Research Article

Exploring the Factors of Smartphone Addiction: An Exploratory Factor Analysis

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Abstract

Overuse of smartphones (smartphone addiction) has become a nuisance in student life. Therefore, this study had an objective to explore the factors of smartphone addiction among undergraduate (UG) students. The descriptive research method was adopted with a quantitative approach. 591 UG Students were selected randomly from different colleges of the University of Delhi. Under the descriptive statistics, the index of skewness and kurtosis and its standard errors were computed to test the normality of the data set. As an inferential statistic, "Exploratory Factor Analysis" (EFA) was applied to explore the factors of smartphone addiction. Further, "Kaiser-Meyer-Olkin Measure of Sampling Adequacy", (KMO) was applied to test Sampling Adequacy. In addition to it, "Bartlett's Test of Sphericity", was applied to test intercorrelations among variables. Multicollinearity was verified by determinant. The varimax rotation method was applied to rotate the factor matrix under orthogonal rotation. The analysis of the data set provides evidence as a result that smartphone addiction has six factors namely 'Time', 'Interference', 'Psychological Worry and Concern', 'Dependency', 'Craving', and 'Technology use and Privacy' This study explains the total 35.397 per cent of the total variance. 'Time' as a factor had the highest explained variance i.e. 16.895 per cent among all six factors whereas the factor namely 'Technology Use and Privacy' explained 2.766 per cent of the total variance which was the lowest among all the factors.

Keywords: Smartphone Addiction, Compulsive Behavior, and Factor Loading.

Introduction

The 21st century is the age of technology and science. Those countries that are doing well in the fields of Technology, communication, and electronics are generally labeled as advanced countries. This advent of technology had provided a ground for a 'today's essential commodity, i.e., smartphone' which was invented and designed by IBM in 1993. Those smartphones were sold by BellSouth (Hosch, 2023). Since then, smartphones has been playing a significant role in connecting people across the globe. The significance comes from the superb features that provide various interactive services through wireless facility, access to the internet, Wi-Fi, web browsing for real time communication. The portability enhanced the smoothness of computing, along with that touchscreen, typing keyboard, voice typing, gaming, embedded memory, digital camera made smartphones Pandora Box of real time usage as well as 'a must for' synchronous and asynchronous transmission which attracts the mass across the world. This is the reason that smartphone users are multiplying rapidly across the world. The ownership of smartphones in the population is highest in Germany at 82.4 per cent. A large portion of the population in Japan i.e. 78.4 per cent also use smartphones,

followed by Italy 77.5 per cent, US 73.7 per cent, Russia 73.2 per cent whereas the ownership of smartphones in India is 45.7 per cent (Horwath, 2023). However, there is a prediction of exponential increase in the number of smartphone users in India. One billion Indians will have a smartphone by 2026 as reported by (Business Standard, 2023).

The smartphone is a kind of device that has a double-edged sword. The exponential increase in number of smartphone users might not show a clear picture of usage as per time and need. Intelligent use may be put to the advantage whereas overuse and misuse may put the users in miseries. Moreover, there is a great debate on the abuse and addiction of smartphones and its influence on health and interpersonal skills of youths, not only globally but in India to be particular. Here in this research, the researcher talked about two types of addiction, Physical and Behavioural. In physical addiction, the use of substances is involved for instance the consumption of drugs or alcohol whereas behavioral addiction refers to compulsive use or dependency to get pleasure or enjoyment e.g. smartphone addiction. Nowadays, smartphone addiction is a great concern due to its constant overuse as 52.8 per cent of even medical students were found addicted to smartphones as investigated by (Liu et al., 2022). Generally, an addicted person feels that very important things are missing if they don't have a mobile with them. Having a smartphone has become a very important part of life like food, home, and clothes. It has also been observed that youths keep scrolling through their smartphone even if they do not have reason to scroll through it. Youths also keep busy on their smartphone if they encounter a tense situation or avoid someone. The youths become so dependent on their smartphone that creates the situation of nomophobia (Fear/tension without being smartphone) which builds the foundation for health risks and interpersonal problems.

Theoretical Framework

Psychology Associated with Smartphone: A Connection with Skinner's Theory of Respondent Response and Operant Response

Skinner was very much interested in introducing reinforcement as an independent variable to measure its effect on behavior. In this context, He introduces the types of reinforcement schedule which includes ratio schedule and time schedule to verify how these schedules affect the behavior like how frequently learning occurs, rate of response and how the particular behavior persists over period of the time in absence of reinforcement. Ratio schedule means the portion of current responses whereas time schedule refers to passage of time (Lefrancois, 2000). Although Skinner did many experiments to know the influence of reward and punishment on behavior. His famous experiment was on pigeons. He closed the one pigeon into the lever box in which food came out as a reward if a lever of the box was pressed. There was nothing that excited and created curiosity in this experiment. Simply press the lever and get the food if you are hungry. But generally, people get habituated about rewards when it is not known to them how much reward they will get and when. Pigeon knew well that they would get food by pressing the lever so the pigeon pressed the lever only in that situation in which he was hungry. On pressing the lever, if sometimes Pigeon gets the food and sometimes Pigeon doesn't get the food then the Pigeon will stick to the lever box and keep pushing the lever continuously. (Skinner 1938, as cited in Singh, 2006).

Similarly, in the case of gambling, the designer of the gambling machine also created gambling addiction by developing the design of the gambling machine in which gamblers gamble until they have money. Similarly, mobile companies applied this psychology to smartphones and designed the attractive features of smartphones. You must be thinking about the similarity among Skinner's experiment, gambling machine, and smartphone. Let's make it clear through different examples.

Similarity: Skinner's experiment, gambling machine, and smartphone

Hitting the lever in the hope of getting food by Pigeon or Pressing the button of the slot machine by the Gamblers in Casino (Gambling device) or Scrolling the screen of a mobile phone anywhere or checking the timeline of Facebook. There is one common thing in all the above examples that people want to know what is about to come in the form of reels or text messages or videos (rewards like Skinner's experiment). He/she starts to think about what would be the next reels/message (reward) or how many likes/comments have come on my social media posts (reward). It is like an attractive net in which the humans are stuck and pulled deep down in the ocean of entertainment. A person who is so absorbed in entertainment is unable to control the urge of using his/her smartphone.

Smartphone Addiction- Consequences for Eye Vision and Brain

The excessive use of smartphones has negative consequences on the eyes because (39.7 per cent) of students had dryness and pain in the eyes whereas (66 per cent) of students reported ocular problems due to prolonged use of the smartphone as investigated by (Issa et al., 2021). In addition to it, Nayak et al. (2021) found that even after one hour of smartphone reading, the problem of tiredness, sore eyes, and discomfort increases. They further, reported that binocular problem like blurred vision was also noticed. Concerning the smartphone consequences to the brain, it is evident that the excessive use of smartphones is harmful to the brain (Seo, 2017), a neuroradiologist, did research on "Smartphone addiction creates an imbalance in the brain" and found that "smartphone and internet addiction increases the level of neurotransmitter called GABA in one region of the brain which slows down brain's signal". Similar consequences like a foggy mind, headache, and even decreased vision have also been investigated by (Sharma, 2021), a Neurological Scientist & Head, of the Department of Neurology, AIIMS. She also reported the significant change observed in "frequencies of brain wave patterns". Furthermore, similar findings have also been reported by a group of researchers that "excessive use of mobile phone may be a serious problem. It might cause neurological damage which are not observable immediately but in the long term, it may decrease the brain's reserve capacity that might be a great cause of neurological diseases" as examined by (Salford et al., 2003).

Smartphone Addiction- Friendship, Social Isolation, Psychological Well-Being, and Road Accidents

Although smartphones provide the opportunity to make friends in the virtual world through various social media platforms. However, it is very harmful for social well-being in real-life as it is evident that loneliness was found to be high correlated with smartphone addiction as investigated by (Singh and Kumari, 2021). Similar findings have also been endorsed by (Yilmaz et al., 2022). Further, due to being a University student, the separation begins not only from family but also from local and school friends. Smartphone addiction additionally multiplies in raising the magnitude of loneliness. This social loneliness might cause

impact on negative social behavior such as communication, understanding emotions and facial expressions of others, and social interaction. Hence, not only quantity but also the quality of the real relationship starts to deteriorate slowly and unknowingly due to a lack of face-to-face interaction. Moreover, smartphone addiction also discourages students from participating in physical activity. Hence, under such circumstances, the possibility of obesity cannot be ignored. In addition to it, smartphone addiction is not only harmful for psychological well-being but has other health risk factors because it is established that smartphone addiction is significantly correlated with sleep deprivation which implies that higher smartphone addiction has higher sleep deprivation (Kokkaparambil and James, 2023). A similar finding has also been reported by (Rathakrishnan et al., 2021) that those students who were smartphone addicted, had poorer sleep quality while quality sleeping is not for just rest; rather it is essential for good psychological well-being and physical health otherwise sleep deprivation may have very adverse consequences in form of "irritation, depression, anxiety, fatigue in the daytime, poor respiratory system, the problem of cardiovascular, week immunity and digestive system, weight gain, poor balance, and concentration" as medically reviewed by (Johnson et al., 2023).

Further, statistics also reveal that mobile phones are a great cause of road accidents in the country, a report titled "Road Accident in India 2021", reveals that there were 6753 accidents in 2020 which resulted in 2917 fatalities. Similarly, 2982 fatalities in 2021 as reported by (Ministry of Road Transport and Highways, 2021). Hence, the above statistics are sufficient to understand how the mobile phone is dangerous and life-threatening concerning road accidents. Therefore, it is necessary for us to explore those factors which make UG students addicted.

The research at the international level shows discrepancies in their findings. In the case of gender, a contradiction is noticed, both male and female respondents were the same in their smartphone addiction as investigated by (Keshky et al., 2023; Samaha and Hawi, 2016; Wu and Chou, 2023) but a study in Tunisia revealed that male university students were at high risk of smartphone addiction in comparison to female students (Turki et al., 2023). Similarly, on the factor of academic performance, Samaha and Hawi (2016) found that high smartphone addiction leads to poor academic performance. In contrast, Bennett (2020) does not find any relation between smartphone usage and academic performance. As far as dependency and anxiety are concerned, a study done in South Korea and Lebanon showed higher scores on the smartphone dependency test which was identified as the probable cause of anxiety (Lee et al., 2016; Samaha & Hawi, 2016). In contrast, a group of researchers reported a negative correlation between smartphone use and anxiety (Stankovic et al., 2021; Cumino et al., 2017). Similar findings (on smartphone dependency) were also reported by (Bagcı & Peksen, 2018; Zamri et al., 2023). In addition to it, those females addicted to smartphones showed high levels of loneliness and were likely to feel lonelier (Zamri et al., 2023). Likewise, Kim et al. (2015) did a study and found that depressed people rely more on mobile phones to alleviate their negative feelings. Further, concerning sleep quality and smartphones, Parlak et al. (2023) reported a significant correlation between smartphone addiction and poor sleep quality. Apart from it, on the factor of family income, Gökçearslan et al. (2018) presented that family income had no significant effect on smartphone addiction. In contrast to the above

findings, Parlak et al. (2023) found that smartphone addiction increases with an increase in family income. Apart from these contradictory researches, there are researches which focused on factors of smartphone addiction. As per Liu et al. (2022) perceived stress, study pressure, and isolation are some of the factors responsible for smartphone addiction. Similarly, a study done by Meena et al. (2021) showed loneliness had a strong correlation to smartphone addiction but shyness and social anxiety were moderately correlated, whereas, external locus of control were weakly correlated to smartphone addiction. On the other hand, Kim (2021) presented the different factors that adolescents with low economic status, high academic stress, or low perception of parental support, or those who have been victims of bullying, are more likely to be addicted to smartphones. Further, factors reported by Munasinghe (2016) are also not consistent with other researches as he confirmed that common reasons for using a smartphone by students are Usefulness, Loneliness, Gender, and Family income level.It is probably difficult to generalize international research studies in Indian settings.

International researches are probably difficult to generalize in Indian settings. The first reason is being contradictory findings. Second, Changes in geographical area\location show different factors related to smartphone addiction, which limits the external validity of the research. It may be due to various reasons like cultural, socio-economic, political, historical, and environmental factors. Moreover, the local context widely influences the research outcomes. Hence, it is essential to include the Indian context to explore factors of smartphone addiction that may enhance the relevance.

At the national level, research findings are also contradictory. Some research findings support that gender influences smartphone addiction while others contradict it. Chatterjee and Kar (2021) found that male students showed high smartphone addiction in comparison to female students but Oswal et al. (2020) found no association between smartphone addictions with gender. On the factor of academic performance, Chaudhary and Tripathy (2018) showed a negative correlation between smartphone addiction and academic performance whereas Oswal et al. (2020) found no association of smartphone addiction with academic performance. Concerning sleep quality and insomnia, various studies confirmed that smartphone addiction leads to impaired sleep quality (Chatterjee and Kar, 2021; Ghogare et al., 2021; Govarthini, 2023). In contrast, Snekha (2023) indicated that there was no significant relationship between Smartphone addiction and quality of sleep. Further, in view of income, Kundapur et al., (2020) present evidence that smartphone addiction is more prevalent in the family with higher economic status whereas Pooja et al. (2022) found no significant relation between family income and smartphone addiction. Likewise, a study done by Pradeep et al.(2022) confirmed that gender, number of peers, and social quality of life were associated with increased risk of cell phone addiction and Age, empathy, communication skills but physical quality of life were associated with reduced risk of cell phone addiction. Similarly, Handa and Ahuja (2020) reported that the fear of missing out is one factor responsible. However, Malik and Devi (2018) reported various other factors such as cheap internet facilities, behavioral addiction, dependency, communication, a symbol of status, and personal use, etc. as factors responsible for smartphone addiction. Therefore, there is great variation in findings at national level. Hence, this contradiction should be

studied carefully and thoughtfully to understand the cause of the underlying difference. All these variations in research findings culminated in an idea to carry out research to understand the most important factor of smartphone addiction which contributes maximum (explained variance).

Significance of the Study

Although the smartphone has numerous advantages, but it has also emerged as a source of many problems not only for social, personal, and academic, but also for health and psychological wellbeing. Many researches have been conducted related to smartphone addiction based on various issues and demographic variables such as gender (Keshky et al., 2023; Samaha and Hawi,2016, Wu and Chou,2023), education level (Samaha and Hawi, 2016; Bennett, 2020), family income (Gokcearslan et al., 2018), caste (Tenhunen, 2018), age (Gromik, & Litz, 2021), and habitat (Sowndarya & Pattar, 2018) that explains which group has the higher addiction and the lower addiction towards the smartphone but a very important issue has been ignored i.g. identification of highly contributing factors to smartphone addiction. Therefore, in order to minimize the adverse effects of smartphone addiction, it is necessary to determine those factors that are largely accountable for making UG students addicted to smartphones. When it is known which factor has contributed and how much (explained variance) in smartphone addiction then appropriate efforts can be made to reduce the adverse effects of a particular highly contributed factor. Such kind of evidence will not only be helpful to the parents but also the teachers and the psychologist to make UG students smartphone addiction free. Therefore, this study is a need of hour to detect those factors which are highly responsible for making UG students addicted.

Statement of the problem

Exploring the Factors of Smartphone Addiction: An Exploratory Factor Analysis

Objective

To explore the factors of smartphone addiction among undergraduate students.

Research question

What are the factors which are accountable for smartphone addiction among undergraduate students?

Functional Definition of Terms Used

Smartphone Addiction-

Smartphone addiction is a problematic behavioral pattern of students that involves excessive and compulsive use of smartphone, over dependency and inability to control its overuse.

Undergraduate Students-

Undergraduate students refer to those students who enrolled themselves in different undergraduate programs.

Research Methodology

Research method

Based on the nature of the research problem and its objective, the descriptive research method was applied with the quantitative approach.

The population of the study

Those undergraduate students, who registered themselves under any undergraduate program at different colleges of the University of Delhi, constitute the population of this study.

Sample and Sampling Technique

Initially, 650 undergraduate students were selected randomly from different

colleges of the University of Delhi. However, 59 students were excluded from this research because of the non-completion of the scale. Thus, this research comprises 591 UG students as sample.

Data collection

Construction of Smartphone Addiction Scale- A Description

Concerning the collection of scientific data, based on the Likert scale method, a five-point Smartphone addiction scale was constructed to measure smartphone addiction of UG students with the help of experts, personal experiences, and literature. Initially, 64 questions were constructed. For the purpose of validation of the scale, it was also sent to the experts with a request to assess the scale on the criteria of 10 point rating scale and whether every item of the scale can examine the smartphone addiction for which this scale has been constructed. The average rating for each item was computed and only those items were retained in the final version of the scale which were rated an average of 7 or above by the experts. Hence, 9 questions were dropped from the scale due to low ratings. A pilot study was also done to rectify the administrative problems of the scale. The administration of scale was done on a small group of students. Minimum 55 and maximum 275 scores were possible on this scale. z-score norms were also developed to interpret the raw data meaningfully.

Statistical Analysis

To analyze the raw data, various measures of descriptive and inferential statistics were applied. The assessment of the normality of the data was done through descriptive statistics. Therefore, the index of skewness and kurtosis along with its standard errors were computed. The assumptions of exploratory factor analysis were examined by three statistical tests like "Kaiser-Meyer-Olkin Test of Sphericity" which authenticates the sampling adequacy whereas intercorrelations among variables was confirmed by Bartlett's Test of Sphericity". Further, in order to verify the multicollinearity of the data, an index of determinant was calculated. After being satisfied from the cutoff criteria of all three tests, exploratory factor analysis was applied.

Testing of Normality of the Data Set

Table-1: Showing skewness, Kurtosis, and its Standard Errors.

Descriptive Statistics

	N	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Total	591	178.3875	25.86255	668.872	.194	.101	-.003	.201
Valid N (listwise)	591							

It is evident from Table 1, that the data has a positive skewness. The coefficient of skewness is (0.194) which is not too much larger than the standard error (0.101) of skewness. In addition to it, the coefficient of the skewness is very close to the normal value of the skewness i.e. (0). Further, If the index of skewness is divided by the standard error of the skewness, it (skewness= +1.92) falls between +1.96 to -1.96. Similarly, the computed value of the kurtosis is (-.003) which is too close to the normal value of the (.263). Furthermore, the value of kurtosis (-.003) is also divided by its standard error (0.201), it falls (Kurtosis = 0.01) between +1.96 to -1.96. Although, there is a very slight deviation in the

index of skewness and kurtosis of the data set, but it is very negligible. Hence, the data are normally distributed in the distribution and follow the assumption of normality.

Table-2: Showing the value of the determinant

Sl	Computed Value of Determinant	Normal Value of Determinant
1.	1.07	.00001

It is evident from Table 2, that the index of the determinant is 1.07 which is higher than the normal index of the determinant i.e. (.00001) which signifies that the data set is absolutely free from the problem of the multicollinearity and fit to apply to the exploratory factor analysis.

Table-3: Showing the value of the "Kaiser-Meyer-Olkin test" to determine the sampling adequacy and the value of "Bartlett's Test of Sphericity test" to determine the interrelations among the variables

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.880
Bartlett's Test of Sphericity	Approx. Chi-Square	7847.528
	df	1485
	Sig.	.000

In order to determine the sampling adequacy, the measure of the sampling adequacy was applied. For this purpose, "Kaiser-Meyer-Olkin test" (KMO) was adopted. It is revealed from Table 3, that the determined value of the KMO test is 0.880 which is greater than the normal cut-off criteria (0.05) of the KMO test which implies that the data set has sampling adequacy to run the exploratory factor analysis.

Similarly, in order to secure the inter-correlations among the variables, "Bartlett's Test of Sphericity ", was applied. It shows from Table 3, that the calculated value of "Bartlett's Test of Sphericity ", is 7847.528 which is significantly high at 0.0001 level of significance. Therefore, the Null hypothesis that "all variables are not interrelated", is rejected. Therefore, due to the rejection of the above-mentioned null hypothesis, the alternative hypothesis that "all variables are interrelated", is accepted. Hence, the above analysis infers that the data set have inter-correlation and is suitable to run the factor analysis.

Process of Factor extraction

In order to extract the factors, principal component analysis was used. Further, concerning the rotation of the factor matrix, the varimax rotation method was used under the orthogonal factor rotation. As far as "Coefficient Display Format" is concerned in SPSS, the coefficient below (.40) was suppressed. The details of extracted factors are given below in Table 4

Table-4: Total Variance Explained

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.292	16.895	16.895	9.292	16.895	16.895	4.688	8.524	8.524
2	2.809	5.108	22.003	2.809	5.108	22.003	4.412	8.022	16.546
3	2.478	4.506	26.509	2.478	4.506	26.509	2.902	5.277	21.822
4	1.811	3.292	29.801	1.811	3.292	29.801	2.724	4.953	26.776
5	1.556	2.830	32.631	1.556	2.830	32.631	2.520	4.581	31.357
6	1.522	2.766	35.397	1.522	2.766	35.397	2.222	4.040	35.397
Extraction Method: Principal Component Analysis.									

It is evident from Table 4, that only six factors have greater than one eigenvalue which provides evidence that this research has only six factors of smartphone addiction which emerged from 55 variables. Further, altogether these six factors cumulatively share and explain 35.397 per cent of the total variance. Factor one has the highest eigenvalue i.e. 9.292, and followed by factor two-2.809, factor three-2.478, factor four-1.811, factor five-1.556, factor six-1.522. The details of the labeling of the above six factors have been explained below in Table 5.

Table-5: Showing the Rotated Component Matrix and Factor Loading of Components of Smartphone Addiction

Rotated Component Matrix						
Factor 1:Time	Factor Loadings/Component					
	1	2	3	4	5	6
The prolonged use of Smartphones has made me more lazy.	.675					
My working capacity is compromised due to excessive time spent on my smartphone.	.670					
I try to minimize the time spent on my smartphone but I am unable to do so.	.633					
I am well aware of the adverse effects of excessive use of Smartphone still I overuse it.	.564					
I want to spend little time on my Smartphone but get so involved that I spend more time than expected.	.554					

I get distracted by smartphone Apps while I am studying.	.523					
Due to prolonged use of Smartphone I feel strain in my eyes.	.492					
I want to do physical activity but it gets compromised due to my excessive engagement on my Smartphone.	.477					
Before start studying, I like to pass some time on my smartphone.	.441				.416	
I think that the duration of smartphone usage is increasing rapidly.	.417					
Factor 2:Interference						
I am using my Smartphone and scrolling through social media even in my dreams.		.654				
I love to spend my time on my Smartphone rather than spending time with my family members.		.529				
I desire to have multiple Smartphones.		.499				
Due to excessive use of smartphone through headphones and buds, I have begun to face difficulty in the frequency of listening in a normal manner.		.495				
I get too much involved with my smartphone that I even forget about the humans around me.		.490				
Sometimes I am so engaged with my Smartphone that I turn a deaf ear and do not respond to my family members.		.476				
Due to excessive use of Smartphone, my study time is being compromised and it leads to late submissions of assignments.	.459	.469				
Due to too much use of Smartphone I get headaches and dizziness.	.405	.457				
My concentration begins to lose if I do not look at my Smartphone for some time.		.448				
I get angry/ irritated when someone interrupts me while scrolling my smartphone.		.444				
I wish to use my Smartphone during lectures in the classroom.		.442				

Factor 3:Psychological Worry and Concerns						
I don't want my Smartphone should be seen or guarded by parents.			.647			
I feel uncomfortable when someone is scrolling or using my phone.			.626			
I get defensive when someone ask me what I am doing on my Smartphone			.569			
I do not want that my parents should know my Smartphone password.			.494			
I feel annoyed when my phone does not work properly.			.400			
Factor 4:Dependency						
I feel very anxious as if a very important thing is missing when I don't have my Smartphone with me.				.545		
I cannot compromise to have a smart-phone.				.497		
I feel it is impossible to keep away or give up Smartphone.				.494		
I want my smartphone with me even if there is no need.				.473		
I always want to have a Smartphone with the latest technology.				.429		
I feel Smartphones have become an essential part of our lives just like food, home, and clothes.				.411		
I feel very anxious and tense if the bat-tery of my smartphone is low or dead.				.409		
Factor5:Craving						
I prefer using my Smartphone while waiting for someone (College/ railway station/ bus stand).					.601	
I like to use my Smartphone even while eating.					.495	
I like to have smartphone beside me while sleeping					.431	
In the vacant period, I use a Smartphone to fill the gap between two classes at college.					.414	

Factor 6:Technology Use and Privacy						
I like to book tickets through my Smartphone.						.641
I prefer to make payments through my Smartphone.						.568
I keep my smartphone updated and virus-free.						.471
I keep my Smartphone password very complex so that one should not be able to anticipate.						.467
I like to do online shopping through my Smartphone.						.461
I always keep my Smartphone protected by a password.						.401
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]						
a. Rotation converged in 14 iterations.						

Factor 1: Time

It is evident from Table 5, that ten variables are loaded significantly in factor one. The close observation of all these attributes indicates that all attributes are represented by 'time'. Therefore, this factor is labeled as time that explains 16.895 per cent of total variance which is the best and maximum amount of explained variance among all six factors. Further, it is also exhibited from the rotated factor matrix that variables like the prolonged use of Smartphone has made me more lazy, and has the highest factor loading (.675). Similarly, my working capacity is compromised due to excessive time spent on my smartphone (.670), which has the second highest factor loading. Likewise, 'try to minimize the time spent on my Smartphone but I am unable to do so. (.633), has the third highest factor loading. At the fourth level, attributes such as being well aware of the adverse effects of excessive use of smartphones still I overuse it, loaded in this factor with factor loading (.564). Further, ' I want to spend little time on my Smartphone but spend more time than expected (.554), which has the fifth top factor loading in the factor matrix. In addition to it, variables like 'distracted by Smartphone Apps during study time' also loaded with the factor loading of (.523), and followed by 'due to prolonged use of Smartphone I feel strain in my eyes (.492), physical activity gets compromised due to excessive engagement on Smartphone (.477), 'before start studying, I like to pass some time on Smartphone' (.441) loaded in the above factor with good degree of factor loading. At last, variable like 'the duration of Smartphone usage is increasing rapidly' (.417), loaded in the 'time' factor with the lowest factor loading. This factor not only consists of a very good number of attributes but also explains the maximum portion of total variance to understand the phenomenon of smartphone addiction. The scale of the factor loading for the 'time' component is between .675 and.417. The index of eigenvalue for this factor is 9.292 which is greater than the eigenvalue of the rest of all five factors.

Factor 2: Interference

With reference to Table 5, it is evident that eleven variables are loaded significantly in factor two. The analysis of all the variables provides evidence that all attributes are represented by the 'interference'. Therefore, this factor is named as 'interference' which retains 5.108 per cent of the total explained variance. The interference factor has the second maximum explanation power of smartphone addiction. The variance is distributed in the eleven-factor loading such as "I am using my Smartphone and scrolling through social media even in my dreams" (.654), which has the uppermost factor loading whereas 'love to spend time on smartphone rather than with my family members' (.529), has second top factor loading. Similarly, the 'desire to have multiple smartphone' (.499), has the third highest loading. Furthermore, 'Due to excessive use of Smartphone, face difficulty in the frequency of listening in a normal manner' (.495), and have fourth highest loading. In addition to it, an attribute like 'I get too much involved with my smartphone that I even forget about the humans around me', is loaded in the above factor with factor loading of (.490). Surprisingly, sometimes I am so engaged with my smartphone that I turn deaf ears and do not respond to my family members (.476), which has the sixth highest factor loading for the 'interference' factor. At the seventh level, 'due to excessive use of Smartphone, my study time is being compromised and it leads to the late summation of assignments', is loaded with factor loading of (.469). Apart from it, a variable such as 'Due to too much use of Smartphone I get headaches and dizziness', has the eighth highest factor loading (.457). Correspondingly, 'My concentration begins to lose if I don't look at my smartphone for some time (.448), has the ninth highest factor loading, and followed by getting angry/ irritated when someone interrupts me while scrolling my smartphone (.444). Lastly, an attribute like 'I wish to use my smartphone during lectures in the classroom, has the lowest factor loading for this factor. (.442). The range of factor loading confines between .654 and .442. Further, concerning the eigenvalue of this factor, it is 2.809.

Factor 3: Psychological Worry and Concern

Concerning Table 5, the factor matrix demonstrates that five variables are loaded in the factory matrix. The closed observations of these attributes signify that all variables express worry and concerns. It is the reason that this factor is named as 'Psychological Worry and Concern' which contributes 4.506 per cent of the total explained variance. Further, the explained variance is distributed into the five factor loadings such as attributes like 'don't want my smartphone should be seen or guarded by parents, which possesses the maximum amount factor loading (.647) in the above factor. Further, 'feel uncomfortable when someone is scrolling or using my smartphone', has the second highest factor loading (.626). Likewise, at the third level, 'get defensive when someone asks me what I am doing on my smartphone, loaded with factor loading of (.569) in the rotated factor matrix, and followed by 'don't want my parents should know my smartphone password (.494). At last, 'I feel annoyed when my Smartphone phone does not work properly' has loaded with the smallest factor loading of (.400) in this particular factor. As far as the concern of the distribution of factor loading in the above factor, it is between 0.647 and 0.400. It is also evident from Table 5, that the index of eigenvalue of this factor is 2.478 which is larger than factor four, five, and six.

Factor 4: Dependency

Further, with reference to Table 5, it can be observed that seven variables are loaded significantly on the fourth factor which is related to important things missing, not compromising to have a smartphone, impossible to keep it away, want a smartphone even there is no need, desired to have the latest technology, smartphone as an essential part of life, and feel anxious in case battery dead. All these attributes represent the dependency of students on the smartphone. Therefore, this fourth factor is named as 'dependency'. The factor 'dependency' shares 3.292 per cent of the total explained variance which is distributed into the seven different factor loadings like 'feel very anxious as if a very important thing is missing when I don't have a smartphone with me, has loaded with toppest factor loading (.545). Similarly, 'cannot compromise to have a smartphone, has the second highest factor loading (.497) in the factor matrix. Likewise, in third place, variable like 'feel it is impossible to keep away or give up smartphone', loaded with factor loading of (.494). In addition to it, I want my smartphone with me even if there is no need, has the fourth-highest loading (.473). Furthermore, 'want to have a smartphone with the latest technology, is at sixth rank and is loaded with factor loading of (.429), and followed by 'feel Smartphone have become an essential part of our lives just like food, home, and clothes (.411). Lastly, I feel very anxious and tense if the battery of the Smartphone is low or dead, and has the lowest factor loading (.409). The range of between the highest and lowest factor loading for this factor is between .545 and .409. The index of eigenvalue for the above factor is 1.811 which is greater than factors five and six.

Factor 5: Craving

Further, table 5, demonstrates that four variables are grouped together which are highly correlated like using a smartphone while waiting, even eating, sleeping, and to fill the gap between two classes at college. All these attributes show the desire or passion of students towards the smartphone. Therefore, this factor is named as 'craving' which shares 2.830 per cent of the total variance explained that is distributed into four-factor loadings like "prefer using my smartphone while waiting for someone (college/ railway station/ bus stand), has uppermost factor loading (.601) in this factor while I like to use my smartphone even while eating, has second greater factor loading (.495), Further, at the third level "I like have smartphone beside me while sleeping", has third highest factor loading (.431). Similarly, at last "In the vacant period, I use my smartphone to fill the gap between two classes at college", which has the lowest factor loading (.414). The spectrum of factor loading is between .601 and 0.414. Regarding eigenvalue, the factor craving has 2.830 as the eigenvalue.

Factor 6: Technology Use and Privacy

From the analysis of the aforementioned Table 5, it is evident that six correlated attributes form a group that comprises variables like ticket booking, doing payments, online shopping, protection by password and keeping password complex, carefulness about updation, and making smartphone virus-free. All these attributes are well described by the technology use and privacy. Therefore, this factor is labeled as 'Technology use and privacy' which explains 2.766 per cent of the total variance. This variance is shared by six-factor loading such as "like to book

tickets through my smartphone, which has the highest factor loading (.641) whereas "prefer to make payments through my smartphone", which has the second highest factor loading (.566). Similarly, " keep my smartphone updated and Virus free", and has the third highest factor loading (.471). In addition to it, variable like I keep my smartphone password very complex so that one should not be able to anticipate, has the fourth highest factor loading (.467) in the factor matrix, followed by I like to do online shopping through my smartphone (.461) and I always keep my smartphone protected by a password (.401). The range of factor loading for this factor is between .641 and .401. As far as the eigenvalue is concerned, it is 1.522.

Findings of the study

Based on analysis of the data the following results were drawn.

- The index of determinant, "Kaiser-Meyer-Olkin Measure of Sampling Adequacy", and "Bartlett's Test of Sphericity " was suitable as all these parameters were found fit to run the exploratory factor analysis.
- Smartphone addiction has six factors namely 'Time', 'Interference', 'Psychological Worry and Concern', 'Dependency', 'Craving', and 'Technology use and Privacy'.
- This study has 35.397 per cent of explained variance of smartphone addiction whereas it has 64.603 per cent of unexplained variance which is not known.
- Out of the explained variance of this study, 'time' as a factor shares 16.895 per cent of the total variance which is the maximum variance among all six factors of smartphone addiction. Hence, Time as a factor is the dominant factor in the Smartphone addiction of students.
- The second factor i.e. 'Interference', had 5.108 per cent of the total explained variance which was the second dominant factor for Smartphone addiction, followed by 'Psychological Worry and Concern' 4.506 per cent, Dependency 3.292 per cent, and Craving 2.830 per cent.
- Components like 'Technology use and Privacy' explained 2.766 per cent of the total variance which had the least explained variance among all six factors.
- The highest factor loading of .675 was found in factor one i.e. 'time' whereas, in contrast to it, the lowest factor loading of .400 was noticed in factor three i.e. 'Psychological Worry and Concern.

Discussion

This study was conducted with the prime objective of exploring the factors of smartphone addiction. The findings have provided great insight regarding smartphone addiction among undergraduate students. The data analysis suggests that there are six factors that are accountable for smartphone addiction i.e. 'Time', 'Interference', 'Psychological Worry and Concern', 'Dependency', 'Craving', and 'Technology use and Privacy'. There might be numerous potential reasons for such findings. It is evident from the research that in the situation of depression humans rely upon the mobile to alleviate their negative feelings as reported by (Kim et al., 2015). Further, perceived stress, study pressure, and isolation are also big reasons for smartphone addiction as investigated by (Liu et al., 2022). In addition to it, when a student starts to think too much about their academics and future career it builds additional apprehensions and worries. Therefore, students may start to use smartphone as entertainment devices which lead to spend more time

to smartphone to release worriedness, apprehensions, and pressure. It may make them slowly and unknowingly addicted. Research also supports that high academic stress is the leading reason for being smartphone addicted as examined by (Kim, 2021). Apart from it, extreme dependency on smartphones is also a significant reason for smartphone addiction as investigated by (Lee et al., 2016; Bagci & Peksen, 2018; Zamri et al., 2023). Apart from it, social media applications such as WhatsApp, and Facebook Instagram have addictive features, which propels human's endless desire to check social media messages, reels, and other forms of entertainment. Further, the findings contradict the claim of Fidan (2016) who investigated that mobile addiction has seven factors - relapse, silence, mood modification, mobile internet tendency, tolerance, conflict, and withdrawal, whereas in contrast to the findings of Fidan (2016), this research has the six factors of smartphone addiction. Similarly, although the findings are also inconsistent with the findings of Fernandez (2017) as he reported the different factors of smartphone addiction like tolerance, withdrawal, disruption, disregard, loss of control, and preoccupation but this research has a slight resemblance with his findings because the number of factors are same in both the researches i.e. six. However, the meaning and context of the factors are different. The basic reason for the inconsistency with the findings of Fernandez (2017) is that the smartphone addiction scale was in Spanish and French language whereas in this research the smartphone addiction scale was developed in the English language which might be the potential cause of differences in the findings. Further, no research was found that corroborates with the findings of this research.

Based on the findings of this research, there are great implications to organizing the guidance and counseling program for undergraduate students because the University of Delhi has students from multilingual and multicultural backgrounds where the most of the students come from every corner of the country and reside as either paying guest or hostlers which keep away from the observation of the parents and other family members. As a result, this freedom provides a lot of scope to spend uncontrolled time on smartphones which increases the possibility of smartphone addiction. Hence, on the pattern of the above argument, the data of this research builds evidence that 'time' as a factor has explained the highest variance which implies that time is the highest contributing factor in smartphone addiction. Further, an unexpected factor loading was also noticed that "The prolonged use of the smartphone has made me more lazy", which is highest across all factor loadings which indicates that more time spent on smartphone is not only dangerous to compromise academic performance but also for overall personality development because it is already established through research that smartphone addiction lead to poor academic performance of the students as reported by (Samaha and Hawi, 2016). Similar findings have also been endorsed by (Khan et al., 2019; Rathakrishnan et al., 2021). It is recommended that in the future, another side of the time factor needs to be exploreed "how much time do students spend on their academics using the smartphone as a device?" Moreover, it is also suggested that research may be done to explore the remaining unexplained variance of smartphone addiction.

Conclusion

Concerning the associated research question of this research i.e. what are the factors which are accountable

for smartphone addiction among undergraduate students? The analysis of the primary data provides certain conclusions that smartphone addiction has six factors i.e. 'Time', 'Interference', 'Psychological Worry and Concern', 'Dependency', 'Craving', and 'Technology use and Privacy'. It is observed that Time as a factor has a huge impact on Smartphone addiction which consists of ten variables. Similarly, eleven variables are observed by the Interference factor which has the second highest impact on smartphone addiction. Likewise, five variables are observed under the Psychological Worry and Concern factor which has the third best influence on smartphone addiction. In addition to it, factor four like 'Dependency' possessed seven variables. Further, four other variables are also observed by the Craving factor. At last, six variables are retained by the factor 'Technology use and Privacy' which has the lowest impact on smartphone addiction. Concerning the highest factor loading, variable such as the prolonged use of my smartphone has made lazier, and loaded on time factor.

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