showed the relationship between self-regulation and academic procrastination. All these support the rationale for modifications made in this study.

Values for goodness-of-fit indices, computed along with path analysis after modifications, are listed in Table 5. These latter values satisfied goodness-of-fit criteria: Chi-square/df = .90, RMSEA = .000, NFI = .1.000 RFI = .998, CFI = 1.000, TLI = 1.024. (Byrne, 2015; Hu and Bentler, 1999; Kline, 2005; Tabachnick and Fidell, 2007), thus further analyses were conducted.

Table 5: Goodness-of-fit indices' values for the model to be tested

Indicator	Value	Cut-off Point	Decision
Chi-square/df	.090	< 3	Perfect Fit
RMSEA	.000	< .5	Perfect Fit
NFI	1.000	> .95	Perfect Fit
RFI	.998	> .95	Perfect Fit
CFI	1.000	> .95	Perfect Fit
TLI	1.024	> .95	Perfect Fit

Source: (Hu and Bentler, 1999; Kline, 2005; Tabachnick and Fidell, 2007).

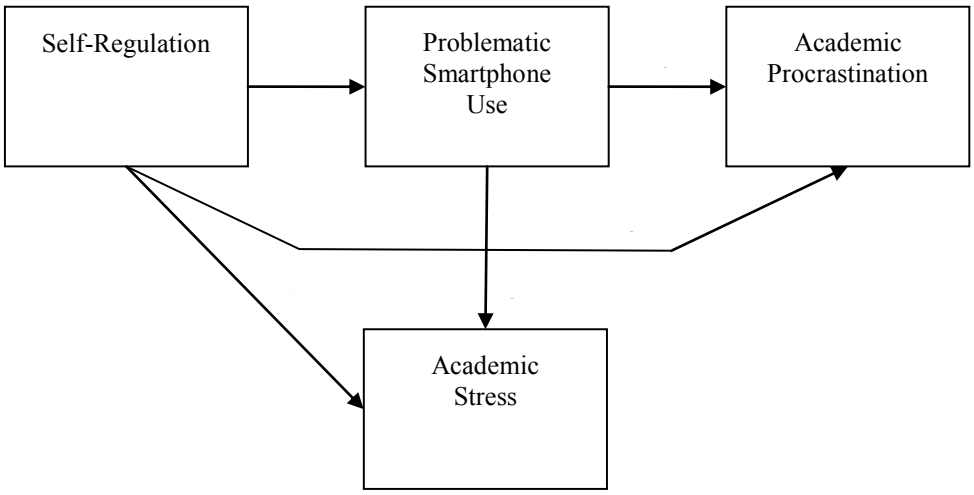

Figure 2: Model Tested (Valid Model)

The unidirectional arrows in Figure 2 depict causal relationships between dependent and independent variables in path analysis. The numbers above the arrows show the values for related path coefficients.

Path coefficients, t values, hypotheses tested, and test results are listed in Table 6.

Table 6. Statistics and test results of the structural model tested

Hyp.	Structural paths			β	Std. Dev.	t	p	Hyp. Decs.
H1	Problematic smartphone use	←	Self-regulation	−.157	.074	−3.984	***	Accept
H2	Academic procrastination	←	Problematic smartphone use	−.350	.020	−9:967	***	Accept
H3	Academic stress	←	Problematic smartphone use	.267	.030	6.879	***	Accept
H4	Academic procrastination	←	Self-regulation	.292	.038	8.317	***	Accept
H5	Academic stress	←	Self-regulation	.114	.057	2.932	.003	Accept

In path analysis, t and p values are used to evaluate if the variable of concern is a significant predictor, while path coefficient (β) shows the degree of this relationship. According to findings listed in table 6, self-regulation has a significant predictive relationship with problematic smartphone use (β=−157, p<.05), academic stress (β=.114, p<.05) and academic procrastination (β=.292, p<.05). Problematic smartphone use, on the other hand, has a significant predictive relationship with academic stress (β=.267, p<.05) and academic procrastination (β=−.350, p<.05). Smartphone addiction affects academic procrastination at a higher degree than it does academic stress. In line with research findings, hypotheses H1, H2, H3, H4 and H5 were accepted.

DISCUSSION

Smartphones got more functional and affordable along with rapid technological advancements. Faster internet access, expanding social media and entertainment applications turned smartphones into an indispensable companion for users from all ages. However, alongside the convenience they bring, smartphones also have become problematic devices of distraction. Excessive use of smartphones, to an extent that conflicts with daily requirements and tasks, became a major topic under addictive behavior (Haug et al., 2015). Increasing smartphone use compounding with the decrease in parental and teacher control, has a negative impact on academic performance among university students. Students are attending classes with their smartphones (and with an "always-on" internet connection) and the observed change in student behavior patterns due to smartphone use in school/academic environments signifies the need for exploring variables that could be predictive for problematic smartphone use. In this study, results to that end and that could be guiding for future research were attained.

According to the findings of this research, self-regulation is a significant negative predictor for mobile phone addiction. This could be interpreted as individuals with higher self-regulation being less prone to developing mobile phone addiction. With that, a possible role of impulsiveness, which is also an indication of addiction in general (Elhai et al., 2017), comes to mind (Karoly, 1993). Smartphones are fun, exciting, stimulating and, because of all that, addictive (Bian and Leung 2015). On the other hand, self-regulation is, in a way, the ability to take impulses under control. Research done in Turkey (Gökçearslan, Mumcu, Haşlaman and Çevik, 2016) and in other cultures (VanDeursen et al. 2015; Yang et al., 2019) confirms this. Looking at these findings, it can be suggested that efforts towards improving the self-regulation of university students would be instrumental in avoiding problematic smartphone use.

Another finding in this study is that smartphone addiction is a significant positive predictor for academic procrastination. Students with problematic smartphone use are also expected to neglect and delay academic responsibilities, and therefore demonstrate lower academic and learning performance. Research shows that mobile phone addiction impedes academic success (Dayapoglu, Kavurmaci and Karaman, 2016; Demir and Kutlu, 2017; Samaha and Hawi, 2016). Problematic smartphone use may also cause decreases in learning motivation and level of attention (Esichaiku, Guha, Dailey and Matthew, 2016; Rozgonjuk, Kattago, Täht, 2018). Results from this study are in line with previous

research (Demir and Kutlu, 2017; Yang et al., 2019; Yurdakoş and Biçer, 2019) on this issue. Şahin (2014), on the other hand, explored that students who spend more time on Facebook have higher academic procrastination levels. Research on problematic smartphone use yields similar results that reveal the alarmingly problematic nature of smartphone use among university students, and this calls for immediate action towards finding remedies.

Results from this study also show that mobile phone addiction is a significant positive predictor for academic stress. We can expect stress from fear of failure among university students to become more prevalent with increasing mobile phone use. The majority of young people prefer to opt-in for the amusement and convenience that smartphones bring, disregarding bigger loads of stress they are to carry due to rising anxiety of failure in their personal, academic and social lives. Past studies also illustrate a relationship between problematic smartphone use and academic stress (Esichaiku et al., 2016; Kim and Lee, 2019; Kim, 2019; Oh and Kim, 2019; Samaha and Hawi, 2016; Seo, 2018; Thomas, 2016; Yang et al., 2019). In addition, smartphone addiction was shown to have an impact on general life stress levels in students (Kang and Park, 2018; VanDeursen et al. 2015). Smartphone addiction is not only a predictor for stress but was also shown to be a predictor for psychological problems like depression (Gökçearslan et al., 2016; Demirci et al., 2015; Özen and Topçu, 2017), anxiety (Gökçearslan et al., 2016; Hussain et al. 2017; Özen and Topçu, 2017), obsessive-compulsive behavior and difficulty in identifying feelings (Özen and Topçu, 2017).

This research shows that self-regulation negatively affects problematic smartphone use. The results of this study also indicate that self-regulation is a positive predictor for academic stress and negative predictor for academic procrastination, which could mean that students with higher self-regulation bear higher academic stress but are more loyal to academic duties and less inclined to neglect academic responsibilities. In another study, self-regulation was found to be a negative predictor for both academic stress and academic procrastination (Yang et al, 2019). Students with low self-regulation are more inclined to problematic smartphone use. There is evidence for addictive behavior being related to the level of self-regulation (VanDeursen vd., 2015).

Lastly, it was concluded in this study that academic stress is not a predictor for academic procrastination. In other words, findings did not point to any meaningful relationship between stress resulting from academic responsibilities and dereliction of academic duties. On the contrary, Yang et. al (2019) had concluded in their study that academic stress was a significant predictor for academic procrastination.

CONCLUSION

According to the theoretical model tested in this study, smartphone addiction is an important predictor of academic procrastination in university students. Excessive smartphone usage results in the deferral of academic duties. Smartphone addiction also predicts academic stress. Rising level of smartphone addiction results in higher academic stress from fear of academic failure. Students with lower self-regulation are more prone to problematic smartphone use, while students with higher self-regulation are less prone to academic procrastination but more prone to academic stress.

Suggestions

Since problematic smartphone use relates to the lack of self-regulation, improving self-regulation skills among students can be an effective way to decrease or eliminate problematic smartphone use.

In this study, it is also found that problematic smartphone use affects academic procrastination and academic stress. There is growing literature providing supporting evidence for the negative impact of smartphone use on academic procrastination and academic stress. The degree of the predictive

relationship of problematic smartphone use with academic procrastination and academic stress may be examined in future studies.

Data for this study were collected from students of a single university. In future studies, it could be of value if analyses utilized in this study are performed with data from participants from multiple universities from various regions in the country. Data used in this study is based on self-evaluation and self-reporting. Future research could be based on data collected using direct measurement methods.

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