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Validation of Thai Smartphone Addiction Scale-short version for school students between 10 to 18 years

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ABSTRACT

Background: With the dramatic increase in the number of smartphone users, concern has been raised that smartphone overuse can be hazardous to health. There is a need of smartphone addiction screening instrument that can be used for the Thai people, particularly children and adolescents.

Objectives: This study aimed to translate Smartphone Addiction Scale – Short Version (SAS-SV) into Thai for school students between 10 to 18 years and to comprehensively validate the translated version.

Materials and methods: After completing the translation according to published guidelines, Thai version of the SAS-SV (THAI-SAS-SV) for school students underwent thorough many psychometric tests. The content validity was evaluated by a panel of seven experts. Internal consistency and construct validity of the THAI-SAS-SV were then tested among 200 Thai school students between ages 10 and 18 (mean age 12.82±2.21 years). The test-retest reliability was also evaluated in half of all participants.

Results: THAI-SAS-SV for school students demonstrated an excellent validity index for scale (S-CVI = 0.97) and an item content validity index (I-CVI) ranging from 0.86 to 1.0. Cronbach's alpha for internal consistency was calculated as 0.85. The THAI-SAS-SV for school students has similar construct to the original instrument because the confirmatory factor analysis clearly revealed a single-factor structure. Intraclass correlation coefficient (ICC) value for test retest reliability was 0.73 (95% CI: 0.62-0.81).

Conclusion: The findings suggest that THAI-SAS-SV for school students between 10 to 18 years is a valid and reliable instrument for screening smartphone addiction targeted towards Thai children and adolescents.

Introduction

Smartphones are becoming ever more essential in the lives of human beings, as they can be used as a multifunction device. Despite the many benefits of using a smartphone, mental-and physical-health problems related to the cumulative effect of excessive smartphone user are increasingly raising concern among healthcare professionals. Today, smartphone overuse is an emerging object of worldwide concern, especially for teenagers, who can relatively easily develop dependency upon the device.[1] Unsurprisingly, a high prevalence of smartphone addiction has been reported in many countries in the past few years, especially among young people.[2]

The number of smartphone users has dramatically increased all over the world, as tracked through the year 2018. Globally, there are 5.11 billion unique smartphone users

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today, and increase of 100 million (2 percent) over the year 2018.[3] In the previous year, Thailand is ranked eighteenth highest in the world as to number of active smartphone users. Meanwhile, Thailand was the fourth-highest as to number of smartphone owners in Southeast Asia after Indonesia, Philippines, and Vietnam.[4] Furthermore, the digital intelligence quotient (DQ) impact report revealed that Thai children and adolescents aged between 8 and 12 years spend an average of 35 hours a week browsing the internet which is more than 3 hours worldwide average. Moreover, the Thai school students access the Internet via personal smartphone up to 73 percent. Critically, excessive use of smartphones may lead to an increased risk of online perils in Thai youths.[5] It is, however, difficult to determine whether or not spending more time with smartphone leads to the development of behavioral addiction. It is worrisome that teens were found to be highest across all age groups that use social media on smartphones.[6] Also, it is predicted that mobile internet usage by this age groups will likely continue to increase.[7] Given that there has been a rapid progress in increasing access to smartphones in Thai vulnerable persons, an effective instrument is necessary to identify Thais who are at risk of developing smartphone addiction. Although there is the Thai version of Smartphone Addiction Scale – Short Version[8], the participants in previous work were young adult university students, which different from the original version. Importantly, only two tests of the psychometric properties of the translated version were performed. It is important to conduct several types of psychometric properties to confirm validity and reliability of the newly translated questionnaire.

Smartphone Addiction Scale - SV (SAS-SV) developed by Kwon et al[9] is an acceptable questionnaire instrument for evaluation of smartphone addiction. The intention of this original questionnaire instrument was to produce a brief screening instrument to evaluate smartphone addiction for use in 2nd year of junior high school students.[9] The instrument consists of 10 items that are relatively short and suitable for use with young people subjects. SAS-SV has been shown to possess validity and reliability. There are adaptations of the SAS-SV to other languages including German[10], Spanish, French[11], Arabic[12], Turkish[13], Italian[14], Chinese[15], and Thai.[8] The good to excellent validity and reliability of all translated versions have been reported. The SAS-SV has been used in several studies that indicated its usefulness and adequate psychometric properties. So far, the prevalence of smartphone addiction in Thai school students between 10 to 18 years have been inadequate due to some limitations in the instrument's development as mentioned earlier.

As the use of smartphone increases worldwide, there is wide concern among healthcare professionals about the spreading of chronic mental and health problems of device dependence. Although the smartphone device seems to be an essential tool of modern life, it is likely to be a "double-edged sword" for users as well.[1] Previously, many self-report questionnaires were developed for determining smartphone addiction among smartphone users.[2] Among these questionnaires, the SAS-SV has fewer items than others and it has a cut-off score for each gender. It is well known that a brief questionnaire should be selected to deal with teenager. In addition to the rapid growth of smartphone penetration, it is well known that the rate of social media and Internet usage of Thailand and South Korea are quite similar. Accordingly, it is probably best suited to use this questionnaire in teens. Thus far, few valid or reliable instruments have been available to screen smartphone addiction for Thais, even though there is a fairly high rate of smartphone usage in Thailand. Currently, there are only two screening questionnaires for Thai children and adolescents, related to addiction of Facebook[16] and game.[17] It is well accepted that prevention is better than a cure. Going forward, screening instruments are needed to assist in early detection of this behavioral addiction, particularly for a group like children and adolescents with high-risk for smartphone dependence. Therefore, this study aimed to translate the SAS-SV into the Thai language for school students between 10 to 18 years and to determine the various psychometric properties of the Thai version of the SAS-SV (THAI-SAS-SV) for school students, thus establishing the psychometric properties as well as suitability of its use for further research in Thailand.

Materials and methods

Material

Smartphone Addiction Scale Short Version (SAS-SV) is a self-reporting questionnaire instrument that consists of 10 items with a six-point Likert-type scale, ranging from 1 ("strongly disagree") to 6 ("strongly agree"). The total score ranges from 10 to 60, and higher scores indicate a high risk use of the smartphone. This instrument was developed and validated in a sample of 343 boys and 197 girls in South Korea. The average age of participants was 14.5 years. The cut off score is 31 point for males and 33 point for females.[9] SAS-SV was developed from the Smartphone Addiction Scale (SAS) that have 33 items and was proven to be relatively reliable and valid, though it was validated in adults aged 18 to 53 years.[18] SAS-SV has a proven internal consistency reliability (Cronbach's alpha of 0.911) and concurrent validity which correlated with the Korean Internet Addiction Self-Assessment Tool (r=0.421) and Smartphone Addiction Proneness Scale (r=0.762).[9]

Study design

The study was a cross-sectional design conducted in two phases from December 2018 to April 2019. Phase I comprised translation and cross-cultural validation of SAS-SV for school students between 10 to 18 years. Phase II determined the psychometric properties of the THAI-SAS-SV for school students including content validity, construct validity, internal consistency reliability, and test-retest reliability.

Sample size determination

Sample size determination was divided into two phases: translation and validation of the psychometric properties of the translated questionnaire. Based on previous recommendation for testing of the prefinal version in translation phase, the sample size was 40 persons.[19] Based on previous recommendations for testing the psychometric

properties of questionnaire, the sample sizes of 200 persons for confirmatory factor analysis and internal consistency reliability. The subject-to-item ratio considered in this study was 1:10[20] and 100 persons for the test-retest reliability test. The minimum sample size required in this study was 50 persons.[21] In this phase, sample size determination was chosen to be twice the minimum requirement because we attempted to recruit the same number of primary school students and high school students. Therefore, we set out to recruit approximately 200 individuals for factor analysis as well as internal consistency reliability and 100 individuals for repeatability. For assessing repeatability of THAI-SAS-SV for school students, the 100 participants were randomly selected from 200 participants in main study by the lottery method to avoid bias the test.

Participants

For this study, participants between the ages of 10 and 18 years were recruited in both genders. This study intended to recruit a homogeneous set of participants in term of school setting. As a result, the participants consisted of school students (Grades 4 to 12). According to the Thai education system, the participants were primary school students (10 to 12 years) and high school students (13 to 18 years). The participants were recruited from five schools in large province (Chiang Mai) and small province (Phayao) in northern Thailand.

The inclusion criteria were 1) experience of smartphone usage at least three months prior to study participation and 2) the ability to read and understand Thai language.

Translation process

In this study, the translation process was carried out based on international standard regarding the translation of research instruments.[19]

Forward translation: the original SAS-SV was authorized for translation and validation as Thai version. This questionnaire was translated into Thai by two independent bilingual translators whose first language is Thai. Both translators had lived in Australia and France for more than three years.

Synthesis of the translations: the two forward translations (Thai version) and original SAS-SV (English version) were compared and synthesized by forward translators and the researcher. The synthesis was performed regarding ambiguities and discrepancies of words, sentences, and meanings of the initial Thai version of SAS-SV.

Back translation: the initial Thai version of SAS-SV was back translated accurately by two independent bilingual translators whose first language is English. Both translators had no access to the English version of SAS-SV.

Expert committee: the pre-final version was derived by the expert committee comprising translators, a lecturer in the department of Physical Therapy who had lived in the United Kingdom for more than four years, a high school English teacher who has worked with intensive English program, a child and adolescent psychologist, and a psychiatric nurse. The aim of this step was to consolidate all versions of the questionnaires and produce the appropriate pre-final Thai version of SAS-SV for testing in the field. To achieve successful adaptation, the committee's considered four aspects including semantic equivalence, idiomatic equivalence, experiential equivalence, and conceptual equivalence. The committee also were required to ensure that the pre-final version would be appropriate for understanding by a 10-year-old child.

Test of the pre-final version: forty participants were recruited to read and answer without assistance the pre-final Thai version of SAS-SV for school students between 10 to 18 years and were later questioned about its conceptual clarity. The pilot testing used an equal number of male and female participants. All participants were interviewed subsequent to pilot testing to prove their understanding of each questionnaire item as well as their choices of responses. All participants reported that they understood the translation, and the items in the translated version were relatively simple to score.

Psychometric properties testing

In the present study, the psychometric properties testing followed the previous suggestion.[22]

Content validity: the THAI-SAS-SV for school students was assessed for its content validity by a panel of seven experts from different institutions, including three psychiatrists, two psychologists, one psychiatric nurse, and one lecturer in mental health nursing. All of the experts possessed more than five years of experience in work related to psychology. Content validity was assessed by asking the experts to rate each question as a valid measure of the construct using a four-point Likert scale (1= not relevant, 2=somewhat relevant, 3=quite relevant, and 4=highly relevant). Content validity of individual items (I-CVI) was calculated from the number of experts giving the item a relevance rating of either 3 or 4, divided by the total number of experts. Content validity of the overall scale (S-CVI) was calculated from the number of items given a rating of either 3 or 4, divided by the total number of items. A value greater than 0.78 is considered satisfactory for I-CVI, and a value of at least 0.80 of S-CVI value is acceptable given also that there is congruence between the evaluation question and the objectives, or content.[23]

Construct validity: the construct validity of the THAI-SAS-SV for school students was tested by confirmatory factor analysis (CFA). In this study, we hypothesized that the THAI-SAS-SV would exhibit a single dimension similar to the original instrument. Thus, it would be said that the structural model of the THAI-SAS-SV was well overall fit to the Thai culture. Several model fit indices and their criteria were used to examine the goodness-of-fit of the model with the given dataset: Relative chi-square value (ratio of chi-square to degrees of freedom), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), normed fit index (NFI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). The relative chi-square should be less than 3. The recommended value of RMSEA and SRMR should be less than 0.08 and 0.05, respectively. The value of GFI, AGFI, NFI, and CFI larger than 0.90 are acceptable.[24]

Internal consistency reliability: the THAI-SAS-SV for school students was assessed for internal consistency using Cronbach's alpha coefficient, corrected item-total correlation,

and Cronbach's alpha if item deleted. A result of high Cronbach's alpha indicates high correlations among the items in the instrument. An alpha value between 0.70 and 0.95 was regarded as acceptable reliability.[21] Corrected item-total scale correlation of 0.30 or higher was considered acceptable for each item in the instrument.[25] In principle, all of the alpha if item deleted values should not be greater than the overall alpha.[26]

Test-retest reliability: the THAI-SAS-SV for school students was investigated for test-retest reliability using the intraclass correlation coefficient (ICC).

In this study, all participants were asked to maintain their regular amount of smartphone usage with the same their smartphones throughout the 2-week interval. Time interval between two weeks was conducted to minimize recall bias[21] and behavior cannot become an addiction within a short period of time.[27] Based on the study by Koo et al[28], the values of ICC between 0.5 and 0.75, between 0.75 and 0.9, and greater than 0.90 are indicative of moderate, good, and excellent reliability, respectively.

Data collection

Data were collected from December 2018 to April 2019. Permission was granted to administer this questionnaire from the headmaster in each school. In the field, a paper-based questionnaire was used for collecting data. The present study was approved by the Ethic Review Board of the Faculty of Associated Medical Sciences, Chiang Mai University (Ethic Code: AMSEC-61EX-076). Written informed consent was obtained from the parents or legal guardians of the participants prior to data collection.

Statistical analysis

Statistical Package for the Social Science (SPSS) version 17.0 was used to analyze descriptive statistics such as frequency, percentage, mean, standard deviation (SD), and 95 percent confidence intervals (95% CI) and the statistical significance was set at $p<0.05$. Confirmatory factor analysis was determined using LISREL 8.8.

Results

Translation and pilot testing

In consensus with the expert team, instructional guideline and cartoon pictures representing facial expressions of agreement were provided in the THAI-SAS-SV for school students between 10 to 18 years for more understanding when using this instrument. The original SAS-SV did not provide cartoon images. Based on a pilot testing together with a consensus of the expert team, we decided to add instructional guidance and cartoon images representing facial expressions of agreement for more understanding when using this instrument. It is important to note that the youngest participants in this study were 10 years. During the pilot testing, most of the youngest participants complaint about a six-point Likert-type scale ("strongly disagree, disagree, somewhat disagree, agree, somewhat agree, and strongly agree") that is difficult to distinguish one from the other. To clarify subjective information and avoid confusion, cartoon images were then used as an appropriate solution as shown in Figure 1.

Figure 1. *Cartoon images used in this study to represent strongly disagree, disagree, somewhat disagree, agree, somewhat agree, and strongly agree, respectively.*

In this study, seven items were adapted properly for use in Thai culture and examples of events were provided for youngsters. All participants were instructed to read and answer the questions by themselves. Therefore, some situations and common nouns as such in item 7 and 10 were used to decorate for enhancing good understanding of the participants. The term "I" was provided in items 1 to 4, and in item 8 to represent the respondent. The term "activity" was added into the items 1 and 2 because term "work" might not be appropriate for activity involvement of children and early adolescents. For item 7, some situations were intended to serve as examples for better understanding. Based on the context of social media use in Thailand, the term "Line" and "Instagram" were also added into item 8 and ranked in order of popularity among Thais. Similar to item 7, the term parents, teacher, friend, brother, and sister were intended to represent "the people around me" in item 10. In addition, local language was used to expand the term "holding" in item 5. The participants during pilot testing reported that they understood the translation and that the items in the translated version were easy to score. Following the pilot study, THAI-SAS-SV for school students between 10 to 18 years was approved without further changes.

Participant characteristics

A total of 200 participants were included in the main study. Of those, 110 participants were males (55 percent). The average age of participants was 12.82±2.21 years (range 10 to 18 years). Regarding school grade level, the mean ages of primary school students (male 52, female 48) and high school students (male 58, female 42) were 10.95±0.72 years and 14.69±1.50 years, respectively. The demographics of participants are presented in Table 1.

Table 1 General characteristics of participants (N=200).

Characteristics	Mean±SD	Male (n)	Female (n)
Age (years), Overall	12.82±2.21	110	90
Primary school students (10 to 12 years)	10.95±0.72	52	48
High school students (13 to 18 years)	14.69±1.50	58	42

Reliability and validity

Content validity: the content validity results showed that THAI-SAS-SV for school students had a S-CVI score of 0.97. All of the I-CVI scores ranged from 0.86 to 1.00, as presented in Table 2. THAI-SAS-SV for school students demonstrated excellent content validity.[23]

Table 2 I-CVI and S-CVI scores of the THAI-SAS-SV for school students between 10 to 18 years.

Item	The opinion of experts							I-CVI
	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Rater 7	
1	4	4	3	4	4	4	4	1.00
2	4	4	4	4	4	4	4	1.00
3	4	4	3	4	4	4	4	1.00
4	4	3	4	2	4	4	4	0.86
5	4	4	3	4	4	4	4	1.00
6	4	4	3	2	4	4	4	0.86
7	4	4	3	3	4	4	4	1.00
8	4	4	4	4	4	4	4	1.00
9	4	4	4	4	4	4	4	1.00
10	4	4	4	4	4	4	4	1.00
S-CVI	1.00	1.00	1.00	0.80	1.00	1.00	1.00	0.97

Note: *I-CVI indicates content validity index for item, S-CVI indicates content validity index for instrument.*

Construct validity: Thai version for school students was found to be consistent with the original version which included one dimension.[9] The results of CFA indicated that the model was well fitted.[24] The model fit indices were as follows: X2=82.18, df=35, GFI=0.92, AGFI=0.88, NFI=0.95, CFI=0.97, IFI=0.98, RFI=0.94, RMSEA=0.08, and SRMR=0.05). Result of the factor analysis are presented in Figure 2.

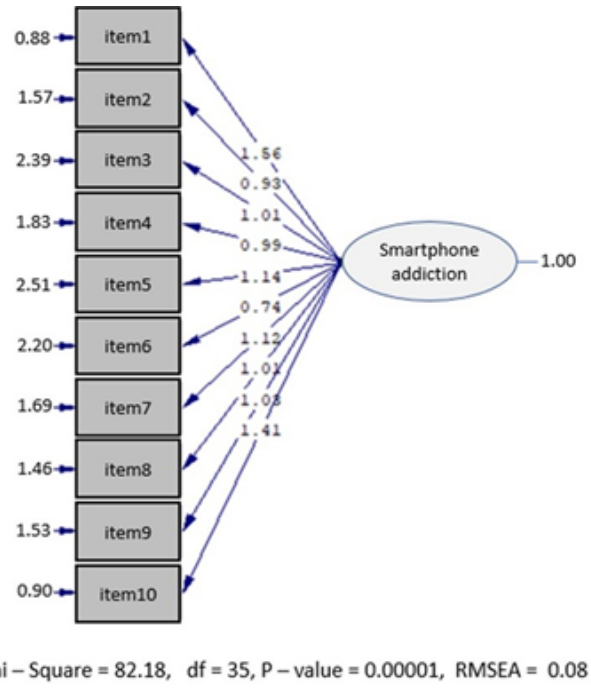

Figure 2. *Factor loadings for the THAI-SAS-SV for school students between 10 to 18 years..*

Internal consistency reliability: results of internal consistency reliability showed the overall Cronbach's alpha coefficient was 0.85 for the ten items in the Thai version of SAS-SV for school students. The corrected item total correlation coefficients ranged from 0.399 to 0.717. The deletion of any individual item would have decreased the internal consistency of the instrument. This result reflects that all the items of THAI-SAS-SV for school students had good relationships.[21,25-26] The values of corrected item-total correlation and Cronbach's alpha if item deleted are shown in Table 3.

Table 3 Item-total Correlation and Cronbach's alpha if item deleted of THAI-SAS-SV for school students between 10 to 18 years (N=200).

Item content	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1) การใช้สมาร์ตโฟน ทำให้ฉันพลาดงาน หรือ กิจกรรม ที่วางแผนไว้	0.717	0.820
2) การใช้สมาร์ตโฟน ทำให้ฉันไม่มีสมาธิในขณะเรียน ขณะทำแบบฝึกหัด ขณะทำกิจกรรม หรือ ขณะทำงาน	0.497	0.840
3) ฉันรู้สึกปวดข้อมือหรือด้านหลังคอ ขณะใช้สมาร์ตโฟน	0.495	0.840
4) ฉันรู้สึกทนไม่ได้ เมื่อไม่มีสมาร์ตโฟน	0.527	0.837
5) ฉันรู้สึกกระวนกระวายและหงุดหงิด เมื่อไม่ได้พกสมาร์ตโฟน	0.512	0.839
6) ฉันมักนึกถึงสมาร์ตโฟนอยู่ในใจของฉัน แม้ว่าไม่ได้ใช้มันอยู่ก็ตาม	0.399	0.849
7) ฉันจะไม่ยอมเลิกใช้สมาร์ตโฟน แม้มันจะกระทบต่อการใช้ชีวิตประจำวันของฉันอย่างมากแล้วก็ตาม เช่น กิจวัตรประจำวัน หรือ การเรียน	0.546	0.836
8) ฉันเช็คสมาร์ตโฟนอยู่เสมอ เพื่อไม่ให้พลาดการพูดคุยสนทนากับคนอื่นๆ ผ่านทางไลน์ เฟซบุ๊ค อินสตาแกรม หรือ ทวิตเตอร์	0.548	0.836
9) ฉันใช้เวลากับสมาร์ตโฟน นานกว่าที่ฉันตั้งใจไว้	0.565	0.834
10) คนรอบ ๆ ตัวฉัน เช่น ผู้ปกครอง พี่น้อง ครู หรือ เพื่อน บอกฉันว่า ฉันใช้สมาร์ตโฟนมากเกินไป	0.691	0.822

Test-retest reliability: the analysis of the repeatability results demonstrated that THAI-SAS-SV for school students exhibited moderate reliability, indicated by the ICC value of 0.73 (95% CI; 0.62-0.81).[28]

Discussion

The present study determined the validity of THAI-SAS-SV instrument for use with smartphone addiction screening in Thai school students between 10 to 18 years. Due to the increasing number of smartphone users, particularly Thai youth, a brief questionnaire for screening smartphone addiction should also be developed in addition to Facebook and game addiction questionnaire. In this study, SAS-SV was selected to translate and culturally adapt to Thai language since number of items is relatively less than other instruments. It is easy for school children to complete the score with themselves in a short period of time (on average, answer all questions in 5 minutes). As youths generally have short attention spans[29], it seems suitable to use THAI-SAS-SV for screening smartphone addiction in this age group. Overall, THAI-SAS-SV for school students was shown to be reliable and valid in the Thai language. In addition, the participants during pilot testing and the main study reported that they well understood THAI-SAS-SV and the rating score of each item was fairly simple.

This study is the first attempt to cross-cultural adaptation concerning the use of this instrument with children and adolescents and investigate the usefulness of THAI-SAS-SV in primary school students together with high school students. According to a study by Kwon et al[9], SAS-SV was developed from SAS which consisted of 31 items.[18] The mean age of participants in the present study is relatively lower than that in previous studies.[8,10-12,14-15] Although some previous studies have shown that the translated versions of SAS-SV are valid and reliable, most participants were over the age of 18 years. Ideally, the principal goal of development was to produce the short form of SAS for cooperating in adolescents. The original SAS-SV was validated in second-year junior high school students from two schools, and the average age of those participants was 14.5 years. Correspondingly, the mean age of participants in the present study is similar to the previous one. In addition to using the same number of instrument items (ten) as in SAS-SV, THAI-SAS-SV school students incorporates instructional guidance and facial expressions of agreement to assist participants' comprehension. According to the findings, all components of THAI-SAS-SV for school students might offer the user an accurate understanding. This might reflect that THAI-SAS-SV for children and adolescents can be used for early detection of smartphone addiction.

In the current study, THAI-SAS-SV for school students showed excellent content validity (I-CVI 0.86 to 1.00, S-CVI 0.97). The mean I-CVI in this study was a little higher than that (mean I-CVI 0.94) in the original study.[9] Content validity helped assess whether the content was relevant to the concept of smartphone addiction defined for the study. The number of experts in this study is equal to the number of experts (expert committee of seven persons) in the study by Kwon et al.[9] No previous study examined the content validity of the translated version. As a result, our findings provide much more comprehensive testing than the previous studies with respect to all translated versions. In addition to content validity, we also investigated construct validity via factor analysis to ensure validity. Factor analysis assessed

the theoretical construct of THAI-SAS-SV for school students. The results indicated that THAI-SAS-SV in this study had only one dimension which was similar to the results for the original version.[9] The one factor was also consistent with other translated versions,[11,13,15] which supported that THAI-SAS-SV for children and adolescents can be used across cultures.

Regarding internal consistency, the Cronbach's alpha (Cronbach's α=0.85) reached the recommended level for clinical use because THAI-SAS-SV in this study showed good internal consistency. Cronbach's alpha coefficient was higher than 0.70, reflecting homogeneity of items. Importantly, Cronbach's alpha coefficient in our study was lower than 0.95, and thus redundancy was not an issue. In addition, the corrected item-total correlation for all items was higher than 0.30, which reflected their homogeneity. In previous studies, internal consistency reliability was examined to indicate the reliability of the translated version of SAS-SV. As in all other translated versions, the internal consistency reliability of THAI-SAS-SV was slightly lower than the other languages. The Cronbach's alpha coefficient for total instrument of THAI-SAS-SV for school students was high (α=0.85), and was fairly similar with the original (α=0.91)[9], THAI-SAS-SV for university students (α=0.94)[8], German (α=0.85)[10], Spanish (α=0.88), French (α=0.90)[11], Arabic (α=0.84)[12], Turkish (α=0.88)[13], Italian (α=0.79)[14], and Chinese (α=0.84).[15]

Regarding repeatability, the test-retest reliability of THAI-SAS-SV for school students was moderate (ICC=0.73). To the best of our knowledge, only one study has investigated test-retest reliability of a translation of SAS-SV. The test-retest reliability of the THAI-SAS-SV in this study was fairly comparable with the Chinese version of SAS-SV (ICC=0.76).[15] Nevertheless, the Chinese version of SAS-SV was examined for repeatability, given its set of adults participants of age 18 to 65 years. In the present study, the results are specific to participants of age 10 to 18 years. Therefore, our results indicate the stability of the responses to the items on THAI-SAS-SV over time even using the instrument with children and adolescents.

The current study has several strengths and limitations. First, the current study cooperates with experts and specialists from different locations to minimize bias. Second, experts engaged in this study comprised professionals with direct work experience with children and adolescents. Third, use of five content experts is commonly considered adequate for assessing content validity in developing clinical instruments. In this work, THAI-SAS-SV was examined for content validity by seven experts with experience in working with psychiatric patients. Finally, the study's collection of data used an adequate sample size according to the simple random sampling method. Although we attempted to establish a rigorous translation process followed by comprehensive testing of the newly translated questionnaire, we acknowledge that the present study had some limitations. To ensure the consistency of the amount of smartphone usage, screen time should be recorded. In this work, the participants were recruited from five schools; however, the data was collected from students living in two provinces in northern Thailand, thus limiting generalization to other populations. To gain a broader understanding of THAI-SAS-SV for school students between 10 to 18 years, the instrument should be tested in various settings. Multicenter collaboration that includes all regions of Thailand should be considered in future studies. Further studies are necessary to consider whether socio-demographic characteristics are related to the smartphone addiction level score such as socio-economic state and family environments. In addition, data collection was performed during the final examination period in the study participants' various schools. An improvement to the current study would be to conduct the questionnaire during a class period or semester break. Future studies might be aimed toward investigating whether THAI-SAS-SV demonstrates concurrent validity. Importantly, the cut-off scores used for Thai version of SAS-SV were based on the Korean version of the instrument that conducted Receiver Operating Characteristic (ROC) analysis using a sample of teenagers from Korea. Hence, statistically supported cut-off scores for screening smartphone severity in Thai school students between 10 to 18 years should be investigated in future studies. Separately, it might be worthwhile to develop a parent version of THAI-SAS-SV for combination with THAI-SAS-SV for children and adolescents in future research.

Conclusion

In summary, this study translated and cross-culturally adapted the-SAS-SV into Thai. This study also provides robust evidence that THAI-SAS-SV for school students between 10 to 18 years is a valid and reliable, self-administered tool that can be used for screening smartphone addiction in Thai youth. Our results suggest that the Thai version of SAS-SV may assist in early detection of problematic use of smartphones in Thai children and adolescents.

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Conflict of interest

The authors declare no conflicts of interest.

References

[1] World Health Organization [Internet]. Public health implications of excessive use of the internet, computers, smartphones, and similar electronic devices: meeting report. 2015 [cited 2019 Sep 4]. Available from: http://www.who.int /iris/handle/10665/184264.

[2] De-Sola Gutiérrez J, Rodríguez de Fonseca F, Rubio G. Cell-phone addiction: a review. Front Psychiatry 2016; 7: 175. doi: 10.3389/fpsyt.2016.00175.

[3] We Are Social [Internet]. Digital 2019: global internet use accelerates. 2019 [cited 2019 Sep 6]. Available from: https://wearesocial.com/blog/2019/01/digital-2019-global-internet-use-accelerates.

[4] Newzoo [Internet]. Top 50 countries/markets by smartphone users and penetration. 2019 [cited 2019 Sep 11] Available from: https://newzoo.com/insights/rankings/top-50-countries-by-smartphone-penetration-and-users/.

[5] DQ Institute [Internet]. 60% at Cyber-Risk. Thailand 4,652 4,960. Average DQ Screen Time Management Score Schools & Organizations Reached in 2017. 2018 [cited 2019 Sep 10]. Available from: https://docplayer.net/amp/90511553-60-at-cyber-risk-thailand-4-652-4-960-average-dq-screen-time-management-score-schools-organizations-reached-in-2017.html.

[6] Pew Research Center [Internet]. Teens, social media & technology 2018. 2018 [cited 2019 Sep 2]. Available from: https://www.pewinternet.org/2018/05/31/teens-social-media-technology-2018/.

[7] National Statistical Office of Thailand [Internet]. The ITU indicators from 2017 household survey on the use of information and communication technology [cited 2019 Sep 12]. Available from: http://www.nso.go.th/sites/2014en/itu

[8] Charoenwanit S, Soonthornchaiya R. Development of Smartphone Addiction Scale: Thai Short Version (SAS-SV-TH). J Ment Health Thai 2019; 27(1): 25-36.

[9] Kwon M, Kim D-J, Cho H, Yang S. The smartphone addiction scale: development and validation of a short version for adolescents. PLoS ONE 2013; 8(12): e83558. doi:10.1371/journal.pone.0083558.

[10] Haug S, Castro RP, Kwon M, Filler A, Kowatsch T, Schaub MP. Smartphone use and smartphone addiction among young people in Switzerland. J Behav Addict 2015; 4(4): 299-307. doi:10.1556/2006.4.2015.037.

[11] Lopez-Fernandez O. Short version of the smartphone addiction scale adapted to Spanish and French: towards a cross-cultural research in problematic mobile phone use. Addict Behav 2017; 64: 275-80.

[12] Samaha M, Hawi NS. Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. Comput Human Behav 2016; 57: 321-25. doi.org/10.1016/j.chb.2015.12.045.

[13] Akın A, Altundağ Y, Mehmet ET, Turan ME, Akin U. The validity and reliability of the Turkish version of the smart phone addiction scale-short form for adolescent. Procedia Soc Behav Sci 2014; 152: 74-7. doi:10.1016/j.sbspro.2014.09.157.

[14] De Pasquale C, Sciacca F, Hichy Z. Italian validation of smartphone addiction scale short version for adolescents and young adults (SAS-SV). Psychology 2017;8:1513-18. doi:10.4236/psych.2017.810100

[15] Luk TT, Wang MP, Shen C, Wan A, Chau PH, Oliffe J, et al. Short version of the Smartphone Addiction Scale in Chinese adults: psychometric properties, sociodemographic, and health behavioral correlates. J Behav Addict 2018; 7(4): 1157–65. doi:10.1556/2006.7.2018.105.

[16] Phanasathit M, Manwong M, Hanprathet N, Khumsri J, Yingyeun R. Validation of the Thai version of Bergen Facebook Addiction Scale (Thai-BFAS). J Med Assoc Thai 2015; 98(2): S108-17.

[17] Pornnoppadol C, na Ayudhaya SL, Phoasavasdi C, Surapongphiwattana T. Development of Game Addiction Protection Scale (GAME-P). J Psychiatr Assoc Thailand 2017; 62(1): 3-16.

[18] Kwon M, Lee JY, Won WY, Park JW, Min JA, Hahn C, et al. Development and validation of a smartphone addiction scale (SAS). PLoS ONE 2013; 8(2): e56936. doi:10.1371/journal.pone.0056936.

[19] Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine 2000; 25(24): 3186-91. doi:10.1097/00007632-200012150-00014.

[20] Nunnally JC. Psychometric Theory. 2nd ed. New York: McGraw-Hill; 1978.

[21] Terwee CB, Bot SD, de Boer MR, van der Windt DA, Knol DL, Dekker J, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol 2007; 60(1): 34-42. doi:10.1016/j.jclinepi.2006.03.012.

[22] Bolarinwa OA. Principles and methods of validity and reliability testing of questionnaires used in social and health science researches. Niger Postgrad Med J 2015; 22(4): 195-201.

[23] Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? critique and recommendations. Res Nurs Health 2006; 29(5): 489-97. doi:10.1002/nur.20147.

[24] Kline RB. Principles and practice of structural equation modeling. New York: Guilford Press; 1998.

[25] Nunnally JC, Bernstein IH. Psychometric theory. 3rd ed. New York: McGraw-Hill; 1994.

[26] De Vellis RF. Scale development: theory and applications. 3rd ed. California: SAGE Publications; 2012.

[27] Rosenberg KP, Feder LC. Behavioral addictions: criteria, evidence, and treatment. Amsterdam: Elsevier/Academic Press; 2014.

[28] Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J Chiropr Med 2016; 15: 155-63.

[29] American Psychological Association [Internet]. Developing adolescents: a reference for professionals. 2002 [cited 2019 Sep 11]. Available from Retrieved from https://www.apa.org/pi/families/resources/develop.pdf.