

The Use of the Children's Creative Music Application (AMKA) to Enhance Elementary School Students' Musical Intelligence

Wawan Priyanto*, Ali Mustadi, Haryanto

Universitas Negeri Yogyakarta, Indonesia. *Corresponding Author's Email: wawanpriyanto.2022@student.uny.ac.id

Abstract

The purpose of this study is to develop a valid, practical, and effective of AMKA to enhance the musical intelligence of fourth-grade elementary school students. The research employed the Plomp development model (preliminary investigation, design, assessment, and implementation). Subject of this study were 116 students in four elementary schools in the Ex-Residency of Semarang, Indonesia. Data collection techniques included interviews, observations, questionnaires, and a musical intelligence test. AMKA was developed based on theoretical foundations related to musical intelligence, user characteristics, and music education content for Grade 4. The validation results indicated that AMKA falls into the "highly valid" category, with an average validity score (passing grade) from experts I and II of 3.64. Practicality testing by teachers showed that AMKA was "highly practical," with a score of 98%, while students rated it as "practical," with a score of 88%. The implementation of AMKA across all participating schools demonstrated its effectiveness in improving students' musical intelligence. The average significance value was $0.000 < 0.05$. The average improvement was categorized as "moderate," with an N-gain interpretation score of 0.6. AMKA can serve as an alternative tool to foster student-centered learning, promote active engagement, enhance creativity, and integrate modern technology in music education.

Keywords: Application, Elementary School, Musical Intelligence, Musical Test.

Introduction

Various studies have been conducted to demonstrate the impact of musical intelligence on children's development. Musical intelligence has been shown to support the development of creativity (1), enhance reading and language skill (2), and improve emotional regulation, behavior, and social skills (3). Neurological research confirms that music has a significant influence on brain function (4). Studies on the effects of musical activities have also highlighted their contribution to visual-spatial intelligence (5), and to the development of children's ability to judge distances, assess speed, maintain focus, and utilize proprioceptive, interoceptive, and exteroceptive nervous systems (6). Furthermore, rhythmic training has been found to significantly enhance mathematical competence (7) and improve students' academic achievement (8). Efforts to enhance musical intelligence have also been undertaken through the integration of technology. The use of multimedia in education has been shown to improve musical intelligence, particularly among elementary school children (9). Other experimental studies have demonstrated

that virtual reality (VR) technology has had a positive impact on music education, specifically in clarinet instruction. This technology addresses challenges such as the limited availability of musical instruments in classrooms, insufficient teacher expertise in music, and the need to diversify learning experiences in music education (10). An application called Musicroid, which focuses on music learning particularly guitar and piano has been developed to assist students in understanding chord concepts and how to play them (11). The Score Creator application is used as a tool to facilitate students' understanding and creation of music notation. This application has been proven to enhance students' creativity and comprehension of musical notation concepts (12). The Music Lab, a website developed by the Yale Child Study Center, which offers a "Kids' Music Quiz" to assess children's musical aptitude (13). Nevertheless, the available quizzes are limited in number and scope, focusing solely on pitch recognition, without addressing rhythm and melody the essential components of musical intelligence. Meanwhile, ChordIQ serves as an

This is an Open Access article distributed under the terms of the Creative Commons Attribution CC BY license (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted reuse, distribution, and reproduction in any medium, provided the original work is properly cited.

(Received 01st August 2025; Accepted 26th October 2025; Published 31st October 2025)

interactive learning platform for solfeggio training (14). Several important findings emerged from this study. One of them is that mobile based music learning applications have proven effective in teaching students across different age groups. Students' interest and academic performance were shown to improve with the integration of technological innovations and engaging instructional content. However, the main limitation of these applications lies in the restricted range of musical instruments available. Most of the music elements presented are confined to reading notation and recognizing pitch. Consequently, the previously mentioned applications offer limited capacity in fully enhancing children's musical intelligence. The application menus often focus solely on notation or pitch, and their visual designs are not always well-suited to the developmental characteristics of young learners. In fact, children with strong musical intelligence are expected to possess the ability and sensitivity to recognize various musical elements such as rhythm, melody, timbre, and to create original musical compositions. Therefore, there is a pressing need to develop a more comprehensive music learning application that incorporates all key musical components and allows children to engage in music creation, thereby optimizing their musical potential. Currently available children's music applications still have limitations in terms of content and their capacity to enhance musical intelligence. On mobile application platforms such as the Play Store, most available apps are limited to collections of children's songs or music learning tools that focus on a single musical instrument. Applications like *Indonesian Children's Song*, *Lagu Anak PAUD TK Indonesia*, *Lagu Anak Muslim*, and others primarily consist of song compilations without structured learning components. Consequently, there is a growing need for an application that not only provides music content but also actively guides children in developing their musical intelligence. Such an application should support learning to recognize, understand, and create music by including activities such as distinguishing pitches, rhythms, and melodies; imitating tones, rhythms, and melodic patterns; and responding to rhythmic elements.

This study offers a solution by developing the *Aplikasi Musik Kreasi Anak* (AMKA), a creative

music application designed to enhance the musical intelligence of fourth-grade elementary school students in the Ex-Residency of Semarang. AMKA is an Android-based mobile application that incorporates interactive media, audiovisual elements (such as sound, music, and animation), educational games, and tutorial modules. The music learning menus within the application are aligned with key indicators of musical intelligence, including recognition of musical notation, rhythm, tempo, and musical creativity, and are supplemented with a music test feature. The implementation of music learning is based on the constructivist learning model, which emphasizes student-centered instruction and considers the developmental tasks of children aged 9 to 12 years. At this age, children begin to engage with society and develop social roles; thus, group-based learning activities are used to stimulate their participation in social life. The development of this application is expected to have a positive impact on the musical intelligence of fourth-grade students in particular, and on elementary school-aged children in general.

Methodology

Research Design

This study employed a research and development (R&D) design. The development of the *Aplikasi Musik Kreasi Anak* (AMKA) was adapted from the development model proposed by Plomp & Nieveen. This general development model is commonly used to address problems in the field of education and is referred to as the Plomp model (15).

The conceptual framework of this study is illustrated in Figure 1 below, which outlines the relationship between the independent variable (Children's Creative Music Application or AMKA) and the dependent variable (Musical Intelligence). The framework begins with problem identification and formulation of research questions, followed by the development of research instruments through both quantitative and qualitative approaches. The development phase of AMKA involves validation by media and material experts, practicality assessment by teachers and students, and effectiveness testing through pretest and posttest designs.

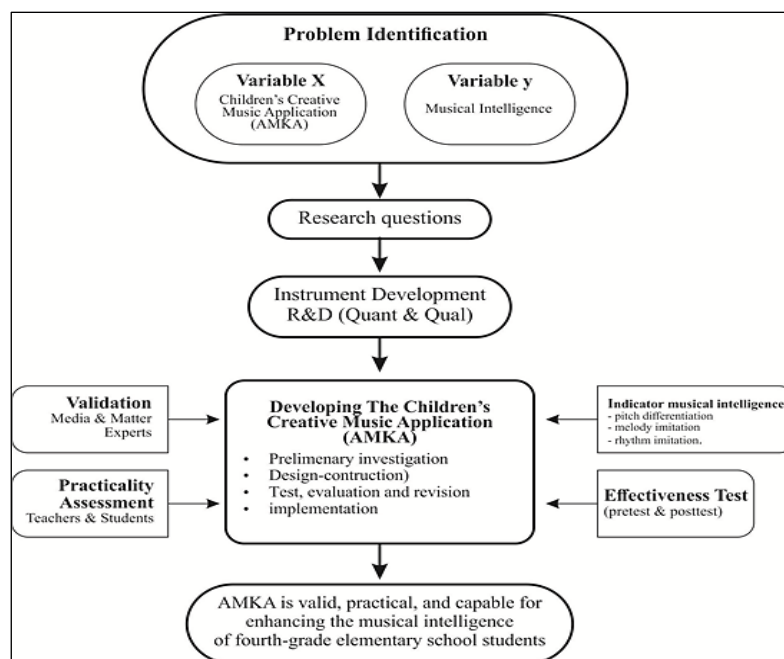


Figure 1: Conceptual Design of the Development of the Children's Creative Music Application (AMKA) to Enhance the Musical Intelligence of Fourth-Grade Elementary School Students

As shown in Figure 1, the research process concludes with the finding that AMKA is valid, practical, and capable of enhancing the musical intelligence of fourth-grade elementary school students. The model is organized into four main

phases: the preliminary investigation phase, the design and construction phase, the assessment phase (including testing, evaluation, and revision), and the implementation phase. The detailed development procedure is presented in Table 1.

Table 1: Development Phases Based on the Plomp Model

No	Phase	Description
1	Preliminary investigation	This phase involves identifying and analyzing the educational problems, needs, and context. It includes literature review, field observations, and interview of users and analysis curriculum.
2	Design and Construction	In this phase, the prototype of the product (AMKA) is designed based on the findings from the previous phase. Learning content, features, and user interface are developed in alignment with musical intelligence indicators.
3	Assessment (Test, Evaluation, and Revision)	The prototype is tested for validity, practicality, and effectiveness. Evaluation data are collected from experts, teachers, and students. Based on the feedback, revisions are made to improve the application.
4	Implementation	The final version of the application is implemented in real classroom settings. Its impact on students' musical intelligence is measured, and the results are analyzed for educational implications.

Population and Sample

This study was conducted in public elementary schools located in the Ex-Residency area of Semarang, Indonesia. A total of 116 fourth-grade students participated as research participants during this phase of the study. The study involved

116 fourth-grade students, comprising 62 male and 54 female participants. The majority of participants were 10 years old ($n = 111$), with one student aged 9 and five students aged 11.

The selected schools were located in coastal regions along the northern coast of Java Island,

known for a strong cultural affinity toward dangdut music, a genre that is particularly popular in this area. All four schools involved in the study held an “excellent” accreditation status, reflecting

a high standard of institutional quality and educational performance. The distribution of participants across schools, presented in Table 2.

Table 2: The distribution of The Research Participants

Research Area	Gender		Age			Total
	M	F	9 th	10 th	11 th	
Semarang City	14	15	1	26	3	29
Demak Regency	15	13	-	27	1	28
Kendal Regency	17	12	-	28	1	29
Semarang Regency	16	14	-	30	-	30
Total	62	54	1	111	5	116

Research Instruments

The data collection techniques used in this study included observation, interviews, questionnaires, and tests to measure the level of students’ musical

intelligence. The data obtained from these techniques consisted of both qualitative and quantitative data. The methods and instruments used for data collection in this study are presented in Table 3.

Table 3: Data Collection Methods

Criteria	Purpose	Technique	Instrument
Needs Analysis	Identification of initial problems and learning needs	Observation, Interview	Observation sheets and interview guides
Validity	Quality of the AMKA prototype and supporting tools	Expert judgment using validity scales	AMKA validity assessment sheets and validation instruments
Practicality	User responses (teachers and students) after implementing AMKA in learning	Questionnaire	Closed-ended teacher and student response questionnaires
Effectiveness	The effect of AMKA on students’ musical intelligence	Musical Intelligence Test	Musical intelligence test application

Observation was used to examine the process of music learning and to identify various challenges that have occurred in schools. The observation was conducted in fourth-grade classrooms at elementary schools in the Ex-Residency of Semarang. The observation sheet consisted of

structured teaching steps, organized into an observation form with a column for assessing the implementation of each instructional activity. The sub-dimensions and indicators used in the observation are presented in Table 4.

Table 4: Observation Sub-Dimensions and Indicators of Music Learning Activities

No	Sub-Dimension	Indicator	No. of Items
1	Introductory Activities in Music Learning	Preparing students physically and psychologically to participate in learning activities	4
2	Core Learning Activities	Delivering music learning content	3
		Use of music learning components	5
3	Closing Activities in Music Learning	Teacher summarizes the lesson	1
		Teacher reinforces the learned material clearly	1
		Teacher conducts an evaluation of the music lesson	1
		Teacher assigns tasks clearly	1
		Teacher explains the plan for the next meeting	1
		Total	17

As presented in Table 4, the observation instrument for music learning activities consists of three sub-dimensions: introductory, core, and closing activities. Each sub-dimension includes several indicators related to the teacher's and students' roles, totalling 17 items used for observation.

Interviews were conducted between the researcher and four teachers as well as 40 fourth-

grade elementary school students in the Ex-Residency of Semarang. The interview guidelines were developed by taking into account the variables of the study. The interview variables were categorized into four main themes: knowledge of music in the students' surrounding environment; musical intelligence; music applications currently in use; and the need for instructional media in music education.

Table 5: Open-Ended Interview Guide Grid for Need Assessment

No	Category	Indicators	No. of Items	Sample Question
1	Knowledge of music in the environment	Students' exposure to music in daily life	7	What kinds of music do you often hear at home or in your surroundings?
2	Musical intelligence	Ability to recognize, differentiate, and reproduce musical elements	7	Can you distinguish between high and low notes? Can you imitate a rhythm after hearing it?
3	Music applications currently in use	Familiarity with existing music learning applications	4	Have you ever used a music learning app? What kind of features did it have?
4	Needs for music learning media	Expectations for effective and fun music learning tools	2	What kind of music learning media would help you understand music better and make it more enjoyable?

This table 5 serves as a guide for developing interview questions in a needs assessment study on music learning, covering aspects of knowledge, musical intelligence, app usage, and learning media expectations. The Open-Ended Interview Guide Grid for Need Assessment in Table 5, outlines four key categories used to explore students' needs in music learning. These include knowledge of music in their environment, musical intelligence, familiarity with existing music learning applications, and expectations for effective and enjoyable learning media. Each category is supported by specific indicators, a number of items, and example questions designed to gather qualitative data on students' experiences and preferences. The validity assessment sheet

consists of two components: content validity (relevance and currency) and construct validity (consistency). The AMKA validity assessment sheet uses a four-point scale: 4 (highly appropriate), 3 (appropriate), 2 (less appropriate), and 1 (not appropriate). The purpose of the validation sheet in this study is to obtain expert judgments particularly from subject matter experts regarding the quality of the music application being developed. The content validity of AMKA evaluates the quality of the application in terms of the relevance of the material, content presentation, language use, and the currency of the information. The assessment aspects and the content validity rubric used by experts are presented in Table 6.

Table 6: Content Validity Assessment Grid of AMKA by Subject Matter Experts

No	Aspect	Indicator	Item Number
1	Content Relevance	Alignment of the material with the learning objectives of Grade 4 elementary school music lessons	1
		Material presented in the application meets students' learning needs	2

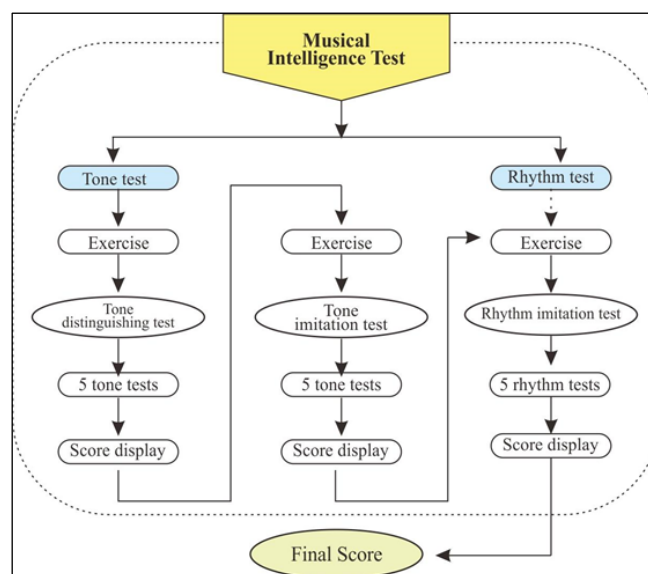
No	Aspect	Indicator	Item Number
		Material is appropriate to the developmental level of elementary school students	3
2	Material Presentation	Presentation techniques	4-9
3	Language Use	Readability	10-11
		Use of proper and standard Indonesian language	12-13
4	Content Currency	Novelty and up-to-dateness of the material presented in the application	14-16

Table 7: Media Validity Assessment Grid of AMKA by Media Experts

No	Aspect	Indicator	Item Number
1	Ease of Use and Navigation	Ease of accessing/downloading the application	1-2
		Ease of navigating through the application features	3-5
2	Visual and Audio Display	Visual appearance (layout, design)	6-7
		Quality of audio, text, color, and illustrations	8-12
3	Integration of Creative Music Content	Responsiveness of navigation buttons	13
		Integration of illustrations, music, and text	14-15
4	Benefits of the Application	Usefulness of the application in supporting music learning	16-18

The Media Validity Assessment Grid of AMKA by Media Experts in Table 7, presents four main aspects evaluated by experts, including ease of use and navigation, visual and audio display, integration of creative music content, and benefits of the application. Each aspect is accompanied by specific indicators and corresponding item numbers, which serve as a guide for assessing the overall quality, functionality, and effectiveness of the AMKA application in supporting music learning. The practicality questionnaire in this

study was used to obtain responses from users. The target users in this research were fourth-grade teachers and students from elementary schools across the Ex-Residency of Semarang. The assessment used the Guttman scale, in which the response options were limited to "Yes" and "No". The children's musical intelligence test consisted of three categories: pitch differentiation, melody imitation, and rhythm imitation. The flow of the musical intelligence test is illustrated in Figure 2.

**Figure 2:** Flow of the Musical Intelligence Test

Data Analysis

The implementation of music learning in fourth-grade elementary school was analyzed using both quantitative and qualitative descriptive methods. The researcher acted as an observer, providing assessments by marking (√) in the evaluation

column using a four-point rating scale: 4 (Very Good), 3 (Good), 2 (Fair), and 1 (Poor) (16). The data from the AMKA validity assessment were analyzed quantitatively using descriptive statistics. The results were averaged to obtain a passing grade (P), and the criteria for interpretation are presented in Table 8.

Table 8: Passing Grade Criteria

Score Interval	Assessment Category	Description
$3,26 \leq P < 4,00$	Highly Appropriate	Can be used without revision
$2,51 \leq P < 3,25$	Appropriate	Can be used with minor revisions
$1,76 \leq P < 2,50$	Less Appropriate	Can be used with major revisions
$1,00 \leq P < 1,75$	Not Appropriate	Cannot be used; requires substantial improvement and consultation

Table 8 presents the passing grade criteria used in the assessment process. The criteria are categorized into four levels; highly appropriate, appropriate, less appropriate, and not appropriate, based on specific score intervals and corresponding descriptions.

Practicality was measured through teacher and student response questionnaires. These questionnaires were used to gather feedback after the implementation of learning using the AMKA

application. Teachers and students provided their responses by placing a check mark (√) in the evaluation column with the following scale: Yes = 1 and No = 0. The criteria for interpreting the average score of responses were based on a rating scale. The data analysis procedure for practicality follows the method proposed by Nurhusain & Hadi (17). The interpretation of respondents' response scores is presented in Table 9.

Table 9: Interpretation Criteria for Practicality

No.	Percentage (%)	Category
1	$90 \leq P \leq 100$	Highly Practical
2	$80 \leq P < 90$	Practical
3	$70 \leq P < 80$	Fairly Practical
4	$60 \leq P < 70$	Less Practical
5	$P < 60$	Not Practical

Table 9 presents the interpretation criteria for practicality. The criteria are divided into five categories ranging from highly practical to not practical based on percentage scores obtained from the assessment results. The assessment of the musical intelligence test was divided into three components: pitch differentiation, melody imitation, and rhythm imitation (18). For the pitch

differentiation and melody imitation tests, responses were evaluated using a binary scoring system: "correct" and "incorrect." A correct answer was awarded a score of 10, while an incorrect answer received a score of 0. In contrast, the rhythm imitation test was assessed using a rating scale adapted from the Likert scale, consisting of four levels: 4–3–2–1.

Table 10: Musical Intelligence Score Categories

Category	Score Range
Highly Musical	240–300
Musical	179–239
Moderately Musical	118–178
Less Musical	57–117
Not Musical	10–56

Based on the categories above, children's musical intelligence can be identified according to their obtained scores (Table 10). If a child achieves a score between 179 and 239, their level of musical intelligence is classified as "musical." In a study (18), it was explained that students categorized as "fairly musical" can still enhance their musical intelligence through training or by being supported in an environment that provides opportunities for development. However, students categorized as "less musical" or "non-musical" face significant challenges in improving or developing their musical intelligence.

The improvement of musical intelligence in fourth-grade elementary school students was measured

through the administration of pre-tests and post-tests. The test data were analyzed using the Paired Sample t-Test and N-gain analysis. The paired sample t-test is used to compare two related samples, which involve the same subjects under different treatment conditions (19). The test was conducted using a significance level of 0.05 ($\alpha = 5\%$) to examine the relationship between the independent and dependent variables (19). N-gain analysis was applied to determine the level of improvement resulting from the use of AMKA in enhancing students' musical intelligence. The results of the N-gain calculation were interpreted according to the criteria high, medium, low, and no improvement (20) presented in Table 11.

Table 11: N-gain Interpretation Criteria

Interval (g)	Category
$0.70 \leq g \leq 1.00$	High
$0.30 \leq g < 0.70$	Medium
$0.00 \leq g < 0.30$	Low
$g = 0.00$	No improvement

Table 11 presents the interpretation criteria for the N-gain score. The data indicate that an N-gain value between 0.70 and 1.00 is categorized as high, values between 0.30 and 0.70 are medium, and values between 0.00 and 0.30 are low. Meanwhile, an N-gain of 0.00 indicates no improvement in learning outcomes.

Results

Preliminary Investigation

Based on the interview results, several findings were obtained regarding children's knowledge of music in their environment. Almost all students stated that they enjoyed listening to and singing music. As shown in Figure 3, YouTube was

identified as the most frequently used platform for music learning, selected by 77.5% of participants. Other media used included song applications (40%), social media (17.5%), and a smaller proportion utilized television, video players, and other sources.

All interviewed students stated that they were able to operate gadgets or mobile devices. Initial information regarding music applications showed that students primarily accessed and listened to music through internet, based applications on their devices. Figure 3 illustrates the types of mobile applications most frequently used by students to play and listen to music.

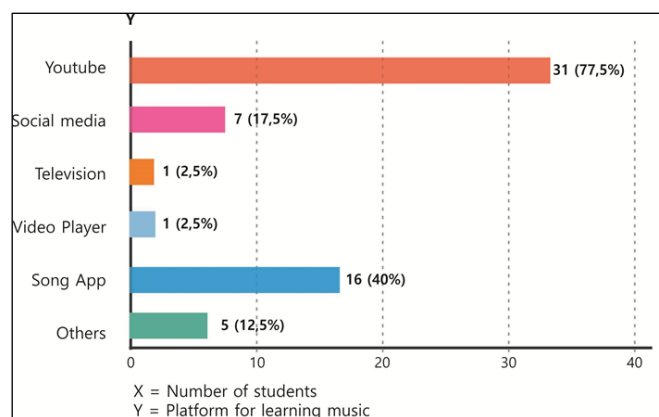


Figure 3: Student Use of Music Applications

The initial condition of students' musical intelligence was also supported by the results of the musical intelligence pre-test conducted using the AMKA application. A total of 40 students participated in the pre-test, consisting of 10 students each from Semarang City, Demak

Regency, Kendal Regency, and Semarang Regency. The test results indicated that students fell into the categories of "Not Musical," "Less Musical," and "Moderately Musical." The detailed results of the musical intelligence test are presented in Figure 4.

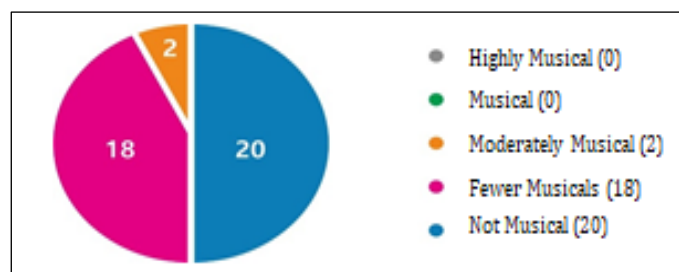


Figure 4: Overview of Students' Musical Intelligence

Figure 4 shows that the majority of students fell into the "Not Musical" category, totaling 20 students. Eighteen students were categorized as "Less Musical," while only two students were classified as "Moderately Musical." No students were found in the "Musical" or "Highly Musical" categories based on the pre-test results.

Design and Construction

The design process of AMKA was carried out through several stages, including: (i) collecting visual assets such as images, audio, and text; (ii) selecting the appropriate software for programming; (iii) designing a system flowchart; (iv) programming; and (v) testing the application. The assets used in AMKA included images or photographs, audio files, text or font types, and other supporting elements. The color scheme applied consisted of soft tones as well as black and white. The proportion of visual elements on each page ranged from 20% to 70% (21).

The audio assets were created using Cubase, a Digital Audio Workstation (DAW) used for recording, mixing, and mastering purposes. Cubase, developed by Steinberg, is designed for music and MIDI recording, arrangement, and

editing (22). The textual elements used in the application were designed to capture users' attention, employ legible typography, and be laid out in a manner that enhances readability (23). Based on these considerations, the fonts used in AMKA were selected for their simplicity, clarity, and suitability for children's cognitive and visual characteristics.

The software used to build the AMKA program is Kodular. Developers can create custom extension blocks in the Integrated Development Environment (IDE) as needed (24). User data generated from the AMKA application such as user settings, location preferences, user scores, and other relevant data are stored in the back end. The back-end development utilizes JavaScript, HTML, CSS, and PHP. The system flowchart of the main menu in AMKA is presented in Figure 5.

The screen layout was designed in portrait orientation, as it was deemed the most suitable for the overall design concept. This orientation was selected based on the consideration that it provides a more comfortable user experience and enhances readability. The layout in portrait mode is presented in Figure 6.

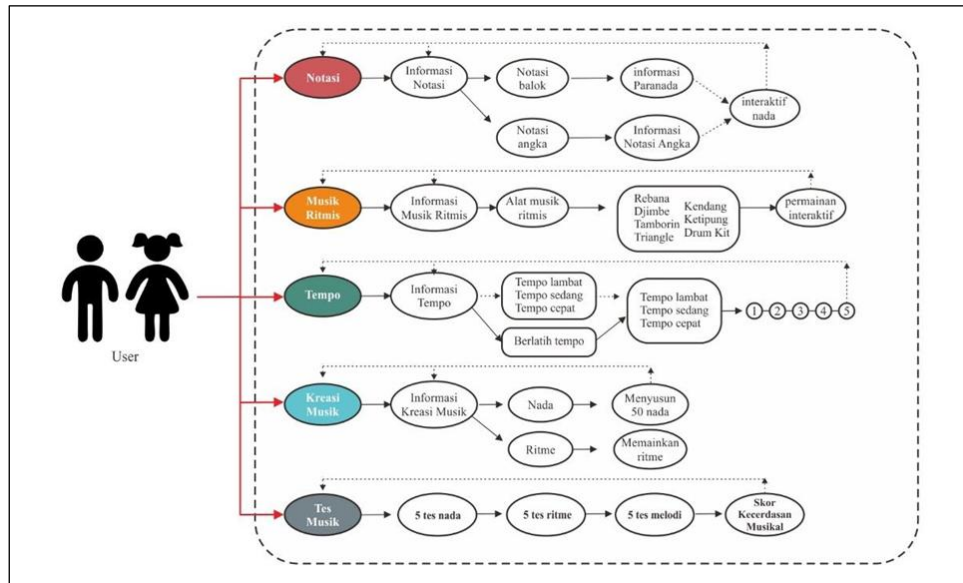


Figure 5: AMKA Main Menu (Home) Flowchart

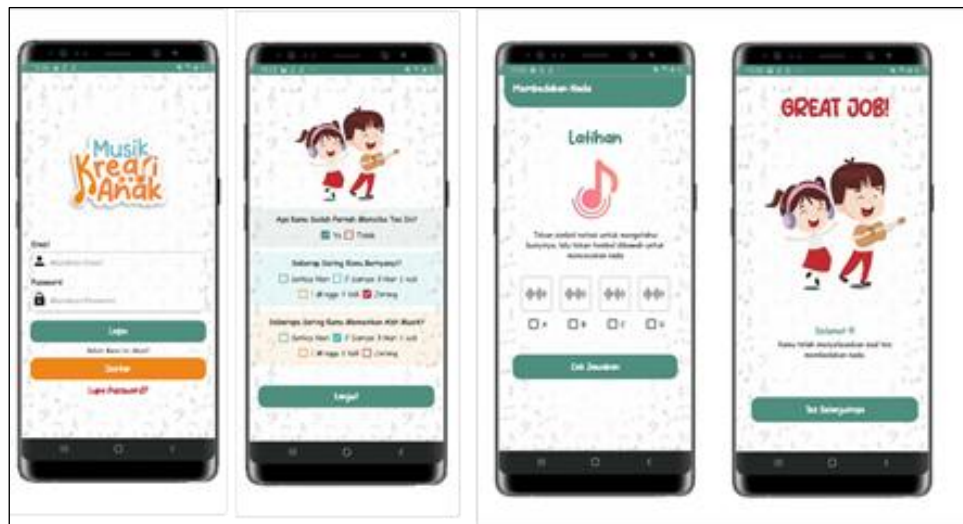


Figure 6: Portrait Orientation Display of AMKA

Table 12: Content Validity Assessment of AMKA by Subject Matter Experts

Expert	Validity		Reliability (R %)	
	Score	Category	Score	Category
Expert I	3.88	Highly Valid	97%	Reliable
Expert II	3.75	Highly Valid	94%	Reliable

Assessment (Test, Evaluation, and Revision)

Validation Assessment of AMKA Prototype I

The content validity of the AMKA application reflects the quality of the application in terms of content relevance, material presentation, language use, and content currency. The results of the content validity assessment of AMKA by subject matter experts are presented in Table 12.

Table 12 presents the results of the content validity assessment of AMKA by subject matter experts. The average validity score or passing grade (P) from Expert I and Expert II was 3.81. This result falls within the range of $3.26 \leq P < 4.00$, indicating that the content is categorized as "Highly Valid." Meanwhile, the average percentage of agreement (R) between the two experts was 95%, which exceeds the minimum threshold of 75%, signifying that the instrument is "Reliable."

Table 13: Content Validity Assessment of AMKA by Media Experts

Expert	Validity	Category	Reliability (R %)	
	Score		Score	Category
Expert I	3,56	Highly Valid	89	Reliable
Expert II	3,72	Highly Valid	93	Reliable

Table 13 shows the results of the content validity assessment of AMKA by media experts. The average validity score or passing grade (P) from Experts I and II was 3.64. This result indicates that $3.26 \leq P < 4.00$, which falls into the "Highly Feasible" category. Meanwhile, the average percentage of agreement (R) between Experts I and II was 91%, showing that the reliability percentage was $\geq 75\%$. Therefore, the evaluation of AMKA is considered reliable according to expert judgment. Based on the results presented in Table 13, it can be concluded that, in terms of construct,

AMKA is highly feasible and reliable for use in teaching Music for fourth-grade elementary school students.

Practicality Test Results

The second trial involved a practicality questionnaire aimed at obtaining responses from fourth-grade elementary school students and teachers in the Ex-Residency of Semarang regarding the use of the AMKA application. The practicality assessment was conducted after the music learning sessions utilizing AMKA.

Table 14: Practicality Assessment of AMKA According to Fourth-Grade Elementary Students in the Ex-Residency of Semarang

Research Area	Percentage (%)	Assessment Result
Semarang City	86,4	Practical
Demak Regency	85	Practical
Kendal Regency	90	Highly Practical
Semarang Regency	90	Highly Practical

Table 14 shows that the average results of the AMKA practicality test, as evaluated by students from all fourth-grade elementary schools in the former Semarang Residency area, fall within the

categories of "Practical" and "Highly Practical." Therefore, AMKA is accepted and can be effectively implemented in music learning for fourth-grade elementary school students.

Table 15: Practicality Assessment of AMKA According to Fourth-Grade Teachers in the Ex-Residency of Semarang

Research Area	Response		Percentage (%)	Category
	Yes	No		
Semarang City	20	0	100	Highly Practical
Demak Regency	19	1	95	Highly Practical
Kendal Regency	19	1	95	Highly Practical
Semarang Regency	20	0	100	Highly Practical

The results of the practicality assessment of AMKA by fourth-grade teachers in the Ex-Residency of Semarang in Table 15, indicate that the application is considered "Highly Practical" across all research areas. Teachers from Semarang City and Semarang Regency rated AMKA with a 100% positive response, while teachers from Demak Regency and Kendal Regency provided a 95% positive response. These findings demonstrate that AMKA is perceived as highly practical and suitable for use in elementary music learning.

Although the majority of teachers responded with "Yes" to the practicality questionnaire items, two teachers selected "No" for item number 2, which stated: "The installation of this application is simple." This response was due to an automatic security warning notification generated by the Android system during the installation process. To address this issue and facilitate the installation of AMKA for teachers, the researchers developed a step-by-step installation tutorial. Overall, the results of the practicality test showed that AMKA was rated as "Highly Practical" by teachers of all

fourth-grade classes in the Ex-Residency of Semarang. Therefore, AMKA is considered acceptable and suitable for implementation in fourth-grade elementary school music learning.

Implementation

After the AMKA product was declared valid and practical, it proceeded to the implementation phase. Implementation involved the broader dissemination of AMKA to a wider range of schools. The subjects involved in the assessment phase included fourth-grade students and teachers from elementary schools in the Ex-Residency of Semarang, which comprises Semarang City, Demak Regency, Kendal Regency, and Semarang Regency. The technical steps of AMKA implementation included; explaining the concept of musical intelligence; distributing the AMKA application along with the learning materials; providing guidance on the learning flow using AMKA; conducting music learning sessions with AMKA, and administering the musical intelligence test.

Effectiveness Test Results

The assessment phase involved fourth-grade students and teachers from elementary schools in the Ex-Residency of Semarang, which includes Semarang City, Demak Regency, Kendal Regency,

and Semarang Regency. A total of 116 students participated in this phase. Prior to using the AMKA application in classroom learning, students completed a pre-test to measure their level of musical intelligence. Following the completion of music learning sessions using AMKA, students then took a post-test through their individual user accounts. The pre-test and post-test data were analyzed through a normality assumption test and a paired sample t-test. The next step in the analysis was the calculation of the N-Gain score, which was used to measure the degree of improvement in students' musical intelligence as a result of using the AMKA app. The average N-gain score was 0.6, which falls into the "moderate improvement" category based on the interpretation criteria. A summary of the effectiveness analysis of AMKA for fourth-grade students in the Ex-Residency of Semarang is presented in Table 16.

Table 16 presents the summary of the effectiveness analysis of the AMKA application across four research areas. The results show a significant improvement from pretest to posttest in all areas (Sig. 2-tailed = .000), with an average N-Gain score of 0.6, indicating a moderate level of effectiveness.

Table 16: Summary of the Effectiveness Analysis of the AMKA Application

Research Area	Pretest		Posttest		Normalitas (Sig)		Uji-T (Sig. (2-tailed))	N-Gain
	Max	Min	Max	Min	Pretest	Posttest		
Semarang City	20	140	60	180	.292	.090	.000	0,6
Demak Regency	20	120	40	240	.068	.121	.000	0,6
Kendal Regency	20	120	40	240	.106	.092	.000	0,6
Semarang Regency	20	240	40	260	.116	.089	.000	0,6

Discussion

Utilization of Technology in Music

Education for Primary School Students

Investigative findings indicate that nearly all elementary school students enjoy singing and playing music, as these activities are enjoyable and contribute positively to children's psychological and emotional development (25). Singing is an engaging activity that provides satisfaction for children (26). This interest is further supported by students' access to music through mobile devices such as YouTube and various music applications. According to Zhao *et al.*, 63% of children in Indonesia spend at least 30 minutes per day using gadgets for entertainment (27).

Observational data also revealed that teachers frequently rely on singing activities due to the lack of musical instruments and inadequate school facilities. Moreover, teachers have not fully utilized technology in music instruction, primarily due to limited knowledge and access to appropriate tools. In the past, one researcher emphasizes that teachers must use technology effectively and stay updated with innovations to meet the needs of the new generation (28). The use of technological tools is an essential resource in supporting classroom music instruction (29).

Therefore, there is a strong need for an educational, engaging, and application-based learning medium to assist teachers in delivering music lessons. Previous studies have also highlighted the importance of leveraging

educational technology to enhance students' creativity and the overall effectiveness of music learning (30).

Advantages and Characteristics of the AMKA Application in Primary School Music Education

The AMKA application offers several advantages over other children's music learning applications, such as ChordIQ, by providing more comprehensive content ranging from notation, rhythm, tempo, and music creation, to integrated musical intelligence testing. AMKA is specifically designed to align with the characteristics of fourth-grade elementary students and is developed based on Indonesian Curriculum. The development of AMKA is grounded in constructivist learning theory and Howard Gardner's theory of musical intelligence, and incorporates the Problem Based Learning (PBL) model. This approach fosters collaboration, problem-solving, and student creativity in music learning (31). Within the PBL framework, teachers are also encouraged to utilize various learning resources from the surrounding environment, making the learning experience more enjoyable and meaningful, thereby supporting children's holistic development (32).

AMKA is also tailored to the characteristics of elementary school children, who generally enjoy games and group activities. The application is designed to resemble a game, featuring engaging visuals and audio elements, and it encourages active peer interaction. The widespread use of mobile devices among elementary students is also leveraged to boost learning motivation (33). Engaging digital media can foster an enjoyable learning environment and help optimize the development of students' musical intelligence (34).

One identified limitation within the "Music Creation" menu is that it does not yet fully align with the ideal concept of musical composition. In the context of elementary school students, the term "music creation" is more accurately interpreted as virtuoso practice, referring to musical exercises based on the mastery of rhythm and pitch (35). Overall, AMKA was developed with careful consideration of educational theories, principles of musical intelligence, student characteristics, and alignment with the official elementary school curriculum.

AMKA meets the quality standards for the development of instructional media, as it has undergone a validity test prior to implementation, followed by practicality and effectiveness testing. One of the key criteria for selecting appropriate learning media is its alignment and relevance to instructional task requirements (36).

Enhancing Primary School Students' Musical Intelligence through AMKA-Based Learning

A total of 87.5% of students reported enjoying singing and playing music and were accustomed to accessing music through digital applications. However, initial test results indicated that their musical intelligence remained low, primarily due to insufficient stimulation from their environment, limited instructional exposure, and lack of learning facilities. In fact, musical activities integrated into classroom instruction have the potential to significantly enhance students' musical abilities (37). Learning through the AMKA application, which adopts the Problem-Based Learning (PBL) model, has been shown to enhance students' musical intelligence through activities of exploration, expression, and appreciation of music (38). AMKA provides an active and enjoyable learning experience by engaging students directly with musical elements such as pitch, rhythm, and melody.

Data indicate that 94% of students experienced an improvement in their musical intelligence after using the AMKA application. This effectiveness stems from the app's ability to allow students to focus on listening and responding to music freely, without teacher intervention. Student interaction with music through the app had the most significant impact on their auditory perception (39). Moreover, AMKA serves as a practical solution for elementary school teachers who may lack musical teaching skills or face limitations in musical instruments. Like other educational technologies, AMKA is cost-effective, accessible, and capable of overcoming barriers in music education at the primary level. Technology can help reduce constraints and teaching challenges commonly faced with traditional instructional materials in music education (40).

Other findings also reveal that musical intelligence can influence other forms of intelligence. Students categorized as highly musical or musical tended to demonstrate higher academic achievement

compared to those classified as less musical or unmusical. Previous studies have noted that musically intelligent students prefer instructional methods that emphasize sensory engagement and reflective thinking (41). Musical intelligence has been shown to support the development of language and reading abilities (42), numeracy, general academic intelligence (43), as well as fine motor coordination, concentration, self-confidence, emotional awareness, sensitivity, social skills, teamwork, self-discipline, and relaxation (44). Moreover, musical intelligence plays an important role in vocabulary acquisition. Musical training has been shown to offer multiple cognitive and developmental benefits. It can enhance verbal memory skills (45, 46), improve overall memory retention (47), and increase performance outcomes (48). Additionally, musical training contributes to the development of musical proficiency (49), supports children's ability to assess distance, consider speed, and maintain focus, and promotes higher-level creative thinking (50, 51).

Based on the discussion above, the results of the musical intelligence test, which includes pitch, melody, and rhythm tests, are related to the musical stimuli that students receive from their environment. A person's activity towards the rhythm, melody, and timbre of the music they hear has a positive relationship with students' musical intelligence (52). Students whose musical intelligence falls into the highly musical and musical categories have better academic achievement compared to those in other categories.

Conclusion

The results of this study demonstrate that AMKA was developed in accordance with user characteristics and was found to be highly valid, highly practical, and effective in enhancing the musical intelligence of fourth-grade elementary school students. AMKA serves as a viable alternative to promote student-centered learning, foster active participation, enhance students' creativity, and integrate the use of modern technology into music education. The development of similar technology-based instructional media is strongly recommended, particularly to support the growth of musical intelligence. Musical intelligence plays a crucial role in human development as it

helps individuals solve problems encountered in daily life. For children, musical intelligence contributes significantly to the development of other forms of intelligence, including the enhancement of creativity and imagination, intellectual abilities, memory retention, as well as emotional and creative development.

Limitations

This study has several limitations that should be acknowledged. First, the research was geographically limited to fourth-grade students in the Ex-Residency of Semarang, which may restrict the generalizability of the findings to other regions or countries with different cultural, social, and educational contexts. Second, the sample size and age range were limited, focusing solely on a single grade level, thus not capturing the full developmental variation of musical intelligence across elementary school years.

Third, the measurement instrument used assessed only two components of musical intelligence pitch and rhythm while other important dimensions, such as musical expression, composition, and appreciation, were not included. Fourth, although environmental and familial factors were identified as influential, the study did not explore in depth how specific contextual variables such as socioeconomic status, cultural exposure, or the quality of music education affect musical intelligence development.

Abbreviations

None.

Acknowledgement

This article is part of a doctoral dissertation on Primary School Education pursued by the first author (A) at Yogyakarta State University, Indonesia. We express our deepest gratitude Higher Education Financing Center Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia and the Education Fund Management Institution (LPDP) of the Republic of Indonesia, which have provided Indonesian Education Scholarships (BPI) so that the first author (A) is able to pursue this academic degree.

Author Contributions

All authors contributed equally.

Conflict of Interest

There is no conflict of interest with the content of this article

Declaration of Artificial Intelligence (AI) Assistance

The authors declare that they did not use any AI-assisted tools during the writing process.

Ethics Approval

Not applicable.

Funding

This study did not receive any specific funding from public, non-profit, or commercial organizations.

References

1. Cuadrado F. Music and talent: An experimental project for personal development and well-being through music. *Int J Music Educ.* 2019;37(1):156–74.
2. Daquila JP. Musical intelligence to improve pronunciation. *Sch Int J Linguist Lit.* 2023;6(1):1-20.
3. Giannopoulou P, Makri-Botsari E, Allison M. Relating musical intelligence to empathy and aggression in adolescence. In: *Scientific Conference Determinants and Prospects in Education.* 2016;1(1):67-76.
4. Trimble M, Hesdorffer D. Music and the brain: The neuroscience of music and musical appreciation. *BJPsych Int.* 2017;14(2):28–31.
5. Bilhartz TD, Bruhn RA, Olson JE. The effect of early music training on child cognitive development. *J Appl Dev Psychol.* 1999;20(4):615–36.
6. Rose D, Jones Bartoli A, Heaton P. Measuring the impact of musical learning on cognitive, behavioural and socio-emotional wellbeing development in children. *Psychol Music.* 2019;47(2):284–303.
7. Rauscher FH. The impact of music instruction on other skills. *Oxford Handb Music Psychol.* 2009;244–52. doi: 10.1093/oxfordhb/9780199298457.013.0023.
8. Southgate DE, Roscigno VJ. The impact of music on childhood and adolescent achievement. *Soc Sci Quarterly.* 2009;90(1):4–21.
9. Huralna S, Demianko N, Sulaieva N, et al. Multimedia technologies for teaching musical art under present-day conditions. *Int J Educ Inf Tech.* 2022;16(3):128–35. doi: 10.46300/9109.2022.16.14.
10. Gao H, Li F. The application of virtual reality technology in the teaching of clarinet music art under the mobile wireless network learning environment. *Entertain Comput.* 2024;49(7):100619.
11. Zhang M, Hou K. Research on the Application of Computer Music Making Technology in New Media Environment. *J Phys Conf Ser.* 2021; 1871(1): 0-5. doi: 10.1088/1742-6596/1871/1/012142.
12. Antara F, Ardipal. Development of learning media for the digital native generation. *RISSEJ.* 2025;2(2):127–32. <https://ejournal.ump.ac.id/rissej/article/download/166/162>
13. Hoffding S, Hansen NC, Jensenius AR. Music research “in the Wild” – Introducing the MusicLab Copenhagen Special Collection. *Music Sci.* 2024;7. <https://doi.org/10.1177/20592043241294161>
14. Ouyang M. Employing mobile learning in music education. *Educ Inf Technol.* 2023;28(5):5241–57.
15. Plomp T. Educational design research: An introduction. *Educ Des Res.* 2013;1:11–50. <https://www.fi.uu.nl/publicaties/literatuur/educational-design-research-part-a.pdf#page=12>
16. Yeo JP. Research in art and design education: A review. *Acad Res Int.* 2012;3(3):303-12. [http://www.savap.org.pk/journals/ARInt/Vol.3\(3\)/2012\(3.3-36\).pdf](http://www.savap.org.pk/journals/ARInt/Vol.3(3)/2012(3.3-36).pdf)
17. Bessant K. Instructional design and the development of statistical literacy. *Teach Soc.* 1992;20(2):143-9.
18. Reker P, Domschke K, Zwanzger P, et al. The impact of depression on musical ability. *J Affect Disord.* 2014;156:150-5. <https://doi.org/10.1016/j.jad.2013.12.010>
19. Afifah S, Mudzakir A, Nandiyanto AB. How to calculate paired sample t-test using SPSS software: From step-by-step processing for users to the practical examples in the analysis of the effect of application anti-fire bamboo teaching materials on student learning outcomes. *Indonesian J Teach Sci.* 2022;2(1):81-92.
20. Nissen JM, Talbot RM, Nasim Thompson A, et al. Comparison of normalized gain and Cohen'sd for analyzing gains on concept inventories. *Phys Rev Phys Educ Res.* 2018;14(1):010115. <https://doi.org/10.1103/PhysRevPhysEducRes.14.010115>
21. Çer E. Preparing books for children from birth through age six: A new children's reality approach. *Univ J Educ Res.* 2016;4(5):1024-36.
22. Dodgson M. Technology learning, technology strategy and competitive pressures. *Br J Manag.* 1991;2(3):133-49.
23. Van Leeuwen T. Typographic meaning. *Visual communication.* 2005;4(2):137-43. <https://doi.org/10.1177/1470357205053749>
24. Syarlisjswan MR, Wahyuningsih D. The development of e-modules using Kodular software with problem-based learning models in momentum and impulse material. In: *Journal of Physics: Conference Series.* IOP Publishing. 2021;1796(1):012078. doi: 10.1088/1742-6596/1796/1/012078.
25. Zarate JM, Zatorre RJ. Experience-dependent neural substrates involved in vocal pitch regulation during singing. *Neuroimage.* 2008;40(4):1871–87.
26. Rowland C. *Understanding child language acquisition* (1st ed.). Routledge. 2013. <https://doi.org/10.4324/9780203776025>
27. Zhao F, Egelman S, Weeks HM, et al. Data collection practices of mobile applications played by preschool-aged children. *JAMA Pediatr.* 2020;174(12):e203345–e203345. <https://doi.org/10.1001/jamapediatrics.2020.3345>
28. Gorgoretti B. The use of technology in music education in North Cyprus according to student music teachers. *South African J Educ.* 2019;39(1):1–6.
29. Wise S, Greenwood J, Davis N. Teachers' use of digital

- technology in secondary music education: Illustrations of changing classrooms. *Br J Music Educ.* 2011;28(2):117-34.
30. Hamidi F, Meshkat M, Rezaee M, et al. Information technology in education. *Procedia Comp Sci.* 2011;3:369-73.
<https://doi.org/10.1016/j.procs.2010.12.062>
 31. Wood DF. Problem based learning. *BMJ.* 2003; 326:328.
doi: <https://doi.org/10.1136/bmj.326.7384.328>
 32. Dean J. *Managing the primary school* (2nd ed.). Routledge. 1995.
<https://doi.org/10.4324/9780203138113>
 33. Kerr MS, Rynearson K, Kerr MC. Student characteristics for online learning success. *Internet High Educ.* 2006;9(2):91-105.
<https://doi.org/10.1016/j.iheduc.2006.03.002>
 34. Kusuma DA, Dwipriyoko E. The relationship between musical intelligence and the enhancement of mathematical connection ability using ethnomathematics and the mozart effect. *Infinity J.* 2021;10(2):191-202.
<https://doi.org/10.22460/infinity.v10i2.p191-202>
 35. Henry ML. The effect of pitch and rhythm difficulty on vocal sight-reading performance. *J Res Music Educ.* 2011;59(1):72-84.
<https://doi.org/10.1177/0022429410397199>
 36. Ediyani M, Hayati U, Salwa S, et al. Study on development of learning media. *BIRCI-Journal: Human Soc Sci.* 2020;3(2):1336-42.
 37. Hallam S, Prince V. Conceptions of musical ability. *Res Stud Music Educ.* 2003;20(1):2-22.
<https://doi.org/10.1177/1321103X030200010101>
 38. Milbrandt MK, Miraglia KM, Zimmerman E. An analysis of current research in *Studies in Art Education and the International Journal of Education Through Art.* *Stud Art Educ.* 2018;59(1):39-54.
<https://doi.org/10.1080/00393541.2017.1401882>
 39. Cho S, Baek Y, Choe EJ. A strategic approach to music listening with a mobile app for high school students. *Int J Music Educ.* 2019;37(1):132-41.
 40. Correa AGD, Lemos BHV, Nascimento M, et al. AR musical app for children's musical education. *Proc Int Symp Consum Electron ISCE.* 2016:125-6.
doi: 10.1109/ISCE.2016.7797403.
 41. Rachmatsyah TH, Franky. The relation of multiple intelligence and teaching style. *Arts Educ.* 2024;38(3):112-21.
<https://artseduca.com/submissions/index.php/ae/article/view/248/71>
 42. Long M. The effect of a music intervention on the temporal organisation of reading skills PhD degree examination. 2007.
<https://core.ac.uk/download/pdf/40064792.pdf>
 43. Criscuolo A, Bonetti L, Särkämö T, et al. On the association between musical training, intelligence and executive functions in adulthood. *Front Psychol.* 2019;10(6):1-12.
 44. Hallam S. 21st century conceptions of musical ability. *Psychol Music.* 2010; 38(3):308-30.
 45. Roden I, Kreutz G, Bongard S. Effects of a school-based instrumental music program on verbal and visual memory in primary school children: A longitudinal study. *Front Psychol.* 2012;3(12):1-9.
 46. Ho YC, Cheung MC, Chan AS. Music training improves verbal but not visual memory: Cross-sectional and longitudinal explorations in children. *Neuropsychol.* 2003;17(3):439-50.
 47. Gu J, Du Y, Zhang C, et al. Music intervention in human life, work, and disease: a survey. *Int J Crowd Sci.* 2023;7(3):97-105.
 48. Degé F, Kubicek C, Schwarzer G. Music lessons and intelligence: A relation mediated by executive functions. *Music Perception.* 2011;29(2):195-201.
 49. Treichler FR. Testing musical ability: An American dissenter and some related historical comparisons. *Hist Human Sci.* 2013;26(5):48-68.
 50. Puspitasari L, In'am A, Syaifuddin M. Analysis of Students' Creative Thinking in Solving Arithmetic Problems. *Int Elect J Math Ed.* 2019;14(1):49-60.
<https://doi.org/10.12973/iejme/3962>
 51. Ramón LN, Chacón-López H. The impact of musical improvisation on children's creative thinking. *Think Skills Creat.* 2021;40:100839.
<https://doi.org/10.1016/j.tsc.2021.100839>
 52. Anderson JD. Children's song acquisition: An examination of current research and theories. *VRME.* 2021;16(2):37.
<https://digitalcommons.lib.uconn.edu/cgi/viewcontent.cgi?article=1753&context=vrme>

How to Cite: Priyanto W, Mustadi A, Haryanto. The Use of the Children's Creative Music Application (AMKA) to Enhance Elementary School Students' Musical Intelligence. *Int Res J Multidiscip Scope.* 2025; 6(4):1393-1408. doi: 10.47857/irjms.2025.v06i04.08303