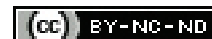


Development and Validation of the Smartphone Addiction Scale for Children- Parent Version (SASC-P)

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ABSTRACT

Introduction: The use of smartphone among children and adolescents has been increasing steadily over the past decade and is becoming a cause of concern for parents and healthcare professionals alike. Excessive use of smartphone could make a child vulnerable to develop addictive behaviour leading to decrease in academic performance and impairments in social and personal environment. Early identification is key to addressing this issue and although there are scales to measure smartphone addiction in adults, there are no scales to measure smartphone use in children objectively.

Aim: To construct a smartphone addiction scale for children that can be administered to parents.

Materials and Methods: A set of statements were created to assess smartphone addiction in children. Initially, 43 statements were selected after identifying its content validity and face validity and the scale was administered to parents of children in the age group of 3-17 years after obtaining informed consent from the parents. The construct validity was examined by the

exploratory factor analysis. The screen plot of ordered eigen values of a correlation matrix was used to decide the appropriate number of factors extracted. A factor loading of >0.30 was used to determine the items for each factor. Intra-class correlations were calculated for the test-retest reliability, and Cronbach's alpha was calculated for the internal consistency. The final questionnaire contained 24 statements across six subdomains of smartphone addiction and it was administered to a small sample group of 65 parents of children aged 3-17 years and the data was used to test for reliability and validity of the scale.

Results: Alpha correlation for the Smartphone Addiction Scale for Children-Parent (SASC-P) ranged from 0.670 to 0.823. The intrinsic validity for the domains was calculated using Cronbach's alpha and it ranged from 0.819 to 0.907 for the domains and was 0.972 for the whole questionnaire. Thus the scale was found to be reliable and valid for use in children and adolescents.

Conclusion: The SASC-P has good reliability and validity and can be used to measure smartphone use in children and adolescent.

Keywords: Environment, Measure, Questionnaire, Reliability

INTRODUCTION

The advent of the smartphone has made technology easily accessible, bringing the world into our palms. Smartphones with their innumerable features and usage among children and adolescents as a recreational and educational purpose has increased which has both benefits and adverse effects. Despite warnings given by child health specialists about the adverse effects, the prevalence of smartphone usage among children and adolescents is increasing alarmingly. Though there has been necessity of smartphone use for various activities, excessive use of smartphone particularly for recreational activities can lead to addiction as shown in various studies among young people across the globe [1-3].

A study in Australia [4] in 2008, had shown that young people are more attached to their phones and warned of addictive behaviours linked to mobile usage. This has proven to be true with another online study showing that young people are more vulnerable to develop smartphone addiction [5] due to increased usage, lack of self-regulation and presence of social stress.

Griffiths M operationally defined 'technological addictions as a behavioural addiction that involves human-machine interaction and is non chemical in nature' [6]. Gaming disorder is the only disorder included as behavioural addiction in the fifth edition of the Diagnostic and Statistical Manual of Disorders (DSM-5) [7] and in the International Classification of Disorders, 11th edition (ICD 11) [8] by the World Health Organisation (WHO). With the easy accessibility of smartphone [9-11], addiction to it has become a rising problem in recent years demanding attention and the need for evaluation [12].

Through exploratory factor analysis by Lin YH et al., demonstrated that smartphone addiction has several similar aspects to DSM-5

substance-related disorders including the following four main factors: compulsive behaviour, functional impairment, withdrawal, and tolerance [13]. Lin YH et al., proposed six behavioural symptoms and 4 functional impairments with the exclusion criteria for the diagnosis of smartphone addiction [14], while Peckel L proposed that smartphone addiction leads to problematic behaviours and psychological problems with symptoms of craving, dependency, decreased academic performance, impulsivity, impairment in social relationships, irritability, stress, and mood changes associated with decline in smartphone use among others [15].

Utilising these criteria for the diagnosis of smartphone addiction, few scales have been validated to assess the presence of smartphone addiction among young people and very few of these have been modified for use in children like the smartphone addiction scale for use in adolescents [16], and the Smartphone Addiction Inventory (SPAI) [13] among others [17,18]. All these scales are self-administered and hence only evaluate the presence of addiction behaviour as perceived by the children. They fail to account for the fact that children might not have an objective evaluation of their behaviours especially if functional impairments as mentioned by Lin YH et al., have to be evaluated [14]. Hence, the authors felt the need to construct a scale that can be given to parents to evaluate smartphone usage in the children.

The aim of this study was to construct and validate a self-administered smartphone addiction scale for children for use in parents.

MATERIALS AND METHODS

The Institutional Ethics Committee, at Ahana hospitals in Madurai, approved the study (Reference no. 09/2018) and the research was conducted from January 2019 to March 2019. Simple random

sampling was done. Parents who had children in the age group of 3-17 years were invited to participate in the study through social media and through known contacts. The age group was selected because this is the typical school years in the life of the child, when parents can observe their children's behaviours.

Inclusion criteria: Parents who had children between the age groups of 3 to 17 years, of both gender and who were well versed in English language were included.

Exclusion criteria: Parents who had children with pre-existing psychiatric problems and who were differently abled were excluded from the study.

Construction of the Smartphone Addiction Scale for Children-Parent Version (SASC-P)

Six domains of smartphone addiction were proposed based on previous studies detailing the diagnostic criteria for smartphone addiction [14,15,19]. The six domains were:

- Smartphone dependency
- Psychological ill health
- Physical ill health
- Lack of academic performance
- Social relationship
- Family relationship

Items were formed based on these dimensions and 54 statements were formed. The statements were designed as a 5-point Likert response scale (with scores 4- strongly agree, 3-agree, 2-neutral, 1-disagree and 0-strongly disagree). The content validity was examined by an expert panel of 4 psychiatrists and 4 psychologists. Based on their feedback, some statements in the questionnaire were reworded and 11 statements were excluded. The resulting questionnaire contained 43 statements. A focus group was identified to establish face validity and feedback from the focus group was used to amend the statements.

The questionnaire was administered to a representative sample of 397 parents. Parents completed the questionnaire after signing an informed consent form to participate in the study. Trained psychologists were present with the parent while they completed the questionnaire. Total 389 participants completed the questionnaire and their responses were taken for the initial analysis. The smartphone addiction scale was reduced to 24 item scale and was administered to 65 participants who were not part of the previous sample to test for validity and reliability.

STATISTICAL ANALYSIS

Data analysis was done using the Statistical Package for Social Services (SPSS) software, (IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp). The construct validity was examined by the exploratory factor analysis using a principle component factoring estimation method and oblique promax rotation. The screen plot of ordered eigen values of a correlation matrix was used to decide the appropriate number of factors extracted. A factor loading of >0.30 was used to determine the items for each factor. Intra-class correlations were calculated for the test-retest reliability, and Cronbach's alpha was calculated for the internal consistency.

RESULTS

The total scores of SASC-P ranged from 0 to 96 (mean=67.1).The internal consistency of the statements was calculated as described in [Table/Fig-1], by calculating the item discriminating values of the statements based on the responses obtained from the sample. The statements with values lesser than two were excluded and a total of 24 statements were chosen as the final statements for use in the scale [Table/Fig-2].

The proposed 24 item questionnaire with four items for each of the six domains is shown in [Table/Fig-3,4].

S. No.	Item. No.	Statement	Item discriminating value
1	S4	My child is missing the necessary work due to use of smartphone.	42.903
2	S6	I feel that my child is losing family bonds due to use of smartphone.	40.398
3	S7	My child becomes impatient when not having smartphone.	39.911
4	S13	I find it difficult to control my child's smartphone use.	38.651
5	S8	My child is getting irritable and angry due to smartphone use.	38.007
6	S10	My child's academic performance has been affected due to use of smartphone.	37.447
7	S19	I feel that my child is addicted to smartphone use.	36.583
8	S12	I feel that my child's smartphone use is causing problems among family members.	35.448
9	S5	My child is avoiding physical games with other children due to use of smartphone.	33.431
10	S17	My child is avoiding public mingling and being prefers to be alone due to use of smartphone.	33.241
11	S25	I am noticing changes in my child's routine lifestyle due to use of smartphone that affects overall performance.	32.178
12	S18	My child is having adjustment problems with siblings due to smartphone use.	31.923
13	S23	I think my child lost socio-cultural values due to use of smartphone.	30.883
14	S2	My child is having irregular sleep due to use of smartphone.	30.342
15	S3	My child's eating habits has changed due to use of smartphone which caused changes in body weight.	30.209
16	S20	My child is exhibiting unnecessary fear and tension due to use of smartphone.	27.426
17	S9	My child is having frequent headache due to use of smartphone.	24.591
18	S21	My child is having eye problem due to excessive use of smartphone.	23.230
19	S15	My child's physical health is not affected in anyway due to use of smartphone.	19.444
20	S24	My child's smartphone use does not affect our family relationship in anyway.	18.893
21	S22	I think my child is using smartphone only for necessary activities.	17.739
22	S14	My child's psychological health is not affected in anyway due to use of smartphone.	16.198
23	S1	My child must cut the time of using smartphone.	15.449
24	S16	I feel my child's academic and cognitive skills has improved using smartphone.	8.794
25	S26	My child has been spending all the time on smartphone.	1.950
26	S11	I think my child has developed good friends using smartphone.	1.740
27	S35	Social communication has improved through my child's smartphone use.	1.630
28	S30	Smartphone usage helps my child to improve communication within family members.	1.610
29	S34	I feel proud seeing my child using smartphone.	1.540
30	S43	My child's smartphone use creates unnecessary fight among my family.	1.540
31	S33	My child has been frequently suffering from digestion problem.	1.330
32	S42	Smartphone usage helps us in building family bond.	1.120
33	S31	My child is using smartphone only on his/her permissible time.	1.110
34	S36	Due to my child's smartphone use, problems between siblings has reduced.	1.110
35	S27	My child is getting angry unnecessarily for no reason.	1.050

36	S32	My child's concentration ability has reduced due to smart phone overuse.	1.020
37	S37	I feel that, living without smartphone is difficult for my child.	0.970
38	S38	My child's physical appearance has been affected due to smartphone use.	0.910
39	S28	My child is frequently fatigued due to over use of smartphone.	0.880
40	S40	My child's overall performance is better, comparing with other children due to smartphone use.	0.680
41	S39	My child's extra-curricular skills has improved through smartphone use.	0.550
42	S41	I feel my child's social media relationship is good for his/her future	0.390
43	S29	My child has become smart by using smartphone	0.210

[Table/Fig-1]: Item discriminating values of the statements.

Domains	Items	Selected final items
Smartphone dependency	1, 7, 13, 19, 26, 31, 37	1, 7, 13, 19
Psychological ill health	2, 8, 14, 20, 27, 32	2, 8, 14, 20
Physical ill health	3, 9, 15, 21, 28, 33, 38	3, 9, 15, 21
Academic performance	4, 10, 16, 22, 29, 34, 39, 40	4, 10, 16, 22
Social relationship	5, 11, 17, 23, 25, 35, 41	5, 17, 23, 25
Family relationship	6, 12, 18, 24, 30, 36, 42, 43	6, 12, 18, 24
Total	43	24

[Table/Fig-2]: Items selected for final use in the Smartphone addiction scale.

S. No.	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	My child must cut the time of using smartphone					
2	My child is having irregular sleep due to use of smartphone					
3	My child's eating habits has changed due to use of smartphone which caused body weight related problems					
4	My child is missing the necessary work due to use of smartphone					
5	My child is avoiding physical games with other children due to use of smartphone					
6	I feel as my child losing family bond due to use of smartphone					
7	My child become impatient when not having smartphone					
8	My child is getting irritable and angry due to smartphone use					
9	My child is having frequent headache due to use of smartphone					
10	My child's school academic performance affected due to use of smartphone					
11	I feel that my child's smartphone use is causing problems among family members					
12	I find it difficult to control my child's smartphone use					
13	My child's psychological health is not affected in anyway due to use of smartphone					

14	My child's physical health is not affected in anyway due to use of smartphone					
15	I feel my child's academic and cognitive skills improved using smartphone					
16	My child is avoiding public mingling and being prefers to be alone due to use of smartphone					
17	My child is having adjustment problems with siblings due to smartphone use					
18	I feel as my child addicted to smartphone use.					
19	My child is exhibiting unnecessary fear and tension due to use of smartphone					
20	My child is having eye problem due to excessive use of smartphone					
21	I think my child is using smartphone only for unnecessary and unproductive activities					
22	I think my child lost socio-cultural values due to use of smartphone					
23	My child's smartphone use does not affect our family relationship in anyway					
24	I notice changes in my child's routine lifestyle due to use of smartphone that affects his/her relationship with others					

[Table/Fig-3]: The Smartphone Addiction Scale for Children-Parent Version (SASC-P).

Domain	Items
Smartphone dependency	1, 7, 12, 18
Psychological ill health	2, 8, 13R, 19
Physical ill health	3, 9, 14R, 20
Academic performance	4, 10, 15R, 21
Social relationship	5, 16, 22, 24
Family relationship	6, 11, 17, 23R

[Table/Fig-4]: Domains of the SASC-P.
R: Reverse scoring

Reliability and Validity Testing

The 24-item questionnaire was administered to a small sample population consisting of 65 parents and the scores were used to calculate the reliability and validity of the final questionnaire. The overall sampling adequacy of the 24-item scale was tested using Kaiser-Meyer-Olkin, and a high value of 0.945 was reported. The internal consistency of the questionnaire was established by calculating the correlations between the items and the domains, the items and the whole questionnaire and between the domains. Alpha correlation for the items in the domains ranged from 0.670 to 0.823, significant at p-value <0.001. The intrinsic validity for the domains was calculated using Cronbach's alpha and it ranged from 0.819 to 0.907 for the domains and was 0.972 for the whole questionnaire. The reliability coefficient for the whole questionnaire was 0.945, significant at p-value <0.001. The coefficients were significant indicating that the scale was reliable as shown in [Table/Fig-5].

The reliability of the questionnaire was further tested using the test-retest method by re-administrating the questionnaire to the same

Domains	Final items	Alpha reliability	Intrinsic validity
Smartphone dependency	1, 7, 12, 18	0.801**	0.895
Psychological ill health	2, 8, 13R, 19	0.693**	0.832
Physical ill health	3, 9, 14R, 20	0.696**	0.834
Academic performance	4, 10, 15R, 21	0.670**	0.819
Social relationship	5, 16, 22, 24	0.823**	0.907
Family relationship	6, 11, 17, 23R	0.768**	0.876
Total	24	0.945**	0.972

[Table/Fig-5]: Reliability and validity of the smartphone addiction scale.

**Correlation significant at p-value <0.001

sample consisting of 65 parents after an interval of 2 weeks. The scores were used to find the correlation between the domains using the Pearson's moment correlation. The correlation coefficient was found to be within 0.678 to 0.845 for the various domains and the correlation coefficient was 0.955 for the whole questionnaire, significant at p-value <0.001. The Cronbach's alpha for the entire questionnaire was 0.972 indicating that the questionnaire was reliable and valid for use.

DISCUSSION

The Smartphone Addiction Scale for Children-Parent (SASC-P) has been proven to be reliable and valid tool for measuring smartphone use and addiction in children and adolescents. It measures smartphone usage levels based on symptoms of addictive behaviour [15] namely lack of control, craving and irritability when denied use as described by the statements assessing dependency in this scale like "my child becomes impatient when not having smartphone" and "I find it difficult to control my child's smartphone use". The functional impairments are assessed in 5 domains (family, social, physical, psychological and academic areas) as described by Lin YH et al., by statements such as "my child is facing unnecessary fear and tension due to use of smart phone", "my child is having adjustment problems with siblings due to use of smartphone" and "my child is having frequent headaches due to use of smartphone" [14].

The subscales have high internal consistency and the entire scale has high reliability as shown by the test-retest reliability scores. The items in the subscale are reflective of the domains specified and help in measuring smartphone addiction, and the domains that are most impacted by the increased use of smartphone. Males are more likely to become addictive to games while females are more likely to become addictive to different social media platforms [20], but addictive use has always been shown to affect a child's physical, social and psychological health and has a negative impact on academic life of the child [21]. The statement in the present scale "my child is missing necessary work due to use of smartphone" has the highest factor loading indicating that parents are worried about their children missing out of necessary academic work due to use of smartphone. This is in accordance with another study conducted in 2014, involving parents perception of the children's smartphone use [22], which indicated that parents were more worried about decline in academic performance due to smartphone use.

Most smartphone addiction scales are meant as self-assessment tools [23], constructed for use in young adults [24] and then modified for use in adolescents [16]; implying that responses to the items could be biased due to various reasons. Children and adolescents tend to become very attached to their smartphone and they may not be aware of their addiction [25]. But parents are able to ascertain the symptoms of addictive behaviour [26] and hence become worried about their children [27]. The smartphone addiction has been found to impact the children's psychological [21], academic [28] and social life. Hence, this questionnaire has

been designed to be self-administered scale for use with parents. Early detection of smartphone addiction can help in formulating plans to help deal with the issue and therapy could be targeted to address specific impairments as identified in the scale.

This scale can objectively measure smartphone use in children and adolescents and specifically addresses symptoms of dependency and functionally impairments that clearly fulfils diagnostic criteria for smartphone addiction.

Limitation(s)

The authors acknowledge that this scale was for use, with parents who have a good knowledge of the English language. The scale need to be translated in local languages for easy administration and assessment. It may need explanation/helpful intervention of researcher to make the participants understand the exact meaning of each question.

CONCLUSION(S)

This study has proven that the SACS-P was a reliable and valid tool to measure smartphone use in children and adolescents.

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