

Development of a Mobile Application for Assessing Multiple Intelligences in Primary School Students

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Abstract

This study focuses on the development of an Android-based mobile application designed to assess multiple intelligences in primary school students, specifically in grades 4–6. Grounded in Howard Gardner’s theory of multiple intelligences, the application enables both teachers and parents to observe and rate children’s behaviors across eight intelligence domains. The aim is not to label students as gifted or non-gifted, but rather to identify individual strengths and areas for support, thereby informing holistic and differentiated educational planning. The assessment tool consists of four rating scales with 64 behavior-based items. A total of 145 teachers and 77 parents from 19 schools participated in the study, which was selected through a multi-stage sampling process to ensure a diverse range of educational contexts. The validity of the instrument was examined through content validation by experts, item-total correlation, and reliability analysis, including internal consistency and test-retest methods. Cut-off scores were determined through expert judgment and refined based on the results of pilot testing. These scores help users interpret student profiles without stigmatization, providing targeted recommendations for fostering each child’s potential across all areas of intelligence. User feedback indicated high levels of satisfaction regarding ease of use, clarity, and usefulness of the results for both classroom and home contexts. The findings suggest that the application is a valid, reliable, and accessible tool that can guide teachers and parents in supporting the comprehensive development of students through a strength-based perspective. The study highlights the potential of integrating digital assessment tools into daily educational practice to promote inclusive, student-centered learning environments.

Keywords: assessment, multiple intelligences, mobile application

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Introduction

In the context of Thailand's education system, academic achievement remains a dominant priority. Standardized national assessments are widely implemented across grade levels; however, these assessments often lack alignment with broader curriculum goals and tend to reinforce a high-stakes, exam-oriented culture (OECD/UNESCO, 2016). Success in education is typically measured by test performance, which leads to intensive academic competition and a narrow focus on linguistic and logical-mathematical abilities. As a result, other dimensions of student development—such as creativity, interpersonal skills, and emotional intelligence—are frequently overlooked. Despite national reform efforts, overall student learning outcomes in core subjects such as mathematics, science, and English remain low, and progress has been limited, particularly in rural and under-resourced schools (Durongkaveroj, 2023). This narrow focus can result in children developing only a limited range of skills, while their other intelligences—such as musical, kinesthetic, interpersonal, or naturalistic—are left undernourished. Consequently, many students are unable to fully explore and express their potential across different areas.

Howard Gardner's (1999) Theory of Multiple Intelligences (MI) provides a comprehensive framework that challenges the traditional notion of intelligence as a single, general cognitive ability. Instead, Gardner posits that human intelligence is multidimensional, comprising multiple interrelated domains that collectively influence learning and problem-solving. In practical contexts, individuals rarely rely on a single cognitive ability; instead, they draw upon a dynamic combination of intelligences—such as logical reasoning, spatial awareness, emotional understanding, and interpersonal collaboration—to navigate complex tasks and real-world challenges. This theoretical perspective has contributed significantly to educational paradigms that emphasize the holistic development of learners.

As Thailand prepares for a rapidly changing future, shaped by advanced technologies and automation, it is increasingly important to develop a workforce with diverse capabilities. Intelligent systems are replacing routine, single-skill jobs, while demand is growing for individuals who can think critically, adapt creatively, and apply diverse skills across various contexts. This requires an education system that goes beyond academic testing and supports the holistic development of every learner. Thailand's 20-Year National Strategy (2018–2037) and the National Education Scheme (2017–2036) place a strong emphasis on developing human capital in a multidimensional manner. This includes cultivating multiple intelligences from an early age through coordinated efforts across family, educational institutions, and broader social environments (Government of Thailand, 2017). The policy aims to foster physical, mental, intellectual, social, and moral growth, equipping citizens with 21st-century skills and enabling them to engage in lifelong learning, thereby achieving personal well-being.

This study addresses this need by developing an Android-based mobile application grounded in multiple intelligence theory. The app enables both teachers and parents to assess students' observable behaviors across eight intelligence domains, identifying strengths and areas for support. Rather than labeling students as gifted or non-gifted, the tool helps guide inclusive and personalized educational planning that nurtures every child's potential.

The objective of this research is to design and develop a digital application that assesses the characteristics of various intelligences in primary school children, based on the Theory of Multiple Intelligences.

Literature Review

Howard Gardner's (1999) Theory of Multiple Intelligences (MI) challenges the traditional view of intelligence as a single, general cognitive ability. Instead, Gardner conceptualizes intelligence as comprising multiple distinct yet interrelated domains, including linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, intrapersonal, naturalistic, and existential intelligences. These intelligences function in combination to support learning, problem-solving, and personal development in real-life contexts.

Practical assessment of multiple intelligences requires tools that capture student behavior in naturalistic settings. In alignment with Thailand's 20-Year National Strategy, which emphasizes holistic human development through families, schools, and communities (Government of Thailand, 2017), efforts have been made to develop assessment tools that reflect a broader conception of intelligence. One such initiative is the development of a multiple intelligences (MI) screening tool for basic education students, based on Gardner's MI theory. The tool was created by the Office of the Education Council (Office of the Education Council, 2021). It adopts an indirect measurement approach, using behavioral observations by adults to assess students' strengths across nine intelligence domains: linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, naturalistic, and existential intelligences. The tool includes 45 items—five per domain—rated on a two-point scale. Scores are interpreted to identify whether a student demonstrates distinctive strengths in particular intelligences or exhibits development consistent with general peer-level expectations. This initiative represents a national-level effort to integrate MI theory into educational practice and assessment, supporting inclusive and individualized learning in alignment with national reform objectives.

Teachers and parents, as primary observers of children in school and home contexts, play critical roles in identifying students' strengths. When both groups collaborate in assessment, educational planning becomes more accurate and responsive to individual needs. However, few available tools facilitate such collaboration through accessible, context-sensitive formats suitable for everyday use.

The growing adoption of mobile applications in educational assessment reflects their potential to address these gaps. Mobile tools offer accessible, time-efficient platforms for collecting and visualizing student data. Projects such as the Tree of Intelligences (TOI) software have demonstrated the feasibility of evaluating MI through interactive digital games for young children (Garmen et al., 2019). Nevertheless, few existing platforms are designed to support structured, scalable MI assessment based on adult observer input. Even fewer allow comparison of teacher and parent perspectives or provide immediate, strength-based recommendations tailored to a student's intelligence profile. This lack of integrated, collaborative digital tools limits the potential for holistic educational planning.

Previous research has introduced a range of MI-based tools, including paper-based checklists, classroom observation instruments, and digital prototypes. While some of these tools incorporate existential intelligence, educators and caregivers often report difficulty understanding and applying this domain. As a result, most practical instruments focus on the eight more observable intelligences in early and primary education settings.

In summary, although the concept of multiple intelligences is widely acknowledged, many existing tools remain overly theoretical, limited in practical utility, or inaccessible to

everyday users. There is a clear need for a validated, user-friendly, mobile-based instrument that enables collaborative assessment by both teachers and parents, and that offers concrete, constructive insights to support each child's development. This study responds to that need.

Methodology

Ethical Considerations

All research procedures were conducted in accordance with ethical standards and were approved by the Human Research Ethics Committee of Srinakharinwirot University (Approval No. SWUEC 323/61).

Development of the Rating Scales Instrument

This study aimed to develop a behavior-based rating scale instrument embedded within a mobile application for assessing multiple intelligences in primary school students. The application was designed for use by both teachers and parents to support personalized educational planning based on each child's strengths and needs.

Needs Analysis and Literature Review

To establish a strong theoretical and contextual foundation for the assessment tool, a comprehensive needs analysis and literature review were conducted. The needs analysis involved examining current educational practices in Thailand, which continue to emphasize academic achievement, standardized testing, and narrow conceptions of intelligence. These practices often result in the underdevelopment of children's broader abilities and reduce opportunities for holistic learning. As Thailand transitions into an innovation-driven society, there is an increasing need to cultivate diverse talents among students to meet the demands of the 21st-century workforce.

The literature review covered international and Thai studies on multiple intelligences, including Gardner's theoretical framework, MI assessment tools, and digital applications for education. Particular attention was given to existing MI-based instruments used in schools, as well as their limitations, particularly in terms of accessibility, cultural relevance, and parent involvement. The review also identified key behavioural indicators associated with each of the eight selected intelligences (excluding existential intelligence), which served as the basis for constructing the rating scale items.

Findings from this phase confirmed the need for a user-friendly, digital assessment tool that could be used collaboratively by both teachers and parents. It also highlighted the importance of avoiding labels such as "gifted" or "non-gifted," instead focusing on identifying strengths, emerging potentials, and areas for support in each child to inform inclusive, strength-based educational planning.

Design of Application Structure and Content

The mobile application was designed to assess students' multiple intelligences based on Howard Gardner's theory, with consideration given to developmental appropriateness for primary school children and usability for adult assessors, namely teachers and parents. The

design focused on creating a comprehensive and user-friendly tool that supports collaborative assessment and educational planning.

Interface Design. The user interface (UI) was designed to be intuitive and accessible, allowing adult users to navigate the system easily. Upon launching the application, users are prompted to select their role—either teacher or parent—which directs them to distinct but parallel assessment modules. Each module contains behavior-based items relevant to the user’s context of interaction with the child (e.g., classroom behaviors for teachers and home-based behaviors for parents). This structure ensures that both assessors can contribute valuable, context-specific observations based on their daily interactions with the student.

Assessment Structure and Rating Scale. The assessment comprises 64 behavioral items, distributed equally across eight domains of intelligence (eight items per domain). These items were developed based on a review of MI literature and expert input, excluding existential intelligence in this version due to observed difficulties in interpretation and application in previous trials. Each item is rated using a five-point Likert scale to capture the frequency of observed behaviors, with scale points interpreted as follows:

- 4 = Always – The child consistently demonstrates this behavior.
- 3 = Often – The child frequently demonstrates this behavior.
- 2 = Sometimes – The child occasionally demonstrates this behavior.
- 1 = Rarely – The child seldom demonstrates this behavior.
- 0 = Never / Not Yet Tried – The child has never demonstrated this behavior or has not yet had the opportunity.

This frequency-based format enables flexible yet structured observation of students' abilities in natural settings, thereby enhancing both ecological validity and practical utility.

Interpretation Framework. To support constructive interpretation and avoid labeling, a three-level classification system was developed in collaboration with expert reviewers. Each intelligence domain is interpreted as follows:

Level	Suggested Term	Interpretation
High	Strength Area	The student consistently demonstrates this domain. Further enrichment is encouraged.
Moderate	Emerging Potential	The student shows developing ability; continued support will help nurture this area.
Low	Encouragement	The student shows limited behaviors in this area; targeted intervention is recommended.

This framework supports strength-based educational planning, allowing both teachers and parents to recognize diverse talents without categorizing students as gifted or non-gifted.

Assessment Features and Reporting. To facilitate comprehensive use, the application includes the following features:

- *Data saving and PDF reporting.* The application allows users to save assessment data, export results, and automatically generate reports in PDF format, making it easier to archive and share student profiles.
- *In-app result sharing via email.* Users can send completed reports directly from the application through email, streamlining communication between teachers and parents.

- *Radar chart comparisons between assessors.* The app features visual comparisons of teacher and parent assessments using radar charts, helping to identify consistent or divergent observations and foster collaborative educational planning.

These functions aim to foster a shared understanding among stakeholders and serve as a foundation for developing individualized learning plans.

Recommendation System. Upon completion of the assessment, the system automatically generates personalized recommendations tailored to each child's intelligence profile. The recommendations differ by user group:

- *For teachers.* Suggested classroom strategies, lesson adaptations, and activity-based supports aligned with students' identified strengths and areas for development.
- *For parents.* Home-based activities, play-based learning ideas, and communication techniques that reinforce specific domains of intelligence.

This feature enables users to translate assessment results into practical actions that support the student's ongoing development in both school and home environments.

Development of the Prototype

The prototype version of the application was developed through close collaboration between the research team, software developers, and instructional designers. The objective was to create a functional and user-friendly mobile tool that accurately reflects the theoretical framework of multiple intelligences and supports practical use by both teachers and parents. The prototype integrated 64 behavioral assessment items representing eight intelligence domains, with a consistent structure across both teacher and parent modules. The design also incorporated features for data entry, report generation, and automated recommendations tailored to users' roles and the child's assessed strengths.

Validity and Reliability Analysis of the Application

To ensure the quality and rigor of the developed instrument, the application underwent a multi-phase validation and reliability analysis process, using both qualitative expert review and quantitative statistical methods.

Content Validation. Five experts with backgrounds in gifted education, educational psychology, and instructional technology were invited to evaluate the clarity, relevance, and theoretical alignment of all 64 behavioral items across the eight intelligence domains. The Item-Objective Congruence (IOC) index was calculated.

Item Analysis. Total Item Correlations were computed to assess the internal consistency of each domain-specific subscale.

Reliability Analysis. Two types of reliability assessments were employed:

- *Test-Retest Reliability.* A subset of participants ($n = 30$ teachers) completed the same assessment twice over a two-week interval. Pearson's correlation coefficient was calculated between the two test administrations to evaluate temporal stability.
- *Internal Consistency.* Cronbach's alpha coefficients were calculated for each of the eight subscales. All domains demonstrated acceptable to high internal consistency,

with alpha values equal to or exceeding 0.70, indicating that the items reliably measured each intended intelligence domain.

Expert-Defined Cut-Off Scores and Educational Implications. To support the practical interpretation of assessment results, expert-defined cut-off scores were developed in consultation with the validation panel. These scores were refined through the analysis of pilot data, taking into account item difficulty and the distribution of scores. The interpretation framework categorizes each intelligence domain into three levels—strength area, emerging potential, and area for support—without labeling children as “gifted” or “non-gifted.” Instead, the focus is placed on identifying individual profiles to inform differentiated learning opportunities and encourage the holistic development of all students.

Pilot Testing and Refinement

To ensure that the developed mobile application was both practical and pedagogically suitable, a pilot study was conducted before its wider implementation. This phase focused on examining the usability, clarity, and contextual suitability of the application in authentic classroom settings to refine the tool based on user experience and feedback.

Participants were selected from diverse primary school contexts to represent a variety of classroom environments, including both urban and rural schools. Teachers and students who participated were chosen to represent diverse teaching practices and learner needs, ensuring that the tool could be evaluated for its adaptability across real-world educational settings. Before implementation, participating teachers received a brief orientation session. This session aimed to familiarize them with the structure and function of the application, including how to complete the behavioral assessments, interpret results, and provide constructive feedback to the research team. Where applicable, parents were also included in the training to promote alignment between home and school assessment perspectives.

The application was then integrated into classroom activities over a trial period of one to two weeks. Teachers were encouraged to use the tool during regular student observations, entering data through the app as they identified behaviors aligned with the eight domains of multiple intelligences. This allowed for a naturalistic assessment of the child’s strengths and areas for development without disrupting everyday classroom routines.

Data collection during this phase employed multiple methods to ensure a comprehensive evaluation. The research team conducted classroom observations to document how teachers interacted with the application, the clarity of the instructions, and the level of engagement among both teachers and students. In addition, teachers were invited to complete usability questionnaires and participate in semi-structured interviews or focus group discussions. These interactions provided valuable insights into the tool’s perceived usefulness, its compatibility with teaching practices, and any challenges encountered during implementation. Parents who used the application in parallel were also invited to submit brief feedback forms to reflect on their experience using the app at home.

The data collected were analyzed using a set of pre-determined usability and appropriateness criteria. Usability was assessed based on the ease of navigation, clarity of language, time efficiency, accuracy of data entry, and user engagement. Teachers’ feedback on the relevance and clarity of the automated recommendations generated by the application was also taken into consideration. Meanwhile, appropriateness was evaluated by examining the tool’s

alignment with classroom objectives, its perceived value for supporting student development, and its adaptability to different types of learners.

Following the pilot phase, the research team synthesized the findings and identified key areas for improvement. These included refinements to the interface design, adjustments to item wording for greater clarity, and enhancements to the structure and language of the recommendation system. The insights gathered during this stage contributed significantly to the finalization of the application, ensuring that it is not only theoretically sound but also practically usable by teachers and parents working together to support the holistic development of primary school students.

Finalization of the Application

Following the pilot testing and usability evaluation phase, the research team finalized the application by systematically incorporating all necessary revisions. The feedback obtained from teachers, parents, and direct classroom observations played a critical role in guiding these improvements. Key aspects revised during this stage included user interface design, clarity of assessment items, and the recommendation system that generates personalized suggestions based on each child's intelligence profile.

Special attention was given to ensuring that the application operated smoothly and consistently across different Android devices. Technical refinements included optimizing the screen layout for various screen sizes, enhancing system responsiveness, and ensuring stable data storage and export functions. Functions such as PDF report generation, email sharing, and side-by-side comparison of teacher and parent assessments were also reviewed and tested extensively to ensure accuracy and usability.

At this stage, the full integration of all components, including the behavior-based rating system, role-specific user pathways, automated interpretation framework, and recommendation features, was completed. The refined version of the application was reviewed for internal coherence, user flow, and consistency with the theoretical foundation of Gardner's multiple intelligences.

This final version of the application was then prepared for future phases, including broader classroom implementation and more extensive quality evaluations. These subsequent stages aim to examine the application's effectiveness in supporting differentiated instruction, enhancing parent-teacher collaboration, and promoting the holistic development of students. The final product is positioned not merely as a digital assessment tool but as a practical resource that encourages inclusive, strength-based educational planning in both school and home environments.

Results and Discussion

The results of this study are presented in three parts: (1) content validity and reliability of the rating scales, (2) findings from the pilot testing and classroom implementation, and (3) overall usability and appropriateness of the application based on teacher and parent feedback.

Validity and Reliability of the Instrument

Content validation was conducted by five experts in the fields of gifted education, educational psychology, and instructional design. The Item-Objective Congruence (IOC) scores for the 64 behavioral items across eight intelligence domains ranged from 0.60 to 1.00, with all items meeting or exceeding the commonly accepted threshold of 0.50. Items receiving lower scores were revised based on expert feedback to enhance clarity and ensure alignment with Gardner's theoretical constructs.

Internal consistency was assessed using Cronbach's alpha. All eight subscales demonstrated strong internal reliability, with alpha coefficients ranging from 0.83 to 0.90—exceeding the recommended minimum of 0.70—indicating that items within each domain consistently measured the intended constructs.

Test-retest reliability was evaluated with a subsample of 30 teachers who completed the assessment twice over a two-week interval. The Pearson correlation coefficient between the two administrations was 0.79, indicating strong temporal stability and consistency of the tool over time.

These findings support the psychometric soundness of the developed instrument and confirm its suitability for use in both school and home contexts.

Pilot Testing and Classroom Implementation

The pilot testing phase involved teachers using the application in real classroom settings throughout one to two weeks. Observations revealed that the application was easy to integrate into regular classroom activities and that teachers were able to complete the assessments with minimal technical support. Most users found the behavior-based rating scale intuitive and age-appropriate for students in grades 4–6. The process of observing and rating behaviors encouraged more intentional reflection on individual student strengths and learning preferences.

Teachers also reported that the ability to generate personalized profiles for each student provided practical insights into how to support differentiated instruction. In cases where both teachers and parents completed the assessments, the visual comparison features (e.g., radar charts) helped reveal consistent patterns and differences in perspectives, fostering deeper dialogue between school and home.

Usability and Appropriateness of the Application

Feedback gathered through usability questionnaires and interviews indicated high levels of satisfaction among teachers and parents. The application was rated positively in terms of ease of navigation, clarity of instructions, and time efficiency. The generated recommendations—tailored to each user's role—were perceived as relevant, specific, and applicable to both classroom and home contexts.

The appropriateness of the tool was also affirmed, particularly in its alignment with educational goals that emphasize student-centered learning. Teachers appreciated the three-level interpretation framework (“Strength Area,” “Emerging Potential,” and “Area for Support”) as a non-stigmatizing way to guide instructional planning. Rather than labeling

students as “gifted” or “non-gifted,” the system encouraged educators and parents to view intelligence as multifaceted and developmental.

Conclusion

This study developed and validated a mobile application designed to assess multiple intelligences in primary school students, based on Howard Gardner’s theory of multiple intelligences. This tool enables teachers and parents to collaboratively observe and evaluate children’s behavior across eight intelligence domains through a user-friendly, behavior-based rating system. By avoiding labels such as “gifted” or “non-gifted,” the application encourages strength-based educational planning that supports each child’s holistic development. The app’s features—such as PDF report generation, comparison between teacher and parent input, and tailored recommendations—were positively received in pilot testing, demonstrating high usability, contextual relevance, and educational value.

However, the study faced some limitations. The sample size was limited to a specific group of schools, which may affect the generalizability of the findings. Additionally, the assessment relied solely on adult observations without incorporating student self-assessment or performance-based tasks.

Future research should explore broader implementation across diverse educational settings, including rural and underserved areas. Integrating student input and developing supporting materials, such as training modules for parents and teachers, could further enhance the impact and sustainability of this tool. The continued development of inclusive, accessible assessment technologies holds promise for advancing personalized, student-centered learning in both school and home environments.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

ChatGPT was utilized to assist with content organization and language refinement, while Grammarly was employed for proofreading. All content was reviewed and finalized by the authors.

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