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Musical Ability of Elementary School Studens: Rasch Model Analysis

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ABSTRACT: Music education in Indonesian primary schools continues to face substantial challenges, primarily because most learning is delivered by classroom teachers who lack formal training in music education. This situation has resulted in a gap in the development of students' musical abilities, despite the essential role of music in fostering cognitive, affective, social, and psychomotor growth. This study aims to analyze the musical abilities of primary school students taught by non-specialist classroom teachers. Employing a descriptive quantitative method, the research collected data through musical tests administered to 601 students from Tasikmalaya, Ciamis, Banjar, Garut, and Pangandaran districts/cities in West Java Province. The tests assessed three domains: rhythm imitation, melody imitation, and rhythm response. Instrument validity was examined using the Pearson Product Moment, while reliability was measured with Cronbach's Alpha. Data were further analyzed using Rasch modeling through the Winstep application to obtain precise estimates of student ability and a detailed mapping of item distribution. The findings show that 13.98% of students demonstrated high musical ability, 70.55% moderate ability, and 15.47% low ability, with an overall mean ability of 0.72 logits. Rhythm response emerged as the most challenging domain compared with rhythm and melody imitation. These results indicate that music learning in primary schools has not yet been fully effective in fostering students' musical development. Therefore, strategic interventions are necessary, including providing music competency training for classroom teachers, assigning specialized music teachers to primary schools, and developing a competency-based music curriculum to support more effective and sustainable music education.

Keywords: musical ability, music education, primary school.

ABSTRAK: *Pendidikan musik di sekolah dasar Indonesia masih menghadapi tantangan yang signifikan, terutama karena sebagian besar pembelajaran dilakukan oleh guru kelas yang tidak memiliki latar belakang pendidikan musik. Kondisi ini menyebabkan adanya kesenjangan dalam perkembangan kemampuan musikal siswa, padahal musik memiliki peran penting dalam menunjang pertumbuhan kognitif, afektif, sosial, dan psikomotor mereka. Penelitian ini bertujuan untuk menganalisis kemampuan musikal siswa sekolah dasar yang mengikuti pembelajaran musik dari guru kelas nonspesialis. Dengan menggunakan metode deskriptif kuantitatif, data dikumpulkan melalui tes musikal yang diberikan kepada 601 siswa dari Kabupaten/Kota Tasikmalaya, Ciamis, Banjar, Garut, dan Pangandaran di Provinsi Jawa Barat. Tes tersebut mengukur tiga aspek, yaitu imitasi ritme, imitasi melodi, dan respons ritme. Validitas instrumen diuji menggunakan Pearson Product Moment, sedangkan reliabilitas diukur dengan Cronbach's Alpha. Analisis data dilakukan menggunakan pemodelan Rasch melalui aplikasi Winstep untuk memperoleh estimasi kemampuan siswa yang lebih akurat serta pemetaan item yang lebih rinci. Hasil penelitian menunjukkan bahwa 13,98% siswa berada pada kategori tinggi, 70,55% kategori sedang, dan 15,47% kategori rendah, dengan rata-rata kemampuan sebesar 0,72 logit. Respons ritme muncul sebagai aspek yang paling menantang dibandingkan dengan imitasi ritme dan melodi. Temuan ini mengindikasikan bahwa pembelajaran musik di sekolah dasar belum sepenuhnya efektif dalam mengembangkan*

kemampuan musikal siswa. Oleh karena itu, diperlukan langkah strategis, seperti pelatihan kompetensi musik bagi guru kelas, penempatan guru musik spesialis di sekolah dasar, serta pengembangan kurikulum musik berbasis kompetensi untuk mendukung pembelajaran musik yang lebih efektif dan berkelanjutan.

***Kata Kunci**: musikalitas, pendidikan musik, sekolah dasar.*

INTRODUCTION

One of the main goals of music education is to develop the musical intelligence naturally possessed by every child since birth (Maldonado, 2024; Dyson & Gabriel, 1968). Musical intelligence is part of multiple intelligences that enables children to understand, appreciate, and express themselves through sound (Gardner, 2003). The development of this intelligence is strongly influenced by the surrounding environment, including stimulation provided by family, school, and the community (Turyamureeba, 2024). The more frequently children are exposed to meaningful musical experiences, such as listening to music, singing, or playing instruments, the more their musical intelligence develops (Stekić, 2024; Zhu, 2023). Therefore, music education at the primary school level plays an important role in optimizing the development of children's musical intelligence, while also supporting their balanced growth and development (Alonso et al., 2024; Çenberci & Tufan, 2023).

Musical intelligence does not stand alone; it intersects with other basic intelligences in child development (García & Maldonado, 2017). Music involves the processing of patterns, structures, and rhythm, which directly contributes to the development of logical-mathematical and linguistic intelligence (Salselas, 2013; Slevc & Okada, 2015). Children trained in music tend to have stronger analytical skills and greater sensitivity to language, including intonation and rhythm in speech (Chern et al., 2017). Musical intelligence is also closely related to kinesthetic intelligence, as skills in playing instruments or dancing require good motor coordination (Cruz et al., 2017). From the emotional and social perspective, music helps children express feelings, increase empathy, and build cooperation through group musical activities (Ussenbaev, 2024; Molero, 2020). As musical intelligence increases, other aspects of development—cognitive, social, emotional, and motor—also grow optimally (Foti, 2020).

Given the importance of developing musical intelligence in education, the government through the *Kurikulum Merdeka* has designated music learning as part of the primary school curriculum. One of the main objectives is to provide meaningful musical experiences so that students can gradually develop musical understanding and skills (Kemendikbudristek, 2022). The expected learning outcomes include the ability to listen to various sounds and musical elements, actively participate in different musical experiences, and imitate sounds and musical patterns they hear (Mulyana & Sari, 2021). Students are also directed to develop creativity by creating simple new musical patterns based on their understanding and experiences (Permendikbud, 2022).

In practice, however, music education in Indonesian primary schools is often taught by general classroom teachers without a formal background in music education. This situation significantly affects the learning process, as most

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classroom teachers lack adequate mastery of important components of music teaching (Siswanti & Sularso, 2024). These include teaching methods, use of learning media, evaluation, and strategies to stimulate students' potential. Such limitations can hinder students' ability to develop both skills and appreciation for music (Respati et al., 2023).

Empirical evidence from case studies highlights systemic weaknesses in primary school music education, including low initial student interest (53.29%), the dominance of non-specialist teachers, difficulties in curriculum implementation, and limited facilities (Saputra, 2020). Furthermore, music lessons in primary schools are often conducted through rote memorization of songs or notation, which is then applied to instrument playing (Wicaksono, 2019). This mechanical approach results in students engaging only with the technical aspects without truly understanding or experiencing the meaning of music. Consequently, music education tends to become repetitive and fails to foster musical appreciation and creativity (Respati, 2025).

Several studies have examined the potential of primary school students' musical abilities. For instance (Alves, 2021) emphasized that multimedia use in music education fosters active listening, creativity, and artistic expression. (Serani, 2019) highlighted how the Dalcroze method empowers sensory faculties (ears, eyes, muscles) to build sensitivity, perception, and understanding of musical elements. (Jelita, 2021) demonstrated that solfeggio video media is highly valid and practical for improving sixth-grade students' ability to read notes and sing. (Tejapermana & Runasari, 2018) explained that the use of the traditional *Gamolan Lampung* instrument can help primary teachers develop students' musical ability. (Niltufarichah et al., 2024) showed that the application of Cooperative Learning significantly enhances students' musical skills by fostering collaboration, creativity, and active participation.

Unlike previous research that largely focused on the implementation of methods, media, or learning strategies to improve musical ability, this study offers novelty in several unexplored areas of primary music education. First, this research does not only focus on instructional implementation but also empirically measures students' levels of musical ability through a systematic musical test. The measurement was conducted on a large scale, involving 601 primary school students with diverse characteristics in terms of educational background, social environment, and prior musical experience. Second, this study introduces a new approach to evaluating the effectiveness of music education, which until now has mostly relied on memorization and mechanical practice.

The purpose of this study is to analyze and map the musical ability profiles of primary school students, thereby providing a clearer picture of their developmental levels. By employing a more structured and systematic musical test, this research is expected to produce accurate and objective data regarding the musical aspects that students have mastered and those still in need of development. The results are also expected to serve as a foundation for formulating data-driven recommendations for more effective and adaptive models of music education, aligned with students' needs and characteristics. Thus,

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music education in schools can be designed more optimally to stimulate students' musical potential across cognitive, affective, and psychomotor domains.

RESEARCH METHOD

This study employed a quantitative approach by administering performance tests to elementary school students. The research respondents consisted of 601 students (271 boys and 330 girls) from the regions of Tasikmalaya, Ciamis, Banjar, Garut, and Pangandaran in West Java Province. The sample was selected using stratified random sampling based on region, ensuring proportional representation from each area. The research instrument was a musical ability test developed by the researchers based on the theory of musical intelligence (Gardner, 2003). The test items were also adapted from instruments previously used in earlier studies (Dyson & Gabriel, 1968). The test comprised three main aspects: rhythm imitation, melody imitation, and rhythm response. The format was a direct performance test, in which students were asked to reproduce rhythmic or melodic patterns and respond to rhythms through clapping, singing, or bodily movements. Each response was assessed using a scoring rubric that had been piloted with a small group of students to ensure clarity of instructions and rating reliability. Data collection was conducted by classroom teachers who had received brief training on test administration procedures and the use of the scoring rubric to ensure objectivity and inter-rater consistency. The validity of the instrument was examined using Pearson Product Moment correlations for each test item, while internal reliability was assessed with Cronbach's Alpha ($\alpha = 0.872$), indicating high reliability. The test data were analyzed using Rasch modeling with the aid of the Winstep application. Rasch modeling was chosen because it allows the conversion of ordinal scores into more precise interval logit scales while also providing detailed information on item quality and respondent ability. In addition, Rasch enables visualization of student ability distribution and item difficulty levels through the Wright Map, which supports a more comprehensive interpretation of students' musical ability profiles. Table 1 and Table 2 below present the results of the validity and reliability of the musical ability test instrument:

Validity Test

Table 1. Validity Test

No test Item	r table value.	obtained r value	Criteria
Rhythm imitation test			
1	0,316	0,732	Valid
2	0,316	0,561	Valid
3	0,316	0,809	Valid
4	0,316	0,748	Valid
5	0,316	0,858	Valid
Melody imitation test			
6	0,316	0,373	Valid

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7	0,316	0,555	Valid
8	0,316	0,351	Valid
9	0,316	0,749	Valid
10	0,316	0,390	Valid
Rhythm response test			
11	0,316	0,415	Valid
12	0,316	0,788	Valid
13	0,316	0,326	Valid
14	0,316	0,724	Valid
15	0,316	0,802	Valid

Reliability Test

Table 2. Reliability Test

Cronbach's Alpha	N of Items
.872	15

Based on the reliability test results, it was found that the reliability test for the musical test yielded a coefficient value of 0.872. This result indicates that the musical test instrument have a very high level of reliability (Sugiyono, 2016).

RESULT AND DISCUSSION

Based on the analysis conducted using the Rasch Model, several insights were obtained, particularly regarding the general overview of the sample and the aspects of students' musical abilities. Figure 1 provides general information about the overall quality of respondents, the quality of the instruments used, and the interaction between persons and items.

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SUMMARY OF 601 MEASURED Person

	TOTAL SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	41.1	15.0	.72	.43	.98	-.12	.95	-.17
SEM	.4	.0	.07	.00	.02	.05	.02	.05
P.SD	10.3	.0	1.77	.07	.47	1.28	.47	1.23
S.SD	10.3	.0	1.77	.07	.47	1.28	.47	1.23
MAX.	58.0	15.0	4.05	.73	4.04	5.50	3.80	4.84
MIN.	19.0	15.0	-3.85	.37	.14	-4.02	.14	-3.61

REAL RMSE	.47	TRUE SD	1.71	SEPARATION 3.62	Person RELIABILITY .93
MODEL RMSE	.44	TRUE SD	1.72	SEPARATION 3.93	Person RELIABILITY .94
S.E. OF Person MEAN = .07					

Person RAW SCORE-TO-MEASURE CORRELATION = .99
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .94 SEM = 2.48

SUMMARY OF 15 MEASURED Item

	TOTAL SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	1646.3	601.0	.00	.07	.98	-.33	.95	-.68
SEM	44.1	.0	.19	.00	.04	.66	.03	.52
P.SD	164.9	.0	.71	.00	.14	2.46	.12	1.96
S.SD	170.7	.0	.73	.00	.14	2.54	.13	2.03
MAX.	1891.0	601.0	1.10	.07	1.27	4.62	1.22	3.49
MIN.	1387.0	601.0	-1.08	.06	.76	-4.45	.77	-3.69

REAL RMSE	.07	TRUE SD	.71	SEPARATION 10.41	Item RELIABILITY .99
MODEL RMSE	.07	TRUE SD	.71	SEPARATION 10.66	Item RELIABILITY .99
S.E. OF Item MEAN = .19					

Item RAW SCORE-TO-MEASURE CORRELATION = -1.00
Global statistics: please see Table 44.
UMEAN=.0000 USCALE=1.0000

Figure 1. Summary Statistics of Musical Ability

Figure 1 above is an output table generated from Winstep using the Rasch Model. This output provides extensive information; however, the information can be simplified as presented in Table 2.

Table 2. Summary of Musical Ability Result

Deskripsi	Mean Measure	Separation	Reliability	α Cronbach
Person	0.72	3.62	0.93	0.94
Item	0.00	10.41	0.99	

From Figure 1, it can be seen that the students' logit scores range from a minimum score of -3.85 to a maximum score of 4.05. Furthermore, the mean measure for persons is 0.72, indicating that, in general, students have good musical abilities, as their logit scores are above 0.0 (Mulyasari et al., 2024).

Additionally, the person reliability score is 0.93, which falls into the excellent category. This indicates that respondents took the test consistently, and the results are reliable. The item reliability score is 0.99, meaning that the quality of the items is exceptional for measuring respondents. Other information also shows that the Cronbach Alpha value (KR-20) is 0.94, which falls into the excellent category, indicating that the overall interaction between persons and items is very

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strong (Herdiasnyah & Fauziah, 2024; Yudiar et al., 2022). The classification of persons and items can be determined by applying the separation value from Table 3 into the following formula:

$$H = [(4 \times \text{separations})+1]/3$$

From Table 3, it is known that the person separation value is 3.62. After applying this value to the formula above, the result is 5.16, which is rounded to 5. This indicates that there are five groups of respondents. Furthermore, the item separation value is 10.41, and when applied to the formula, the result is 14.21, which is rounded to 14. This means there are 14 groups of items (Nur et al., 2022; Parkitny et al., 2012)

The data distribution can be analyzed using the Rasch model. Figure 2 presents the output from the application regarding the distribution of persons and items.

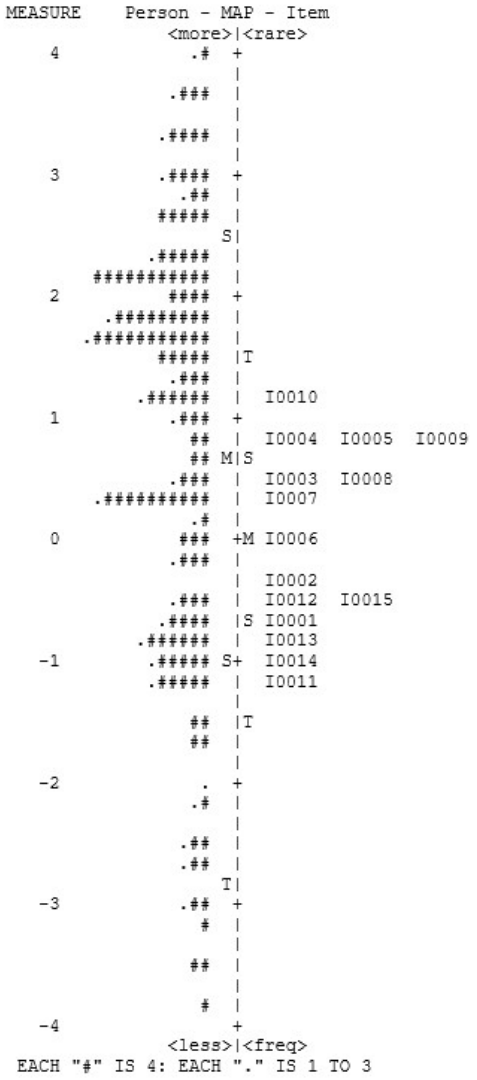

Figure 3. Wright Maps of Person Map Item

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From Figure 3, it is evident that the data is well-distributed, with the left side illustrating the ranking distribution of respondents' quality and the right side showing the ranking distribution of item quality. The higher the position, the better the quality of the person or item (Hermansyah et al., 2024). This figure provides valuable insights and aids in categorizing respondents' abilities. To simplify this categorization (Nugrahnastiti & Kamaludin, 2024), the following formula is used: High = Mean + 1SD < X; Medium = Mean -1SD ≤ X ≤ Mean +1SD; and Low = X < Mean -1SD. The mean value applied is 0.72, with a standard deviation of 1.77. Table 4 presents the categorization of students' musical abilities.

Table 4. Frequency Distribution of Musical Ability

Category	Total	Interpretation
High 2.49 < X	84 (13.98%)	Students are able to replicate rhythm steadily and accurately according to the tempo, as well as imitate melodies with precise intonation, pitch, and note duration. They can also respond to rhythm spontaneously and in harmony, either through body movements or instruments.
Moderate -1.05≤ X ≤ 2.49	424 (70.55%)	Students perform fairly well in imitating simple rhythms, although minor errors in tempo and stability still occur. Melodic imitation is done with reasonable accuracy, but there are still inaccuracies in intonation or note duration. Their response to rhythm is fairly synchronized, but they struggle with consistency in following tempo changes.
Low X < -1.05	93 (15.47%)	Students have difficulty accurately imitating rhythms and often struggle with maintaining the correct tempo. Their melodic imitation contains many errors in pitch and note duration. Their response to rhythm is not well-coordinated, often delayed, or does not align with the given pattern.

Additionally, another profile that can be observed is the achievement profile of each aspect, as shown in Table 5.

Table 5. Musical Ability Aspects Profile

Aspect	Mean	High	Medium	Low	Total
Imitating Rhythm	0.64	117 (19,47%)	390 (64,89%)	94 (15,64%)	601 (100%)
Imitating Melody	0.23	118 (19,63%)	389 (64,73%)	94 (15,64%)	601 (100%)
Responding to Rhythm	2.03	122 (20,30%)	352 (58,57%)	127 (21,13%)	601 (100%)

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Based on research conducted on 601 elementary school students, musical ability, which consists of the aspects of imitating rhythm, imitating melody, and responding to rhythm, shows the following distribution. In the aspect of imitating rhythm, the majority of students fall into the medium category, with 390 students (64.89%), while 117 students (19.47%) have high ability, and 94 students (15.64%) fall into the low category, with an average score of 0.64. In the aspect of imitating melody, most students also fall into the medium category, with 389 students (64.73%), while 118 students (19.63%) belong to the high category, and 94 students (15.64%) fall into the low category, with an average score of 0.23. Meanwhile, in the aspect of responding to rhythm, 352 students (58.57%) have medium ability, 122 students (20.30%) fall into the high category, and 127 students (21.13%) fall into the low category, with an average score of 2.03. Overall, the aspects of imitating rhythm and imitating melody show similar distribution patterns, where the medium category dominates, whereas the aspect of responding to rhythm exhibits greater variation, with a higher percentage of students in the low category compared to the other aspects.

The above results indicate that most students have musical ability in the medium category across all three measured aspects. This suggests that while the majority of students can follow rhythmic and melodic patterns fairly well, there are still limitations in the accuracy and stability of their execution. This is consistent with (Chantanasut, 2024; Utama & Julia, 2019), where students showed significant improvement in rhythm and melody reading skills. However, challenges in execution accuracy and stability may still occur, highlighting the need for continuous practice and adjustments in teaching methods to address these limitations. Additionally, the aspect of responding to rhythm has a higher percentage of students in the low category compared to the other aspects, indicating that students tend to struggle more with providing spontaneous rhythmic responses than with imitating rhythmic and melodic patterns. This aligns with the study by (Kołodziejski, 2018), which found that students generally performed worse in improvisation compared to imitation, particularly in triple meter, indicating greater difficulty in spontaneous rhythmic responses than in imitating rhythmic and melodic patterns. These findings can serve as a foundation for developing more effective learning strategies, such as utilizing more interactive and experience-based methods to enhance students' musical skills, particularly in actively and accurately responding to rhythm.

CONCLUSION

The findings indicate that the majority of elementary school students possess musical abilities in the moderate category (70.55%) and low category (15.47%), while only 13.98% fall into the high category. When broken down by aspect, the abilities to imitate rhythm and melody were predominantly in the moderate category (64.89% and 64.73%), whereas in the rhythm response aspect, the percentage of students in the low category was higher (21.13%) than in the other aspects. This highlights that rhythm response is the greatest challenge for students. Such weaknesses are attributed to the lack of stimulation through

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interactive learning activities and insufficient musical experiences, such as auditory experiences, sound exploration, improvisation, or the use of interactive digital media. Thus far, music teaching methods have tended to emphasize rote memorization of songs or notation, which is less effective for developing comprehensive musical skills. Therefore, improvement strategies should focus on enhancing classroom teachers' competencies through specialized training in basic music education, the provision of dedicated music teachers in elementary schools, and the utilization of relevant instructional media. Furthermore, the development of competency-based music learning models should be aligned with the *Kurikulum Merdeka* standards to ensure music education is more structured, contextual, and supportive of national learning outcomes.

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