REVIEW ARTICLE

Tools to Assess Screen-related Dependency in Children: a Narrative Review of Validated Questionnaires

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ABSTRACT

Children are using digital screen media at an even younger age as they use it for a wide range of activities such as watching videos, playing games, and educational purposes. Due to its accessibility and portability, children also spend a significant amount of time on screen. Excessive screen time in children is associated with many consequences, including language delay, hyperactivity, impulsivity, visual problems, and lower psychological well-being. With the emergence of behaviour addictions related to technologies such as addiction towards online games, the internet, and the mobile phone, researchers are looking into these incidences among children. However, a validated and reliable tool is important to detect the problem early, especially for young children at increased risk. To date, many tools have been developed to detect screen-related dependencies for adolescents and adults but lacking among children. This review aims to elicit tools available specifically for children below 10 years of age, to analyse its psychometric properties and validation process as well as to compare between them.

Keywords: Screen media, Digital, Addiction, Questionnaires, Children, Preschool

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INTRODUCTION

Screen media is defined as "media specifically produced, created for, and unfolding on the screen yet are general enough to encompass a broad array of different media, both moving (film, video, television, and gaming) as well as those which are generally more static (websites, social media, blogs)" (1 p250). With the rapid advancement in technology, screen media now plays a significant part in our daily lives in almost all forms of activities. The affordability of screen media devices means that children are exposed much earlier. A nationwide survey in the United States showed that 74% of children below two were exposed to the screen (2). While in Malaysia, the National Health Morbidity Survey (NHMS) 2016 for Maternal Child Health (MCH) showed that the prevalence of children less than two years old who were exposed to the screen was 73.3%, which makes it worryingly similar with a developed country (3). As screen media devices are getting more portable and high-speed internet more accessible, children are at risk of being exposed to the screen longer and continuously, especially to online streaming content such as online videos. A recent survey indeed had shown that online videos now dominate children's screen time, replacing the television as the screen media most used by children previously. The same study showed that children from birth to eight years old spent about two and half hours on screen media daily (4). In Malaysia, 52.2% of children under five years of age were exposed to the screen for more than 2 hours per day (3). This is longer than the recommended time limit suggested by The American Academy of Pediatrics (AAP). The AAP recommends no media for children under two years old except for video calls and only up to 1 hour of quality media for children from 2 to 5 years old per day (5).

Prolonged exposure to screen media beyond the recommended limits is associated with several health complications, such as language delay (6), hyperactivity (7), impulsivity (8) , visual problems (9), and lower psychological well-being (10). Neurobiological research has found evidence to suggest that the effect of problematic screen media use is associated with epigenetic and brain structure changes in young children (6,11,12). This has led to concern amongst some researchers of another complication of the screen: screen media dependency. Screen media dependency is a term used to describe the use of the screen in a problematic manner (which includes preoccupation, withdrawal symptoms, increasing tolerance, failure to reduce or stop screen activities, and so on), which affect health and daily functioning (12). In literature, various

terminologies are used in classifying screen media-related dependencies, which are interchangeable with one another, such as internet addiction, mobile phone dependency, video game disorder, etc. It is not suitable to categorize a specific media addiction to young children since they are generally exposed to all kinds of screen media devices such as television, mobile phones, laptops, and tablets (13).

Research on screen media-related (such as internet, smartphone, and video games) dependencies are established among adolescents, teenagers, and adults, with worrying results. But with surveys showing earlier and increasing use of screen media devices among young children, attention is now shifting to this age group. There are also other reasons why screen media dependency research need to concentrate on this age group. Firstly, young children's brains are at a critical stage of development and possibly at higher risk of severe adverse effects. Between the age of one to two years, the brain is at the peak of plasticity, producing excess neurons before it is pruned by early adolescence (14,15). WHO (World Health Organization) defines adolescence as the age from 10-19 years of age (16). Therefore, the earlier the detection during childhood may lead to a better outcome with intervention and rehabilitation. Secondly, hyperactivity and impulsivity were observed with prolonged exposure of screen in experimental studies on rats (8), and hyperactivity developed during preschool years are one of the risk factors for future substance and alcohol abuse as well as other behavioural problems (17). Therefore, screening and detecting screen media dependency in younger children may lead to a better outcome if intervened early with parental involvement.

However, research on screen media-related dependencies among young children below the adolescence age (less than 10 years) is scarce. This could be due to the lack of suitable tools to measure screen media dependency in this age group. Therefore, the purpose of this paper was to search for any appropriate tools that can be used to screen for media related dependency in children less than 10 years of age; to evaluate their validation process; to analyse the psychometric properties of each tool; and to make an in-depth comparison, with the purpose to facilitate researchers in choosing the right tool.

METHODS

We searched two databases for relevant articles: PubMed and PsycInfo. Search terms for PubMed were MeSH terms [Internet Addiction] AND [Questionnaire Design] AND [Validation Studies]. Results were further filtered by year of publication from 2015 to 2020. and age categories from 2-12 years old. Search terms for PsycInfo were (screen OR media OR videogame OR internet OR smartphone OR digital) AND (addiction OR dependence OR problematic OR disorder) AND (preschool OR children) AND (questionnaire OR tool OR measure) AND (validation OR development). Results were further filtered by age group (birth to 12 years), Methodology (Quantitative measures), and year of publication from 2015 to 2020. The language of publication was restricted to English in both databases. 77 articles were manually reviewed by title and abstracts by two reviewers working together to include and exclude relevant studies. The full-text articles of the final list were then examined in more detail. Additional articles found in references were hand-searched on Google Scholar (Figure I).

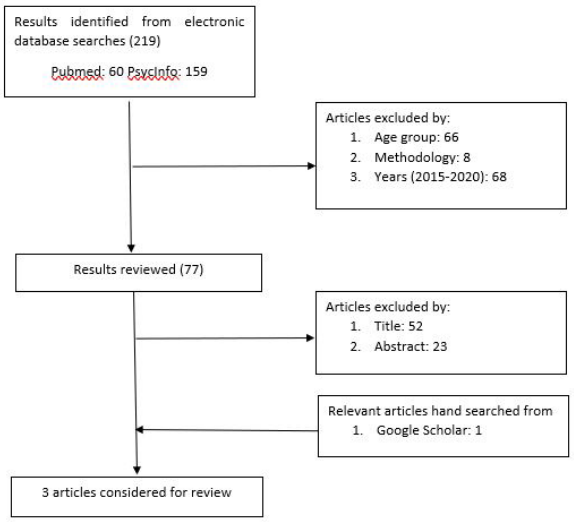

Figure 1: Flowchart of literature included for review

Selection process

Inclusion criteria

Articles that focused on new questionnaire development for any screen-related addiction and the age range of the participants from 4 to 9 years old were selected.

Exclusion criteria

Articles were excluded if it is a commentary and if full-text articles were not available.

RESULTS

We identified 3 tools to detect screen-related addictive behaviour that can be used for young children less than 10 years old, which were the Videogame Addiction Scale (VASC) by Griffith et al, the Digital Addiction Scale for Children (DASC) by Hawi et. al, and the Problematic Media Use Measure (PMUM) by Domoff et. al.

The Videogame Addiction Scale for children (VASC) was developed to assess video game addiction among 780 Turkish schoolchildren aged 9 to 12 years old (18). Five specialists in the academic and psychological fields were involved in the development of the initial draft. Its Exploratory Factor Analyses (EFA) resulted in 21 items and a 4-factor structure explaining 55% of the variance.

The 4-factor structure was "self-control, reward/ reinforcement, problem, and involvement" (12 p874). The VASC was found to have good internal consistency reliability of 0.89. The Confirmatory Factor Analyses (CFA) found the VASC to have an excellent fit (RMSEA = 0.05 and CFI 0.96) (18). Overall, the VASC scale is a reliable and valid questionnaire to be used. For this scale, the authors recommended that the responses' scores to be summed up, with a total score ranging from 21 to 105. A score above 90 indicates a possible addiction to video games, making this scale a screening and not a diagnostic tool. The time to complete the scale was approximately 25 minutes. Based on our knowledge, the VASC scale is only available in the Turkish language.

Another questionnaire is the Digital Addiction Scale for children (DASC) (19). It is a self-reporting instrument that was constructed on the internet gaming disorder from DSM V and Griffith's 6 core addiction criteria. This scale was validated in Lebanon among 822 schoolchildren but is available in English. The content was validated by an English teacher, scale development professionals, and child psychologist. Discriminant validity is good as none of the 9 criteria highly correlate with each other. Its internal consistency reliability is excellent at 0.936. It contains a 4-factor structure with 21 items obtained via exploratory factor analysis (EFA). CFA found that the DASC had a perfect fit and confirmed the dimensional structure (RMSEA: 0.0418, CFI: 0.959). The DASC score underwent criterion-related validation correlated with duration using digital devices. It was used to assess children aged 9 – 12 years old who were already in primary school and exposed to digital devices in various ways. The scores for DASC range from 25 to 125. The higher the scores mean higher digital dependency.

The latest questionnaire produced to detect children's problematic media use was the Problematic Media Use Measure (PMUM) (20) which was developed in the United States and to be used for children from the age of 4 to 11 years old. The responses were from 632 parents. It was developed based on the DSM V's 9 criteria of internet gaming disorder. Experts involved in content validity were from pediatrics, developmental and clinical psychology, communications, and adolescent medicine. The Cronbach alpha was 0.97 for 27-item questionnaire and 0.93 for PMUM short form (PMUM SF). Exploratory Factor Analyses (EFA) of the items found one-factor construct of screen media addiction. The authors proceeded to conduct Confirmatory Factor Analysis (CFA) for the PMUM-SF only since it has "demonstrated similar psychometric properties, was highly correlated with the PMUM full scale, similarly predicted child psychosocial difficulties and was shorter" (11 p7). The CFA for PMUM-SF was RMSEA=0.085, CFI=0.961, and SRMR=0.024, which showed an acceptable fit to the data. The finalized 27 items of the PMUM reflect all 9 criteria of internet gaming disorder, including unsuccessful control, loss of interest, preoccupation, psychosocial consequences, serious problems due to use, withdrawal, tolerance, deception, escape, or relieve mood (Table I).

Table I: Criteria of each Questionnaire

PMUM	DASC	VASC
Unsuccessful control	Deception	Self control
Loss of interest	Conflict	Reward/re-inforcement
Preoccupation	Displacement	Problems
Psychosocial consequences	Problems	Involvement
Serious problem due to use	Preoccupation	
Withdrawal	Relapse	
Tolerance	Mood modification	
Deception	Withdrawal	
Escape/relieve mood	Tolerance	

DISCUSSION

The questionnaires share some similarities and differences that can be compared (Table II). The VASC was validated among Turkish children, the DASC among Lebanese children, while the PMUM was validated among predominantly (84%) White ethnicity in the United States. The tools may not be generalizable to other populations, and it is recommended to translate and validate in local settings before being used. The DASC and the PMUM were the only questionnaires developed in English, while the VASC was developed in the Turkish language. To our current knowledge, an English version is not yet available. For content validation, all three tools developed items from the Internet Gaming Disorder (IGD) criteria in DSM V, with the VASC did not mention which criteria it followed. The PMUM specifically said following all 9 criteria from the IGD in DSM V, while the developers of DASC also based on Griffith's 6 core addiction criteria, including (problems, deception, and displacement). The VASC and DASC are targeted at children ages 9 to 11, and both questionnaires underwent a cohesive language reviewing process to ensure the questions were suitable to be understood for that age group. Both DASC and VASC had experts in education in their team to ensure the language was ideal for their target population. The VASC was the only questionnaire that underwent face validity among children. The questions developed for the PMUM were created for adults since it is a parent-report measure. The wordings for their questions were reviewed during content validity.

All three tools were analysed for their internal consistency reliability. As for validation analysis, all three tools underwent a robust construct validity. The VASC and DASC both stated that they went through the face and/ or language validity, while it was not clear whether the PMUM had any, though it is noted that they had a communication expert as part of the team. The DASC and PMUM also underwent criterion and convergent validity, respectively, while the authors of VASC noted their limitations in not doing this.

Table II: Comparison between questionnaires

Tool	Author	Target age	Number of items	Areas of strengths							Report measures	
				1	2	3	4	5	6	7	A	B
VASC	Griffiths et. Al 2017	9-11	21	●	●		●			●	●	
DASC	Hawi et. Al 2019	9-11	25	●	●	●	●	●		●	●	
PMUM	Domoff et. Al 2019	4-11	27	●		●	●	●	●			●

1. Internal consistency reliability
2. Face/language validity
3. Content validity
4. Construct validity
5. Convergent or concurrent validity
6. Short Form
7. Scoring information

A. Self-report measure
B. Parent report measure

Two questionnaires, the VASC and the PMUM went through the validation process using two separate samples. At the same time, the creators of DASC did not mention this method, so it was assumed to have gone through its validation procedure using one sample. The standard and recommended procedure for validation studies are to use two separate samples (21,22). The first sample was to determine the tool structure, while the second sample was to confirm the fit of the tool structure.

The VASC and the PMUM can be used for any media device, while the DASC can be explicitly used for video game use. Video game addiction is a suitable parameter for the age of 9 – 12 years old since playing a videogame is common among children (23,24). The creators of the VASC and PMUM felt that the approach towards screen devices, in general, is suitable since young children tend to use multiple devices. In this aspect, the PMUM is the only questionnaire used among preschool children, starting from the age of 4. While the VASC and the DASC both can be used from the age of 9. Because the PMUM is a tool that can be used in young children, it is also the only questionnaire that uses parent's report measure, which is essential to get accurate information via the parents or the primary caregiver. The creators of PMUM also produced a validated short-form version along with the extended version, which is fast and practical to be used in studies where other tools are also being used.

All questionnaires used a 5-point Likert scale answer format. In addition, both DASC and VASC gave instructions on scoring and interpretation while the PMUM did not mention this. Lastly, all three share the same limitations of self-reporting tools, which may be influenced by memory recall and social desirability biases.

Eventhough the aim of this review was to find tools that are suitable to be used for children below adolescence age (<10 years old), there is only one questionnaire (the PMUM) available at this moment that covers the early childhood age range. The other two questionnaires were developed for children starting from the age of 9. We coud not find any tools for the toddler age group . Therefore it is recommended that more research on developing parent report measures for younger age groups such as pre-school age (4-6 years old) and toddler or nursery age (1-3 years old) to be carried out, since these are the age groups where screen media are usually introduced. Earlier detection of young children at risk of dependency may lead to successful intervention outcome.

CONCLUSION

Research has shown that prolonged use of screen media may have health implications among children. However, screening tools for screen-related dependency for young children below 10 years old are still scarce, with the majority of tools were developed for adolescents and older age groups. Our search came up with only 3 tools, and out of this, one tool can be used exclusively for young children from pre-school age. In addition, only two tools were available in English, and one tool was specific for video game addiction. All three tools are valid and reliable to be used. Still, re-validation in the researcher's target population is highly recommended since all three tools were developed and validated in specific populations. It is also recommended for more parent-report questionnaires to be developed especially for pre-school and nursery age children.

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