

A Comprehensive Framework for Assessing Screen-Based Media Use in Young Children: Adapting the ScreenQ Measure for Broader Application

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Abstract

Screen-based media use is increasingly prevalent among young children, posing various health and developmental risks. Despite the American Academy of Pediatrics (AAP) recommendations on screen access, frequency, content, and co-viewing, a comprehensive and validated composite measure reflecting contemporary media use patterns has been lacking. This study addresses this gap by introducing and psychometrically assessing the ScreenQ, a novel 15-item parent-report measure designed to align with AAP recommendations. We employed Rasch methods and Spearman's ρ correlations to evaluate the ScreenQ's properties. The measure was administered to 69 parent-child dyads, with children aged 36 to 63 months. Four established external criteria—Comprehensive Test of Phonological Processing, Second Edition (CTOPP-2), Expressive Vocabulary Test, Second Edition (EVT-2), Get Ready to Read! (GRTR), and StimQ-P (cognitive stimulation in the home)—were utilized to assess its validity. Our findings indicate that the ScreenQ possesses strong psychometric properties, with its scores negatively correlating with children's executive function, language, and literacy skills, as well as the cognitive stimulation level of their home environment. These results underscore the ScreenQ's potential as a valuable tool for assessing screen-based media use in young children, offering critical insights into its associations with developmental outcomes and parenting practices. This research contributes to

the understanding of media's impact on early childhood development and provides a foundation for future interventions and policy-making.

Keywords: Screen-based media use, young children, ScreenQ, psychometric assessment, child development

1 Introduction

In the contemporary digital era, screen-based media has become an ubiquitous component of children's daily lives, with exposure often commencing in infancy[1]. This pervasive integration of digital devices, particularly portable ones, offers unprecedented access to a vast array of content, fundamentally reshaping the developmental ecosystem in which children learn, play, and form relationships [1, 2]. The American Academy of Pediatrics (AAP) has issued recommendations that highlight the cognitive, behavioral, and health risks associated with excessive and inappropriate screen time[3]. These risks include, but are not limited to, obesity[4], language delay[5], sleep disturbances[2, 6], impaired executive function[7], and diminished parent-child engagement[8–10]. Recent neurobiological studies have also suggested potential adverse effects on brain structure and connectivity[11–13]. Despite these well-documented risks, screen media consumption among young children has been steadily increasing, with recent estimates indicating an average of nearly three hours per day for children aged three to eight[14].

The rapid evolution of screen-based technologies and the diversification of media content present a significant challenge for accurately assessing children's media exposure and its impact. Existing measurement tools are often outdated, focusing primarily on traditional television viewing[15], or they rely on simplistic methods like parent-reported diaries or single-frequency items for various devices[16, 17]. Consequently, there is a critical evidence gap due to the absence of a validated, composite measure that reflects the multifaceted nature of modern screen media use, including the prevalence of portable devices and the variety of available content and applications. This study addresses this gap by introducing and psychometrically evaluating the ScreenQ, a novel, comprehensive parent-report measure of screen-based media use in preschool-aged children.

The AAP's recommendations provide a conceptual framework for understanding the various dimensions of screen media use that may influence child development. These dimensions include not only the quantity of exposure but also the quality of the content, the context of viewing (e.g., co-viewing with a caregiver), and the accessibility of screens (e.g., in the bedroom)[12]. While numerous studies have explored the associations between screen time and various developmental outcomes, the lack of a standardized and comprehensive measurement tool has limited the comparability and generalizability of their findings. The ScreenQ was developed to address this limitation by

incorporating the key domains identified in the AAP recommendations into a single, composite measure.

A significant limitation of previous research is the reliance on measures that fail to capture the complexity of contemporary screen media use. The proliferation of portable devices, such as tablets and smartphones, has made it more challenging to monitor and quantify children's screen time accurately. Furthermore, the nature of the content consumed and the extent of parent-child interaction during media use are crucial factors that are often overlooked. The ScreenQ was designed to fill these gaps by providing a more holistic assessment of children's screen media experiences, encompassing access, frequency, content, and co-viewing.

The primary objective of this study is to introduce and psychometrically assess the ScreenQ as a novel, composite measure of screen-based media use in young children. We aim to establish the internal consistency and criterion-related validity of the ScreenQ by examining its associations with a range of established measures of cognitive abilities and parenting practices. Specifically, we hypothesize that higher ScreenQ scores, indicating greater non-adherence to AAP recommendations, will be negatively correlated with children's expressive language, phonological processing, emergent literacy skills, and the level of cognitive stimulation in the home environment. This study is positioned to make a significant contribution to the field by providing a much-needed, validated tool for researchers and clinicians to assess children's screen media use in a more comprehensive and nuanced manner.

This paper is organized as follows: Section 2 provides a review of the relevant literature on screen media use in young children and its associations with developmental outcomes. Section 3 describes the methods used to develop and validate the ScreenQ, including the sample characteristics, the reference measures, and the statistical analyses. Section 4 presents the results of the psychometric analyses, including the item-level statistics, the internal consistency, and the criterion-related validity of the ScreenQ. Section 5 discusses the implications of the findings, the limitations of the study, and directions for future research. Finally, Section 6 provides a summary of the main conclusions.

2 Related Work / Literature Review

2.1 Evolution of Screen Media Research and Measurement Challenges

The landscape of screen media use has undergone a dramatic transformation over the past few decades, evolving from communal television viewing to highly individualized and portable device engagement [18]. Early research on screen time primarily focused on television exposure and its associations with child development, often employing simple measures such as daily viewing hours or parental reports of television presence in bedrooms [19]. While these studies provided foundational insights into the potential negative impacts of excessive screen time, such as obesity [4], sleep disturbances [6], and language delays [5],

they are increasingly insufficient to capture the complexity of contemporary media environments. The advent of smartphones, tablets, and a vast array of interactive applications has introduced new dimensions to screen media use, including diverse content types, interactive features, and varied social contexts of engagement [1, 2]. This technological shift necessitates more nuanced and comprehensive measurement tools that can account for these evolving patterns of use.

Traditional measures often fail to differentiate between passive viewing and active, interactive engagement, or between educational content and purely entertainment-driven media [17]. Furthermore, the context of media use, such as whether it occurs during meals or before bedtime, and the degree of parental involvement (e.g., co-viewing, discussion), are critical factors that influence developmental outcomes but are rarely captured comprehensively by existing instruments [3, 8, 10]. The lack of a gold standard measure for screen time that reflects current usage patterns and AAP recommendations highlights a significant gap in the literature, hindering robust research and effective clinical guidance.

2.2 The American Academy of Pediatrics Recommendations and Conceptual Frameworks

The American Academy of Pediatrics (AAP) has consistently updated its recommendations regarding children's screen media use, moving beyond simple time limits to emphasize a more holistic approach that considers content, context, and co-viewing. The AAP's guidelines are structured around four key domains: access to screens (e.g., presence in bedrooms, monitoring portable devices), frequency of use (e.g., daily limits, age of initiation), media content (e.g., non-violent, slower-paced, educational value), and caregiver-child co-viewing (e.g., shared engagement, discussion during and after use). These recommendations underscore the importance of qualitative aspects of screen time, recognizing that not all screen exposure is inherently detrimental and that certain types of media use, particularly when mediated by engaged caregivers, can offer developmental benefits.

Several conceptual models have emerged to frame the study of media effects on children, often drawing from ecological systems theory, which posits that child development is influenced by multiple interacting systems, from the immediate family environment to broader cultural contexts. Within this framework, screen media is viewed as an integral part of the child's "ecosystem," with its impact mediated by various factors, including family dynamics, parenting practices, and the child's individual characteristics. The ScreenQ measure, as presented in the source paper, is explicitly designed based on the AAP's conceptual model, aiming to provide a comprehensive assessment that aligns with these multi-dimensional aspects of media use .

2.3 Existing Measurement Tools and Their Limitations

While various instruments have been developed to measure children's screen time, most suffer from limitations that restrict their utility in the current media landscape. These include:

- **Self-report or Parent-report Diaries:** These methods can provide detailed accounts of media use but are often burdensome for participants, leading to low compliance and potential recall bias [16]. They may also struggle to capture simultaneous media use or the specific content consumed.
- **Single-item Frequency Measures:** Many studies rely on single questions about daily screen time, which provide a quantitative estimate but lack the granularity to assess the quality, context, or content of media exposure [17]. Such measures cannot differentiate between a child watching an educational program with a parent versus passively consuming violent content alone.
- **Technology-specific Measures:** Some tools focus exclusively on specific technologies, such as television viewing [15], neglecting the increasing prevalence and impact of portable devices like tablets and smartphones. This narrow focus fails to capture the full spectrum of a child's screen media environment.
- **Lack of Composite Measures:** A significant limitation is the absence of validated composite measures that integrate multiple dimensions of screen media use into a single, comprehensive score. This makes it challenging to assess adherence to multi-faceted guidelines like those from the AAP and to understand the cumulative impact of various media-related behaviors.

For instance, the StimQ assessment, which measures cognitive stimulation in the home, served as an inspiration for the ScreenQ's conceptual model, particularly in its approach to assessing environmental factors influencing development [Source Paper, p. 1212]. However, StimQ does not specifically focus on screen media. Other validated measures, such as the CTOPP-2 (Comprehensive Test of Phonological Processing, Second Edition), EVT-2 (Expressive Vocabulary Test, Second Edition), and GRTR (Get Ready to Read!), are crucial for assessing developmental outcomes but do not provide insights into the media behaviors themselves[Source Paper, p. 1212].

2.3.1 The Need for a Novel, Comprehensive Measure

The limitations of existing measures underscore the critical need for a novel, psychometrically sound, and comprehensive tool that can accurately assess screen-based media use in young children in the context of contemporary media environments. Such a measure must be capable of capturing not only the quantity of screen exposure but also the qualitative aspects, including content, context, and co-viewing, as outlined by the AAP recommendations. The

development of the ScreenQ directly addresses this need by providing a composite score that reflects adherence to these recommendations, offering a more holistic and ecologically valid assessment of children's screen media experiences. This innovative approach allows for a more precise understanding of the complex interplay between screen media use, parenting practices, and child developmental outcomes, paving the way for more targeted interventions and evidence-based policy development.

3 Methods

3.0.1 3.1 Research Strategy and Design

This study employed a cross-sectional design to psychometrically assess the ScreenQ, a novel parent-report measure of screen-based media use in young children. The overall research strategy involved the development and refinement of the ScreenQ instrument, followed by its administration to a sample of parent-child dyads. Concurrently, a battery of validated external measures assessing child cognitive abilities and parenting practices were applied. The study aimed to establish the internal consistency and criterion-related validity of the ScreenQ by examining its correlations with these external criteria. This approach allowed for a comprehensive evaluation of the ScreenQ's utility as a composite measure reflecting adherence to AAP recommendations, particularly in the absence of a direct "gold standard" for screen time measurement in contemporary media environments.

3.1 Participants and Recruitment

The study was conducted between August 2017 and November 2018, involving a sample of 69 parent-child dyads. Participants were recruited through advertisements at a large children's medical center and local pediatric primary care clinics. Inclusion criteria for children were: age between 3 and 5 years (36 to 63 months), born at least 36 weeks gestation, from a native English-speaking household, no history of neurodevelopmental disorder conferring risk of delays, and no contraindications to MRI. The mean age of the children was 52 ± 8 months, with 51% being girls. The sample exhibited diversity in terms of household income and maternal education, as detailed in Table 1 of the original paper. All participating families received compensation for their time and travel. The study protocol received approval from the Institutional Review Board.

3.2 ScreenQ Measure Development and Administration

The ScreenQ is a 15-item parent-report measure conceptually derived from the four key domains of media use cited in the American Academy of Pediatrics (AAP) recommendations: access to screens, frequency of use, media content, and caregiver-child co-viewing. These domains are incorporated as subscales within the measure. The instrument was designed to be administered by a

clinical provider, with wording refined through consultation with measure development experts and parents of young children. A previous version was pilot tested and revised. Items are largely binary or ordinal (Likert scale), with some frequency-based items translated to an ordinal score based on AAP recommendations. Ordinal scoring assigns 0 to 2 points, with 0 indicating perfect adherence to recommendations and higher scores reflecting greater non-adherence. Weightings for binary items were determined a priori based on the level of evidence of risks (e.g., use in bedrooms scored 2 points for high risk, fast vs. slower-paced content scored 1 point for moderate risk). The total score ranges from 0 to 26 points. For this study, research coordinators administered the ScreenQ to a custodial parent in a private room, with responses entered into a REDCap database[20].

3.3 Reference Measures

To establish criterion-related validity, four validated measures of child cognitive abilities and parenting practices, known to be associated with screen-based media use, were utilized:

- **Expressive Vocabulary Test, Second Edition (EVT-2; Pearson):** A norm-referenced assessment of expressive vocabulary for children aged 2.5 years and older[21].
- **Comprehensive Test of Phonological Processing, Second Edition (CTOPP-2; Pearson; Rapid Object Naming subtest):** A comprehensive, norm-referenced instrument designed to assess phonological processing abilities, which are prerequisites to reading fluency[22]. The Rapid Object Naming subtest was chosen for its suitability for preschool-aged children, assessing efficiency of information retrieval and processing speed.
- **Get Ready to Read! (GRTR):** A norm-referenced assessment of core emergent literacy skills for children aged 3–6 years, predictive of reading outcomes [18].
- **StimQ-P:** A validated measure of cognitive stimulation in the home for children aged 3 to 6 years, comprising four subscales: availability of learning materials, reading, parental involvement in developmental advance, and parental verbal responsiveness [23].

The EVT-2, CTOPP-2, and GRTR were administered to the child prior to MRI scans, while the StimQ-P was administered to the parent after the ScreenQ.

3.4 Statistical Analysis

Statistical analyses were conducted in four main steps. First, demographic characteristics of the sample were computed. Second, descriptive statistics for all ScreenQ items, subscales, external standards, and relevant demographic variables were calculated. Third, individual ScreenQ items were analyzed using

a combination of classical test theory and modern Rasch analysis. Partial-credit Rasch modeling was deemed appropriate given the ordinal and varying nature of response options across items[24]. Rasch coefficients, expressed as log odds ratios (logits), were used to estimate item difficulty. Model fit was tested for each item to identify any undue influence on scale-level distributions. Finally, relationships between ScreenQ scores and those on external standards were explored using Spearman's $\rho(r\rho)$ correlation coefficients, chosen due to the non-normal distribution of the data. Cronbach's coefficient alpha (αCr) was used to assess internal consistency. The criterion for statistical significance was set at an unadjusted $\alpha = 0.05$. All analyses were performed using SAS v9.4 and Winsteps v4.0 software.

3.5 Results

3.6 Demographic Characteristics

The study included 69 parent-child dyads. The mean age of the children was 52 ± 8 months, ranging from 36 to 63 months. Girls constituted 50.7% (n=35) of the sample, while boys made up 49.3% (n=34). The racial distribution was 32% African American/Black (n=22), 67% Caucasian/White (n=46), and 1% Other (n=1). Parental marital status showed 29% single (n=20), 65% married (n=45), and 6% divorced/separated (n=4). Annual household income distribution was diverse, with 18.8% earning $<=\$25,000$, 14.5% between \$25,001 and \$50,000, 30.4% between \$50,001 and \$100,000, 20.3% between \$100,001 and \$150,000, and 15.9% above \$150,000. Maternal education levels were also varied: 10.1% had high school or less, 23.2% had some college, 34.8% were college graduates, and 31.9% had more than college education. These demographic details are summarized in Table 1.

Table 1: Demographic characteristics of participants (N=69)

Characteristic	N (%) or Mean \pm SD (Min, max)
Child age (months)	52 \pm 8 (36, 63)
36+	23 (33.3)
48+	28 (40.6)
60+	18 (26.1)
Child gender	
Male	34 (49.3)
Female	35 (50.7)
Child race	
African American/Black	22 (32)
Caucasian/White	46 (67)
Other	1 (1)
Parental marital status	
Single	20 (29)
Married	45 (65)

Characteristic	N (%) or Mean \pm SD (Min, max)
Divorced/separated	4 (6)
Annual household income (\$)	
$\leq 25,000$	13 (18.8)
25,001–50,000	10 (14.5)
50,001–100,000	21 (30.4)
100,001–150,000	14 (20.3)
Above 150,000	11 (15.9)
Maternal education	
High school or less	7 (10.1)
Some college	16 (23.2)
College graduate	24 (34.8)
More than college	22 (31.9)

3.7 Descriptive Statistics for ScreenQ and External Standards

Research coordinators reported no difficulties in administering the ScreenQ, with all parents completing the survey in less than 2 minutes and no concerns regarding item clarity. The mean ScreenQ total score was 9.6 ± 5.0 , with a range of 1 to 22. Subscale scores were as follows: Access 3.2 ± 2.0 (range 0–7), Frequency 2.6 ± 2.0 (range 0–7), Content 1.2 ± 1.3 (range 0–5), and Co-viewing 2.6 ± 1.5 (range 0–6).

For the external standards, the mean CTOPP-2 Rapid Object Naming standard score was 9.1 ± 3.2 (range 2–15). The mean EVT-2 standard score was 110.3 ± 15.4 (range 87–144), with 70% of scores falling within the average range for age ($\pm 1SD$; 85–115). The mean GRTR score was 16.5 ± 6.4 (range 5–25), with 18% below average, 38% average, and 44% above average. The mean StimQ-P total score was 41.8 ± 6.9 (range 21–52). These descriptive statistics are summarized in Table 2.

Table 2: Summary statistics for ScreenQ and external measures (N=69)

Measure	N	Mean \pm SD (Min, max)
ScreenQ total score	69	9.6 ± 5.0 (1, 22)
Access	69	3.2 ± 2.0 (0, 7)
Frequency	69	2.6 ± 2.0 (0, 7)
Content	69	1.2 ± 1.3 (0, 5)
Co-viewing	69	2.6 ± 1.5 (0, 6)
CTOPP-2 Rapid Object Naming scaled	49	9.1 ± 3.2 (2, 15)
EVT-2 scaled score	66	110.3 ± 15.4 (87, 144)
GRTR total score	69	16.5 ± 6.4 (5, 25)
StimQ-P total score	68	41.8 ± 6.9 (21, 52)

3.8 ScreenQ Item Analysis

Item analytics for the ScreenQ, including response frequency counts, percentages, item difficulty, standard error, and Spearman's ρ point-measure correlation, are presented in Table 3. All 15 ScreenQ items were evaluated for difficulty, smoothness, modality, polarity, and sufficiency of scores. Item response density was over a minimum of 5% for each response option. Rasch estimates of item difficulty were balanced overall and symmetrical around zero (average difficulty), ranging from -1.22 (less difficult; item 4: Use on school nights) to 1.45 (more difficult; item 10: Violent content). Point-measure correlations were all positive, ranging from 0.14 (item 12: Fast/slow content pacing) to 0.71 (item 7: Hours/day of use), indicating that each item contributed uniquely to the overall score. Item fit statistics were within acceptable limits, suggesting no outliers influencing the distributions. Inter-item correlations were low to moderate, with significant correlations ranging from $\rho = 0.25$ (items 1 and 2: bedroom access—has a portable device) to 0.72 (items 1 and 8: bedroom access—use to help sleep).

Table 3: Item-level summary statistics for ScreenQ (n=69), including response frequency counts and percentage for individual items, item difficulty, standard error, and Spearman's ρ point-measure correlation.

Item descrip- tion (ques- tion number)	Domain	0 f (%)	1 f (%)	2 f (%)	Item difficulty	Standard error	Point- measure correlation
Violent content (Q10)	Content	40 (58.0)	21 (30.4)	8 (11.6)	1.45	0.26	0.37
Use to help calm down (Q9)	Frequency	57 (82.6)	8 (11.6)	4 (5.8)	1.29	0.25	0.39
Fast/slow content pacing (Q12)	Content	42 (60.9)	5 (7.3)	22 (31.9)	0.84	0.3	0.14
Use during meals (Q3)	Access	51 (73.9)	18 (26.1)	N/A	0.66	0.29	0.46

Item descrip- tion (ques- tion number)	Domain	0 f (%)	1 f (%)	2 f (%)	Item difficulty	Standard error	Point- measure correlation
Use to help sleep (Q8)	Frequency	50 (72.5)	7 (10.1)	12 (17.4)	0.5	0.19	0.6
Screen(s) in bed- room (Q1)	Access	49 (71.0)	0 (0.0)	20 (29.0)	0.14	0.16	0.66
Co- view TV/videos (Q13a)	Inter - activity	43 (62.3)	26 (37.7)	N/A	0.04	0.27	0.2
Dialog after use (Q15)	Inter - activity	24 (34.8)	35 (50.7)	10 (14.5)	0.01	0.2	0.36
Chooses media by self (Q11)	Content	57 (82.6)	9 (13.0)	3 (4.4)	-0.07	0.16	0.53
Dialog during use (Q14)	Inter - activity	25 (36.2)	31 (44.9)	13 (18.8)	-0.12	0.19	0.25
Age child started use (Q6)	Frequency	32 (46.4)	7 (10.1)	30 (43.5)	-0.51	0.16	0.59
Hours/day of use (Q7)	Frequency	14 (20.3)	42 (60.9)	13 (18.8)	-0.51	0.22	0.71
Use while waiting (Q5)	Access	32 (46.4)	37 (53.6)	N/A	-0.73	0.26	0.47

Item descrip- tion (ques- tion number)	Domain	0 f (%)	1 f (%)	2 f (%)	Item difficulty	Standard error	Point- measure correlation
Co-use games /apps (Q13b)	Inter - activity	30 (43.5)	39 (56.5)	N/A	-0.87	0.26	0.44
Child has portable device (Q2)	Access	27 (39.1)	0 (0.0)	42 (60.9)	-0.9	0.15	0.57
Use on school nights (Q4)	Access	25 (36.2)	44 (63.8)	N/A	-1.22	0.27	0.26

3.9 Internal Consistency and Validity

Internal consistency of the ScreenQ, as estimated by Cronbach's coefficient alpha (α_{Cr}), was 0.74, indicating strong reliability for a new measure. For criterion-related validity, significant negative correlations were observed between ScreenQ total scores and all external standards (all $p \leq 0.01$): EVT-2 standard scores ($r\rho = -0.45$), CTOPP-2 Rapid Object Naming ($r\rho = -0.57$), GRTR ($r\rho = -0.30$), and StimQ-P ($r\rho = -0.42$). These correlations are visually represented in Figure 1, showing scatter plots of ScreenQ total scores against each criterion-referenced standard.

3.10 4.5 Demographic Associations

Significant correlations were found between higher ScreenQ scores and certain demographic variables. Specifically, higher scores were associated with male child gender ($r\rho = 0.31$), non-Caucasian race ($r\rho = 0.44$), unmarried parent ($r\rho = 0.41$), lower household income ($r\rho = -0.54$), and lower maternal education ($r\rho = -0.41$; all $p < 0.05$). No significant correlation was found with child age.

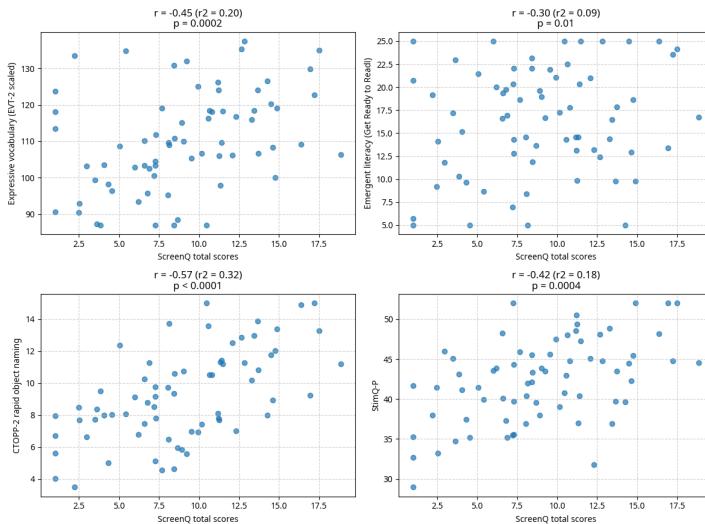


Fig. 1 Figure 1: Scatter plots of ScreenQ total scores vs. criterion-referenced standards.

4 Discussion

4.1 Interpretation of Findings and Comparison with Existing Research

This study provides initial psychometric evidence supporting the internal consistency and validity of the ScreenQ, a novel composite parent-report measure of screen-based media use in young children. The strong performance of the ScreenQ can be attributed to its conceptual model, which is directly derived from the comprehensive recommendations of the American Academy of Pediatrics (AAP). This evidence-based foundation guided the development of each item and the overall scale, ensuring its relevance to contemporary media use patterns and associated risks. The balanced range of item difficulty, interpreted as the frequency with which parents endorsed certain aspects of media use, suggests the ScreenQ's capacity to capture diverse usage patterns across a spectrum of adherence to AAP guidelines. For instance, items related to violent content, use for calming, and fast-paced content were found to be more difficult (less frequently endorsed), possibly reflecting parental awareness of AAP recommendations or social desirability bias. Conversely, items related to screen access (e.g., child having a portable device, use on school nights) were less difficult, aligning with the widespread prevalence of portable devices and their integration into children's daily routines.

The observed negative correlations between ScreenQ scores and measures of expressive language (EVT-2), phonological processing (CTOPP-2), and emergent literacy (GRTR) are consistent with a growing body of literature linking excessive screen time to language delays and impaired executive function[25–27]. The significant negative correlation with StimQ-P, a measure

of cognitive stimulation in the home, further suggests that higher ScreenQ scores are associated with less stimulating home environments, potentially mediated by decreased parent-child engagement during media use[10, 28]. This finding highlights the critical role of parental interaction and the quality of the media environment in mitigating the potential negative effects of screen exposure.

Inter-item correlations within the ScreenQ reveal important insights into the interconnectedness of various screen media behaviors. For example, the strong positive correlation between screens in the bedroom(Item 1) and hours of use, earlier initiation age, and use to aid sleep,aligns with established research on the detrimental effects of bedroom screens on sleep patterns and maladaptive media use[19, 29]. Similarly, the robust correlations associated with portable device access (Item 2) underscore their pervasive influence on overall screen time and related behaviors. These interrelationships emphasize the value of a composite measure like the ScreenQ in capturing the complex interplay of factors contributing to children's screen media experiences, rather than relying on isolated measures of screen time.

4.2 Limitations and Future Directions

Despite its strengths, this study has several limitations that warrant consideration. First, the relatively small sample size (N=69) and its specific demographic characteristics, while diverse, may limit the generalizability of the findings to broader populations or other cultural contexts. Future research should aim for larger, more diverse samples to enhance external validity. Second, as a parent-report measure, the ScreenQ is susceptible to social desirability bias, where parents may underreport behaviors perceived as undesirable. Future studies could incorporate objective measures of screen time (e.g., app usage data, direct observation) to validate parental reports and quantify potential biases. Third, the cross-sectional design of this study precludes the establishment of causal relationships between ScreenQ scores and developmental outcomes. Longitudinal studies are needed to explore the temporal dynamics and long-term impacts of screen media use on child development.

Furthermore, while the study focused on the potential risks of screen media use, it did not explicitly investigate potential benefits, such as those derived from high-quality educational content or interactive applications. Future research could explore the nuances of content quality and its differential effects on development. The ScreenQ's current version also excluded an item on "educational" use due to initial wording concerns; revising and reintroducing such an item in future versions would enhance its comprehensiveness, aligning more closely with the AAP's emphasis on content quality. Finally,while the ScreenQ was administered by research coordinators in this study, its feasibility for routine clinical use by parents during well-child visits needs further investigation, although its simple reading level and brief administration time suggest potential for adaptation.

4.3 Value and Implications

This study represents a significant step towards developing a psychometrically sound and comprehensive measure of screen-based media use in young children. The ScreenQ, grounded in AAP recommendations, offers a valuable tool for researchers and clinicians to assess complex media behaviors beyond simple time spent. Its ability to capture multiple dimensions of screen use and their associations with key developmental outcomes provides a more nuanced understanding of the impact of digital media on early childhood. The findings underscore the importance of parental guidance and the home media environment in shaping children's development. The ScreenQ can facilitate more targeted interventions, inform public health campaigns, and contribute to evidence-based policy development aimed at promoting healthy screen media habits in young children. Continued research, including longitudinal studies and validation with objective measures, will further enhance the utility and impact of the ScreenQ in this rapidly evolving field.

5 Conclusion

This study successfully introduced and psychometrically assessed the ScreenQ, a novel 15-item parent-report measure designed to comprehensively evaluate screen-based media use in young children, aligning with the American Academy of Pediatrics (AAP) recommendations. Our findings demonstrate that the ScreenQ exhibits strong psychometric properties, including robust internal consistency (Cronbach's $\alpha_{Cr} = 0.74$) and significant criterion-related validity. Specifically, higher ScreenQ scores, indicative of greater non-adherence to AAP guidelines, were consistently correlated with lower performance in key developmental domains, including expressive language, phonological processing, and emergent literacy skills, as measured by the EVT-2, CTOPP-2, and GRTR, respectively. Furthermore, higher ScreenQ scores were associated with less cognitively stimulating home environments, as assessed by the StimQ-P. These results underscore the ScreenQ's potential as a valuable and efficient tool for researchers and clinicians to gain a nuanced understanding of children's screen media exposure and its associations with developmental outcomes.

This research makes several significant contributions to the field of early childhood development and media studies. Firstly, it addresses a critical gap in the literature by providing a validated, composite measure that reflects the multifaceted nature of contemporary screen media use, moving beyond simplistic time-based assessments. The ScreenQ's alignment with AAP recommendations ensures its practical relevance for guiding parenting practices and clinical interventions. Secondly, the study reinforces the growing body of evidence highlighting the negative associations between certain patterns of screen media use and crucial developmental milestones. By demonstrating these correlations, the ScreenQ can serve as an early detection tool for identifying children at risk of developmental delays related to screen exposure. Lastly, the

findings provide a foundation for developing more targeted and effective public health campaigns and educational programs aimed at promoting healthy screen media habits among young children and their families.

While this study offers valuable insights, it is important to acknowledge its limitations. The relatively small sample size and its specific demographic characteristics may limit the generalizability of the findings. Future research should aim to replicate these findings in larger, more diverse populations. The reliance on parent-report data, while practical, introduces the potential for social desirability bias; thus, integrating objective measures of screen time in future studies would enhance the validity of the assessments. Furthermore, the cross-sectional design prevents the establishment of causality. Longitudinal studies are crucial to understand the long-term developmental trajectories associated with different patterns of screen media use as measured by the ScreenQ.

Future research directions include: (1) conducting longitudinal studies to track the developmental impact of screen media use over time and to assess the predictive validity of the ScreenQ; (2) exploring the effectiveness of interventions designed to improve screen media habits based on ScreenQ assessments; (3) refining the ScreenQ to include items related to the quality of educational content and its potential benefits; (4) validating the ScreenQ in diverse cultural contexts and with different age groups; and (5) investigating the neurobiological mechanisms underlying the observed associations between screen media use and developmental outcomes.

DECLARATIONS

Ethics approval and consent to participate

Not applicable.

Conflict of interest

No potential conflict of interest was reported by the authors.

Dataset to be available

All data generated or analysed during this study are included in this published article.

Consent for publication

Not applicable.

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