

Online developmental assessment inventory for early childhood (0–72 months): scale development and validation study

Erken çocukluk dönemi (0–72 ay) için çevrim içi gelişimsel değerlendirme envanteri: ölçek geliştirme ve geçerlik-güvenirlilik çalışması

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ABSTRACT

Aim: The objective of this study is to develop a developmental assessment inventory (NEGDE) for children aged 0–72 months that is both valid and reliable. The inventory will evaluate cognitive, language, motor (gross and fine), social-emotional, and self-care domains based on parental observations.

Method: The development of the NEGDE is founded on the principles of affordability and expert independence, positioning it as an online assessment instrument that is both economical and user-friendly. NEGDE employs a norm-referenced system for the assessment of children's development, with this system being based on parental observations. Validity and reliability analyses were conducted, and descriptive statistics, item-total correlations, and Cronbach's alpha coefficients were calculated using SPSS.

Results: The gender distribution of participating children was balanced, with the highest age groups being 37–48, 49–60, and 61–72 months. The study found high reliability across all subdimensions (Cronbach's alpha = 0.974–0.985), with item-total correlations exceeding 0.30. The psychometric properties of NEGDE demonstrated strong reliability and validity.

Conclusion: The conclusion drawn from this analysis is that NEGDE is a reliable and valid developmental assessment tool with high internal consistency and acceptable correlation values across different age groups. Its merits include low cost, accessibility, and independence from expert administration, rendering it a valuable instrument for early childhood developmental assessments.

Keywords: early childhood; developmental assessment; validity and reliability

ÖZET

Amaç: Bu çalışmanın amacı, 0-72 aylık çocukların gelişimlerini bilişsel, dil, motor (kaba ve ince), sosyal-duygusal ve öz bakım alanlarında ebeveyn gözlemleri ile çevrimiçi olarak değerlendiren, düşük maliyetli ve uzman gerektirmeyen, geçerli ve güvenilir bir gelişim değerlendirme envanteri (NEGDE) geliştirmektir.

Yöntem: Türkiye'nin yedi coğrafi bölgesinden 1334 ebeveynin katıldığı çalışmada, veriler www.negde.com.tr üzerinden çevrimiçi olarak toplanmıştır. NEGDE, çocukların gelişimini norm-referanslı bir sistemle ebeveynlerin gözlemleri doğrultusunda değerlendirir. Geçerlilik ve güvenilirlik analizleri yapılmış, SPSS programı kullanılarak betimleyici istatistikler ve madde-toplam korelasyonu ile Cronbach's Alpha katsayıları hesaplanmıştır.

Bulgular: Çalışmaya katılan çocukların cinsiyet dağılımı dengeli olup, en yüksek yaş grupları 37-48, 49-60 ve 61-72 ay olmuştur. Ölçeğin tüm alt boyutlarında yüksek güvenilirlik (Cronbach's Alpha = 0.974-0.985) ve madde-toplam korelasyonları (0.30'un üzerinde) elde edilmiştir. NEGDE'nin psikometrik özellikleri yüksek güvenilirlik ve geçerlilik göstermektedir. NEGDE, farklı yaş gruplarında güvenilir ve geçerli bir gelişim değerlendirme aracı olarak yüksek iç tutarlık ve kabul edilebilir korelasyon değerlerine sahiptir.

Sonuçlar: Erken çocukluk dönemi gelişim değerlendirmelerinde düşük maliyet, erişilebilirlik ve uzman gerektirmeme gibi avantajlar sunmaktadır. NEGDE, çocukların gelişim alanlarını başarılı bir şekilde değerlendirerek erken müdahalede önemli bir araçtır.

Anahtar kelimeler: erken çocukluk dönemi; gelişimsel değerlendirme; geçerlilik ve güvenilirlik

Introduction

The Convention on the Rights of the Child is a seminal document in the field of human rights, recognised by the international community as one of the most widely adopted treaties in this area. It emphasises the right of children to development and obliges state parties to support children's survival and optimal development. Within this framework, the Convention asserts that every child is entitled to reach their full potential, and that the protection of this right constitutes a fundamental responsibility of states and societies. Developmental risk factors in early childhood pose significant challenges not only on an individual level but also at a societal scale. In developing countries, a substantial proportion of young children face developmental risks (Engle et al., 2007).

It is estimated that approximately half of children under the age of five experience some form of developmental risk (Walker et al., 2011). The high prevalence of developmental risks in early childhood is therefore of significant concern, as it has been shown to have a decisive role in shaping both individual and societal futures (Black et al., 2017). Research indicates that parent-based interventions incorporating components that strengthen the parent-child relationship are more effective in fostering early cognitive, language, motor, and socio-emotional development (Britto et al., 2017). To this end, it is vital for parents to be cognizant of their child's developmental level across various domains. This underscores the necessity for parents to systematically monitor and evaluate their children's development using scientifically validated methods (Snow & Van Hemel, 2008).

Consequently, there is an increasing demand for reliable and valid instruments that enable parents to monitor and assess their children's developmental levels based on scientific principles. However, existing developmental assessment inventories are beset by limitations relating to feasibility, the necessity for expert involvement, cost, and time constraints. The present study aims to develop a norm-referenced developmental assessment inventory that enables online evaluations of early childhood development based on parent or caregiver observations. The proposed inventory is designed to be cost-effective, require no expert administration, and be easily implementable, thereby addressing key limitations of existing developmental assessment tools.

Literature review

Developmental assessment is chiefly concerned with the collection of information pertaining to a child's developmental progress, the subsequent organisation of this information, and its interpretation through the utilisation of scientific methodologies. Through this interpretation process, potential risk factors are identified, and developmental intervention strategies are formulated (Bredenkamp, 2015). In this context, the primary objective of developmental assessment is to detect developmental delays that may pose a risk and later become a disadvantage, ensuring that children at risk can be developmentally aligned with their typically developing peers (Thambirajah, 2011). Standardised tests designed for early childhood assessment enable the early identification and mitigation of developmental risk factors. These tests are designed to do two things: first, to highlight any risk factors; and second, to emphasise the child's strengths. Consequently, both parents and educators can access essential data to maximise the individual potential of children with either developmental challenges or strong developmental attributes (Elbaum et al., 2010).

Developmental assessment, which includes the preschool period, is not solely a concern for families; its impacts and outcomes extend beyond the family unit. The preschool years constitute a critical phase in which the foundations of all developmental domains are established. During this period, preschool teachers must consider genetic and environmental factors influencing children's development, particularly making necessary adjustments in educational settings to improve the conditions of children growing up in disadvantaged environments. For this process to be effectively managed, teachers must have comprehensive knowledge of children's cognitive, language, motor, social-emotional, and self-care developmental characteristics across different developmental stages. Through early education services, it is possible to reduce developmental risks, address social-emotional difficulties, and implement strategies that support active participation in preschool education (Mahoney, 2007).

Despite the well-documented benefits and importance of standardised developmental assessment tools, one of the major challenges is their implementation and widespread adoption. The deployment of these tools often necessitates considerable time and effort, entails substantial financial costs, and requires the expertise of professionals to administer and interpret the results, thereby restricting their accessibility and utilisation. The predominant approach to developmental assessment entails parents seeking evaluation services from authorised institutions. However, when developmental assessments are conducted solely through authorised institutions, the timely identification of developmental risks is compromised, reducing opportunities for early intervention (Sices et al., 2004). The most effective solution to this issue is the implementation and expansion of online, low-cost, expert-independent screening methods that allow families, teachers, and preschool institutions to assess and monitor children's development within a unified system.

A further critical issue in the widespread implementation of developmental assessment tools pertains to the accuracy of the data collected for evaluation. It has been contended by certain experts that data obtained from parents and caregivers may lack objectivity in developmental assessments. However, numerous studies have demonstrated a strong correlation between professional assessments and parent-reported evaluations, indicating substantial agreement between these sources (Lagerberg, 2005; Aylward, 2009). Furthermore, research indicates that approximately 41% of young children targeted for professional developmental assessments refuse to complete all items or selectively avoid more challenging items. This resistance may stem from fear of failure or anxiety toward unfamiliar evaluators (Aylward, 2009). Consequently, it can be posited that naturalistic observations made by parents or caregivers, who spend the most time with the child, can be considered a reliable method for gathering data for early childhood assessments.

The similarity of scales in the literature

Bayley scales of infant and toddler development – fourth edition (Bayley-4)

The Bayley-4 is a norm-referenced assessment tool designed to evaluate the development of children up to 42 months of age. The assessment tool is comprised of five subscales: cognitive, language, motor, social-emotional, and adaptive behaviour domains. The Bayley-4 employs a dual assessment method, incorporating both expert evaluation through specially designed materials and parent or caregiver reports (Bayley & Aylward, 2009). While the Bayley-4 is capable of assessing children up to 42 months of age,

its reliance on expert administration and the time and financial costs associated with its use make it less suitable for general developmental screening (Bayley & Aylward, 2009).

Denver developmental screening test II (Denver II)

The test was originally published in 1967 and revised in 1990 as the Denver II. It is now widely used globally and has been standardised in numerous countries. The test requires minimal training and enables an evaluator to conduct a developmental assessment of a child that is both comprehensive and long-lasting. The test is designed for children from birth to six years of age and is divided into four primary domains: personal-social skills, fine motor skills, language development, and gross motor skills. The assessment of items is achieved through two methods: direct observation of the child and reports from parents or caregivers (Pilz & Schermann, 2007). Despite its extensive utilisation, the necessity for professional administration and the unavailability of online administration methods constrain its application to healthcare institutions.

Development of the dimensional inventory of child development assessment (IDADI)

The IDADI is a parent-report-based assessment tool developed to evaluate the development of children between 0 and 72 months. It encompasses six distinct developmental domains: cognitive skills, motor skills (gross and fine), communication and language (receptive and expressive), socio-emotional development, and adaptive behaviour. The inventory consists of 524 items, which are distributed as follows: 106 items for cognitive development, 109 for communication and language, 118 for motor skills, 83 for socio-emotional development, and 108 for adaptive behavior. The items describe observable behaviours and developmental skills deemed essential in children's daily lives. The developmental items are arranged chronologically and categorised into seven age groups, with an interval of six months between each group. In addition, IDADI incorporates a sociodemographic interview form administered to parents, thereby enabling researchers to collect essential background information on participants' developmental history (Silva et al., 2019). The administration of the test can be conducted in both paper format and online, with expert guidance. While this flexibility offers a time advantage, the need for expert evaluation and associated costs limit its feasibility for widespread implementation.

Battelle developmental inventory for young children (BDI-2)

The BDI-2 is based on the developmental milestones approach, which assumes that child development follows a specific sequential order, with each skill acquired depending on the mastery of a preceding competency (Papalia & Feldman, 2013). This tool facilitates long-term developmental monitoring while also guiding intervention planning and evaluating intervention effectiveness (Mancías-Guerra et al., 2015). The full version of BDI-2 comprises 450 items spanning five developmental domains: adaptive skills, personal-social development, communication, motor skills, and cognitive development. The original standardization study included 2,500 children (Newborg, 2005). The assessment process involves interviews with parents or caregivers, a detailed developmental history, the use of specialized materials and toys, and direct interaction with the child through assessment tools. Given the complexity of this process, the time-intensive nature and requirement for professional administration pose significant challenges to its widespread use. Furthermore, the cost of implementation limits its accessibility for broader populations.

Current study

Early childhood represents a critical period in which the developmental trajectories of individuals are largely shaped, and rapid advancements occur across multiple domains. The early identification of developmental differences is of crucial importance for both individual and societal well-being. However, existing assessment tools face significant challenges, including high costs, the requirement for expert personnel, and time constraints, which frequently hinder early intervention efforts (Bayley & Aylward, 2009; Pilz & Schermann, 2007; Silva et al., 2019; Newborg, 2005; Papalia & Feldman, 2013).

In light of these challenges, the present study aims to develop a cost-effective, time-efficient, location-independent, and non-expert-dependent developmental assessment inventory for children aged 0–72 months. The Nehir Online Developmental Assessment Inventory (NEGDE) has been developed as a norm-referenced screening tool that evaluates children's development across six core domains based on caregiver reports. These domains include, but are not limited to, cognitive development, language development, gross motor development, fine motor development, social-emotional development, and self-care skills.

The name "Nehir" was chosen in honour of the author's daughter, following the tradition in psychology and educational research of naming assessment tools after individuals who serve as sources of inspiration. The development of NEGDE was guided by a rigorous scientific approach to ensure its validity and reliability on a solid empirical foundation.

Table 1 provides a brief comparative overview of commonly used developmental assessment tools, highlighting their age range, domains assessed, administration methods, and limitations.

Table 1. Comparison of commonly used early childhood developmental assessment tools

Tool	Age range	Domains assessed	Administration	Length & cost	Mode	Limiting factors
Bayley-4 (Bayley & Aylward, 2009)	0–42 months	Cognitive, language, motor, social-emotional, adaptive behavior	Dual: Expert + Caregiver	High time and cost burden	In-person	Requires trained personnel and special materials
Denver II (Pilz & Schermann, 2007)	0–72 months	Personal-social, fine motor, language, gross motor	Minimal training needed	Moderate duration; low cost	In-person only	Limited accessibility; expert still required
IDADI (Silva et al., 2019)	0–72 months	Cognitive, language, emotional, motor, social-adaptive behavior	Parent-report + Expert-supervised	High item count (524); moderate cost	Paper/Online	Expert guidance required; still time-consuming
BDI-2 (Newborg, 2005)	0–96 months	Adaptive, personal-social, communication,	Direct interaction + Parental interview	Very long, costly	In-person	Complex setup, high cost, expert needed

2005; Papalia & Feldman, 2013)		motor, cognitive						
NEGDE (Current Study)	0–72 months	Cognitive, language, gross/fine motor, social- emotional, self-care	Caregiver-report only	Time- cost-efficient	and Online		Designed for independent use; no expert required	

Method

Study group

The study population comprises children aged 0–72 months living in Turkey, with a total of 8,022,081 children in this age range according to the 2023 data from the Turkish Statistical Institute (TÜİK, 2023). The study sample consists of 1,334 parents of children aged 0–6 years who were accessible, voluntarily agreed to participate, and represented all seven geographical regions of Turkey. The distribution of participants by age group is as follows: 40 children (0–3 months), 51 children (4–6 months), 42 children (7–9 months), 50 children (10–12 months), 106 children (13–18 months), 118 children (19–24 months), 115 children (25–30 months), 121 children (31–36 months), 238 children (37–48 months), 237 children (49–60 months), and 216 children (61–72 months). The data were collected online through a specialized software platform developed for the study (www.negde.com.tr), ensuring that the final sample was representative of the target population.

The data were collected online through a customized digital platform (www.negde.com.tr), which enabled broad participation from across Türkiye. Thanks to the accessibility and ease of use of the platform, participants from all seven geographical regions were successfully reached. In fact, responses were received from nearly all provinces, ensuring high geographical diversity and representativeness of the sample. However, to preserve space and maintain focus in the manuscript, the names of individual provinces have not been detailed.

Data collection instruments

NEGDE: The NEGDE is a norm-referenced developmental screening tool designed to assess children aged 0–72 months across six developmental domains: These are: Cognitive Development, Language Development, Gross Motor Development, Fine Motor Development, Socio-Emotional Development, and Self-Care Development. The inventory is based on parental or caregiver observations. In this study, NEGDE was utilised as a data collection instrument within the scope of validity and reliability analyses.

The inventory comprises six distinct forms, each corresponding to one of the aforementioned developmental domains. Each form comprises 11 age groups, covering the 0–72 month period (0–3, 4–6, 7–9, 10–12, 13–18, 19–24, 25–30, 31–36, 37–48, 49–60, and 61–72 months). The skills expected to emerge within each age group are matched with observable daily life activities and are arranged sequentially based on developmental progression. For each developmental domain, parents or caregivers are invited to provide binary ("yes" or "no") responses based on their observations of whether the child demonstrates the respective skill.

By design, NEGDE is administered online, thus obviating the need for expert supervision for evaluation or interpretation. Its mobile and desktop software allows for implementation independent of location, facilitating widespread accessibility at a low cost. The assessment can be accessed and completed via a mobile application (available on Play Store and App Store) or through the web platform (www.negde.com.tr), with all assessment processes—initiation, completion, and reporting—being trackable under a single user profile.

One of the most crucial aspects of developmental assessment is developmental monitoring. The NEGDE developmental tracking module facilitates the documentation of skills that parents or caregivers have reported as "not yet achieved" by the child, organised by developmental domains. For each skill that has not yet been acquired, the module provides three recommended activities to support the development of that particular skill. Once a child has acquired a previously unachieved skill, caregivers can update the skill tracking module, marking the respective skill as "achieved." This data is then reflected in the child's developmental report, ensuring continuous updating and real-time access to the most recent developmental status.

The development of NEGDE followed these structured steps:

1. **Review of Existing Developmental Assessment Tools:** A comprehensive review was conducted on multiple standardized developmental assessment tools, including Denver II, AGTE, GEÇDA, IDADI, Bayley IV, BDI-2, Stanford-Binet, Metropolitan, Brigance, ASQ-3, and FirstSTEP. These tools were systematically categorized by developmental domains and age groups. Additionally, research reports published by the World Health Organization (WHO, 2024) were analyzed from a developmental perspective, and relevant data were incorporated into the categorized dataset. This process confirmed the necessity of assessing development across six domains: cognitive, language, gross motor, fine motor, socio-emotional, and self-care. Developmental tasks were structured into hierarchical steps and explicitly defined in relation to daily life activities. Consequently, a question pool consisting of 716 items was developed:

- Cognitive Development: 124 items
- Language Development: 136 items
- Fine Motor Development: 107 items
- Gross Motor Development: 115 items
- Socio-Emotional Development: 133 items
- Self-Care Development: 101 items

2. **Ethical Approval Process:** Before commencing the scientific studies necessary to establish NEGDE as a norm-referenced developmental screening inventory, an application was submitted to the Scientific Research and Ethics Committee of Afyon Kocatepe University. Ethical approval was granted with the decision numbered 15.01.2025-331854.

3. **Expert Review and Content Validity Analysis:** The question pool was evaluated based on the following criteria:

- Relevance to the targeted developmental domain
- Availability of required materials for skill assessment

- Appropriateness for the respective age group
- Alignment with preceding and subsequent skills in the developmental sequence

To ensure content validity, the items were reviewed by 10 experts: 3 preschool teachers (each with over 10 years of professional experience), 4 child development specialists, and 3 faculty members specializing in child development. Items with a content validity ratio below 0.8 were excluded, and necessary revisions were made based on expert feedback. As a result, a refined version of NEGDE containing 418 items was established:

- Cognitive Development: 81 items
- Language Development: 78 items
- Fine Motor Development: 63 items
- Gross Motor Development: 74 items
- Socio-Emotional Development: 75 items
- Self-Care Development: 47 items

4. Development of Digital Implementation Software: A distinguishing feature of NEGDE is its online implementation and expert-independent interpretation. To facilitate data collection, a customized software system was developed, operational via the www.negde.com.tr website. Following the software launch, the assessment was conducted on a sample of 1,334 children (representative of all age groups) through parental or caregiver reports. Informed consent was obtained prior to participation.

5. Data Processing and Reliability Analysis: Following the assessments, the collected data were extracted and systematically classified. Data from 28 children who did not meet the required conditions were excluded. The final dataset, consisting of 1,306 children, was used for validity and reliability analyses.

Pilot study and test–retest reliability

Before the main data collection, a pilot study was conducted with a group of 112 parents to evaluate the clarity and usability of the NEGDE items and the functionality of the online platform. Necessary revisions were made based on user feedback. For test–retest reliability, 121 participants were invited to complete the same developmental assessment two weeks apart. The Pearson correlation coefficients ranged between .81 and .91 across developmental domains, indicating strong temporal reliability.

Data analysis

The dataset obtained in this study consists of a total of 1,334 survey responses. Prior to analysis, a data cleaning process was conducted to identify and eliminate incomplete, erroneous, or improperly completed surveys. Consequently, 28 surveys were identified as incomplete or erroneous and were excluded from the subsequent analyses. Consequently, all subsequent analyses were performed on the remaining 1,306 surveys.

During the data analysis process, descriptive statistics were initially applied, and demographic variables were classified based on gender and the child's age in months. At this stage, frequency and percentage distributions were reported.

To assess the validity of the scale, expert opinions were sought from 10 specialists. Reliability analysis entailed the calculation of the corrected item-total correlation and Cronbach's Alpha coefficient.

All statistical analyses were conducted using the SPSS statistical software package.

Results

The gender and age distribution of the study sample is presented in Table 2.

Table 2. Distribution of the sample by gender and age

Variables	Category	n	%
Gender	Female	615	47,1
	Male	691	52,9
Age (in months)	0-3	33	2,5
	4-6	46	3,5
	7-9	39	3,0
	10-12	48	3,7
	13-18	103	7,9
	19-24	115	8,8
	25-30	113	8,7
	31-36	120	9,2
	37-48	238	18,2
	49-60	236	18,1
61-72	215	16,5	

A thorough examination of Table 2 reveals that 47.1% of the participating children are female ($n = 615$), while 52.9% are male ($n = 691$), indicating a balanced gender distribution. This balance is crucial in minimizing potential gender biases during the scale development process.

With respect to age distribution, the largest percentage of the sample is comprised of the 37–48 months (18.2%), 49–60 months (18.1%), and 61–72 months (16.5%) age groups, whereas the smallest percentage includes the 0–3 months (2.5%), 4–6 months (3.5%), and 7–9 months (3.0%) age groups. This discrepancy is likely due to the relative difficulty in collecting data from younger age groups. However, the present sample encompasses all age ranges, thereby ensuring a sufficient distribution for testing the validity and reliability of the scale across different age groups.

Although participation rates were lower in the younger age groups (e.g., 0–9 months), the scale development process was structured in alignment with norm-referenced test design principles (Crocker & Algina, 2006). The NEGDE inventory was developed to assess developmental milestones across 11 age bands, and the validity and reliability analyses were conducted within each age interval to ensure that the scale provides meaningful developmental norms. Rather than applying group-level norms alone, the scale utilizes age-specific items and performance data, allowing developmental interpretation to be tailored to the child's exact age range (Bagnato et al., 2010). Despite lower subgroup sizes in early infancy, item-level analyses confirmed the consistency and applicability of the scale within these age groups.

The results demonstrate a wide demographic range in terms of age and a balanced gender distribution, thus facilitating the assessment of the NEGDE scale across different age groups.

Table 3. Summary of the scale's validity and reliability analysis

Subscales of the scale	Pre-analysis number of items	Post-analysis number of items	Cronbach's alpha (α)	Corrected item-total correlation value range
Cognitive development	81	80	.982	.378-.970
Language development	78	76	.985	.302-.627
Gross motor development	74	73	.983	.304-.859
Fine motor development	63	63	.980	.309-.863
Socio-emotional development	75	75	.984	.311-.862
Self-care development	47	47	.974	.303-.799
Total Number of questions	418	414		

To evaluate the psychometric properties of the NEGDE scale, validity and reliability analyses were conducted. Table 3 presents the Cronbach's Alpha reliability coefficients and the corrected item-total correlation value ranges for the subscales of the scale.

The Cronbach's Alpha values for all subscales range between 0.97 and 0.99. Generally, Cronbach's Alpha coefficients of 0.70 or higher indicate high internal consistency (Hajar, 2018; Cronbach, 1951). The fact that all subscales of the NEGDE scale yielded internal consistency coefficients of 0.97 or higher demonstrates that the scale is highly reliable.

Items with a corrected item-total correlation above 0.30 are considered to be consistent with the scale (Zijlmans et al., 2019). All subscales demonstrate item-total correlations above 0.30, with the highest correlation value (0.970) observed in the cognitive development subscale. This finding suggests that the items within the scale are highly consistent and effectively measure the intended constructs.

Following the validity and reliability analyses of the scale, certain items were removed. The primary reason for item removal was that these items did not contribute to the overall consistency of the scale or were deemed unsuitable based on item analysis results (i.e., Corrected Item-Total Correlation Value < .30).

Discussion

This study developed the NEGDE scale to address the need for developmental assessment in early childhood. The development process of NEGDE was designed by considering the advantages and disadvantages of existing developmental assessment tools. This resulted in a low-cost, expert-independent, and online-accessible scale that allows parents to evaluate their children's development. The findings of this study indicate that the NEGDE scale is a valid and reliable assessment tool.

In comparison with existing developmental assessment inventories, NEGDE presents several key advantages. Firstly, the administration of tools such as Bayley IV and Denver II necessitates the involvement of a specialist, which renders them both time-consuming and costly, thus limiting their widespread utilisation (Bayley & Aylward, 2009; Pilz & Schermann, 2007). In a similar vein, other developmental scales such as IDADI and BDI-2 also require expert supervision, which restricts their accessibility for large-scale screenings due to financial constraints (Silva et al., 2019; Mancías-Guerra et al., 2015). In contrast, the NEGDE scale offers a structure that enables parents or caregivers to conduct assessments based on their own observations, thus eliminating the need for professional expertise.

While the development of NEGDE based on parental reports may raise concerns, previous research has demonstrated that parental reports largely align with expert evaluations (Lagerberg, 2005; Aylward, 2009). Furthermore, children may be reluctant to complete certain assessment tasks in expert evaluations due to fear of failure or shyness toward unfamiliar individuals, underscoring the importance of parent-based observations (Aylward, 2009). Consequently, the information provided by parents can be regarded as reliable and can be effectively utilised in developmental screening processes.

Another significant contribution of this study is enhancing the accessibility of developmental assessment. The online applicability of NEGDE is particularly advantageous in regions with limited access to developmental assessment services. As Sices et al. (2004) have previously observed, the restriction of developmental assessment services to authorised institutions has the effect of limiting opportunities for early intervention. The internet-based implementation of NEGDE eliminates such restrictions, offering parents the opportunity to monitor their children's developmental progress.

The findings of this study suggest that NEGDE could serve as an effective tool for developmental assessment in early childhood. However, it is important to acknowledge the limitations of this study. Firstly, the data collected in this study is based on parental self-reports, and the potential for response bias should not be overlooked. Future research should include comparative analyses of NEGDE with expert evaluations to further support its validity and reliability. Furthermore, an examination of how parents from different socioeconomic backgrounds approach the assessment process could provide more detailed insights into the applicability of the scale.

Limitations of the study

The present study was conducted with the objective of developing the NEGDE inventory for the purpose of assessing developmental progress in children aged between 0 and 72 months. However, it is important to acknowledge the limitations of the

study. Firstly, as the data collection process was conducted entirely online, concerns may arise regarding the objectivity of parental responses. Secondly, the developmental assessment process relies on parental reports, and variations in how parents evaluate their children's competencies may introduce inconsistencies. Furthermore, the normative data for NEGDE are based on a specific sample group, and its applicability to different socioeconomic or cultural groups should be further supported through future research. The relatively lower participation rates in the younger age groups should be acknowledged as a limitation of the study.

Recommendations for the literature

This study focused on developing a developmental assessment tool based on parental reports. Future research could explore the relationship between NEGDE and various factors influencing child development in greater detail. Furthermore, linguistic and cultural adaptation studies should be conducted to test the validity of the inventory across different countries and cultural contexts. In particular, longitudinal studies assessing the long-term usability of NEGDE could provide valuable insights into its effectiveness in monitoring child development over time.

Implications for practice

NEGDE has been conceptualised as a developmental screening instrument that is readily accessible and utilised by parents. Access to the system can be gained by visiting www.negde.com.tr or by downloading the mobile application from app marketplaces such as the Play Store and App Store. Users are required to register by supplying certain personal details, after which they can commence the assessment process. The system also facilitates the review of assessment reports and the provision of verbal feedback, thus obviating the need for expert interpretation. Additionally, the system incorporates a monitoring feature that provides guidance on atypical developmental characteristics. This tracking system offers information on areas where developmental delays are observed and provides recommendations for supporting these areas.

The NEGDE system is designed for use by parents as well as professionals working with children aged 0–72 months in the fields of health and education. Registered professionals are able to access the system, create profiles for the children they assess or monitor, and utilise the platform accordingly. Specifically, preschools and early childhood educators stand to benefit from NEGDE by tracking students' developmental progress and implementing early intervention programs when necessary. This facilitates timely intervention in atypical developmental domains. Consequently, the promotion of NEGDE in early childhood education institutions and healthcare centres may support early intervention efforts. To facilitate comprehension of the assessment, reporting, and monitoring processes, supplementary resources such as instructional videos and guide documents have been integrated into the system.

Recommendations for the use of the scale

For effective use of the NEGDE inventory, it is essential that both parents and professionals interpret the assessment results accurately. One of the most important factors in ensuring the accuracy of the assessment is that parents register in the system with correct and accurate information. Once registered, parents can initiate the assessment by selecting a developmental domain from the menu provided. The assessment process begins at a starting point determined by the system based on the information provided during registration, and questions are directed to the parent accordingly. It is essential that parents answer these questions honestly and accurately in order to obtain reliable assessment results.

The system also determines the end point of the assessment, similar to the starting point. Parents must answer all the questions presented until the test is automatically terminated. While all developmental areas can be assessed, parents also have the option to assess only specific areas of interest. Once the assessment is complete, the results can be accessed in the 'My Reports' section. Two different types of reports are generated: norm-referenced and standardised score-based reports, which document the child's development in the relevant domain. The standardised score-based report includes verbal interpretations of the child's status, categorised as 'advanced', 'normal' or 'needs support'. Even parents with no experience in interpreting graphical data can understand their child's developmental progress based on these verbal assessments.

During the assessment, questions that are answered in the negative are categorised by developmental area and age group and transferred to the developmental monitoring module. The monitoring menu allows parents to track their child's progress and receive developmental recommendations. If a child achieves a previously unattained skill, parents can update this information in the system, which then revises the developmental report. This ensures that the developmental report is always up to date. Depending on the number of skills that need to be monitored, the system reopens the assessment interface, allowing parents to pick up where they left off. This cycle of assessment, reporting and monitoring continues until the child reaches 72 months of age, ensuring that their developmental progress is consistently tracked.

As well as providing parents with information about their child's development, NEGDE also offers customised interfaces for professionals working in the field. In particular, early childhood education institutions can enable teachers to have parents assess their students and then monitor the results through their professional dashboards. The ability for teachers to access these developmental reports via web or mobile platforms facilitates early identification of children's needs, ensuring timely intervention.

To maximise the efficiency of the system within the parent-teacher-school triangle, it is essential to effectively communicate the functionalities of NEGDE to all stakeholders. Therefore, organising training programmes and seminars on the use of NEGDE can increase user awareness. In addition, awareness campaigns can be launched to extend the reach of NEGDE's mobile and web-based platforms to a wider audience. Finally, continuous refinement of NEGDE based on feedback from parents and professionals can further enhance its scientific validity and reliability.

Conclusion

The NEGDE scale has been tested and evaluated on a large sample of people of different ages. Validity and reliability analyses indicate that the scale has high internal consistency, with item-total correlations at acceptable levels. The high Cronbach's alpha

coefficients also confirm the high reliability of the scale. In addition, the majority of the item-total correlations exceed 0.30, indicating that the scale items effectively measure the relevant sub-dimensions.

The NEGDE offers significant advantages in the assessment of early childhood development, including accessibility, cost-effectiveness, independence from expert administration, and online applicability. In conclusion, the NEGDE scale appears to be a reliable and valid instrument, as evidenced by its high internal consistency coefficients and acceptable item-total correlations. The analyses conducted indicate that the scale provides consistent measures across different age groups and successfully assesses children's developmental domains.

Competing Interests

The authors declare that they have no competing interests.

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Ethical Statement

Before commencing the scientific studies necessary to establish NEGDE as a norm-referenced developmental screening inventory, an application was submitted to the Scientific Research and Ethics Committee of Afyon Kocatepe University. Ethical approval was granted with the decision numbered 15.01.2025-331854.

Referee Evaluation

External independent.

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