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Validity and Reliability of the Scale Problematic Smartphone Use (PSU)

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Abstract

This study aims to examine the validity and reliability of the Smartphone Addiction Scale – Short Version (SAS-SV) among teachers in Vocational High Schools in Bekasi Regency. The research uses a cross-sectional design with a sample of 132 teachers, selected through multistage random sampling. Content validity was tested via expert judgment, construct validity was assessed through Confirmatory Factor Analysis (CFA), and reliability was tested using Cronbach's Alpha. The findings indicate that SAS-SV has excellent validity and reliability, with a Cronbach's Alpha value of 0.923. This instrument proved consistent in measuring the construct of Problematic Smartphone Use (PSU) among Vocational High Schools teachers, making it relevant for future studies. This finding contributes significantly to the development of PSU instruments for educators and provides a foundation for policies related to smartphone usage in schools, as well as digital literacy programs and psychological support for teachers. Future studies are recommended using a longitudinal design to expand generalizability and understanding of PSU stability.

Keywords: *Problematic Smartphone Use (PSU), Smartphone Addiction Scale-Short Version (SAS-SV), Vocational High Schools teachers*

INTRODUCTION

The development of mobile communication technology, particularly smartphones, and the massive internet penetration in the last two decades have led to major changes across various aspects of life. Social interaction patterns, work systems, and learning processes are now heavily influenced by easy access through mobile devices. In Indonesia, internet penetration and smartphone use have increased sharply, making these devices the primary means for the public to access information and connect socially. National survey data show a significant increase in the number of internet users in recent years, which has consequently increased both the duration and frequency of daily smartphone use. This situation has the potential to cause Problematic Smartphone

Use (PSU), which refers to excessive and maladaptive smartphone use patterns (APJII), 2023).

Conceptually, PSU is not only measured by the duration of use but also by behaviors that resemble addiction. Symptoms such as preoccupation, tolerance, withdrawal, and loss of control frequently emerge, and these conditions are often associated with sleep disturbances, anxiety, depression, decreased productivity, and social relationship problems (Busch et al., 2021; Elhai et al., 2019). Therefore, PSU is a critical research topic across various population groups, including adolescents, students, workers, and professionals such as teachers (Busch et al., 2021).

The most commonly used instrument to measure PSU is the Smartphone Addiction Scale – Short Version (SAS-SV), developed by (Kwon, Lee, et al., 2013). This scale consists of 10 items and serves as a quick screening tool to detect symptoms of problematic smartphone use. The SAS-SV has been widely adapted into various languages and cultural contexts because it is considered simple and has good initial reliability. However, whenever used with a new population group, this scale still requires re-validation to ensure content validity, construct validity, and internal reliability. Without this process, interpreting the results risks bias due to differences in item meaning or response patterns across groups (Kwon, Kim, et al., 2013).

In Indonesia, several studies have adapted the SAS-SV and similar instruments, particularly among students. The results generally show good reliability, but there are variations in factor structures and cut-off scores across studies. This highlights the need for contextual validation to match the characteristics of the target population, such as VOCATIONAL HIGH SCHOOLS teachers (Arthy et al., 2019).

Teachers, as professionals, have a unique workload that includes instructional and administrative responsibilities, communication with parents and colleagues, and the demands of digital learning. Constant access to smartphones can trigger compulsive usage patterns, both to support work tasks and as a means of stress relief. Therefore, it is crucial to map the PSU levels among teachers and ensure that the instrument used is both valid and reliable. This is relevant for both academic and practical purposes, including the design of school interventions or policies (Nurmala et al., 2022).

In addition to practical reasons, there are also strong methodological considerations. Instrument validation should minimally include content validity testing through expert judgment and readability tests, construct validity testing via factor analysis (CFA), and internal reliability calculation using Cronbach's Alpha. Language adaptation and job context can change item meaning, necessitating psychometric analysis to adjust or filter out irrelevant items.

Globally, PSU research has been rapidly growing since the early 2010s. Early studies focused on instrument development and prevalence measurement among adolescents and students (Kwon, Kim, et al., 2013). Over time, research expanded to examine the relationship between PSU and mental health (anxiety, depression), sleep quality, cognitive function, and work productivity (Ratan et al., 2021; Yang et al., 2020). Recent systematic reviews and meta-analyses emphasize that PSU is linked to various

psychological and social disorders, although there is heterogeneity in measurement methods and definitions across studies (Akbari et al., 2021; Zhang et al., 2023).

In Indonesia, PSU research has grown in recent years, particularly through adaptations of the SAS-SV and related instruments like the SABAS. Local studies report good reliability, but varying factor structures highlight the importance of further validation specific to the population being studied (Arthy et al., 2019; Nurmala et al., 2022). Given the high duration of smartphone use in Indonesia, the urgency of PSU research, particularly among professional groups such as teachers, is becoming increasingly apparent.

Vocational High Schools teachers have a different work context compared to students or adolescents. The items of the SAS-SV, originally designed with examples of academic or social activities, may be understood differently by teachers. Additionally, the need for professional communication, such as through school WhatsApp groups or administrative coordination, can influence how they respond to the scale's items. The impact of PSU on teachers is also more far-reaching, potentially reducing teaching quality, relationships with students, and psychological well-being.

Therefore, validation of the SAS-SV for the Vocational High Schools teacher population is carried out through three main stages: content validity, construct validity, and internal reliability. Content validity is obtained through expert judgment and readability testing to ensure item relevance to teachers' work contexts. Next, construct validity is tested using factor analysis, both exploratory (EFA) and confirmatory (CFA), to ensure that the SAS-SV's dimensional structure remains consistent when applied to Vocational High Schools teachers. The final stage is testing internal reliability using Cronbach's Alpha to measure the consistency of responses across items within the instrument. By undergoing these three processes, SAS-SV is expected to accurately represent the PSU construct according to the realities of teachers' work.

The benefits of this study are not only methodological but also practical. Methodologically, the validation and reliability of the SAS-SV for Vocational High Schools teachers contribute a valid and consistent instrument for use in further research. Practically, the tested instrument can help schools and policymakers identify teachers who may be experiencing PSU. The results can then serve as a basis for designing appropriate interventions, such as digital literacy programs, smartphone usage policies in schools, and psychological support services for teachers.

METHODS

This study employs a quantitative approach with a cross-sectional survey design (Nurgiyantoro & Gunawan, 2017), aimed at testing the validity and reliability of the Smartphone Addiction Scale – Short Version (SAS-SV) among teachers in Vocational

High Schools. The population of the study consists of all Vocational High Schools teachers in Bekasi Regency, with a sample selected using multistage random sampling to ensure representation from various Vocational High Schools institutions. A total of 132 teachers were successfully surveyed, which is considered adequate for the purposes of construct validity analysis through factor analysis and internal reliability testing.

The main instrument used in this study is the SAS-SV, developed by (Kwon, Lee, et al., 2013). This instrument consists of 10 items with a six-point Likert scale, ranging from 1 (strongly disagree) to 6 (strongly agree). The SAS-SV is designed to measure five aspects of problematic smartphone use: daily life disruption, withdrawal, virtual relationships, excessive use, and tolerance. Before distributing the instrument to respondents, it underwent a language adaptation process and readability testing to ensure it was contextually appropriate and easy for Vocational High Schools teachers in Indonesia to understand.

The research procedure began with the preparation phase, which included language adaptation, expert consultations, and the development of the questionnaire. Next, content validity was tested through expert judgment, involving one psychology lecturer and one teacher to assess the relevance of each item with the PSU construct using Gregory's formula (Gregory, 2004). Readability testing was then conducted with a small group of teachers to ensure each item was easy to comprehend. The next phase involved collecting field data by distributing the SAS-SV questionnaire to the selected respondents.

The collected data were analyzed using several statistical techniques. Content validity was measured using Gregory's index to assess the agreement level among experts. Construct validity was evaluated through Confirmatory Factor Analysis (CFA), with the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity used to assess data adequacy, as well as factor loading tests to determine the contribution of each item to the PSU construct. Meanwhile, the reliability of the instrument was analyzed using Cronbach's Alpha to assess the internal consistency of the items. A Cronbach's Alpha value ≥ 0.70 is considered to indicate good reliability, meaning the instrument can be consistently used in subsequent studies.

RESULTS AND DISCUSSION

This study first conducted a discrimination analysis to test whether any items were invalid for the 68 Vocational High Schools teachers. The results of the analysis are presented in Table 1.

Table 1.
Discrimination Results of Problematic Smartphone Use (PSU) Items

		item1	item2	item3	item4	item5	item6	item7	item8	item9	item10
Correlation	item1	1	0.45	0.15	0.41	0.45	1	0.45	0.15	0.41	0.4
	item2	0.45	1	0.39	0.72	1	0.45	1	0.39	0.72	1
	item3	0.15	0.39	1	0.42	0.39	0.15	0.39	1	0.42	0.4
	item4	0.41	0.72	0.42	1	0.72	0.41	0.72	0.42	1	0.7
	item5	0.45	1	0.39	0.72	1	0.45	1	0.39	0.72	1
	item6	1	0.45	0.15	0.41	0.45	1	0.45	0.15	0.41	0.4
	item7	0.45	1	0.39	0.72	1	0.45	1	0.39	0.72	1
	item8	0.15	0.39	1	0.42	0.39	0.15	0.39	1	0.42	0.4
	item9	0.41	0.72	0.42	1	0.72	0.41	0.72	0.42	1	0.7
	item10	0.45	1	0.39	0.72	1	0.45	1	0.39	0.72	1
a. Determinant = .000											
b. This matrix is not positive definite.											

The Problematic Smartphone Use scale contains 10 items. The analysis results show that all 10 items have correlation coefficients above 0.30 (Azwar, 2022). The total item correlation coefficients ranged from 0.4 to 1.000, demonstrating significant discriminatory power.

Next, the researcher conducted Confirmatory Factor Analysis (CFA) on the Problematic Smartphone Use (PSU) variable. The analysis results in Table 2 indicate the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (MSA) score: The obtained KMO value is 0.700, indicating that the data are suitable for factor analysis. Generally, KMO values above 0.5 are considered adequate, and a value of 0.7 suggests that the sample is well-suited for factor analysis. The Bartlett's Test of Sphericity yielded a Chi-Square of 232.718 with 45 degrees of freedom (df) and a p-value of 0.000. This very small p-value ($p < 0.05$) indicates that the correlation matrix is not an identity matrix, confirming that the data are diverse and suitable for further factor analysis. In other words, the Bartlett test proves that the data is appropriate for factor analysis.

Table 2.
Hasil skor Keiser-Meyers-Oklin (KMO)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.700
Bartlett's Test of Sphericity	Approx. Chi-Square	232.718
	df	45
	Sig.	.000

Table 3 presents the results of the factor analysis using Principal Component Analysis (PCA) with Varimax rotation to determine the underlying dimensional structure of the PSU construct. Each item (item 1 through item 10) is measured and assigned to the relevant component based on its correlation. Component 1: Items 1 (0.874) and 2 (0.880) have very high factor loadings on the first component, indicating a strong relationship with the first PSU dimension, likely measuring the same aspect of PSU. Component 2: Items 4 (0.804), 5 (0.786), and 6 (0.609) have relatively high loadings on the second component, indicating these items are related to the second PSU dimension, though with slight variation in item correlation strength.

Component 3: Items 3 (0.815), 8 (0.601), and 9 (0.798) show high loadings on the third component, suggesting these items measure a distinct PSU dimension. Component 4: Items 7 (0.591) and 10 (0.562) have lower loadings on the fourth component but still contribute to identifying a separate PSU dimension.

After performing Varimax rotation, the factor loading was maximized, with all loadings above 0.5, indicating that the factor structure is valid and the PSU construct is clearly represented.

Table 3.

Rotated Component Matrix[a] Variabel Problematic Smartphone Use (PSU)

Rotated Component Matrix[a]				
	Component			
	1	2	3	4
item1		.874		
item2		.880		
item3				.815
item4			.804	

item5		.786
item6	.609	
item7	.591	
item8	.601	
item9	.798	
item10	.562	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.		
a. Rotation converged in 4 iterations.		

Figure 1 illustrates the Rotated Component Matrix from the factor analysis conducted using Varimax rotation and Kaiser normalization. The diagram shows the relationships between the 10 items tested and the four identified factor components. On the X-axis, the 10 items are displayed, while the Y-axis represents the loading values that indicate the strength of each item's relationship with the identified components.

Each component is marked in a different color: Component 1 is orange, Component 2 is blue, Component 3 is green, and Component 4 is yellow. The figure indicates that several items, such as item 2, item 3, item 5, and item 9, have higher loading values on certain components, suggesting a stronger correlation with those components. Conversely, other items exhibit lower loadings, meaning they are less strongly correlated with their respective components.

Overall, this figure provides insight into how each item relates to the identified components through factor analysis, offering a clearer understanding of the dimensional structure underlying the data.

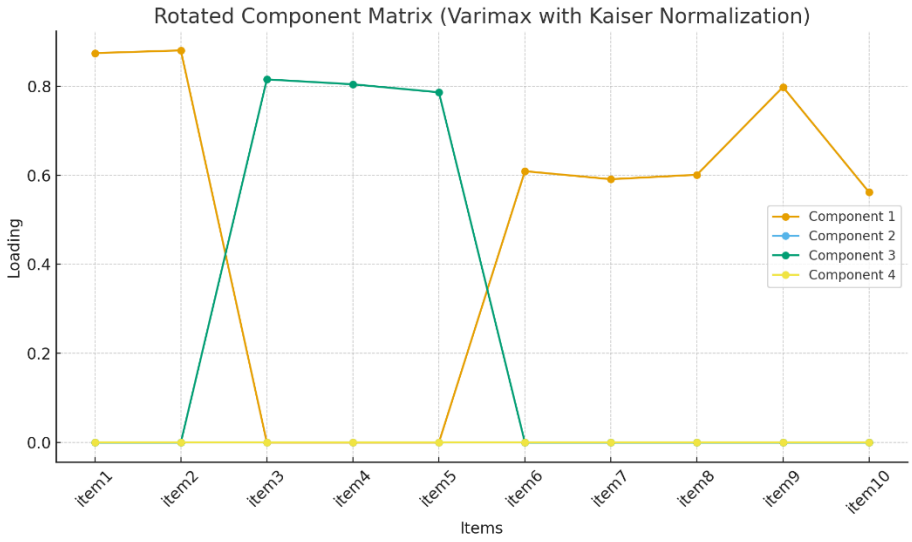

Figure 1: Rotated Component Matrix

Figure 2 depicts the results of the Confirmatory Factor Analysis (CFA) or structural model used to test the relationship between latent variables and the measured indicators. In this diagram, the main latent variable is "PSU" (Problematic Smartphone Use), represented by the yellow circle. This variable is influenced by the ten indicators or items, each listed as "Item 1" through "Item 10" in blue boxes on the right side of the diagram. The CFA analysis shows that all items have factor loadings above 0.5, making them suitable indicators of the PSU construct. The item with the highest loading is Item 2 (0.880), while the lowest is Item 10 (0.562). Overall, the model is acceptable, although some items with low loadings need further evaluation. The relationship between the latent PSU construct and its indicators is visualized through a path diagram showing the loading values and error terms for each item.

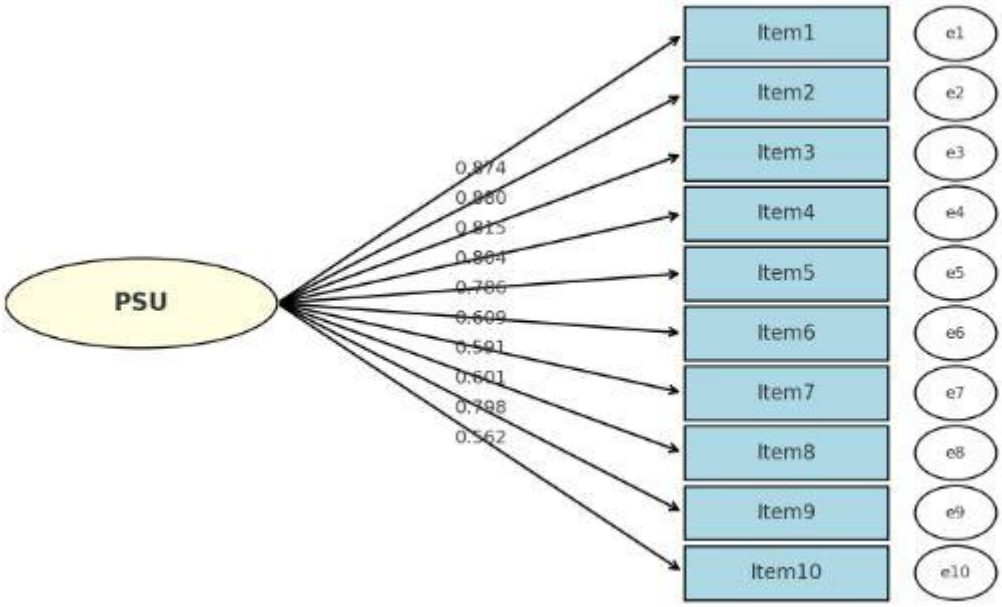

Figure 2 *path diagram*

The content validity test was conducted through expert judgment involving two experts: a psychology lecturer and a vocational high school teacher. The experts were asked to assess the relevance of each item on the SAS-SV with the Problematic Smartphone Use (PSU) construct. The results showed that all 10 items of the instrument obtained a validity index (Vi) of 1.00, using Gregory's formula. This value is categorized as very high, indicating that all items were deemed relevant and appropriate for use in the Vocational High Schools teacher population. These findings align with (Gregory, 2004) criteria, which state that a Vi ≥ 0.80 indicates high validity. Therefore, conceptually, the items on the SAS-SV are considered valid for measuring PSU in the educational context of Indonesia.

Construct validity was tested using Confirmatory Factor Analysis (CFA). The Kaiser-Meyer-Olkin (KMO) test yielded a value of 0.700, which is higher than the minimum threshold of 0.50, indicating that the data are suitable for factor analysis. Additionally, Bartlett's Test of Sphericity resulted in a significance value of 0.000 (<0.05), indicating that the correlation matrix between items is not an identity matrix and can therefore be further analyzed.

Factor analysis with varimax rotation showed that all items had factor loadings above 0.50, meaning that each item effectively represents the PSU construct. The five-factor structure of PSU daily life disturbance, withdrawal, virtual relationships, excessive use, and tolerance was confirmed through the CFA results. Thus, the SAS-SV demonstrates adequate construct validity when applied to Vocational High Schools teachers.

Reliability testing was performed using Cronbach's Alpha coefficient to assess internal consistency among the items. The analysis showed that the Cronbach's Alpha value for SAS-SV was 0.923. This value is well above the recommended minimum threshold of 0.60 (Azwar, 2022; Nurgiyantoro & Gunawan, 2017), indicating very high internal consistency. With such strong reliability, the SAS-SV can be consistently used to measure PSU in Vocational High Schools teachers.

The content validity obtained through expert judgment with a Vi value of 1.00 confirms that the items on the SAS-SV are relevant for measuring PSU in Vocational High Schools teachers. This finding is consistent with previous studies in Indonesia, which also reported high content validity when SAS-SV was adapted into the local language (Arthy et al., 2019). These results suggest that, although the instrument was originally developed for adolescents and university students in South Korea (Kwon, Lee, et al., 2013), its items are still understandable and relevant in the context of teachers in Indonesia.

The CFA results show that the factor structure of SAS-SV remains stable when applied to Vocational High Schools teachers. This is in line with Lopez-Fernandez (2017), who found that the factor structure was consistent when the SAS-SV was adapted into Spanish and French. Similar findings were reported by (Rozgonjuk et al., 2020), who discovered that PSU in workers in Europe could still be explained by the SAS-SV's dimensional structure. Thus, this instrument shows cross-cultural and professional flexibility, including for Vocational High Schools teachers in Indonesia.

The data suitability for CFA, indicated by a KMO = 0.700 and Bartlett's Test significance = 0.000, strengthens the evidence that the correlations between items are strong enough to form the PSU construct. All items with factor loadings > 0.50 also support the assumption that the instrument has good construct validity. This is crucial as it ensures that the SAS-SV is not only relevant in content but also has a factor structure consistent with the theoretical model.

The very high reliability ($\alpha = 0.923$) shows that the SAS-SV items have good internal consistency. This result aligns with (Kwon, Kim, et al., 2013), who found a Cronbach's Alpha for SAS-SV > 0.90 in adolescents in South Korea. This finding reinforces that the

SAS-SV can be consistently used to measure PSU, not only among adolescents or university students but also among Vocational High Schools teachers.

CONCLUSION

This study confirms that the Smartphone Addiction Scale – Short Version (SAS-SV) is both valid and reliable for measuring problematic smartphone use (PSU) among Vocational High Schools teachers in Bekasi Regency. The content validity ensures that the items are relevant to the teachers' work context, while the construct validity, assessed through Confirmatory Factor Analysis (CFA), supports the consistency of the dimensional structure. A high Cronbach's Alpha value of 0.923 further affirms the internal consistency of the SAS-SV, indicating its reliability. These results suggest that the SAS-SV is an effective tool for measuring PSU among Vocational High Schools teachers and can assist in designing targeted digital literacy and psychological support programs for teachers.

Despite the positive findings, the study has some limitations. First, the research was confined to Bekasi Regency, meaning the results may not be applicable to teachers in other regions. Second, as the study used a cross-sectional design, it cannot provide insights into the long-term stability of the SAS-SV. Future research should employ a longitudinal design with a larger sample to improve the generalizability and understanding of PSU. Implementing the SAS-SV across Vocational High Schools schools could help identify PSU among teachers and inform policies related to smartphone use and digital literacy. Moreover, further research should explore PSU risks in other professional groups, such as healthcare workers and office employees.

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