

## Smartphone Addiction Scale: Development and Validation

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The present study was aimed to develop Smartphone addiction scale and to develop its psychometric properties like objectivity, reliability and validity. To achieve the purpose, a systematic and planned literature review was done to generate an item pool. For face and content validity experts from different universities were consulted. After the pilot study, it was applied to the targeted group. The study was carried out on 450 school and college students within the age range of 14 to 24 years. Responses were collected on a likert type scale. For factorial validity, the scale was first analysed Exploratory factor analysis and six factors emerged finally. Cronbach's Alpha of the scale was 0.85 which is considered good enough. To confirm the factors, Confirmatory factor analysis was performed which resulted in high construct validity. Further, inter-factorial correlation among sub dimensions of Smartphone addiction scale was found highly significant.

**Keywords:** Smartphone Addiction; reliability; validity; students

### *Theoretical Framework*

Modern era is not only limited to the addiction of drugs and alcohol but also to the technology like Smartphone. Smartphone is a cellular mobile device which is designed to provide more comfort to human being with modern technology like touch screen, internet access, operating systems, web browsing, clicking photos and downloading apps etc. it is like a pocket computer which is easily accessible and can be carried out everywhere that results in more and more usages of Smartphone.

Smartphone addiction is also known as mobile phone dependency, problematic use of mobile phone and mobile phone overuse. It is a physical and psychological state of mind where the person has strong and uncontrolled desire to use his phone, neglecting its harmful effects and daily activities. According to WHO expert committee (1964), addiction is considered as dependence, as the continuous use of something for the sake of relief, comfort or stimulation, which often causes craving when it is absent. "Substance addiction" involving drug or alcohol addiction and "behavioural addiction" like mobile phone are the two major categories of addiction (Kim, 2013).

In a survey study done by Comscore (2018), it was found that Indians spent 89% of their

time on mobile phones, people from Indonesia spent 87%, Mexico 80% and Argentina spent 77% of their time on mobile phones. The research done by Aligarh Muslim University highlights that 14 percent of the surveyed people used Smartphones for less than three hours in a day, 63 percent use Smartphone for 4 and 7 hours whereas 23 percent use Smartphones for more than 8 hours daily (<https://www.firstpost.com/tech/news-analysis/smartphone-addiction-university-students-in-india-check-their-smartphones-up-to-150-times-a-day-4442283.html>).

The person with Smartphone addiction spend much of his time on social media, texting, browsing or playing games using his Smartphone. Overuse of Smartphone can lead to other problematic behaviours and psychological problems like lack of concentration, increased stress, depression, anxiety, social withdrawal, feeling of isolation and disturbed daily routine. Particularly, it can be a risk factor for depression, loneliness, anxiety and sleep disturbances (Gao et. al., 2016).

### *Development of Smartphone Addiction Scale*

In order to develop Smartphone addiction scale, the researchers consulted books, encyclopaedia and other related material

including the previous related scales to get comprehensive knowledge about all factors which may be associated with Smartphone addiction. Finally, six dimensions of Smartphone addiction scale were identified through the review of related literature and by consulting 15 experts from Education and Psychology Department of L.M.N.U. Darbhanga, Banaras Hindu University, Varanasi, Calcutta University and V.K.S.U. Aara.

#### **Dimensions of the Smartphone addiction scale are as follows:**

For the development of the 'Smartphone addiction scale,' the investigators identified the six dimensions of study habits with the help of related literature. These dimensions are as follows:

**Compulsive behaviour:** It is an uncontrolled and irresistible urge to perform certain behaviours. These behaviours are persistent and repetitive which may or may not lead to pleasure. It may be an option to go away the obsessions or reoccurring thoughts.

**Forgetfulness:** It is a state of mind where the person is unable to store/recall the information or he faces difficulty to input new information. Distraction plays an important role in forgetfulness.

**Depression and anxiety:** Depression is lowering the mood for a longer period of time, lacking interest in daily activities, numbness towards emotions, disturbed routine and pessimistic attitude towards self and society. Anxiety is the persistent fear and worry towards any situation or behaviour. Increased heart rate, rapid breath, restlessness and tiredness are the common symptoms of anxiety.

**Social withdrawal:** Any person who avoids social gatherings; don't want to communicate with family members, friends and relatives; who wants to be alone is facing social withdrawal. It is a stage of total or partially lack of contact with any individual or society.

**Lack of attention:** It is the state where a person is unable to concentrate, fail to be attentive and feels hard to listen to others and conversation. Due to attention distraction he is unable to complete the task.

**Disturbed hunger and sleep:** When regular pattern of hunger and sleep is disturbed; the person feels no hunger, forgets to take meal on time or don't have an urge for food is the disturbed pattern of hunger. Similarly Irregularity in sleep pattern, unable to sleep, waking up again and again at night or feels no need to sleep is called disturbed sleep.

#### **Description of the Scale**

The Smartphone addiction scale has been developed for assessing the level of Smartphone addiction among students, the age range is 14 to 24 years. The present scale was developed on the Likert method, in which statements are followed by several levels of agreements which are useful and practical means for determining one's opinion and attitude (Likert, 1932). The present 'Smartphone Addiction Scale' is a five-point Likert scale these points are as follows: Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree.

#### **Preparation of the first draft**

In order to develop indicators of Smartphone addiction scale investigators went through the different journals, related books, reports, newspapers and previously related tools were also consulted. After reviewing the extensive related literature the investigators constructed the statements with due cares that each item should be associated with the dimensions as chosen for the Smartphone addiction scale. In order to cover the all six dimensions of Smartphone addiction scale investigators constructed 65 items under the guidance of the experts of the relevant area on the basis of their relevance to the current study and on their contextual appropriateness.

Over the 65 items of Smartphone addiction scale, expert opinion was undertaken. The first draft of the Smartphone addiction scale was discussed with the 13 experts; these experts were belong to Lalit Narayan Mithila University, Darbhanga; Veer Kunwar Singh University, Aara; Aligarh Muslim University, Aligarh, in various departments such as Department of Education, Department of Psychology, and Department of English. After the expert's valuable suggestion twenty (20) items were rejected as they were

found to be ambiguous and some of the items were restructured and a draft of 45 items was prepared to make the scale more effective and valid. It enhanced the validity of the scale in terms of language, item clarity, appropriateness, the arrangement of items under appropriate dimensions in the Indian context. Finally, after getting the experts' approval, the revised version of the scale contains 45 statements for the first try-out of the scale.

### The first try out of the scale

The initial draft consisted of 45 items in the scale. In order to ensure the communication effectiveness of the scale, the preliminary try-out was carried out on a randomly selected sample of 50 students (30 males and 20 females) selected from the secondary schools of Aara city. In this process the students were free to respond to each item and could discuss it with the investigators if they feel any problem with it. Then those items which were subjected to more rejection and considered as unclear by the students were not considered in the final draft of the scale. Now there were 40 statements in the sheet.

### The second try out of the scale

The second try out of the Smartphone addiction scale with 40 items, was administered on a representative sample of 150 students, selected through purposive sampling technique. The sample was comprised of 75 girls and 75 boys of secondary school from Aara, Darbhanga, districts of Bihar as well as from Aligarh districts of Uttar Pradesh. For collecting the data investigators personally approached all the secondary school students through proper channel, from the selected schools and requested them to answer all the 40 items on this scale.

The scale data was arranged in the order of highest to lowest scoring. From this order, two groups, one of 27% from highest scoring and other of 27% from the lowest scoring were selected. In these two groups inter-correlation matrix was examined in order to determine existence of multicollinearity and singularity of items in the scale. In addition to inter-correlation matrix, 'Determinant' of the R-matrix was

estimated and it was greater than 0.0001 (i.e. 0.006), in this case. Sampling adequacy through Kaiser-Meyer-Olkin (KMO) test was also carried out and found to be greater than 0.50 (i.e. 0.60). On the basis of reliability check, 8 items having multicollinearity and singularity were rejected and the final manuscript of the scale had 32 items, again researchers rejected 5 items having  $< .30$  item total correlation and 5 items having less than .40 factor loading. Finally 23 items frozen and distributed across six dimensions extracted through the Exploratory Factor analysis with Principle Component Analysis extraction and Varimax rotation methods. The distribution of items and dimensions is given in Table 1.

Table 1: Dimension wise distribution of items of Smartphone Addiction Scale

Sr. No.	Dimensions of Tool	Items	Total No. of Items
1	Compulsion (D1)	01, 05, 10, 16, 20, 21, 23	07
2	Forgetfulness (D2)	06, 09	02
3	Lack of attention (D3)	07, 19	02
4	Depression (D4)	02, 13, 17, 22	04
5	Disturbed hunger/ sleep (D5)	08, 11, 14, 15	04
6	Social withdrawal (D6)	03, 04, 12, 18	04
Total			23

### Scoring System

The scale has positively worded statements and the response was sought on the five points.

Table 2: Scoring System

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
5	4	3	2	1

The responses of the corresponding items were added to generate dimension scores and summing-up all 23 items to generate overall

Smartphone Addiction score. Thus, the minimum possible score of the scale will be 23 and the maximum 115. The higher the score indicates high level of Smartphone Addiction and lower the score indicates low level of Smartphone Addiction.

### Standardization of the Scale

The final form of the Smartphone Addiction Scale with 23 items was administered on a representative sample of 200 students randomly selected from schools of Aara, Darbhanga, and

Aligarh. The sample students were students of class 10th and Graduation.

### Instructions for Administration

As per the instructions of administration is concerned the scale is in printed form. The scale can be administered on an individual or on a group (preferably not more than 30 at a time) on student's population.

### Reliability of the Scale

The considerations of reliability and validity

**Table 3A: Descriptive Statistics of Items, Scale and Alpha**

Item No.	Descriptive Statistics for Items				Descriptive Statistics for Scale			
	Range	Mean	SD	Var.	Scale Mean if item deleted	Scale Variance if item deleted	*Item total correlation	*Alpha if item deleted
01	4	2.76	1.308	1.711	55.21	180.270	.486	.850
02	4	2.74	1.217	1.482	55.24	186.425	.335	.855
03	4	2.56	1.340	1.796	55.42	185.109	.333	.855
04	4	2.57	1.250	1.564	55.41	184.504	.382	.853
05	4	2.88	1.236	1.527	55.10	184.965	.374	.854
06	4	2.41	1.249	1.561	55.56	179.916	.524	.848
07	4	2.34	1.226	1.502	55.63	184.585	.389	.853
08	4	2.16	1.227	1.505	55.81	179.361	.553	.847
09	4	2.08	1.200	1.441	55.89	181.170	.509	.849
10	4	2.93	1.218	1.483	55.04	186.114	.345	.854
11	4	2.02	1.154	1.331	55.95	184.148	.433	.852
12	4	2.31	1.250	1.562	55.66	182.284	.451	.851
13	4	2.75	1.374	1.887	55.22	179.019	.494	.849
14	4	2.33	1.212	1.470	55.64	184.362	.401	.853
15	4	2.48	1.228	1.507	55.49	184.462	.392	.853
16	4	2.21	1.200	1.440	55.77	184.771	.394	.853
17	4	2.74	1.226	1.502	55.24	183.500	.423	.852
18	4	2.68	1.278	1.634	55.29	187.021	.301	.856
19	4	1.90	1.070	1.146	56.07	185.668	.419	.852
20	4	2.89	1.339	1.793	55.08	181.009	.451	.851
21	4	2.78	1.215	1.476	55.19	182.758	.451	.851
22	4	2.75	1.307	1.709	55.23	185.304	.338	.855
23	4	2.71	1.329	1.767	55.27	179.113	.511	.849

$r=0.20$  ( $p<.05$ );  $0.30$  ( $p<.01$ ) - Two Tailed

typically are viewed as essential elements for determining the quality of any standardized tool. However, professional and practitioner associations frequently have placed these concerns within broader contexts when developing standards and making overall judgments about the quality of any standardized test as a whole within a given context. As we know that reliability provides reasons for believing the score to be stable and trustworthy (Garrett, 2009). Thus it predicts the accuracy or the precision of the measurement. The reliability of the present scale was computed through Cronbach's Alpha method. It can be seen by table 3A and 3B.

**Table 3B: Descriptive Statistics of Scale and Reliability (Cronbach's Alpha)**

Mean	Variance	Std. Deviation	Alpha Coefficient	N of Items
57.97	199.050	14.108	.857	23

One of the most commonly used reliability coefficient i.e. Cronbach's Alpha was calculated and found 0.857, significant at 0.01 levels. The internal consistency of the scale is high and this gives a support that the scale is highly reliable. The descriptive statistics and inter-correlations among dimensions of the scale are shown by Table 4.

From the table 4, it is evident that the correlation coefficients of all the dimensions are high and statistically significant far beyond

the 0.01 level of significance which indicates that all the dimensions are related to the Smartphone addiction. Here the correlation of each dimension with the total score verifies that each dimension is measuring the same characteristic individually that the scale as a whole measure i.e., Smartphone addiction, which predicts that the scale has good construct validity.

**Validity**

Validity indicates the degree to which a test accurately measures, what it was supposed to measure (Lindquist, 1951). For the present Smartphone addiction scale content validity and construct validity was determined.

**Content Validity:** In order to determine content validity, the scale was sent to 20 experts from the field of Education, Psychology, and English for their expert opinion. The statements were evaluated by them from the perspective of their experience in the field of research and Smartphone addiction with keeping in mind the population, sampled students for whom the scale was constructed. Further they gave their valuable suggestion based on the definition and dimensions of the Smartphone addiction scale. The investigators rejected those items which did not get the consensus from the experts. For ensuring the content validity the investigators confirmed that the content for the present scale was taken from the authentic sources and all items were covered all the six dimensions of

**Table 4: Descriptive Statistics and Inter-Correlation between Dimensions of Smartphone Addiction Scale.**

Dimensions	Descriptive Statistics				α	Inter-Dimension Correlation						
	Range	Mean	SD	Var.		D1	D2	D3	D4	D5	D6	GDT
D1	21	13.82	4.51	20.35	.69	1						
D2	20	13.89	4.06	16.50	.66	.462	1					
D3	16	9.23	3.40	11.60	.62	.462	.407	1				
D4	8	5.51	2.61	6.85	.95	.340	.359	.220	1			
D5	12	7.99	2.70	7.31	.49	.372	.324	.323	.240	1		
D6	12	7.54	2.86	8.21	.62	.499	.390	.405	.381	.326	1	
GDT	67	57.97	14.10	199.05	.85	.800	.742	.691	.574	.593	.705	1

r=0.20 (p<.05); 0.30 (p<.01) - Two Tailed

**Table 5: Construct/Factorial validity**

Items	Factors					
	1	2	3	4	5	6
Q01	.875					
Q10	.507					
Q17	.574					
Q25	.509					
Q34	.555					
Q35	.654					
Q38	.562					
Q11		.683				
Q16		.549				
Q12			.467			
Q33			.621			
Q04				.548		
Q20				.890		
Q26				.577		
Q36				.677		
Q15					.465	
Q18					.640	
Q21					.591	
Q23					.703	
Q05						.695
Q08						.450
Q19						.527
Q31						.719
PV	10.808	9.783	9.305	9.301	7.779	7.101
CPV	10.808	20.591	29.896	39.197	46.976	54.077

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 10 iterations.

PV=Percent of Variance, CPV=Cumulative Variance

Smartphone addiction scale. Thus, the thorough assessment of the scale by experts ensures that the items are specifically related to the content of the Smartphone addiction, which ensures that the scale has high content validity.

There are various methods to establish construct validity of the tool. Hence, quite a few of them are having limitations as role of time and existence of subjectivity in subject's responses.

To overcome these limitations, Exploratory Factor analysis with Varimax rotation was used to establish the construct/factorial validity of the tool. Data screening was carried out in order to overcome existence of multicollinearity (i.e. items that are highly correlated) and singularity (i.e. items that are perfectly correlated) in the scale and fulfils requisite requirements. Table 5 shows construct/factorial validity along with factor loadings, percent of variance (PV) and

cumulative percent of variance (CPV) for each dimension.

### Conclusion

Based on 450 school college students, data analysis showed that smartphone addiction scale has satisfactory psychometric properties. It can be concluded that it is highly reliable and valid instrument to measure addiction towards smartphone addiction among school/college going students. Highly satisfied structured, exploratory factor analysis provides enough evidences of the construct validity. Inter-factorial validity of the instrument is confirmed by the highly inter-correlated factorial correlation between all factors measuring the same construct.

### Implications

In the present study we standardised the Smartphone Addiction Scale based on the data collected from a represented sample that is school and college going students with increased usage of smartphone. It has been established that psychometric characteristics like reliability and validity of the instrument are highly satisfying. The major contribution of the scale is that it provides sufficient contribution

to diagnose the young adults with smartphone addiction. After reviewing a number of research studies and literature, it is liable to say that six major factors are sufficient to describe addiction towards smartphone. This study which is exploratory and interpreting in nature opens a number of opportunities for further exploration and novel researches.

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