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PAPER

Assessing Smartphone Addiction among Mexican Students: Insights, Implications, and Interventions in the Era of Mobile Learning and Virtual Environments

Ismael Esquivel-Gámez[1](✉), Martín Guerrero-Posadas[2], Julio Cesar Berthely-Barrios[1], Jorge Luis Vázquez-Ariza[3]

[1]Universidad Veracruzana, Veracruz, México

[2]Tecnológico Nacional de México, Campus San Luis Potosí, San Luis Potosí, México

[3]Colegio de Estudios Científicos y Tecnológicos del Estado de Veracruz, Veracruz, México

iesquivel@uv.mx

ABSTRACT

This study conducted a new adaptation of the short version of the Smartphone Addiction Scale (SAS-SV) for the Mexican population. The scale exhibited excellent internal consistency ($\alpha = .88$), with one factor explaining 54.8% of the variance. 286 students aged 15 to 35 years of age from central and southeast Mexico revealed a prevalence of 30% excessive users (18% men, 12% women). They used smartphones primarily for communication, social media, entertainment, productivity, and browsing the Internet. No gender differences were found; however, a significant association with age emerged ($rho = .221$, $p < .001$). Withdrawal (72.7% women) and tolerance (80.8% men) were common symptoms of addiction, while ignorance of consequences was less frequent (33.3% women, 30.8% men). The prevalence of potential excessive use of smartphones was close to the average identified in the reviewed studies. The results revealed a substantial risk of addiction to smartphones, particularly among men. Finally, the successful adaptation of the scale offers a valuable instrument for future study and clinical evaluation. These findings can guide targeted interventions and educational programs tailored to different groups. Additionally, recognition of common symptoms of addiction allows individuals to identify and address potential problems at an early stage. However, more study is needed to validate the findings and explore additional contributing factors in the Mexican context.

KEYWORDS

excessive smartphone use, public health initiatives, educational intervention, social impact, Mexico

1 INTRODUCTION

With the evolution of smartphones, their capabilities have expanded, making the Internet more appealing and user-friendly [1]. These devices serve a wide range of

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purposes, including checking email and weather forecasts, managing bank accounts, conducting online transactions, exploring interpersonal relationships, participating in online shopping, and live streaming real-time experiences [2]. They have become essential in daily life due to their versatility for tasks such as productivity, gaming, and social interaction [3].

However, their widespread presence in our lives is a concerning issue due to their potential overuse [5], which can result in addiction, therefore impacting individuals and various aspects of their lives [1]. There is growing concern about the possible long-term repercussions of prolonged smartphone use on cognitive ability, memory, attention, and emotional regulation [6]. The increasing body of evidence pointing to these potential detriments has ignited extensive study and debate. Based on this understanding, the literature indicates that the presence of a smartphone can reduce attention span, causing disruptions in daily routines [3]. Furthermore, [4] underscores the importance of incorporating mobile technology, particularly touchscreens, into education to increase interactive learning and stresses the development of educational apps to improve learning outcomes and digital skills for both students and teachers. In addition, the author emphasizes the importance of developing educational applications for children and the need for synthesis and evaluation studies.

As a result, smartphone addiction is viewed as a new form of Internet addiction since many young individuals use smartphones throughout the day to access various types of online content [7]. The prevalence of smartphone addiction among students is a critical issue in schools, and many students prioritize their phones over class, leading to adverse academic consequences [8].

It seems that in Mexico, smartphones have become an important part of the lives of young individuals and adolescents, regardless of age, income, gender, and place of residence. Both demographic groups collectively perceive that the ownership of these devices is beneficial [9]. Furthermore, the Mexican Internet Association [10] conducted a study that revealed that users spend an average of 8.20 hours a day surfing the net [11]. Consequently, there is a concern related to the social and health implications of dependence on the smartphones in our country. This dependence can have detrimental effects on various aspects of human life, including sleep quality, mood, interpersonal communication, self-esteem, behavior, anxiety, and physical health. These adverse effects can ultimately affect academic performance [9–17]. In response to this concern, the authors [18] have proposed classifying the dependence on smartphones into three levels: 1. Unproblematic use: It does not have adverse consequences for users and those around them since there are no negative effects from its usage. 2. Problematic use or abuse: It begins to generate complications in the context of the individual, with the behavior often considered normal by the users. 3. Pathological or dependent use: In this case, people already suffer serious impairments in all activities across various contexts. Therefore, it is demanding that educational and health authorities establish intervention programs focused on treating these risks in Mexico, from different perspectives: To prevent the appearance of problems, to identify them in their earliest phase, and to treat already–consolidated problems [12].

This concern has led us, as in other countries and languages, to adapt and validate evaluation scales, such as the Smartphone Addiction Scale in its short version (SAS-SV) [20]. Notably, this scale has gained worldwide popularity, and interest in its use has increased. Since such a scale does not currently exist, it is necessary to have a short and reliable Mexican version that allows us to identify disorders and contribute to early interventions, since we are undoubtedly facing a generation that has a lot of access to smartphones and is therefore exposed to the risk of this addiction.

Consequently, this article has three objectives: (i) to examine the psychometric characteristics of the adapted SAS-SV scale for the Mexican population; (ii) to evaluate the incidence of excessive use of smartphones; and (iii) to compare the addictive symptoms measured by SAS-SV in potential excessive users in both genres.

2 LITERATURE REVIEW

Culture can be seen as one of the nonmaterial needs that people have and that allows them to enjoy leisure time, forms of expression, subjectivities, and a sense of belonging or sociability within a community. Currently, there is a greater distribution of cultural offerings than before, using smartphones [21]. The relevance of knowing how cultural consumption is being transformed and the preferences of young people will allow us to know the effect on their professional and social development, but above all, the degree of affectation due to the increase in leisure time [21]. Ideally, as stated [22], students who use smartphones should focus on the search, selection, grouping, and dissemination of information on policies that affect the general public. Although they discussed digital activism during the COVID-19 epidemic, the future willingness to use smartphones to distribute distinct government-provided information can influence public opinion. Although there have been efforts to investigate the impacts of smartphone-supported learning, applying different approaches and considering the cognitive loads of students [9], and the increase in physical activity using smartphone applications [23], addictive behaviors are shown when the use of technology goes from being a means to becoming an end in itself [12]. In the Mexican context, among recent initiatives sparked by serious concerns was the possibility that a growing number of individuals, given the excessive use of smartphones, could be linked to risky activities and behaviors for the development of pro-criminal behavior [13]. It was also important to know whether impulsivity is an important factor in the development of problematic use, which would help to better understand the phenomenon [14]. In fact, it was relevant to determine whether the unhealthy fear of being left without a smartphone is considered a serious alteration, which, if identified and treated in a timely manner, offers the possibility of preventing addictions [15]. Although it is not a drug use problem, the problem is irrepressible, uncontrollable, and exaggerated behavior that makes young individuals and adolescents stop doing other productive or recreational activities [16].

These kinds of implications have been reported in works aimed at the translation and adaptation of the SAS-SV to different languages. For now, we will begin by describing the original SAS-SV scale, which was created by [20] to examine problematic smartphone use, drawing on contemporary insights into addictions. This questionnaire was derived from the initial version of the SAS [19], which consisted of 33 questions and was developed based on previous assessments of Internet addiction. Six experts in smartphone addiction, including two psychiatrists and four psychologists, contributed to the design of the items. In addition to statistical validation, medical professionals conducted random interviews with participants to confirm their categorization. SAS-SV reduced the length of the questionnaire from 33 to 10 questions, following a study involving adolescents [19]. They reported high internal consistency with a Cronbach alpha coefficient of 0.91. The 10 questions were graded on a Likert-type scale, and the responses varied from one “strongly disagree” to six “strongly agree”. The total scores range from 10 to 60. The different cut-off values for men and women were statistically determined and established as predictors of

smartphone addiction. These cut-off values were set at 33 for women and 31 for men and used by researchers to identify dependence. SAS-SV has been used in studies that examine the use of smartphones among adolescents and adults. It has been adapted and validated in different languages. Italian [24], Arabic [7], Brazilian Portuguese [25], Persian [26], Chinese [27], Japanese [28], and Hindi [29].

In addition, in both French and Spanish, SAS-SV was adapted and evaluated for psychometric characteristics [30]. One of the objectives of the project was to determine the proportion of excessive smartphone users among Spanish and Belgian people and to compare addiction symptoms between the two countries. In Spain, 117 participants aged 18 to 68 years with a mean of 25.6 completed the SAS-SV scale. The adaptation process involved rigorous translation and back-translation, with the input of experts in addiction studies and linguistics. The sample sizes were considered adequate for psychometric analysis, and validity was evaluated using exploratory factor analysis (EFA). SAS-SV exhibited excellent reliability and internal consistency in both countries, consistent with previous studies. In terms of sociodemographic, the descriptive results show that age is negatively related to the score and that there were no differences between genders in the total score. The study found a prevalence of potential excessive use of smartphones, with varying symptoms between Spain and Belgium. Excessive Spanish users are characterized by these common symptoms: tolerance, loss of control, and withdrawal. In a different order, the Belgian participants presented the same. The symptom that was least supported was 'indifference to psychological or physical consequences', although the proportion differed from country to country.

In the Mexican population, the following studies have used the Spanish adaptation of SAS-SV [30]:

In their study, the authors evaluated the one-dimensionality and statistical significance of the Spanish SAS-SV scale among Mexican university students [31]. The study was conducted with students with a bachelor's degree in administration from San Luis Potosí, Mexico. A total of 244 students participated, with a gender distribution of 28.7% male and 71.3% female, aged 17 to 30 years. Using SPSS Amos software, the confirmatory factor analysis revealed that three variables (wrist or neck pain, impatience without a smartphone, and external feedback about smartphone use) did not hold significant weight in the model. Despite this, the model effectively described the sample data with minimal standard error estimates. In addition, it was validated with a Cronbach alpha coefficient of 0.89. The unidimensional nature of the construct was confirmed through Bayesian and maximum likelihood analyses. However, three variables in the examined sample did not reach statistical significance.

As stated in [32], the authors investigated the usage patterns among high school students in a city in eastern Mexico, focusing on identifying possible smartphone addiction and gender-related differences. The investigation involved a non-probabilistic sample comprising 184 students aged 14 to 18 years with a gender distribution of 51.8% men and 48.2% women who met enrollment and school obligation criteria and voluntarily participated. The study used polychoric and tetrachoric matrices for factor analysis, and an ANOVA was used to assess gender-related variations between variables. EFA analysis revealed that three distinct components, physiological, dependency, and distraction, explained 68% of the variance, with orthogonal rotation using Varimax. The factor analysis confirmed the presence of three components related to smartphone use and found no significant gender-based differences.

In the work of [33], the authors assessed smartphone addiction among engineering university students and investigated whether gender influences this behavior.

The sample consisted of 306 undergraduates enrolled in a public university located in Veracruz, Mexico. The participants were 17 to 30 years old, 50.6% men, and 49.4% women. Notably, participation was voluntary and anonymous. Internal consistency analysis yielded a Cronbach alpha of 0.860. The study used EFA to examine the data matrix, which deviated from an identity matrix. This deviation justified the use of factor analysis to discern key factors that explain the phenomenon. The analysis included the calculation of the polychoric correlation matrix due to the Likert-type design of the instrument. Two components (dependency and frustration) emerged from the factor analysis, indicating potential contextual influences on the study. Regarding smartphone addiction, no significant gender differences were identified.

[34] conducted a study to assess the psychometric characteristics of the referred scale among Mexican adolescents living in Veracruz-Boca del Río, Mexico. The study involved 158 high school students aged 14 to 18, with 50.63% male and 49.37% female participants. Confirmatory factor analysis using R software was used to evaluate the single-factor model of the scale. Additionally, a network analysis was conducted to explore the relationships among the items. Initially, two items were excluded, and one item related to the use of Facebook and Twitter was removed due to limited generalizability. The derived Cronbach's alpha value for the remaining items was 0.81. The resulting seven-item SAS-SV, rated on a six-point scale, demonstrated high internal consistency and good fit in confirmatory factor analysis statistics. The limitations of the study included unforeseeable demographic characteristics and a limited sample size of 158 participants.

With the application of the survey, [12] carried out a study to determine the prevalence of addiction among adolescents and whether there were gender-related differences. A total of 164 high school students from a public academic institution in city of Veracruz, Mexico, completed the scale. Women represented 48.2% of the participants, and the age range was 14 to 18 years, with an average of 15 years. SPSS version 25 software was used for data analysis, finding a Cronbach Alpha coefficient of 0.824. In terms of the EFA analysis, three factors were identified, and item 10 did not show a significant association with any factor.

As can be seen, SAS-SV has been applied in studies with different sample sizes, encompassing various age ranges, and conducted in different geographic regions of Mexico, like the samples used in the current study. However, while most reached excellent levels of internal consistency, the validations of the constructs did not yield a factor considering all 10 items, as in [30]. Consequently, we have decided to make modifications to the Spanish adaptation and examine the psychometric properties of the resulting survey.

3 MATERIALS AND METHODS

The scope of the study is descriptive, exploratory, correlational, explanatory, and comparative. The study surveyed 286 students distributed across two convenience samples, one from the central area (N = 57) and the other from the southeast area (N = 229) of Mexico. Permission to participate in the study was obtained from the participants, ensuring that responses remained confidential and anonymous. The participants ranged in age from 15 to 35 years, with a mean age of 19.26 and a SD of 3.08; there were 121 women (42.3%).

The instrument used was adjusted to the Mexican population based on the adaptation of [30]. Modifications were made to align the items with the cultural context

of the target population. The major adjustment involved replacing the term "smartphone" with "cell phone," and a minor adjustment was made to streamline the text without compromising its original meaning or clarity. The instrument also collected sociodemographic data such as age, sex, and cell phone use. For its application, the scale was designed electronically (Google Forms) and distributed to all participants through researchers to answer for 20 days on their cell phones, laptops, or other devices. As stated in Ref. [30], "loss of control, disruption of family or schooling, disregard for consequences, withdrawal, preoccupation, and tolerance" are the addiction symptoms covered by the scale. The author relied on symptoms of pathological gambling conditions and dependence on drugs as outlined in DSM-IV [35]. The items are categorized as follows: numbers 1 and 8 are related to loss of control; 2 and 10 to family disruption; 3 and 7 to disregard of consequences; 4 and 5 to withdrawal; 6 to preoccupation; and 9 to tolerance. The score for each respective symptom is obtained by averaging the corresponding items, with only scores greater than three considered to assess its presence. Data were collected and met the originally stated objectives.

To review the psychometric characteristics of the adapted scale, an EFA was applied, which explains the set of observed variables through a structure of underlying variables called factors [36]. To evaluate the performance of the different statements, an item analysis was performed, and Cronbach's alpha was employed to gauge the internal consistency. A correlation calculation was carried out to identify whether the data matrix was an identity matrix, which could prevent the use of EFA [37]. Other measures that allowed us to justify the relevance of the factorial technique were the Bartlett sphericity test with KMO, the Chi^2 test with n freedom degrees and the significance $p < 0.01$, the sampling adequacy measures (SAM) for each variable, and the factor loadings.

In the case of the incidence of excessive use among participants, the total score per participant was compared with the cutoff values by gender and accumulated to ultimately determine the proportion of addicts. Finally, to compare by gender the incidence of addictive symptoms of excessive users, the averages of the items per symptom were obtained, then compared against the cutoff value (4) to determine their presence and accumulated to obtain the corresponding frequency and percentages.

In addition to those objectives, we found differences in the total score of the scale between the genders using the Mann-Whitney U test, since the scores did not follow a normal distribution. Additionally, we achieved levels of association between age and score, as well as the proportion by type of use and gender, according to excessive users. Given the coincidence that there were the same number of adolescents and young people, it was possible to compare the means of both age groups in general and by gender, in addition to the correlation between age and score by each group. To obtain the association coefficients and their significance values, in all cases, we applied Spearman's rho test.

In all the cases, SPSS v23 software was used to analyze the data, except for the EFA, in which Factor v22 software was applied. According to [38], factor software distinguishes itself as the most complete tool to execute an EFA because it was specifically designed for this purpose and offers the added benefit of being free software.

For the EFA and following the first roadmap recommended by [39], when using this software, we have performed the following tasks: 1) Due to the ordinal and polytomous (Likert-type) nature of the items, whose data did not follow a normal distribution and the sample was larger than 200, the polychoric correlation matrix was used [40]. 2) The factorization of ordinal items when analyzing the polychoric

correlation matrix led to the use of the Unweighted Least Squares (ULS) method. For factor selection, an optimized parallel analysis was also performed, randomly extracting 500 sub-matrices and implementing the minimum rank analysis. It was combined with the available fit indices (NNFI, CFI, GFI, and RMSR).

4 RESULTS

Table 1 shows, in addition to the items and the Spanish items, the descriptive statistics for the imputed data set. SAS-SV showed strong reliability with a Cronbach alpha coefficient of 0.88. In terms of internal consistency, all item-total correlations appeared to be satisfactory, and there were no significant changes in the alpha coefficient when individual items were removed. Lastly, the total mean score was 25.82 ± 10.62, 26.31 ± 10.56 for females, and 25.47 ± 10.66 for males.

The adequacy of the data for the AFE was satisfactory (KMO = .894; Bartlett's test: $\chi^2(45) = 1621.1$; $p < .001$), all MSA values were greater than .81, and all correlations between items ranged between .31 and .75 [41]. When determining the number of factors, the optimal parallel analysis yielded just one factor, as in [30], with item loadings greater than 0.54 (refer to Table 1) and explaining 54.8% of the total variance. The fit measures of the model for this solution approached good fit levels (CFI = .962, NNFI = .951, GFI = .984, RMSR = .076). While the items with the lowest communalities were numerals 3 and 10 with values of 0.302 and 0.305, respectively, the highest communalities were obtained in items 6 and 4 with 0.759 and 0.766, respectively.

The distribution of the participants by addiction level appears in Table 2. Furthermore, no statistically significant differences were observed in the total SAS-SV score between genders (U = 9529.5, p = .51), and there was a small, highly significant association between the level of addiction and age (rho = .221, p < .001). There were 85 (out of 286) 'excessive users' (30%: 18% males and 12% females) who used their smartphones for: communication (23%), social media (22%), entertainment (21%), productivity (18%), and Internet browsing (16%).

Based on the maximum age of adolescence (19 years) as declared by [42], the participants were divided into adolescents and young adults; two groups of 143 individuals were formed each for further analysis. The average age of the adolescent group was 16.9 ± 1.57 years, while that of the young adult group was 21.7 ± 2.25 years, with similar proportions of females (43.4% and 41.3%, respectively). Among adolescents, the average scale score was 23.8 ± 10.84, with 24% (34 of 143) perceiving themselves as addicts, compared to 36% (51 of 143) among young adults, who had an average of 27.9 ± 10.01, significantly exceeding adolescents (F = 11.5, p = .001). When stratified by genre, no significant differences were found in perceived addiction scores between adolescent and young adult females. However, among males, young adults outperformed adolescents significantly (M = 28.18 ± 10.428 vs. M = 22.65 ± 10.234, p < .001). Additionally, regarding excessive users, no significant differences were found between adolescents and young adults, and the proportion by gender was very similar in adolescents, but in the case of young adults, men outperformed women by twice the proportion (24% vs. 12%). Furthermore, regarding the association between age and perceived addiction, a highly significant positive association of a small size was found among adolescents (rho = .282, p < .001), while among young adults, a significant negative association of small magnitude was observed (rho = –.165, p = .049). Finally, when comparing the mean scores of each item, significant differences were found among young adults in all items, except for item number 10.

In general, and according to [30], the percentage and frequency of incidence of symptoms were calculated for people who could potentially be excessive smartphone users (refer to Table 3). The most reported symptoms were 'withdrawal', with a prevalence of 72.7% among women, and 'tolerance', with a prevalence of 80.8% among men. On the other hand, the least frequently reported symptom was 'disregard for consequences', with a prevalence of 33.3% among women and 30.8% among men. Most excessive users indicated 'tolerance' and 'withdrawal' as their main symptoms.

Table 1. Item and internal consistency analyses

Item	Score		Corrected Item-Total r	Alpha if Item Deleted	Item Factor Load
	M	SD			
1. "Due to cell phone use, I have stopped doing assignments/activities/work/etc., that I had planned." / *"Debido al uso del celular, he dejado de hacer tareas/actividades/trabajos/etc., que tenía planeado."*	2.75	1.47	0.56	0.87	0.61
2. "Due to cell phone use, I have had trouble concentrating, while studying or working." / *"Debido al uso del celular, he tenido problemas de concentración, mientras estudiaba o trabajaba."*	2.95	1.58	0.54	0.87	0.62
3. "Due to cell phone use, I have felt pain in one of my wrists or neck." / *"Debido al uso del celular, he sentido dolor en alguna de mis muñecas o en el cuello."*	2.20	1.50	0.46	0.88	0.55
4. "I can't be without my cell phone." / *"No puedo estar sin mi celular."*	2.81	1.74	0.70	0.86	0.80
5. "I feel impatient or restless when I don't have my cell phone." / *"Me siento impaciente o inquieto cuando no tengo mi celular."*	2.57	1.58	0.73	0.86	0.83
6. "I keep my cell phone on my mind, even when I'm not using it." / *"Tengo mi celular en mente, incluso cuando no lo uso."*	2.20	1.45	0.69	0.86	0.82
7. "I will never stop using my cell phone, even if it affects my daily life." / *"Nunca dejaré de usar mi celular, aunque afecte a mi vida cotidiana."*	2.23	1.35	0.55	0.87	0.67
8. "I am continually checking my cell phone, so I don't miss conversations on my social networks." / *"Continuamente estoy comprobando mi celular, para no perderme de conversaciones en mis redes sociales."*	2.63	1.53	0.67	0.86	0.77
9. "I use my cell phone, more than I had initially anticipated." / *"Uso mi celular, más de lo que había previsto inicialmente."*	3.04	1.51	0.63	0.87	0.72
10. "Relatives or friends tell me that I use my cell phone too much." / *"Familiares o amigos, me dicen que uso demasiado el celular."*	2.45	1.56	0.54	0.87	0.63

Source: own.

Table 2. Distribution of participants by level of addiction

Level of Addiction	Female n (%)	Male n (%)	Total n (%)
Low	45 (37)	67 (40)	112 (39)
Medium	43 (36)	46 (28)	89 (31)
High	33 (27)	52 (32)	85 (30)

Source: own.

Table 3. Symptom analysis in Mexican participants with smartphone excessive use

Symptom	Female n (%)	Male n (%)	Total n (%)
1. Loss of control	23 (69.7)	29 (55.8)	52 (61.2)
2. Disruption	20 (60.6)	27 (51.9)	47 (55.3)
3. Disregard	11 (33.3)	16 (30.8)	27 (31.8)
4. Withdrawal	24 (72.7)	34 (65.4)	58 (68.2)
5. Preoccupation	17 (51.5)	26 (50)	43 (50.6)
6. Tolerance	23 (69.7)	42 (80.8)	65 (76.5)

Source: own.

5 DISCUSSION

This study was designed to adapt and re-evaluate SAS-SV for the Mexican population to estimate the incidence of excessive use of smartphones and identify associated symptoms. The survey demonstrated strong internal consistency, with a Cronbach's alpha coefficient of .88, which is comparable to the levels observed in surveys conducted in other languages (.79–.95) [7], [22–27]. For the Mexican population, the value was similar (.81–.89) to [12], [31], [32], and [34]. The adaptation of [30] was the basis of ours for the Mexican population. As he said that it was preferable to use another method instead of principal components, we used parallel analysis for factor selection. As in his case, factor analysis verified the one-dimensionality of the scale and explained a similar variance (54.8%) for the scale. The total correlations between corrected elements and totals ranged from .46 to .73 and were similar.

Between the coincides of Spanish students [30] and our same age group, there were no differences in total score by genre, and an inverse association between age and score was found, although in our case, with a lower mean age (21.7 ± 2.25 vs. 25.61 + 11.65) and a larger sample size (143 vs. 117). Furthermore, its proportion of excessive users was much lower (12.8% vs. 36%), and the most common symptoms were equivalent ("tolerance," "withdrawal," and "loss of control"), although in his case the last two were inverse. Similarly, the symptom 'disregard for physical or psychological consequences' was the least frequently reported among participants.

Based on the analysis of the results from the groups of adolescents and young adults, it was observed that among adolescents, there was a positive association between score and age. However, in the case of young adults, as age increased, the addiction score tended to decrease. This phenomenon may be attributed to the novelty of smartphone usage among adolescents, which initially captivates them for longer periods. As they mature, this novelty diminishes, leading to more selective usage patterns. Although the mean SAS-SV score was significantly higher in young adults compared to adolescents, the deviation of item 10 from this trend might be explained by the fact that, with prolonged use of cell phones, young adults become less bothered by interruptions from their close contacts.

When reviewing the findings of different studies by age group, we found that in adolescents, as seen in [29], participants in the middle and late adolescence age range (14–19 years) represented 73.7% of their sample. Among this group, 24.7% were classified as excessive users, a proportion such as that observed in our study for the same age group (24%).

In the case of youth, in [27], there were 39% of self-perceived addicted users such as this study (36%) for the same age group, but without significant differences between genres. Their average score was slightly higher than ours, in both genders. The proportion of excessive users in the present case was higher than in [30] for Belgian participants (30% vs. 21.5%), and much higher than for Spanish (30% vs. 12.8%). In his two samples, the scale means were slightly lower than those in the present case. According to [26], their prevalence of smartphone addiction was slightly lower than ours (33.1% vs. 36%). Although there is a difference in language, geographic location may be the cause of a similarity in prevalence. A surprising situation in [7] was that among the 310 participants, aged 23.1 ± 4.6 years, their prevalence was almost twice the prevalence reported in our study (55.8% vs. 30%) and the highest among all the studies reviewed. Furthermore, when comparing the main addictive symptoms with those found in the Belgian [30] and Moroccan populations [7], there was similarity to the former but not to the latter, since they reported tolerance, followed by preoccupation and disruption. In all, as in the present, the least symptom was 'disregard for consequences'.

For all our participants, the mean of the SAS-SV score was 25.82 ± 10.62; 30% of them were auto-perceived as excessive users; their use of the smartphone was for pleasure (communication, social media, entertainment). Additionally, it was found that as age increased, so did the addiction score. Consistent with several previous studies, the mean scale score was higher among women compared to men, although in this case there was no significant difference, contrary to [19], [25], and [27]. On the other hand, contrary to [28], the proportion of excessive female users was less than half that in their case (12% vs. 28%). Regarding the mean scores, our participants obtained figures very similar to those found by them.

In the reviewed Mexican studies [9–17], [21–23], common elements emerge, including a genuine concern about the potential adverse effects of problematic cell phone use among the student population, prevention and early intervention measures, and reorientation of its use to the benefit of this population. Across these studies, there was a recognized need for a rapid and reliable instrument that would allow the detection of a possible addiction and its prevalent symptoms. Through this study, we intend to support future studies in the area so that educational and health authorities can promote guidelines to contribute to the integral development of our youth. For example, among the most interesting initiatives to reorient cell phone use is the work of [23], who, through the Pokémon GO application, encouraged users to engage in physical activity, explore new urban tourist spots, and enjoy the natural environment. Additionally, in his study, [21] highlights that although studies on cultural consumption should be permanent, university students preferred music. The same author indicates that such preferences should be known by educational authorities and offer different genres of music to broaden the horizons, tastes, and experiences of young people.

6 CONCLUSION

The adaptation of the SAS-SV instrument for a Mexican sample of students yielded adequate reliability and validity results, which allowed the continuation with the resting objectives. The prevalence of excessive smartphone use was close to the average found in the reviewed studies. Furthermore, the three prevalent addictive symptoms of both sexes were similar: tolerance, withdrawal, and loss of control.

To the authors' knowledge, this study represents the first investigation of symptoms of problematic smartphone use among Mexicans, showing a strong

psychometric adaptation for two Mexican regions. Researchers are encouraged to urgently explore new indicators to better assess this issue for the benefit of Mexican authorities concerned about the healthy development of young people. However, the study has certain limitations, including the inability to evaluate the discriminatory features of SAS-SV due to the absence of a clinical diagnosis of smartphone addiction. Additionally, only two regions of our country were covered (central and southeast), so it is necessary to cover the remaining regions. In addition, it is necessary to verify the validity of the instrument with students between 12 and 15 years of age who attend secondary school in our country. Furthermore, it is necessary to contrast the perceived level of use with the actual level among the participants, even if this implies scrutiny of their devices and therefore a possible impact on their privacy. We consider that the instrument should record the identity of the respondent to detect and address, if applicable, the addictive symptoms found to be most common. Once enriched with the findings derived from studies that correct the above limitations, the scale can be used both in epidemiological studies and in clinical settings.

Finally, we consider it natural for education and public health authorities to be concerned about the time their students use their smartphones, as they fear the pernicious effects on various aspects of their lives. Therefore, and based on the results, we recommend with some urgency that initiatives be generated within schools to address the symptoms of tolerance, withdrawal, and loss of control, since they seem to be the most prevalent. Additionally, organize knowledge rallies aimed at fostering productive use of cell phones among students while also encouraging socialization and physical activity. It is necessary to conduct cultural consumption surveys every semester and design a range of digital goods and services that can positively influence young adults. Furthermore, in terms of the educational process within the classroom, there is an opportunity to influence students to perceive smartphones as allies to increase their productivity and efficiency, as well as entertainment. This notion is supported not only by the studies reviewed but also by the experiences encountered during the scope of this study, particularly following the COVID-19 pandemic lockdown. During this period, videoconference classes required students to have personal computers. However, after the pandemic ended, some teachers, faced with the challenge of continuing their practices under the same conditions, discovered a lack of resources in their schools. Consequently, some teachers have migrated some of their activities to smartphones and have continued their tasks. Although there are currently no indicators in this regard, there is the possibility that more teachers will adhere to this practice.

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8 AUTHORS

Ismael Esquivel-Gámez is with the Universidad Veracruzana, Veracruz, México (E-mail: iesquivel@uv.mx).

Martín Guerrero-Posadas is with the Tecnológico Nacional de México, Campus San Luis Potosí, San Luis Potosí, México.

Julio Cesar Berthely-Barrios is with the Universidad Veracruzana, Veracruz, México.

Jorge Luis Vázquez-Ariza is with the Colegio de Estudios Científicos y Tecnológicos del Estado de Veracruz, Plantel No. 19, Veracruz, México.