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The Conception, Validation, and Reliability of the Questionnaire for Screen Time of Adolescents (QueST)

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Abstract

Purpose: This study analyzed the content validity and reliability of the Questionnaire for Screen Time of Adolescents (QueST). **Methods**: QueST measures screen time across five constructs: studying, working/internship-related activities, watching videos, playing video games, and using social media/chat applications. The content validity, including a pretest, was carried out by experts and adolescents. For reliability analysis, QueST was applied and reapplied after one week in a sample of 104 adolescents (16.3 ± 1.02 years; 66.3% girls). **Results**: The Content Validity Index for Scales indicated 94% and 98% of overall clarity and representativeness, respectively. The QueST was considered comprehensible and clear by adolescents. The intraclass correlation coefficients ranged from 0.41 (95% CI 0.24, 0.56) for videos to 0.76 (95% CI 0.66, 0.83) for social media/chat applications on a weekday, and from 0.24 (95% CI 0.04; 0.41) for videos to 0.67 (95% CI 0.54; 0.77) for social media/chat applications on weekends. **Conclusions**: The QueST has demonstrated satisfactory content validity; however, measuring the time watching videos during free-living is a challenge for researchers. In general, the QueST is recommended to measure different screen time constructs.

Keywords: Adolescent Behavior; Self Report; Sedentary Behavior; Validation Study; Reproducibility of Results

Introduction

Screen time behaviors is a term to describe behaviors that imply interaction with electronic devices (e.g., watching television; using smartphones) and may be performed recreationally, professionally, and in educational settings (Tremblay et al., 2017). Screen time, frequently in the form of television viewing, computer using, or video game playing, has been related to unhealthy outcomes among children and adolescents (Biddle et al., 2017; Biswas et al., 2015; Carson et al., 2016; de Rezende et al., 2014; Tremblay et al., 2011). Behaviors like watching movies and videos were usually limited to television devices, and playing videogames required specific consoles until recently; however, with the advancement of technology, these activities are viewable on several gadgets, including computers, tablets, and smartphones. These innovations caused changes in screen time behaviors such as the decrease in television use and increased computer use among adolescents (Bucksch et al., 2016; Silva et al., 2014). As the diversity of activities done on electronic screens is continually evolving, the impact of these activities on health also changes. For example, the World Health Organization incorporated video game addiction into the International Classification of Diseases-11, describing that addiction to electronic games negatively affects the individuals' health (World Health Organization, 2018). Another example is the excessive social media usage, which is relatively novel, and has been associated with depressive symptoms (da Costa et al., 2020), socialization problems (Arundell et al., 2019; Devine & Lloyd, 2012; Ihm, 2018), poor body image (de Vries et al., 2016), and poor academic performance (Kuss & Griffiths, 2011).

The diversity of activities that can be performed on each electronic device (e.g., it is possible to play, watch videos, and access social media on computers and smartphones) brings new challenges to the measurement of screen time. Two reviews of questionnaires for measuring sedentary behavior demonstrated that most instruments include a single question, often measuring the time watching television, playing video games, and/or using computers

(Hidding et al., 2017; Prince et al., 2017). However, as the relationship of each of these activities with health outcomes may differ (Biddle et al., 2017; Carson et al., 2016; da Costa et al., 2020; Ihm, 2018; Weaver et al., 2010), it is still imperative to identify the different activities in order to broaden the understanding of the etiology of health problems in pediatric populations. Thus, this study aims to propose a questionnaire to measure different constructs of screen time among adolescents and evaluate its content validity and reliability.

Methods

Study Design

The Questionnaire for Screen Time of Adolescents (QueST) was designed for assessing habitual volumes of screen time in different constructs for the adolescent population. After the initial development of the QueST, it went through three steps of psychometric evaluation, with each step being conducted with a different sample, as follows: i) for the content validity, 16 experts in the research field of screen time among adolescents were included; ii) for pretesting the questionnaire, 14 adolescents from a Federal Institute of Technological Education of Santa Catarina state were recruited; iii) lastly, for reliability, a sample of 104 high school students from the Aplicação school, Santa Catarina state, was analyzed. These three steps were conducted in 2019. All adolescents and their parents/legal guardians approved the study protocols and provided written consent forms. This study was approved by the ethics committee for research with human participants of the Federal University of Santa Catarina, Brazil (protocol number: 3.168.745).

The Questionnaire for Screen Time of Adolescents

The QueST aims to measure screen time during weekdays and weekends across different constructs. The initial construction of the instrument followed standardized recommendations (Hidding et al., 2017) and begun after a non-systematic consultation of recent

reviews of questionnaires for measuring sedentary behavior (Hidding et al., 2017; Prince et al., 2017). The development procedures of the QueST can be described as follows: i) identification of the constructs; ii) determination of the administration format of the questionnaire; iii) choice of the number, format, order, and text of the items and response options; iv) review of the questionnaire and optimization of its organization and readability (de Vet et al., 2011; Tsang et al., 2017).

Five screen time constructs were defined based on questions used in research related to sedentary behavior (Cerin et al., 2014; Guimarães et al., 2013; Hidding et al., 2017; Prince et al., 2017; Treuth et al., 2003), as follows: (i) activities related to study or homework; (ii) activities related to work (including internships and non-profit activities); (iii) watching videos, such as series, movies, news, and sports; (iv) playing video games; and (v) use of social media and chat applications. The choice to measure the use of chat applications and social media within a single construct was made as platforms and applications generally offer both services (e.g., it is possible to send direct messages to other users on Facebook, Instagram, and Twitter). The work-related construct was included as some internships and jobs require screen time activities. For each construct, the time in hours and minutes can be reported during weekdays and weekend days.

The QueST was initially written in Brazilian Portuguese and designed to be self-administered by adolescents using a smartphone, tablet, or computer with access to the internet. The instrument was hosted at SurveyMonkey® platform. Each of the described constructs represented an item in the questionnaire. All items were described with the following instructions: “Insert zero if you do not engage in these kinds of activity” and followed by an answering example (e.g., “Example: I watch series for 1 and a half hours per day [insert 1 in the field of hours and 30 in the field of minutes]”). QueST items are shown in Table 1.

<Table 1 here>

Content Validity

Panel of Experts

For the content validation, a team of experts was selected among those who had ongoing research projects, monographic productions, and articles published in scientific journals about screen time behaviors or studies with psychometrics and validation of questionnaires. All experts had a doctoral title and were either professors or researchers in universities or research institutes. The experts were contacted by e-mail, where they received an invitation letter introducing the QueST and explaining the rationale for its development, it included a background text including key concepts and an explanation for its application and use in research.

The experts evaluated the QueST in two steps: (i) an individual evaluation of each of the items, and (ii) a global evaluation of the QueST (Polit & Beck, 2006). The experts rated the content validity of the questionnaire independently, evaluating each item regarding clarity and representativeness (Rubio et al., 2003). The clarity evaluation aimed to rate the writing of the questions considering the comprehension of the construct being measured (Grant & Davis, 1997). Whereas, the representativeness evaluation aimed to verify if the items reflected screen time, its constructs and concepts (Grant & Davis, 1997). The experts analyzed each item and the response scale, then they answered about clarity through a 4-point Likert scale (4 = highly clear; 3 = quite clear; 2 = somewhat clear; 1 = not clear), as well as, they answered about the representativeness of the constructs being measured using a similar scale (4 = the item is representative; 3 = the item needs minor revisions to be representative; 2 = the item needs major revisions to be representative; 1 = the item is not representative) (Rubio et al., 2003). When considering the ratings on clarity and representativeness, the Content Validity Index for each

question was computed (Polit & Beck, 2006). Besides, general comments on the questions could be added by the experts.

For the global evaluation of the QueST, experts answered about the clarity and expressiveness of the title (yes/no); all the items representing adolescents' screen time (yes/partially/no); suitability of the metric (yes/partially/no); suitability of the unit of measure and response scale (yes/partially/no); adequacy of the sequence of items (yes/partially/no); the use of the bold tags on the questions to emphasize primary information on the online questionnaire (yes/partially/no). The experts were able to provide comments on each item and suggest the addition and deletion of items.

Instrument review by the adolescents

This step was conducted to test if the target population understands the questions and response scales proposed (Borsa et al., 2012), as well as, ambiguity and misinterpretation of the items, and possible difficulties (Presser et al., 2004). Based on that, a convenience sample of 14 high school students of a Federal Institute of Technological Education from Santa Catarina state participated in the reviewing of the QueST. This step involved an online questionnaire, which comprised the QueST and additional questions about (i) the clarity of each item (highly clear/quite clear/somewhat clear/not clear); (ii) unfamiliar words in each of the items (no/yes, which one?); (iii) if students did understand how to answer the QueST (I did/I did not understand); (iv) if students had any difficulty in answering the QueST (no/yes, which one?); and (v) if other activities involving the usage of electronic screens were lacking on the questionnaire (no/yes, which one?). This procedure was performed in a classroom, during school hours, and students accessed the electronic link of the questionnaire using their smartphones.

Reliability

To test the reliability of the QueST, all high school students from the Aplicação school were recruited, and those who agreed to participate were asked to answer the QueST twice with a seven days interval between applications (de Souza et al., 2017). This procedure was performed in a classroom, during school hours, and students accessed the electronic link of the questionnaire using their smartphones. The measurement conditions were similar for both test and retest (administrators, environment, instructions).

Analysis

Content Validity Analysis

The five items of the QueST were evaluated on clarity and representativeness using the Content Validity Index for Items (I-CVI) (Polit & Beck, 2006). The I-CVI were calculated by summing the ratings of either “3” or “4” in each item, divided by the total number of experts. Also, the Content Validity Index for Scales (S-CVI) was obtained by the arithmetic mean of the I-CVIs (Polit & Beck, 2006), separately calculated for clarity and representativeness. The authors MTGK, BGGC, and PCS analyzed the qualitative comments provided by the experts, and suggestions were accepted/rejected with the consensus of these three authors after revision and discussions. This step was blinded to secure the identity of the experts and mitigate bias.

The information regarding the review of the QueST by the students was descriptively presented by proportions. Any ratings "*somewhat clear*" or "*not clear*" on the wording of any item, as well as any student who answered that had not understood how to answer the QueST was adopted as the criterion of reformulating the item or the entire instrument, entailing a second evaluation by the students. Furthermore, the authors MTGK, BGGC, and PCS, by consensus, would replace possible unfamiliar words with simpler ones. Also, possible

suggestions for other activities made with screen media devices would be evaluated to compose the questionnaire. The difficulties in answering the QueST were described.

Reliability Analysis

Only students who answered both measures (test and retest) were included in the reliability analysis. Students with missing data were excluded. Also, implausible answers were excluded by adopting >14 daily hours as a cutoff value. For stability, differences between the test and retest were analyzed using *Students t*-tests. As some variables were skewed, additional non-parametric tests (Sign-Rank tests) were conducted to confirm the findings. The stability of the constructs was discerned through intraclass correlation coefficients (ICC). Also, the Bland-Altman dispersion analyses were used for examining the differences and limits of agreement (in minutes) between test and retest measurements.

Results

Content Validity

Of the 24 invited experts, 16 (66.7%) submitted their answers. Eight experts did not answer the questionnaire, but they did not comment on the reason. Table 2 shows the I-CVI and S-CVI values for clarity and representativeness of the QueST. Regarding clarity, the smallest I-CVI was observed in Item 1 (studying): 0.88 (or 88% of agreement among the experts). Items 2, 4, and 5 obtained I-CVI = 0.94; and Item 3 (watching videos) demonstrated 100% agreement among the experts. The calculated S-CVI indicated 94% of overall clarity of the QueST. Concerning representativeness, four out of the five items were considered as 100% representative (playing video games: item 4 I-CVI = 0.88), and the S-CVI indicated representativeness of 98%.

<Table 2 here>

Based on the review of the experts, the title of the questionnaire was modified; some terms in the items were replaced or added (example: to watch “sports” was added in the third item); the response scale was simplified, where the experts proposed a shorter scale with breaks of 10 minutes (0, 10, 20 minutes…), instead of a longer minute-by-minute scale. Experts also contributed to reordering the items to reduce mental effort. There was no addition or exclusion of items.

Fourteen students (18.2±1.0 years old, 42.9% female) participated in the first review of the QueST. All students considered the wording of the questions to be highly or quite clear (Item 1: 71.4% highly clear, and 28.6% quite clear; Item 2: 78.6% highly clear, and 21.4% quite clear; Item 3: 85.7% highly clear, and 14.3% quite clear; Item 4: 84.6% highly clear, and 15.4% quite clear; Item 5: 84.6% highly clear, and 15.4% quite clear). There were no "*somewhat clear*" or "*not clear*" ratings. No student reported issues regarding the vocabulary, and 100% of them understood how to answer the QueST. Eleven students (78.6%) did not express any difficulty in answering the QueST; however, the other three students commented that they had difficulty in precisely reporting their habitual screen time. Based on the review of the students, no modifications to the QueST were necessary.

Reliability

From 203 eligible students, 104 students agreed to participate, provided written informed consent forms, and answered the QueST in both test and retest (16.3±1.02 years old; 66.3% girls). The mean time of social media usage on a weekday was higher at test, whereas studying on weekend days was higher at retest. However, time watching videos on weekend days was higher at test compared to retest (Table 3).

< Table 3 here>

All ICC values were statistically significant (Table 4). The highest ICC was observed for the use of social media on weekdays (ICC= 0.76, 95% CI 0.66; 0.83), whereas the lowest ICC was observed in the construct of watching videos on weekends (ICC= 0.24, 95% CI 0.04; 0.41).

< Table 4 here>

The Bland-Altman analyzes for the QueST constructs are presented in Table 5. Mean differences ranged from -4.6 (Upper limit: 149.6; Lower limit: -158.7) minutes for working on weekdays to 40.6 (Upper limit: 400.0; Lower limit: -318.9) minutes for watching videos on weekend days.

< Table 5 here>

Discussion

The QueST proved to be adequate to evaluate different screen time constructs with satisfactory content validity. However, the stability of the items varied considerably across the constructs and the days analyzed (weekday versus weekend). The content validity was considered appropriate based on the level of agreement among experts for clarity and representativeness of the items and the instrument. According to the acceptability criteria of the items that incorporate the standard error of the proportion of agreement, the lowest I-CVI admitted is 0.78 in a panel of experts with 6 or more individuals (Lynn, 1986; Polit & Beck, 2006). Also, the instrument as a whole has acceptable content validity when the S-CVI is ≥0,90 (Waltz et al., 2005). In addition, the comments/suggestions given by experts were complementary to the validation process. This step contributed to some textual modifications and minor additions in the instrument, which was not robust enough to require another submission to the panel of experts. Overall, the QueST can be used to assess screen time in adolescent populations.

The review of the instrument according to the target population and experts is strongly recommended (Hidding et al., 2017; Mokkink et al., 2010). However, this process was not reported by more than 80% of studies examining the measurement properties of sedentary behavior instruments (Hidding et al., 2017). Regarding the initial review by adolescents, the QueST was considered comprehensible and clear. However, three students reported difficulty in accurately reporting the usual screen time in each of the items. This problem is common in obtaining accurate memories in questionnaires to measure behaviors with children and adolescents (Kohl et al., 2000). The screen time may be variable and unstable over time and are dependent on several factors (Cabanas-Sánchez et al., 2018), which may contribute to poor estimation of habitual behaviors. To improve this estimation, the response scale was updated, making it less arduous for adolescents to understand the items and report their behavior.

The stability of the items ranged from poor to excellent (Rosner, 2005) and the sample size of this procedure was considered adequate (Terwee et al., 2007). The item for watching videos (series, movies, soap operas, news, sports, programs, others), both on weekdays and weekends, showed the lowest ICCs compared to the other items. This may be explained by the fact that this behavior is not stable throughout the time between the repetitions of the measurements as some factors can influence screen behavior even in a short time frame (Hardy et al., 2007). For example, the launch of a new season in a popular series, or the occurrence of acclaimed sporting events (e.g., Olympic games, international league finals) can considerably increase the electronic screen usage within a few days and inflate only one measure, either test or retest. Thus, the answers in the test and retest may be accurately reported by adolescents, but it is still verified as poor stability of the measurements because a particular behavior does not present “typical” or “normal day” patterns (Hardy et al., 2007). Further studies are needed to understand the dynamics of video watching among adolescents in periods longer and shorter

than 1-week in order to investigate the length of the most appropriate test-retest interval to obtain population parameters.

The item for playing video games presented fair and good reliability on week and weekend days, respectively, demonstrating considerable accuracy and stability of the responses to this behavior. The ICCs obtained were similar to those of the Health Behavior in School-aged Children study (2008), which showed ICC= 0.54 (95% CI 0.38; 0.67) on weekdays and 0.69 (95% CI 0.57; 0.78) on weekends for the gaming item (Liu et al., 2010).

Similarly, the item about social media/chatting applications demonstrated good/excellent reliability on both weekdays and weekend days. Stable, but high volumes characterized this behavior; however, this is expected as they are predominantly realized on smartphones over long periods of the day (de Vries et al., 2016; Devine & Lloyd, 2012; Ihm, 2018), possibly while multitasking (e.g., watching a movie on the television while chatting on the smartphone). It was also observed that the amount of time spent on social media and chat applications in the test measurement was statistically higher than the observed in the retest on weekdays. It is not possible to establish a single explanation for this difference; however, school responsibilities and parental controlling are examples of factors that may influence these activities, and consequently, impact test-retest measures over a short period.

The item related to screen time for studying on weekdays showed fair/good stability and was higher compared to the ICC obtained on the weekends. Possibly, the time spent on studies over the weekend is more variable or flexible and determined by school demands, such as the proximity to exams at school compared to the time spent studying on weekdays, when the adolescents already have established a stable routine of school tasks.

Also, low volumes of screen time for working on weekdays and weekends were reported, and these questions demonstrated fair stability. Previously, a survey conducted in the

state of Santa Catarina, Brazil, assessing lifestyle indicators of high school students (15-19 years old) reported that 50.5% of the adolescents had a job in 2011 (Silva et al., 2013). In general, screen time items related to study and work constructs are not common in sedentary behavior research among adolescents, as these constructs are not discretionary, and few studies include questions accessing this information (Hidding et al., 2017; Prince et al., 2017).

The present findings suggested that adolescents' screen time behaviors were less stable on weekend days compared to weekdays. This result may be more related to the natural variability of these behaviors, especially on weekends, than to the reduced reliability of the items. Adolescents' screen time behaviors on weekends can be influenced by opportunities to practice physical activities (Hardy et al., 2007), weather conditions, and events that promote the use of electronic devices (e.g., the release of series or games; exams at school). Also, on weekends, more spontaneous and fewer routine behaviors are expected, when adolescents may have more free time to use electronic devices as they please.

A "typical day" was used as the reference time frame in the items of the QueST to exclude atypical events on the measurements, such as decisive exams at school, because it could directly influence the item for studying, for example. However, possible atypical occurrences could not be controlled in this study. Besides, some adolescents' screen time behaviors, such as watching videos, may vary highly within and between individuals, which also impairs the accuracy of respondents. Nevertheless, some bias may be unavoidable when behaviors are self-reported among this population (Kohl et al., 2000).

Among the strengths of this study, we highlight the use of a wide range of screen time constructs which represent a large amount of sedentary time of adolescents; the use of standardized and recommended methods for the development and validation of questionnaires, which is not documented for the majority of available sedentary behavior instruments (Hidding

et al., 2017); the content validity focused on assessing the representativeness and clarity of the items using qualitative and quantitative methods. Besides that, this study sought to include the complete QueST content validation process, which encompassed two complementary steps: the review of the questionnaire by the target population and its evaluation by the field experts; finally, the methodological procedures of this study were adopted according to the Consensus-Based Standards for the Selection of Health Measurement Instruments (COSMIN) (Mokkink et al., 2010) (see Supplementary Material: Application of the COSMIN checklist on the QueST).

This study had as limitations the small sample size obtained by convenience sampling in the initial test (n=14); the criterion validity was absent due to the lack of a gold standard measure used in the free-living conditions that could be adopted as a reference for the 5-screen time constructs present in QueST. This step remains a challenge for research with this purpose, considering that these screen time behaviors can be performed on different devices (e.g., television, computer, tablet, smartphone); and the QueST was developed to cover the activities that adolescents perform using any electronic screen device in five previously established constructs, however, not all activities fit into a construct of the questionnaire, such as reading eBooks for leisure.

The final electronic version of the QueST is available at pt.surveymonkey.com/r/QLQTQHG (Brazilian Portuguese) and pt.surveymonkey.com/r/Q7QXYL2 (English).

Conclusions

The QueST presented satisfactory content validity determined by the panel of 16 experts and adequate evaluation by the adolescents. The wide variability in reliability that was observed among the five items of the instrument highlights the natural fluctuation of the

adolescent behavior in certain screen time constructs. In general, QueST can be considered an appropriate tool to measure adolescents' screen time in the five constructs presented.

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Authors' contributions: Margarethe Knebel: conceptualization, methodology, formal analysis, investigation, writing - original draft. **Bruno Costa:** conceptualization, methodology, formal analysis, investigation, writing - original draft. **Priscila dos Santos:** conceptualization, investigation, writing - original draft. **Ana Caroline de Sousa:** conceptualization, investigation, writing - original draft. **Kelly Silva:** conceptualization, writing - review & editing, supervision, project administration. All authors have read and approved the final version of the manuscript.

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Table 1. Questionnaire for Screen Time of Adolescents (QueST) (Brazil, 2019).

Questions	**Statement:** On a **typical day**, how much time do you spend...
1. Studying	...**studying, watching video classes, reading, doing research, or school work** on a computer, television, tablet, smartphone, or other electronic devices?
2. Performing work/internship-related activities	**...doing job or internship related work** on a computer, television, tablet, smartphone, or other electronic devices?
3. Watching videos	**...watching TV shows, movies, soap operas, news, sports, programs, or other videos** on a computer, television, tablet, smartphone, or other electronic devices?
4. Playing video games	**...playing video games** on a games console, computer, television, tablet, smartphone, or other electronic devices?
5. Using social media/ chat applications	**...using social media like Facebook, Instagram, Twitter, Snapchat,** or **chat applications like WhatsApp, Telegram, Messenger** on a computer, television, tablet, smartphone, or other electronic devices?

Answers for each question
On a **weekday**: Field for hours (0-23); field for minutes (0-50).
On a **weekend day**: Field for hours (0-23); field for minutes (0-50).

Table 2. Evaluation and rating of the QueST items by 16 experts for content validation. (Brazil, 2019).

	Clarity						**Representativeness**					
	Items						Items					
Expert	1	2	3	4	5	Clarity Proportion	1	2	3	4	5	Representativeness Proportion
1	x	○	○	○	x	0.60	○	○	○	x	○	0.80
2	○	○	○	○	○	1.00	○	○	○	○	○	1.00
3	x	x	○	x	○	0.40	○	○	○	x	○	0.80
4	○	○	○	○	○	1.00	○	○	○	○	○	1.00
5	○	○	○	○	○	1.00	○	○	○	○	○	1.00
6	○	○	○	○	○	1.00	○	○	○	○	○	1.00
7	○	○	○	○	○	1.00	○	○	○	○	○	1.00
8	○	○	○	○	○	1.00	○	○	○	○	○	1.00
9	○	○	○	○	○	1.00	○	○	○	○	○	1.00
10	○	○	○	○	○	1.00	○	○	○	○	○	1.00
11	○	○	○	○	○	1.00	○	○	○	○	○	1.00
12	○	○	○	○	○	1.00	○	○	○	○	○	1.00
13	○	○	○	○	○	1.00	○	○	○	○	○	1.00
14	○	○	○	○	○	1.00	○	○	○	○	○	1.00
15	○	○	○	○	○	1.00	○	○	○	○	○	1.00
16	○	○	○	○	○	1.00	○	○	○	○	○	1.00
I-CVI	0.88	0.94	1.00	0.94	0.94	*S-CVI 0.94*	1.00	1.00	1.00	0.88	1.00	*S-CVI 0.98*

I-CVI = Content Validity Index for Items. S-CVI = Content Validity Index for Scales.
○ = Questions rated 3 or 4 on the 4-point Likert scale.
x = Questions rated 1 or 2 on the 4-point Likert scale.

Table 3. Descriptive characteristics of the test and retest sample (Brazil, 2019).

		Test		Retest		*Student's t test*	*Sign-rank test*
	n	Mean/Proportion	SD	Mean/Proportion	SD	p-value	p-value
Sex (%)	104						
Boys		33.7					
Girls		66.3					
Age (years)	104	16.3	1.02				
Mother education (%)	104						
<8 years		4.8					
8-11 years		35.6					
≥ 12 years		59.6					
ST constructs (min)							
Weekdays							
Studying	101	148.5	147.0	161.10	163.73	0.21	0.07
Working	103	29.90	76.27	34.47	82.56	0.56	0.91
Watching videos	101	132.18	108.11	116.14	107.08	0.17	0.15
Video gaming	102	72.94	130.93	63.53	100.30	0.35	0.54
Using social media	96	221.67	170.87	194.17	148.24	0.02*	0.03*
Weekend days							
Studying	103	142.43	136.33	174.76	160.46	0.04*	0.04*
Working	103	42.42	109.95	49.70	125.38	0.56	0.66
Watching videos	101	253.86	163.75	213.26	135.33	0.03*	0.02*
Video gaming	101	125.34	176.27	120.10	173.91	0.73	0.38
Using social media	88	263.30	156.93	241.82	143.99	0.10	0.12

* indicates $p < 0.05$. SD standard deviation. ST screen time.

Table 4. Intraclass correlation coefficients and 95% confidence interval of each construct between the applications. (Brazil, 2019).

		Weekdays				
		Study (n=101)	Work (n=103)	Videos (n=101)	Video games (n=102)	Social Media (n=96)
Weekdays	Study	0.59 (0.45; 0.70)*				
	Work		0.51 (0.36; 0.64)*			
	Videos			0.41 (0.24; 0.56)*		
	Video games				0.62 (0.48; 0.72)*	
	Social Media					0.76 (0.66; 0.83)*
		Weekend days				
		Study (n=103)	Work (n=103)	Videos (n=101)	Video games (n=101)	Social Media (n=88)
Weekend days	Study	0.41 (0.24; 0.56)*				
	Work		0.43 (0.26; 0.58)*			
	Videos			0.24 (0.04; 0.41)*		
	Video games				0.62 (0.49; 0.72)*	
	Social Media					0.67 (0.54; 0.77)*

* indicates $p < 0.05$

Table 5. Mean difference and limits of agreement of the Bland-Altman analyses (Brazil, 2019).

ST constructs	n	Mean Difference	Upper Limit of Agreement	Lower limit of Agreement
Weekdays				
Studying	101	-18.1	263.9	-300.2
Working	103	-4.6	149.6	-158.7
Watching videos	101	16.0	244.2	-212.1
Video gaming	102	9.4	209.9	-191.1
Using social media	96	27.5	241.7	-186.7
Weekend days				
Studying	103	-32.3	281.2	-345.8
Working	103	7.3	239.2	-253.8
Watching videos	101	40.6	400.0	-318.9
Video gaming	101	5.2	305.1	-294.6
Using social media	88	21.5	358.9	-215.9

ST screen time.

Supplementary Material

The Conception, Validation, and Reliability of the Questionnaire for Screen Time of Adolescents (QueST)

Application of the Consensus-Based Standards for the Selection of Health Measurement Instruments (COSMIN) checklist on the Questionnaire for Screen Time of Adolescents

STEP 1: Evaluated measurement properties in the article:

A. Internal consistency

✓ **B. Reliability**

C. Measurement error

✓ **D. Content validity (including face validity)**

E. Construct validity/structural validity

F. hypotheses-testing

G. Cross-cultural validity

H. Criterion validity

I. Responsiveness

J. Interpretability

STEP 2: Are Item Response Theory methods used in the article?

✓ **No.**

STEP 3: Complete the corresponding boxes marked in step 1.

Box B. Reliability: relative measures (including test-retest reliability, inter-rater reliability and intra-rater reliability)				
Design requirements	**Yes**	**No**	**NA**	**?**
1. Was the percentage of missing items given?	**x**			
2. Was there a description of how missing items were handled?	**x**			
3. Was the sample size included in the analysis adequate?	**x**			
4. Were at least two measurements available?	**x**			
5. Were the administrations independent?	**x**			
6. Was the time interval stated?	**x**			
7. Were patients stable in the interim period on the construct to be measured?			**x**	
8. Was the time interval appropriate?	**x**			
9. Were the test conditions similar for both measurements? e.g. type of administration, environment, instructions	**x**			
10. Were there any important flaws in the design or methods of the study?		**x**		
Statistical methods				
11. for continuous scores: Was an intraclass correlation coefficient (ICC) calculated?	**x**			
12. for dichotomous/nominal/ordinal scores: Was kappa calculated?			**x**	
13. for ordinal scores: Was a weighted kappa calculated?			**x**	
14. for ordinal scores: Was the weighting scheme described? e.g. linear, quadratic			**x**	

Box D. Content validity (including face validity)			
General requirements	**Yes**	**No**	**?**
1. Was there an assessment of whether all items refer to relevant aspects of the construct to be measured?	**x**		
2. Was there an assessment of whether all items are relevant for the study population? (e.g. age, gender, disease characteristics, country, setting)	**x**		
3. Was there an assessment of whether all items are relevant for the purpose of the measurement instrument? (discriminative, evaluative, and/or predictive)	**x**		
4. Was there an assessment of whether all items together comprehensively reflect the construct to be measured?	**x**		
5. Were there any important flaws in the design or methods of the study?		**x**	

STEP 4: Complete the Generalisability box for each property marked in Step 1.

B. Reliability: Box Generalisability box				
Was the sample in which the Health-Related Patient-Reported Outcomes (HR-PROs) instrument was evaluated adequately described? In terms of:	**Yes**	**No**	**NA**	**?**
1. median or mean age (with standard deviation or range)?	**x**			
2. distribution of sex?	**x**			
3. important disease characteristics (e.g. severity, status, duration) and description of treatment?			**x**	
4. setting(s) in which the study was conducted? e.g. general population, primary care or hospital/rehabilitation care	**x**			
5. countries in which the study was conducted?	**x**			
6. language in which the HR-PROs instrument was evaluated?	**x**			
7. Was the method used to select patients adequately described? e.g. convenience, consecutive, or random	**x**			
8. Was the percentage of missing responses (response rate) acceptable?	**x**			
D. Content validity: Box Generalisability box				
Was the sample in which the Health-Related Patient-Reported Outcomes instrument was evaluated adequately described? In terms of:	**Yes**	**No**	**NA**	**?**
1. median or mean age (with standard deviation or range)?	**x**			
2. distribution of sex?	**x**			
3. important disease characteristics (e.g. severity, status, duration) and description of treatment?			**x**	
4. setting(s) in which the study was conducted? e.g. general population, primary care or hospital/rehabilitation care	**x**			
5. countries in which the study was conducted?	**x**			
6. language in which the HR-PROs instrument was evaluated?	**x**			
7. Was the method used to select patients adequately described? e.g. convenience, consecutive, or random	**x**			
8. Was the percentage of missing responses (response rate) acceptable?	**x**			