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Development and Evaluation of the Motivation to Limit Screen-time Questionnaire (MLSQ)
for Adolescents

Running Head: Motivation to Limit Screen-time Questionnaire

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Abstract

Objective: The aim of this study was to design and evaluate a brief scale to assess adolescents' motivation to limit their screen-time using a Self-determination theory (SDT) framework.

Methods: The development and evaluation of the *Motivation to Limit Screen-time Questionnaire* (MLSQ) involved three phases. In Phase 1, experts in SDT were asked to review the content validity of the MLSQ items. In Phase 2, adolescent boys (N=342, mean age=12.7±.5 years) completed the MLSQ and the factorial validity of the model was explored. In Phase 3, adolescent boys (N=48, mean age=14.3 ±1.3 years) completed the MLSQ on two occasions separated by 1-week. Phases 2 and 3 were conducted in New South Wales, Australia in 2012.

Results: Twenty four SDT experts reviewed the original scale items. Validity coefficients associated with six of the original eight items exceeded the threshold value ($V > .68$, $p < .01$). In Phase 2, the revised three-factor (9-items) model provided a good fit to the data (SRMR =.07, CFI =.96). The intraclass correlation (ICC) values were .67 for amotivation and .70 and .82 for controlled and autonomous motivation, respectively.

Conclusion: This study has provided preliminary evidence for the validity and reliability of the MLSQ in adolescent boys.

Abbreviations

CFI: Comparative fit index

CFA: Confirmatory factor analysis

ICC: Intraclass correlation coefficient

MLSQ: Motivation to Limit Screen-time Questionnaire

NSW: New South Wales

RAI: Relative autonomy index

SDT: Self-determination theory

SRMR: Standardized root mean square residual

TSRQ: Treatment Self-Regulation Questionnaire

V: Content validity coefficient

Introduction

Evidence suggests that children and adolescents in Western countries spend 5–10 waking hours sedentary, of which 2–4 hours are spent in screen-based recreation (Salmon, et al., 2011). Considering the range of adverse physiological and psychological outcomes associated with excessive screen-time (Costigan, et al., 2013, Tremblay, et al., 2011), it is not surprising that there has been an increase in the number of interventions targeting young people's screen-time (Biddle, et al., 2011, Lubans, et al., 2012, Mhurchu, et al., 2009, Salmon, et al., 2008). A recent meta-analysis (Biddle, et al., 2011) highlighted the potential of interventions to reduce sedentary behaviour among youth and the need to improve our understanding of the determinants of screen-time.

Self-determination theory (SDT) has emerged as a prominent theory for explaining adolescents' physical activity behavior (Hagger, et al., 2005, Lonsdale, et al., 2009, Plotnikoff, et al., 2013, Rosenkranz, et al., 2012), but little is known regarding the utility of SDT to explain young people's screen-time behaviors. Central to SDT is the assertion that motivation exists along a continuum, ranging from non-self-determined to self-determined forms of behavioral regulation (Ryan and Deci, 2007, Wilson, et al., 2012). The six constructs that contribute to the SDT continuum are: amotivation, external regulation, introjected regulation, identified regulation, integrated regulation and intrinsic motivation (Ryan and Deci, 2007). Amotivation refers to a lack of motivation to perform the behavior. External regulation involves engaging in the behavior to satisfy an external demand. Introjected regulation is concerned with avoiding feelings of guilt, shame and/or to enhance feelings of self-worth. More autonomous forms of motivation include identified, integrated and intrinsic regulation. With identified regulation, the individual values the outcome as personally important. Individuals who have integrated regulation believe that the behavior aligns with their deeply held values and beliefs. Finally, intrinsic motivation is driven by enjoyment, fun, interest, and the inherent satisfaction that comes from participating in the behavior (Deci and Ryan, 2002).

Evidence suggests that recreational screen-time in young people is associated with a range of modifiable socio-contextual factors, including sibling behavior, parental role modeling, and rules limiting screen-time (He, et al., 2010, Leatherdale and Wong, 2008, Ramirez, et al., 2011, Uijtdewilligen, et al., 2011), but little is known regarding adolescents' screen-time behavioral regulations. To the authors' knowledge, no measure exists to assess the different behavioral regulations for limiting screen-time. Therefore, the aim of the current study was to design and

evaluate a brief questionnaire to assess adolescents' motivation to limit their screen-time using a SDT framework.

Phase 1: Item development

Phase 1: Participants and procedures

This phase involved developing potential items for assessing adolescents' motivation to reduce their screen-time and determine their content validity. Our goal was to develop measures to assess the two broad categories of motivated behavior (Deci and Ryan, 2002): controlled and autonomous motivation. We specifically did not develop subscales to measure each type of regulation within these broad categories. This was a pragmatic decision based on concerns around participant burden and a belief that researchers would most likely wish to measure these broad forms using relatively brief measures. Four items for the controlled motivation subscale were designed to assess external and introjected regulation. Four items for the autonomous motivation subscale were focused on identified regulation. We decided not to include integrated regulation items because many youth have not developed a clear sense of self or the ability to self-reflect, which is required for this form of motivation (Vallerand, 1997). The original scale included the common stem "*I try to reduce my screen-time...*" and the original items are included in Table 1.

To determine the content relevance of the items, 30 experts in SDT were invited via email to assess the content validity of the scale using established methods (Dunn, et al., 1999, Hambleton, 1980). Each of the experts had a PhD in a relevant field and had published research papers related to SDT in refereed journals. Twenty four of the experts agreed to participate and all provided written feedback within six weeks of the original invitation. The experts were first provided with conceptual definitions of the underlying constructs. They were then asked to examine the items and rate the degree to which each item matched the content of the three domains using the following 5-point Likert scale: 1 =*Poor match* to 5 =*Excellent match*. Experts were also asked to comment on the overall utility of the measure and provide feedback for improvement.

Phase 1: Data Analysis

We used Aiken's (1985) item content-validity coefficient (V) to determine the relevance of each construct. The V value can range from 0 to 1. When there are 24 reviewers, V values are

significant at $p < .05$ for $V > .64$ and at $p < .01$ for $V > .68$ (Aiken, 1985). Cohen's d (1988) was used to determine whether the items were only relevant to a single construct. This index showed the magnitude of the difference between the mean ratings associated with two different constructs on the same item.

Phase 1: Results

The validity coefficients associated with six of the eight items exceeded the threshold value ($V > .68$, $p < .01$) (Table 1). Two items showed insufficient relevance to the intended construct ("*because I don't want to feel lazy*"- $V = .60$, $p > .05$ and "*because it allows me to do other worthwhile activities*"- $V = .63$, $p > .05$). Examination of mean ratings for each item and effect sizes indicated that all items were rated as more relevant to the intended constructs (Table 2).

Based on the content-validity coefficients (V) and the effect size estimates, six of the eight items were considered relevant to the intended constructs. However, following qualitative feedback from the expert reviewers, minor changes were made to three items. Also, the original stem was removed from the scale and integrated into each item using modified wording ("*I try to limit my screen-time...*"). A number of experts suggested that the scale should include an amotivation subscale and thus three items were developed to assess this construct.

In summary, Phase 1 provided evidence that six items designed to measure controlled and autonomous motivation for limiting screen-time had strong content validity. Furthermore, experts provided valuable suggestions regarding item wording and content. After minor revisions were made and three items designed to assess amotivation were added, the Motivation to Limit Screen-time Questionnaire (MLSQ) was finalized for testing in a sample of adolescents.

Phase 2: Factorial validity

Phase 2: Participants and procedures

The primary aim of this phase was to establish the factorial validity of the MLSQ in a sample of adolescent boys. A secondary aim was to examine the association between adolescents' motivation to limit their screen-time and their self-reported screen-time. Adolescent males spend more time engaged in screen-based recreation than their female peers (Currie, et al., 2012, Hardy, et al., 2010). International guidelines recommend limiting screen-time to less than two hours per day, but 70% of Australian (Hardy, 2011), 71% of English, 64% of Canadian and 54%

of US adolescent boys exceed these guidelines (Currie, et al., 2012). Adolescent boys from 14 secondary schools (N=342) in New South Wales (NSW), Australia participated in the study. Participants (mean age =12.7±.5 years) were adolescent boys who had been recruited to participate in a school-based physical activity and sedentary behavior intervention (Table 3). Study approval was obtained from the relevant human ethics committees and the school principals. Information and consent letters were sent home with students and those students who returned consent forms signed by parents or guardians were permitted to participate in the study.

Phase 2: Measures

Participants were provided with the following explanation: “*Screen-time refers to the time you spend sitting while watching television or DVD’s, playing electronic games (e.g. Xbox, PlayStation), using your iPhone/iPad or computer for anything other than homework (e.g., Facebook, games etc.)*”. The MLSQ included three subscales: i) *autonomous motivation*, (ii) *controlled motivation* and (ii) *amotivation*. Participants were asked to respond to the items using a 7-point Likert scale (1 =“*Not true at all*”; 7 =“*Very true*”). A revised version of the Adolescent Sedentary Activity Questionnaire (ASAQ) was used to assess adolescents’ screen-time (Hardy, et al., 2007). The ASAQ requires respondents to report the time (i.e., hours and minutes) they spend each day in a range of sedentary activities. As evidence shows that media multi-tasking (i.e., use of several devices simultaneously) is common in adolescents (Foehr, 2006, Rey-López, et al., 2012) and may inflate screen-time estimates, the ASAQ was modified accordingly. In the revised ASAQ, participants were asked to report their total recreational screen-time each day using the MLSQ screen-time referent, rather than the time spent in each of the individual screen-based behaviors (i.e., time spent watching TV, watching videos/DVDs and using the computer for fun).

Phase 2: Data analysis

The internal consistency of the three subscale scores was examined using alpha coefficients. Confirmatory factor analysis was used to examine the factorial validity of the hypothesized three-factor model in AMOS (version 19, IBM SPSS Inc., Chicago, Ill, USA). Following Hu and Bentler’s (1999) widely adopted two-index presentation strategy, model fit was assessed using the standardized root mean square residual (SRMR) and the comparative fit index (CFI). SRMR values $\leq .08$ and CFI $\geq .95$ are considered to indicate good fit. Subscales for autonomous

motivation, controlled motivation and amotivation were created by adding the items within each construct and dividing by the number of items. In addition, we calculated a relative autonomy index (RAI)(Deci and Ryan, 2002). Actual weightings used in different studies vary according to the number of behavioral subscales employed; however, convention is to weight regulations at the ends of the motivational continuum more strongly than regulations closer to the centre. The following protocol was considered to be the most appropriate, considering the structure of the MLSQ, $RAI = \sum([Autonomous \times 2] + [Controlled \times -1] + [Amotivation \times -2])$ (Wilson, et al., 2012). The association between motivation to limit screen-time and self-reported screen-time was examined using Pearson's bivariate correlations.

Phase 2: Results

The hypothesized three-factor model and the results supported the factorial validity of the MLSQ scores. Despite a significant Chi square result ($\chi^2 = 61.89$ ($df = 24$), $p < .01$), the data showed good fit to the model according to the approximate fit indices: SRMR = .07 and CFI = .96. The factor loadings were significant at ($p < .001$) and the standardized loadings ranged from .76 to .83 for the autonomous motivation scale, .51 to .77 for the controlled motivation scale and .67 to .74 for the amotivation scale (Table 4). Correlations among the factors ranged from -.55 to .48 and none of the 95% CIs associated with these point estimates encompassed unity, thereby supporting the discriminant validity of MLSQ scores. Cronbach alphas were: autonomous motivation ($\alpha = .75$), controlled motivation ($\alpha = .65$) and amotivation ($\alpha = .84$). While the alpha for the controlled motivation scores was slightly lower than is commonly deemed desirable (i.e., .70), this result was not concerning given the small number of items (3-items) and the broad nature of the construct. Screen-time showed weak-to-moderate negative associations with autonomous ($r = -.31$, $p < .001$) and controlled ($r = -.19$, $p < .001$) motivation and a weak-to-moderate positive association with amotivation ($r = .23$, $p < .001$). There was a negative correlation between RAI and screen-time ($r = -.27$, $p < .001$).

Phase 3: Test-retest reliability

Phase 3: Procedures and participants

The aim of this study was to determine the test-retest reliability of the final MLSQ in a sample of adolescent boys ($N = 48$) attending a school not involved in the previous study. Assessments were conducted by trained research assistants and completed at the study school using an online questionnaire on two occasions separated by one week (Trial 1 and Trial 2, hereafter called T1

and T2). Study approval was sought and obtained from the relevant human ethics committees and the school principal from one secondary school in Newcastle, NSW, Australia. Information and consent letters were sent home with students and those students who returned signed forms were permitted to participate in the study. Eligible participants were adolescent boys in years 7 to 10 from the study school (Table 3). The final sample included 48 males (mean age = 14.3 \pm 1.3 years).

Phase 3: Data analysis

Statistical analyses were conducted using PASW Statistics 17 (SPSS Inc. Chicago, IL) software and alpha levels were set at $p < .05$. Intraclass correlation (ICC) was used to provide an indication of how well the ranking (i.e., from lowest value to highest value) of participants in the first trial (T1) was replicated in the second trial (T2) (Hopkins, 2000). Changes in mean scores were assessed using paired samples t-tests to identify systematic and random change in trial results. Bivariate correlations between the inter-trial difference (T2-T1) and the mean of the trials $[(T2-T1)/2]$ were used to explore proportional bias.

Phase 3: Results

The ICC values were .82(95% CI = .67 to .90) for autonomous motivation, .70(95% CI = .47 to .83) for controlled motivation, .67(95% CI = .41 to .82) for amotivation and .81(95% CI = .66 to .89) for the RAI (Table 5). The group mean differences (i.e., T2-T1) were small and none of the correlations between the inter-trial differences and the mean of the trials were significant.

Discussion

In this paper we report the findings from three inter-related studies focused on the development and psychometric testing of a questionnaire designed to assess adolescents' motivation to limit their screen-time. Evidence from the three studies in this paper supports the content validity, internal consistency, factorial validity, and test-retest reliability of the MLSQ scores. Importantly, motivation scores were found to correlate in an ordered manner consistent with SDT tenets, thus supporting the nomological validity of the scores (Messick, 1980).

The MLSQ was designed as a brief measure for use with children and adolescents and includes autonomous and controlled motivation subscales, but not separate measures for each regulation (e.g., identified regulation, integrated regulation and intrinsic motivation). Scale length and

complexity can have a negative effect on the quality of research data and the number of questionnaires completed in their entirety (Dillman, et al., 1993). This is especially true with children and adolescents, who have shorter attention spans (Ganassali, 2008, Garmy, et al., 2012). The MLSQ was designed for use in both epidemiological and intervention research to identify the modifiable determinants of screen-time in young people and it is likely that it will be used in conjunction with a range of psychosocial and behavioral scales.

Consistent with the tenets of SDT, amotivation was positively associated with self-reported screen-time, while both controlled and autonomous motivations were inversely associated with screen-time. As expected, adolescent boys who did not recognize the importance of limiting their screen-time (i.e., high amotivation) reported the highest levels of screen-time. There was a weak negative association between controlled motivation and screen-time behavior. On the surface this finding could be interpreted as being contrary to SDT tenets that suggest that long-term behavioral persistence will likely not result from controlled motivation and that autonomous motivation is necessary for people to self-regulate their screen-time over the long term. However, it must be noted that our study design was cross-sectional. It is plausible that the influence of controlled motivation on screen-time behavior will lessen over the long-term and in particular when adolescents transition to adulthood and have increased freedom.

In the current study we modified the ASAQ to prevent inflated screen-time estimates due to media-multi-tasking (Foehr, 2006, Rey-López, et al., 2012). The ASAQ and many other screen-time measures (Lubans, et al., 2011) require participants to report the time they spend in a variety of recreational screen-time behaviors (e.g., watching television, playing computer games, surfing the internet). Screen-time estimates are then based on the total time reported by participants in each of the behaviors. However, evidence has shown that young people often use multiple devices (e.g., laptops, smart phones and televisions) simultaneously (Foehr, 2006, Rey-López, et al., 2012), which may contribute to inflated screen-time estimates. Interestingly, the median recreational screen-time reported by adolescent boys in the current study was 99 mins/day. By contrast, the median screen-time self-reported by adolescent boys in the recent NSW Schools Physical Activity and Nutrition Survey (Hardy, et al., 2010), which also used the ASAQ, was 175 mins/day. Respondents are not asked to consider media-multitasking when completing the ASAQ and scoring adjustments are only made if reported values are implausible (e.g., participant reports more than 24 hours of screen-time in one day).

Developing an understanding of how parents influence their children's motivation is particularly important as children become adolescents and are provided with more autonomy for their recreational time. If parental rules and behaviors enhance controlled, but not autonomous motivation to limit screen-time, adolescents may choose sedentary alternatives over active ones when provided with more freedom. Alternatively, parents may be able to enhance autonomous motivation to limit screen-time, by employing autonomy supportive strategies, such as involving their children in the formulation of household rules.

Strengths and limitations

To our knowledge, this is the first study to describe the validity and reliability of scores derived from a measure designed to assess adolescents' motivation to limit their screen-time. However, there are some limitations that should be noted. First, the MLSQ has limited utility for testing theoretical assumptions as it does not include items that assess all of the SDT regulations. Second, the reliability and validity of the original ASAQ was established in adolescent girls and the psychometric properties of the modified version used in the current study are unknown. Finally, although the scale was developed for all adolescents, the validity and reliability studies were conducted with boys only.

Conclusion

Our three inter-related studies have demonstrated the validity and reliability of the MLSQ in adolescent boys. However, psychometric testing is an ongoing process and additional studies are needed in diverse populations. Researchers are encouraged to use the MLSQ in epidemiological and intervention studies to improve our understanding of the modifiable determinants of screen-time in young people.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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Motivation to Limit Screen-time Questionnaire (MLSQ)

Instructions:

Screen-time refers to the time you spend sitting while watching television or DVD's, playing electronic games (e.g. Xbox, PlayStation), using your iPhone/iPad/tablet or computer for anything other than homework (e.g., Facebook, games, etc.).

Please indicate how true each statement is for you by selecting/circling ONE RESPONSE per statement.

Questions	Not at all true							Somewhat true		Very true	
	1	2	3	4	5	6	7	8	9	10	11
1. I try to limit my screen time because I believe that too much screen-time is bad for my health	1	2	3	4	5	6	7				
2. I try to limit my screen-time because my parent(s) will get angry with me if I don't	1	2	3	4	5	6	7				
3. I can't see why I should bother limiting my screen-time	1	2	3	4	5	6	7				
4. I try to limit my screen-time because I believe it is important	1	2	3	4	5	6	7				
5. I try to limit my screen-time because I feel guilty if I spend too much time in front of a screen	1	2	3	4	5	6	7				
6. I don't see the point of limiting my screen-time	1	2	3	4	5	6	7				
7. I try to limit my screen-time because it gives me time to do other things that are important to me	1	2	3	4	5	6	7				
8. I try to limit my screen-time because my parent(s) pressure me to do so	1	2	3	4	5	6	7				
9. I don't see any reasons why I should limit my screen-time	1	2	3	4	5	6	7				

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