The Relationship between Teacher Candidates' Technology Addictions and Their Social Connectedness: A Data-Mining Approach

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ABSTRACT

The purpose of this study is to test the relationships between teacher candidates' technology addiction and their social connectedness. Students studying at a faculty of education in a state university selected by the convenience sampling method constituted the sample of the study. Correlation analysis and association rules were used to analyze the data. The results of the study are as follows: (1) Social connectedness is inversely related to social media addiction and digital game addiction. (2) If Internet addiction and smartphone addiction are low while social connectedness is high, social media addiction is low. (3) If social media addiction and smartphone addiction are low and social connectedness is high, digital game addiction is also low.

Keywords: *social media addiction, digital game addiction, Internet addiction, smartphone addiction, social connectedness*

INTRODUCTION

The spread of the Internet offers many benefits to human life. However, as in all habits, excessive or problematic use of the Internet brings some problems, and the use of more technological devices and smart applications also causes various addictions. In other words, the intense use of the Internet and the inability to keep its usage under control cause Internet addiction (Young, 1998a) and various Internet-mediated addictions that cause serious harm (Leung et al., 2020). Young (1998a) discussed the use of Internet-mediated technological devices and applications at an excessive and careless level under the heading of technological dependencies.

Technological addictions are defined as dangerous habits as much as other behavioral addictions or substance addictions and show the same symptoms (mental occupation, mood variability, tolerance, deprivation, interpersonal conflict, and repetition) as other addictions (Arısoy, 2009). This is because technology addiction causes technology to dominate the behaviors and thoughts of the individual and prevent normal life, and it causes the individual to experience tension when not using technology and to be unable to fulfill his or her duties and responsibilities. Besides, in technology addiction, individuals cannot voluntarily reduce their use of technology, and they use more to experience excitement. When technology addicts use technology, they relax and their mood constantly changes (Turel et al., 2011).

Technological addictions show similar symptoms to other addictions and may also arise for similar

reasons. Although addicts are the leading causes of addiction, their mutual relationship with their environment is also a significant factor. Although individuals are supported by their environment, feelings of loneliness, isolation, and alienation can become permanent in many social situations and cause individuals to experience a lack of belonging in their lives (Lee & Robbins, 1998). Individuals trying to satisfy feelings such as loneliness, lovelessness, and insecurity seek satisfaction, especially in technological tools. This search causes technology addiction (Akkaş, 2019). Lee and Robbins (1995) define an individual's feelings of belonging or lack of belonging as social connectedness. From here, it can be said that the lack of social connectedness causes both other addictions and technology addiction.

It is much easier for individuals to establish relationships with their family, friends, and social environment with Internet-mediated technological devices. As the Internet and technological devices bring together individuals living in different parts of the world, they enable people to be aware of each other and to communicate (Chayko, 2014). Besides, the use of technology (Davis, 2012) and social media (Grieve et al., 2013) contributes positively to the strengthening of friendly relations and to the development and maintenance of social connectedness. Therefore, it can be said that Internet-mediated technologies strengthen social connectedness. However, the use of the Internet and technology to become addictive can hinder real social relationships and consequently reduce social connectedness (Hu, 2009; Valkenburg & Peter, 2009). This is because technology addiction can endanger the social life of the individual; disrupt his or her emotional functioning; and affect his or her school, family, and job. As a result, it can cause the addict to be negatively affected by other people in his or her social environment (Akkaş, 2019). Therefore, an individual's technology addiction is related to social connectedness (Savcı & Aysan, 2017).

Technological addictions are among the significant issues that need to be researched (Akkaş, 2019). Considering that information technologies have become an indispensable part of modern society, more research is needed on the identification, prevention, and treatment of technology addiction (Turel et al., 2011). Family relationships and social environment affect the emergence of Internet addiction (Hırlak et al., 2016). Families of Internet addicts are more confrontational, punishing, and less supportive than to those who are not addicted to the Internet, and family ties are weaker (Li et al., 2014). Social connectedness, which is one of the most important causes of technology addiction, means that individuals are aware of the fact that they are *a meaningful part of the social network* in which they live (Lee & Robbins, 1998). Individuals who do not have this awareness cannot be expected to contribute to any social environment they live in. The environment where the individuals socialize the most after their family is the school environment. In this respect, it is hoped that the social connectedness of education faculty students will contribute to the creation of a positive environment in the schools where they will work in the future. This is because the social connectedness of all stakeholders of the school, especially teachers and students, can help create positive school environments (Bower et al., 2015).

Considering that the teacher–student relationship is the key determinant of social–emotional well-being (Hattie, 2012; Jennings & Greenberg, 2009), it is possible to say that the social connectedness levels of students in education faculty who are today's students and tomorrow's teachers are significant in creating positive school environments in the future. It is stated that students need social support and relationships that will form social ties at the beginning of their university life and that social commitment is an important variable in adapting to a new culture (Duru & Poyrazlı, 2007) and thus in the process of adaptation to university (Duru, 2008). Considering that smartphones, tablets, computers, and game consoles occupy an important place in students' lives, it is important to examine the relationships between students' social connectedness levels and digital addictions. It is also possible that their social connectedness and digital addiction are important factors that will affect the university life of teacher candidates. Duru (2008) states that when students do not create a new environment, relationship, and bond, they may show withdrawal behaviors and return to their previous forms of social connectedness. In this context, the first contribution of this study to the field is to draw attention to the relationship between technology addiction (social media addiction, digital game addiction, smartphone addiction, and Internet addiction) and social connectedness and to offer various suggestions on what can be done to reduce teacher candidates' technology addiction and increase their social connectedness.

The second contribution of this study to the field is to reveal that the interesting, valuable, and hidden relationships between variables examined in social and educational sciences can be revealed by data-mining techniques. This is because the relationships between various variables in social sciences (also in educational sciences) are generally revealed by correlation and regression analysis. Although data mining has been used in educational sciences recently, it is still very new. It is thought that some methods used in data mining will bring a different perspective to educational sciences, especially in terms of revealing and interpreting the relationships between various variables. Therefore, this study aimed to examine the relationship between teacher candidates' technology addiction and social connectedness. In this context, an answer was sought to the following research question: what are the results obtained in testing the relationships between teacher candidates' technology addiction and social connectedness both statistically and with the association rule?

RESEARCH METHOD

Research Model

In the quantitative research paradigm, it is possible to determine the existence, direction, and degree of change between two or more variables with the relational survey model (Karasar, 2010). Relational studies aim to explain the phenomenon better by revealing the relationships between variables (Büyüköztürk et al., 2011). This study adopted a relational research model to test the relationships between pre-service teachers' digital game addiction, smartphone addiction, Internet addiction, social media addiction, and social commitment.

Participants

Students studying in the faculty of education at a state university in Turkey in the 2019–2020 academic year constituted the population of the research. Today, there is a worldwide outbreak of COVID-19, and scientists and medical personnel recommend social distancing, which led to school/university closures, curfews, remote work, etc. For this reason, the students who gave their opinions for the study were determined by the convenience sampling method. Thus, this study aimed to get the opinions of students who received online education during the pandemic process. In this context, eight students studying at the education faculty were reached. Later, these students were asked to send the questionnaire to their friends. After the number of students who gave their opinions reached 402, we waited for 15 days. The survey process was then terminated, as there was no new participation in the survey. Of the students participating in the study, 245 are women and 157 are men. Moreover, 128 were first-year students, 113 were second-year students, 101 were third-year students, and 60 were fourth-year students, and their average age was 20.34.

Data Collection Tool

The *Social Media Addiction Scale*, *Digital Game Addiction Scale*, *Young Internet Addiction Short Form*, *Smartphone Addiction Scale Short Form*, and *Social Connectedness Scale* were used in this study. The details of the scales are as follows:

The *Social Media Addiction Scale (SMA-S)* was developed by Van Den Eijnden et al. (2016). It is a Likert-type scale consisting of nine items and one dimension. The scale, adapted into Turkish by Savcı et al. (2018), explains 47.88% of the total variance. There is no reverse-scored item on the scale, and high scores indicate an increased risk of social media disorder/addiction. The Cronbach's alpha coefficients of the scale were 0.83, 0.86, and 0.86, and the three-week test–retest correlation was 0.805. In the current study, the Cronbach's alpha coefficient of the scale was found to be .89.

The *Digital Game Addiction Scale (DGA-S)*, developed by Lemmens et al. (2009), is a Likert-type scale consisting of seven items and one dimension. The scale, adapted into Turkish by Irmak and Erdoğan (2015), explains 56.96% of the total variance. The Cronbach's alpha coefficient was 0.72, and the three-week test–retest correlation was 0.80. There is no reverse-scored item on the scale, and high scores indicate an increased risk of digital game addiction. In the current study, the Cronbach's alpha coefficient was found to be .92.

The *Young Internet Addiction Short Form (YIA-SF)* was developed by Young (1998b). The scale, which was converted into a short form by Pawlikowski et al. (2013), is a one-dimensional, five-point Likert-type scale consisting of 12 items. The scale was adapted into Turkish by Kutlu et al. (2016). The Cronbach's alpha reliability coefficient of the scale was calculated as .91 for university students. Test–retest reliability was found to be 0.93. There are no reverse-scored items on the scale, and high scores indicate an increased risk of Internet addiction. In the current study, the Cronbach's alpha coefficient was found to be .94.

The *Smartphone Addiction Scale Short Form (SPA-SF),* developed by Kwon et al. (2013), is a Likert-type, one-dimensional scale consisting of 10 items. It was adapted into Turkish by Noyan et al. (2015). As a result of the analysis, the Chronbach's alpha coefficient of the SPA-SF was .87, and the test–retest reliability coefficient was .93. In the current study, the Cronbach's alpha coefficient was found to be .87.

The *Social Connectedness Scale (SC-S)* was developed by Lee and Robbins (1995). It is a one-dimensional scale with eight negative items. It was adapted into Turkish by Duru (2007). The SC-S is evaluated with a six-point rating. The Cronbach's alpha internal consistency coefficient of the SC-S was .90, and the test–retest reliability coefficient was .90. There are no reverse-scored items on the scale, and high scores indicate a high level of social connectedness. In the current study, the Cronbach's alpha coefficient was found to be .94.

Data Analysis

Descriptive and relational analyses were used to analyze the data in the present study. In the descriptive analysis, the means and standard deviations of the data were calculated, and the skewness and kurtosis coefficients were checked. Findings regarding the descriptive analysis of the collected data are shown in Table 1.

Table 1. *Findings on the Descriptive Analysis of Data*

Variables	N	$\overline{\mathrm{X}}$	sd	Skewness (95% CIs)	Kurtosis (95% CIs)
SMA-S	402	2.17	0.901	.841 (.649; 1.025)	.216 (-.279; .773)
DGA-S	402	1.95	1.024	1.071 (.874; 1.261)	.273 (-.249; .857)
YIA-SF	402	2.30	0.906	.705 (.498; .881)	.283 (-.184; .746)
SPA-SF	402	2.38	1.049	.436 (.272; .585)	-.427 (-.677; -.177)
SC-S	402	3.83	1.082	-.677 (-.835; -.504)	-.366 (-.661; -.031)

According to the skewness and kurtosis values in Table 1, the data are normally distributed because according to Tabachnick and Fidell (2013), if these values change between +1.5 and -1.5, the data are distributed normally. In the relational analysis, correlation analysis and association rule, which is one of the data-mining methods, were used to reveal the relationships between variables. Since the data were distributed normally, the relationships between variables were evaluated according to the value of Pearson's correlation coefficient (r). If the correlation coefficient is between .70 and 1.00 as the absolute value, it is interpreted as a high relation; between .70 and .30 as a medium relation; and if less than .30 as a low-level relation (Büyüköztürk, 2012).

Data mining can be defined as the process of obtaining valuable and potentially useful information that is hidden within the accumulated or collected data over time (Ateş & Karabatak, 2017; Karabatak & İnce, 2004). The association rule is a technique used to reveal new and useful information from big data sets (Ruiz, Gómez-Romero et al., 2016) and the relationships between data. The association rule shows not only whether the relationship between variables is significant but also how much the result variable(s) is affected by which variable(s). In other words, while correlation analysis is insufficient to reveal which relationships more than one variable has with other variables at the same time, the association rule makes it easy to obtain all the rules related to each other. Studies using data-mining techniques such as the association rule can provide researchers and practitioners with significant clues about what problems should be focused on and what should be done to solve these problems.

Lift and confidence values used in association rule applications are the two most important parameters

of this method (Ateş & Karabatak, 2017). Lift value is a significant parameter in the association rule technique, which enables the determination of interesting outcomes, not many rules (relationships) (Holsheimer et al., 1995). If the value of the lift becomes "1", it means that the interestingness and the relationship between the variables are weak. A lift value greater than "1" means that the positive relationship is strong, while a lift value less than "1" means that the negative relationship is strong. Besides, as this value increases, the interestingness of the rule created increases. The confidence value expresses the conditional probability value of event B in a rule like "A → B". Accordingly, it is the probability of event B occurring in the condition of occurrence of event A.

Before starting the association rule to determine the relationships between variables, the data were transformed into a format that the WEKA program can handle with a researcher specialized in data mining. To better determine the relationships between the variables (in line with the expert opinion), the averages of the participant opinion scores were divided into three evaluation categories. The average was evaluated as "low" if it was between 1.00 and 2.33, "medium" if between 2.34 and 3.66, and "high" if between 3.67 and 5.00. The frequency distributions of the categories related to the mean of each variable are also given in Table 2.

Table 2. *Frequency Distribution of Participant Opinion Scores*

Variables	High	%	Moderate	%	Low	%
SMA	32	7.96	125	31.09	245	60.95
DGA	33	8.21	89	22.14	280	69.65
YIA	35	8.71	151	37.56	216	53.73
SPA	37	9.20	178	44.28	187	46.52
SC	230	57.21	135	33.58	37	9.20

According to both the normal distribution of the raw data in Table 1 and the processed data by dividing them into the categories in Table 2, opinions about technological addictions and social connectedness are suitable for relational analysis.

FINDINGS

The findings of the analysis are presented sequentially. Accordingly, the findings related to the correlation analysis showing the relationship between teacher candidates' technology addiction and social connectedness are shown in Table 3.

Table 3. *The Relationship between Teacher Candidates' Technology Addiction and Social Connectedness*

Variables	SMA	DGA	*YIA-SF*	SPA	SC
SMA	1				
DGA	.56**	1			
YIA	.77**	.61**	1		
SPA	.69**	.47**	.79**	1	
SC	-.43**	-.40**	-.48**	-.48**	1

As seen in Table 3, there are significant, moderate, and inverse relationships between teacher candidates' social connectedness and social media addiction (r = -.43), digital game addiction (r = -.40), Internet addiction (r = -.48), and smartphone addiction (r = -.48). There are moderate, significant, and inverse relationships between teacher candidates' social connectedness and social media addiction, digital game addiction, Internet addiction, and smartphone addiction.

With the association rule, one of the data-mining methods, 50 rules were produced between teacher candidates' technology addiction and social connectedness. Among these rules, 22 rules with high confidence and lift values and including social connectedness were found. Various relationships were found between social media usage disorder in 16 of these rules, digital game addiction in 18, Internet addiction in 8, and smartphone addiction and social connectedness in 7. Table 4 also shows the rule (Rule 7) showing the

relationship of all variables with each other, the rule (Rule 1) in which social connectedness is produced only as input, five rules (Rule 2, Rule 3, Rule 4, Rule 5, and Rule 6) in which it is produced only as an exit variable, and two more rules (Rule 8 and Rule 9) including social connectedness.

Table 4. *Some Meaningful Patterns and Rules that Emerge with the Association Rule*

Rule Number	Rules	Confidence Value	Lift Value
1	DGA=low IA=low SPA=low SC=high (n=91) ==> SMA =low (n=90)	99%	1.62
2	SPA=low (n=164) ==> SC=high (n=136)	83%	1.37
3	IA=low (n=197) ==> SC=high (n=149)	75%	1.33
4	DGA=low (n=280) ==> SC=high (n=196)	70%	1.22
5	SMA=low (n=245) ==> SC=high (n=175)	71%	1.25
6	SMA=low DGA=low (n=219) ==> SC= high (n= 164)	75%	1.31
7	SC= high (n= 230) ==> SMA =low DGA=low (n=164)	71%	1.31
8	SMA=low SPA= low SC= high (n=133) ==> DGA=low (n=128)	96%	1.38
9	IA=low SPA= low SC=high (n=129) ==> SMA=low (n=124)	96%	1.58

DGA: Digital game addiction; SPA: Smartphone addiction; SMA: Social media addiction; IA: Internet addiction; SC: Social connectedness

As seen in Table 4, Rule 1 is a significant rule showing the relationship between all variables used in the study. According to this rule, 99% of the students with low digital game addiction, Internet addiction, smartphone addiction, and high social connectedness (n = 91) have low social media usage addiction (n = 90) also. The fact that the lift value was 1.62 means that this relationship was interesting and valuable; in other words, the relationship between variables was high. Further, the lift values were also above "1", and the other rules obtained showed that the relationship between the variables was significant and interesting. According to this rule, students with high social connectedness have low technological addiction.

According to Table 4, in Rule 2, 83% of students with low smartphone addiction (n=164) have high social connectedness (n=136). In Rule 3, 75% of students with low Internet addiction (n=197) have high social connectedness (n=149). In Rule 4, 70% of the students with low digital game addiction (n=280) have high levels of social connectedness (n=196). In Rule 5, 71% of students with low social media addiction (n=245) have high social connectedness (n=175). These rules revealed the relationships between teacher candidates' social connectedness and their technological addiction. This finding supported the findings in the correlation analysis.

In Rule 6, 75% of the students who stated that both social media addiction and digital game addiction are low (n=219) have high social connectedness (n= 164). According to this rule, while social media addiction and digital game addiction decrease together, social connectedness increases. In Rule 7, 71% of the students with high social connectedness (n=230) have low social media addiction and digital game addiction (n=164). According to this rule, as social connectedness increases, social media addiction and digital game addiction decrease together. These two rules showed that social connectedness was associated with both social media addiction and digital game addiction.

In Rule 8, 96% of students with low social media addiction and smartphone addiction and high social connectedness (n=133) also have low digital game addiction (n=128). According to this rule, if social media addiction and smartphone addiction decrease and social connectedness increases, digital game addiction decreases. In Rule 9, 96% of the students with low Internet addiction and smartphone addiction and high social connectedness (n=129) have low social media addiction (n=124). According to this rule, if Internet addiction and phone addiction decrease and social connectedness increases, social media addiction decreases.

DISCUSSION

In this study, correlation analysis and association rules were used to reveal the relationship between teacher candidates' technology addiction and social connectedness. The results revealed significant,

moderate, and inverse relationships between teacher candidates' social connectedness and social media addiction, digital game addiction, Internet addiction, and smartphone addiction. This study was conducted with the data collection tools used by Savcı and Aysan (2017). While the opinions of high school students were taken in the study by Savcı and Aysan (2017), the opinions of university students were taken in the current study. In this respect, comparison of the results of the two studies contributes to the field. While digital game addiction and smartphone addiction were inversely related and at low levels in the study by Savcı and Aysan (2017), they are inversely and moderately related in this study. That is, the relationship between university students' social connectedness and technology attachment is higher than that of high school students. This situation is due to the fact that university students are more independent from their social environment than high school students, and it is a natural result of high school students being more under family control. Carbonell et al. (2018) supported the idea that the perception of problematic use of the Internet and mobile phones existed and has increased over the last decade. Hırlak et al. (2016) found a significant and low but positive relationship between university students' social connectedness and Internet addiction. McIntyre et al. (2015) reported that people with poor social connectedness had a greater risk of developing compulsive Internet use. On the other hand, Internet-addicted people can disconnect from their social lives. While they think they are socializing online, their social ties may weaken in real life.

The current study revealed that social connectedness was inversely related to social media addiction and digital game addiction. The use of social media contributes positively to the development and maintenance of social connectedness (Grieve et al., 2013) and increases the sense of belonging (Quinn & Oldmeadow, 2013). Sense of belonging is a significant factor for social connectedness, but in Kırcaburun et al.'s (2018) study, while university students' belongingness was directly associated with problematic social media usage, it was indirectly associated with social connectedness. In addition to the facilitating effects of the Internet and digital devices, their excessive use and the inability to keep this situation under control may begin to harm daily life (Morahan-Martin & Schumacher, 2000). Individuals may experience irritability and negative symptoms in their social life due to problematic Internet use.

Another result revealed that if teacher candidates' Internet addiction and telephone addiction are low while their social connectedness is high, their social media addiction is low. This is an expected result because according to recent statistics, the most used smartphone applications are social media (Panko, 2018), and social media statistics showed that an average of three hours is spent per day per person on social networks and messaging (Mohsin, 2020). Carbonell et al. (2018) stated that among university students, the use of social networks is the main factor responsible for the perception of problematic Internet usage. Brown and Kuss (2020) supported this result because their study revealed that after a seven-day social media abstinence, participants experienced a significant increase in social connectedness and a significant decrease in smartphone use. It is possible to say that the social lives of individuals who stay away from the Internet and smart devices have become more active, so their social ties have begun to strengthen.

One of the results of this study is if the social media addiction and smartphone addiction of the teacher candidates are low and their social connectedness is high, their digital game addiction is also low. Leung et al. (2020) identified social media addiction, smartphone addiction, and digital game addiction as Internet-based disorders. Nowadays, due to the COVID-19 pandemic, various measures are taken to increase social distance. The Organization for Economic Cooperation and Development announced that the epidemic caused dependence on digital technologies in all areas of life, from education to health. According to the report, Internet use and accessibility increased rapidly during the COVID-19 pandemic. Since the beginning of the pandemic, Internet traffic increased by 60% as people got used to living and working online (Schleicher, 2020). Individuals whose social connectedness increased despite intense use of the Internet use the Internet at a high level due to their work or study, but they also maintained their social relations. Thus, it is possible to say that these people do not use the Internet in a harmful way that becomes an addiction.

CONCLUSION

In this study, the results obtained from both the correlation analysis and the association rule supported each other. The association rule also revealed interesting, valuable, and meaningful relationships between

social connectedness and technological addictions. This shows that data-mining techniques can be used to reveal the relationships between various attitudes and behaviors in social fields such as educational sciences.

According to the results obtained from this study, there are moderate, significant, and inverse relationships between technological addictions and social connectedness. The rules produced showed that social connectedness is mostly inversely related to social media addiction and digital game addiction. If teacher candidates' Internet addiction and phone addiction are low while their social connectedness is high, their social media addiction is low. Besides, if teacher candidates' social media addiction and smartphone addiction are low while their social connectedness is high, their digital game addiction is also at a low level.

The results showed that the social connectedness of university students in general and teacher candidates in particular has a significant relationship with their technology addiction and social media usage disorder. Students who use technology frequently and spend lots of time on social media and digital games spend less time with their families and friends in their social environment, and their social connectedness weakens over time. Therefore, it would be appropriate to say that academic success, as well as social relations, will be negatively affected by technology addiction and social media usage disorder.

Suggestions

It has been seen in the study that data-mining techniques can be used to reveal the relationships between various social variables. For this reason, it is recommended to increase students' awareness of such techniques in scientific research method courses in undergraduate programs in education faculties and to present these techniques as a separate course in master's and doctoral programs, especially in educational sciences.

In the study, it was observed that increasing the social connectedness of teacher candidates decreases their technology addiction. According to the rules produced, social connectedness is mostly inversely related to social media addiction and digital game addiction. Therefore, to reduce social media addiction, teacher candidates' Internet addiction and telephone addiction should be reduced, and their social connectedness should be increased. Besides, to reduce digital game addiction, social media addiction and smartphone addiction of teacher candidates should be reduced. The following suggestions can be offered:

- To increase their social commitment, teacher candidates should be made to perceive themselves as a part of the university where they study. For this, university administration candidates should be encouraged to participate in various social activities and excursions or to take an active part in these activities.

- It should be ensured that teacher candidates participate in social clubs at the university. Besides, awareness of social responsibility projects should be increased, and effective assignments should be given to contribute to the development of teacher candidates as sensitive individuals and to develop their sense of responsibility.

- Group sports activities or competitions should be organized to prevent or reduce teacher candidates' orientation towards digital games and to increase their social commitment.

- It should be ensured that teacher candidates participate in artistic activities such as music, dance, visual arts, performing arts, cinema, and theater to raise awareness of technological addictions, generate solutions, and develop social sensitivities.

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