

Development of a Motivation for Smartphone Use Scale for Adolescents

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【Abstract】 The aim of this study was to develop a motivation for smartphone use scale (MSUS) and evaluate the reliability and construct validity of the scale. There were two sample groups that consisted of 847 adolescents in the research. The first sample group was used to conduct EFA and estimate the reliability of the questionnaire, and the second sample group was used to confirm the factor structure of the scale through CFA. The model fit indices of EFA indicated that the six-factor structure was acceptable: entertainment, assisting live, self-expression, interpersonal communication, assisting study and pastime. The internal consistency of the overall scale and subscales was assessed using cronbach's alpha, and the values ranged from 0.76 to 0.94. The results of CFA indicated the structure of the scale should be amended through allowing the correlation between error values of item 16 and item 17. Though TLI and CFI values were not perfect, but other indexes were satisfactory. Therefore, with limited exception, the MSUS was reliable and valid in the context of adolescents.

【Key words】 Adolescents; Motivation for Smartphone Use; Validity; Reliability

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青少年智能手机使用动机的初步编制

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【摘要】 本研究旨在编制智能手机使用动机量表, 并对其信效度进行检验。将847名被试分为两组, 第一组进行探索性因素分析, 评估问卷信度, 第二组进行验证性因素分析, 评估问卷结构效度。根据探索性因素分析获得六个因子: 娱乐, 辅助生活, 自我表达, 人际交往, 辅助学习和打发时间。总量表以及各分量表的 α 系数为0.76~0.94。根据验证性因素分析, 对模型进行修改, 允许条目16和条目17的误差相关, 修改后除TLI和CFI值, 其他指标值较满意, 因此该量表可以用来测量青少年手机使用动机情况。

【关键词】 青少年; 智能手机使用动机; 信度; 效度

There is no doubt that mobile phone is increasingly popular in all over the world. People can use mobile phone to communicate with others anywhere and anytime if they need. Nowadays, smartphone is more than a connectivity device compared to traditional mobile phone, which combines texting, browsing the Internet, watching video and playing games in one. It is obvious to see people with their devices in hand everywhere they go. And more often than not, people are not speaking into their mobile phones, but are rather making them as a tablet^[1]. What's more, adolescents are more likely use smartphones than the older, because smartphones can present their characters and millions of applications or "apps" facilitate learning, transportation, shopping, entertainment, etc.

However, overuse and inappropriate use of mobile phone result in unfavorable consequences of psycholo-

gy and physiology. Numerous researches on problematic mobile phone use have been conducted from the perspectives of predictive factors and outcome factors. Bianchi & Phillips^[2] studied the relationship between personality and mobile phone use. The study reported that extroversion can positively predict problematic mobile phone use and overuse and that self-esteem can negatively predict problematic mobile phone use. They mentioned that extraverts are fonder to contact others by mobile phone and more likely addicted to mobile phone. These conclusions are proofed by subsequent studies^[3, 4]. Kayseri explored relationship of adolescents' self-esteem to mobile phone use, which was consistent with previous researches^[5]. There is no explicit option about the causal relationship of mobile phone use and emotion to date so far, but numerous studies have shown a positive relationship between

problematic mobile phone use and depression^[3,6-8], anxiety^[4,7] and pressure^[6]. Loneliness was employed in the study of overuse and problematic use of mobile phone by Motoharu and Susumu. The research concluded that low lonely individuals tend to spend time writing, reading text messages and calling phone, but loneliness is no relation to problematic mobile phone use^[9]. This result is not in line with other researchers'^[10].

We can find that people with different psychological factors will induce diverse overcome though using the same apparatus. The reasons why those who are extraverted and down in spirits are more likely addicted to mobile phone are not clear. Motivation is the internal stimulation that drive individual behave. Different motivation may result in completely opposite influence to people. The motivation of mobile phone use which may decide the internal and essential cause of difference about problematic mobile phone use has caught the attention of an increasing number of researchers.

Young reported that individuals of depression and loneliness tend to use mobile phone to distract their attention by browsing the web and watching video^[11]. Those who are in anxiety prefer texting to calling^[12]. Regarding the smartphone use, Lemola et al indicated that being online including Facebook and chat was most significantly associated with depression and sleep disorder, while calling and text message were not related with depression and sleep disorder^[13]. All in all, the type of mobile phone functions those are external performance of mobile phone motivation may reflect the status of mental health of the users.

Some researchers directly develop motivation for mobile phone use scale to explore the relationship of motivation of mobile phone use to mental health. According to Kim's study on motivation, depression is positively associated with alleviation motivation, while a positive association between depression and pass-time motivation, was not supported^[14]. Those who use a mobile phone with the motivation of escaping from negative emotion are more prone to be depressed and worried than those who use a mobile phone out of habit or just to pass time^[1].

However, there is no applicable measure tool to evaluate motivations for smartphone use at home. So

developing a measure tool that apply to smartphones' motivation is entirely essential for future studies.

This study was designed to develop a comprehensive scale in order to evaluate the different motivations of smartphone use in teenagers. The authors are expecting that this scale will be used efficiently for distinguishing various use motivations in community areas and further studies, and for the exploration of the relationship between smartphone use motivation and psychological factors.

Materials and Methods

Participants

There were two stages in this study. At the first stage, we interview 212 college students and high school students and 60 adolescents online. at the second stage, two separate sample groups were selected from college schools and high schools. The first sample group consisting of 448 adolescents were used to research the exploratory factor analysis and the internal consistency. Of these, 39 were male and 409 were female, with ages ranging from 14 to 22 years(M=18.13, SD=1.48). The number of participants were over five times more than the number of items, so the sample size were adequate. And the second sample group consisting of 399 participants were used to explore the confirmatory factor analysis. Of these, 197 were male and 197 were female(5 were missing), with ages ranging from 14 to 26 years(M=17.64, SD=1.68). Each participant agree to take part in this research and the data were analyzed anonymously. The study participants' demographic features are shown in Table 1.

Table 1 Characteristics of the study population

sample	n	gender		age	
		female	male	M	SD
1	448	409	39	18.13	1.48
2	399	197	197	17.64	1.68

Measurement

Based on structured interview to 212 high school students and undergraduates and literature review, a questionnaire was developed about smartphone use motivation that consisted of 50 items. Nine items were revised by 10 psychological peers who were invited to evaluate each item according to the face validity. The

amended items were re-examined in terms of grammar and syntax by 60 college students for clarity purposes. All items in this scale were rated on a five-point scale (1=strongly disagree, 2 comparatively disagree, 3 agree, 4 comparatively agree, 5=strongly agree).

847 adolescents including two sample groups voluntarily completed the scale during class time. These data were used for the exploratory factor analysis and the confirmatory factor analysis.

Statistical Analysis

All analyses were conducted using SPSS and Mplus for Windows software package. The internal consistency of the overall scale and subscales was assessed using Cronbach’s alpha. The validity was assessed using Exploratory Factor Analyses(EFA) and Confirmatory Factor Analyses(CFA). Those items with factor loading above 0.3 were retained. Maximum Likelihood Estimator(MLR) was performed with comparative fit index(CFI), Tucker-Lewis index(TLI), root mean square error of approximation(RMSEA) and standardized root mean square residual(SRMSR).

Results

Exploratory factor analysis

Items with factoring loading>0.3 were selected, so thirty-eight items were selected. When kaiser’s rule (eigenvalue>1) was used, six factors were generated from MSUS. These factors conforming to the scale were respectively termed “interpersonal communication”, “entertainment”, “assisting live”, “self-expression” “assisting study” and “pastime”. And “Entertainment”, “assisting live” consisted of seven items. Two items were included in “interpersonal communication”. Eight items were included in “self-expression”. Four items were included in “assisting study” and ten items were included in “pastime”(table 2).

Reliability of the MSUS

The internal consistency of the overall scale and subscales was assessed using Cronbach’s alpha. Alpha=0.938 for the total scale, Alpha=0.781 for “interpersonal communication”, Alpha=0.757 for “Entertainment”, Alpha=0.856 for “assisting live”, Alpha=0.865 for “self-expression”, Alpha=0.824 for “assisting study”, and Alpha=0.882 for “pastime”.

Table 2 factor loading of MSUS items

Item No	F1	F2	F3	F4	F5	F6
1	0.751	0.041	0.013	-0.007	0.025	-0.028
3	0.762	0.040	0.024	0.179	0.001	-0.002
5	0.194	0.508	-0.055	0.045	-0.007	0.173
6	0.035	0.392	0.007	0.101	0.149	-0.042
7	0.149	0.598	-0.012	-0.038	0.142	0.135
8	0.033	0.723	0.070	-0.003	0.033	0.133
9	0.049	0.455	0.093	0.252	0.013	-0.001
10	-0.049	0.321	0.157	0.144	-0.037	0.026
11	-0.171	0.331	-0.017	0.018	0.200	-0.190
14	0.067	0.030	0.569	-0.002	0.000	0.021
15	0.052	-0.077	0.585	0.015	0.016	0.017
16	-0.078	0.103	0.678	-0.020	0.023	0.033
17	-0.056	0.079	0.749	0.065	-0.011	-0.085
18	0.063	0.148	0.530	0.050	0.067	0.018
19	0.038	0.183	0.433	-0.018	0.147	0.002
20	0.154	-0.051	0.387	0.164	0.127	0.061
23	-0.006	0.141	0.125	-0.126	0.658	0.107
24	-0.046	0.055	0.110	0.033	0.707	-0.076
25	0.078	0.047	0.054	-0.002	0.665	0.037
28	0.020	0.128	0.037	0.040	-0.039	0.608
30	0.080	-0.036	0.110	0.489	0.121	0.162
31	0.030	-0.027	0.081	0.385	0.051	0.093
32	0.035	0.011	-0.047	0.207	0.111	0.302
33	0.000	-0.094	0.027	0.552	0.092	0.050
34	-0.085	0.056	-0.015	0.802	0.000	-0.036
35	0.036	0.004	0.039	0.853	-0.024	-0.157
36	-0.041	0.088	-0.132	0.727	0.120	-0.014
37	0.034	0.094	-0.034	0.746	-0.021	0.070
38	0.295	0.112	0.033	0.422	-0.052	0.115
40	0.102	0.073	-0.067	0.066	0.100	0.484
41	-0.029	0.233	0.076	0.228	-0.030	0.360
43	-0.064	-0.035	-0.176	0.051	0.067	0.404
44	-0.021	-0.029	-0.011	-0.041	-0.091	0.527
46	-0.017	-0.004	-0.077	0.173	0.561	0.012
47	0.060	0.060	0.084	0.112	0.149	0.316
48	-0.027	-0.002	0.035	-0.005	0.036	0.837
49	0.053	0.009	0.100	-0.031	-0.169	0.754
50	-0.110	0.028	-0.098	0.001	0.051	0.808

Note: overstriking shows factor loading>0.3

Confirmatory factor analysis

Normality test were conducted on the 38-item scale to decide which method was suitable to estimate parameters. Based on coefficient of skew>2 and coefficient of kurtosis>7, Maximum Likelihood Estimator (MLR) was used to estimate model parameters. According to exploratory factor analysis and item select, we can find that motivation for smartphone use scale (MSUS) consisted of 38 five-point Likert-scale type items, and each item was scored from one to five. Six

subscales were determined as “entertainment”, “assisting live”, “self-expression”, “interpersonal communication”, “assisting study” and “pastime”.

Confirmatory factor analysis(CFA) were conducted to estimate the model structure. And the model fit indices were RMSEA, CFI, TLI and χ^2/df . Model modification indices suggested that the error values of item 16 and item 17 were correlative, based on which, the model fit indices can be improved. The results showed that, $\chi^2/df=2.39$, TLI=0.842, CFI=0.854, RMSEA=0.059.

Discussion

Three aims were analyzed in this study. The first aim was to develop the motivation for smartphone use scale(MSUS) by using structured interview and literature review^[4,14,18-20]. According to the reports of 212 adolescents and some existing studies, 50 items were developed. And the original questionnaire was amended based on advice of 10 psychological peers and 60 college students. After exploratory factor analysis of the scale, 10 items were excluded. Eight items excluded had a loading value under 0.30^[21]. Two items excluded were included in deserted factors. In light of the model fit indices and interpretability, six factors were extracted in the end(entertainment, assisting live, self-expression, interpersonal communication, assisting study and pastime). The second was to evaluate the reliability of the scale. Scale reliability and subscale reliability were measured by internal consistency with Chronbach's alpha coefficient. For internal consistency of factor total scores and general total scores, the Chronbach's alpha values ranged from 0.78 to 0.94. So the reliability of the questionnaire was satisfactory. The third aim was to verify the construct validity of the scale through CFA. According to the values of model fit indices, the structure of the scale should be amended based on model modification indices. When allowing the error values of item 16 and item 17 be correlative, the model fit indices were improved.

However, some limitations of this study should be noted. First, the subjects of this research were not representative on account of no equivalence between men and women. The fact that the number of women were more than the number of men may influence the gener-

alizability of the result. Therefore, studies collecting more representative subjects could be very useful in further research on this topic. Second, the TLI value and CFI value of CFA were not enough satisfactory though the structure of the scale had been modified^[22]. The model of this scale should be revised through more advanced measurements and more representative data in the future. Finally, the scale did not have standard for evaluation. The more one subscale score was, the larger the corresponding motivation was in this scale. Developing a norm to establish the standard of evaluation is absolutely essential in further study.

In conclusion, the MSUS exhibits acceptable levels of reliability and construct validity in the context of adolescents. Although some model fit indices were not very good, the structure of the scale was acceptable. What's more, the scale is the first scale about the motivation for smartphone use, and this questionnaire lay the foundation of future research about correlational studies of smartphone use.

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