KUPAS SENI: *Jurnal Seni dan Pendidikan Seni*
ISSN 2289-4640 /eISSN 0127-9688 ***Jilid 13 Isu Khas, 2025*** *(85-90)*

Article Info:
Published Date: 18 April 2025
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Singing, Dancing, and Graphing: An Artistic Expression Approach in Teaching Graph Functions to Indigenous Students

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To cite this article (APA): Romeo, N., & Majid, S. (2024). Singing, Dancing, and Graphing: An Artistic Expression Approach in Teaching Graph Functions to Indigenous Students. *KUPAS SENI: Jurnal Seni Dan Pendidikan Seni*, *13*(Isu Khas), 85-97. https://doi.org/10.37134/kupasseni.vol13.sp.9.2025

To link to this article: https://doi.org/10.37134/kupasseni.vol13.sp.9.2025

ABSTRACT

Educational equity in Malaysia is especially urgent for marginalized communities like the Indigenous people, particularly in Kuala Lipis, Pahang. Despite efforts by the Ministry of Education (MOE), the Indigenous People Development Department (JAKOA), and the Malaysian Teachers' Institute (IPG), dropout rates among Indigenous students remain a concern due to cultural and lifestyle factors. This study aimed to integrate music into learning Graph Functions by modifying pop song lyrics. The interdisciplinary approach examined how music-based mathematics lessons impact Indigenous secondary students' ability to model, strategise, and apply Graph Functions. Aida Jebat's song Pencuri Hati was adapted for this study, based on the Artistic Development Theory. Four pre-service teachers enrolled in a Science Education degree in Mathematics modified the lyrics and implemented the lessons over three months. The study had two phases: a pre-test in October 2023 and a post-test in January 2024. Respondents were selected through cluster random sampling from secondary students in Kuala Lipis. Quantitative design using descriptive analysis showed that integrating music positively affected students' learning. Singing modified lyrics with body gestures helped them remember graph function concepts, creating an engaging and enjoyable learning experience. The results suggest that music-enhanced math lessons improved students' confidence and attitudes toward mathematics. Future research should explore the impact of this approach on urban, rural, and interior communities.

Keywords: Artistic Expression, Music, Graph Functions, Indigenous secondary students, Artistic Development Theory

INTRODUCTION

Ensuring educational equity in Malaysia is particularly urgent when addressing marginalized communities, such as the Indigenous people, especially in Kuala Lipis, Pahang. Despite various policies and initiatives led by organizations like the District Education Office (PPD), the Ministry of Education Malaysia (KPM), the Indigenous Development Department (JAKOA), and the Malaysian Teachers' Institute (IPG), dropout rates among Indigenous students remain a challenge, influenced by their cultural and lifestyle factors. For Indigenous students, traditional teaching methods may not fully align with their lived experiences, learning styles, and cultural identities. According to Sarra and Ewing (2014), a range of challenges with the provision of education services are faced by children and families, particularly those outside metropolitan regions. To delve into this issue, the artSMart 8 project, initiated by the Faculty of Education at UiTM Selangor, Puncak Alam Campus, aimed to empower the community through quality education. Under the theme "Unlocking Learning Opportunities," the project seeked to enhance educational equity as the core objective. This aligns with the Malaysian Education Blueprint (2013-2025) and reflects the principles outlined in the National Education

Philosophy since 1988. Artistic expression involves conveying ideas and emotions through various art forms such as painting, literature, music and performance (Fiveable, 2025). Dance and movement are also forms of artistic expression that have positive effects on brain function (Colino, 2025). In mathematics classrooms, the integration of music and dance has been explored by a number of educators over the past few years (Carmona, 2023; Allen-Glass, 2018; Capraro, Song, Tillman, 2016; Belcastro & Schaeffer, 2011). Therefore, based on previous studies and literature, the researchers have decided to incorporate music and movement into the teaching of mathematics to Indigenous students. The objective of the research is to explore the effectiveness of integrating singing, dancing and music in teaching Graph Functions to Indigenous secondary school students. In addition, the impact of interdisciplinary music-mathematics lessons on the mathematical abilities of Indigenous secondary school students in modelling, strategies and applications of graph functions, was also examined. Based on the stated objective, a research question was constructed, namely how does the integration of singing, dancing and music affect Indigenous students in learning Graph Functions?

The Indigenous community in Malaysia still faces various challenges in education, especially in ensuring that the curriculum and teaching and learning strategies are appropriate for their needs. According to Noor Hanim et al. (2020), the national curriculum adopted in Malaysian schools cannot meet the practical and socio-cultural needs of the Indigenous community. This uniform curriculum is less relevant to their daily lives, causing gaps in understanding and acceptance of knowledge among Indigenous students. Education that does not consider the local cultural context can reduce the effectiveness of learning and subsequently affect attendance rates and academic achievement. In addition, the teaching and learning strategies used in the mainstream education system are not in line with the cognitive level and socio-cultural background of Indigenous students (Mohd Hasril et al., 2015). Their diverse levels of thinking and learning styles are not given due attention, causing many to fall behind in academics. Teaching approaches that are too exam-oriented and less flexible make it difficult for them to understand the concepts being taught.

To overcome this challenge, the school has taken the initiative to combine academic learning with leisure activities that are related to the lives of the Indigenous community (Chin et al., 2021). Activities such as environmental exploration, cultural arts, and traditional games have been proven to increase interest and encouragement for them to attend school. Additionally, Mathematics Hub (n.d.) discusses how these Indigenous students gain empowerment by seeing their histories, cultures, and identities represented in the curriculum. These approaches make learning more meaningful and interesting for them. Alghufali (2024) agreed that they help develop creativity and innovation, teaching them to deal with the world and express feelings positively. Plus, McLaughlin and Seabrook (2025) believe that the diverse skills and knowledge of creative arts therapists have immense potential to inspire, connect, and contribute to the development of more sustainable social and economic structures, while also promoting sustainability-driven professional practices.

Furthermore, efforts to improve the academic performance of Indigenous students require the cooperation of all parties, including parents, government agencies such as the Indigenous Development Department (JAKOA) and the Ministry of Education Malaysia (MOE) (Zulkefli et al., 2023). Support from families and stakeholders plays an important role in ensuring better access to education, thereby helping to increase educational rights and equality for the Indigenous community in the national development process. By examining the impact of this arts-integrated approach, this research seeks to contribute valuable insights into how creative pedagogical strategies can bridge educational gaps and empower Indigenous students in mathematics learning. Ultimately, the study underscores the importance of culturally responsive education in fostering meaningful and inclusive learning experiences.

METHODOLOGY

To help the researcher examine and analyze the existing knowledge, the related scope, and the issues involved in the related topics to achieve the objectives of this study, the theoretical framework studies conducted are based on the Artistic Development Theory by Lowenfeld (1947) which remains among the most well-known and accepted models for conceptualizing the artistic stages of development. It explores how individuals develop artistic skills, creativity, and expression over time. There are four key

aspects of the Artistic Development Theory including (1) Stages of Artistic Growth, (2) Cognitive and Emotional Development, (3) Cultural and Social Influences, and (4) Integration with Education. This approach offers students opportunities for meaningful artistic experiences and production aligned with their unique perspectives, placing a particular emphasis on quality standards reflective of the student's artistic vision (Dobrovolska et. al., 2024). Based on insights from the theoretical framework, the researchers have designed a customized structure as a guideline for conducting the study, illustrating key elements and their influence on the development of a productive music process.

The conceptual framework for this study is shown below:

Figure 1 *Conceptual Framework of Singing, Dancing, and Graphing*

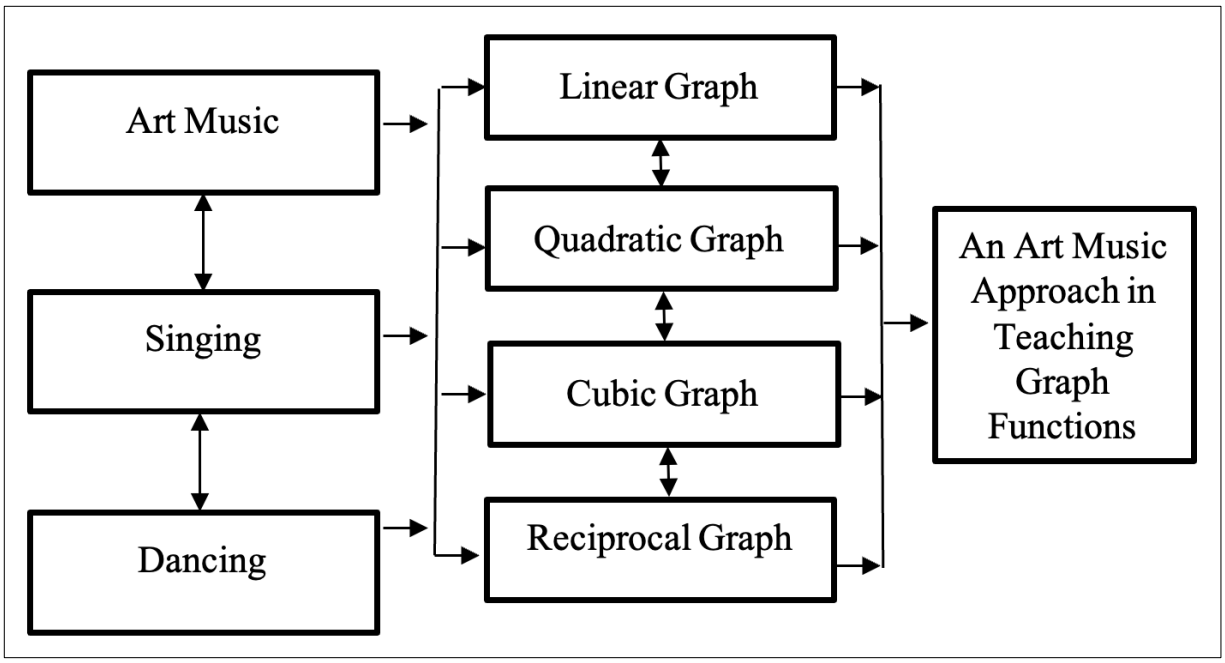


Figure 1 shows the conceptual framework of the mathematics-music approach in teaching Graph Functions to Indigenous students. This conceptual framework contains three sets of elements; namely the musical-artistic aspect (left side), the mathematical aspect (middle), and the output (right side). The first set contains three sub-constructs; music, singing and dancing. The second set contains four sub-constructs for the concept of Graph Functions; linear, quadratic, cubic, and reciprocal. Finally, the relationship between the focus of the study and the purpose of this study is expressed in a subset of the study's purpose, namely a mathematics-music approach in teaching Graph Functions among Indigenous students. There were four student-teachers involved from the undergraduate Mathematics Education. The student-teachers integrated music and movement dancing into the teaching of Graph Functions by using the song "Pencuri Hati" by Ayda Jebat as the background music. To support the learning process, the Indigenous students were provided with song lyrics that had been modified to include key mathematical concepts related to Linear Graphs, Quadratic Graphs, Cubic Graphs, and Reciprocal Graphs as shown in Figure 2.

Figure 2 *Modified Lyrics of Pencuri Hati Song*

Jam di dinding terus berdetak ah
Jom kita belajar tentang fungsi graf ah

Graf linear x akan ke kanan atas negative pula akan turun ke bawah
Kuadratik x kuasa dua akan dapat graf senyum

X kuasa 3 namanya adalah kubik
Bermula dari bahagian kanan atas
Come on baby remember this
Come on remember this
Tak bisa ku ingat-ingat semua graf ini
Membuat aku ah aku makin pening
Come on baby cuba lagi yeah

Peperiksaan semakin dekat ah
Jom kita ulang tentang fungsi graf ah

Graf linear x ke kanan atas negative pula turun ke bawah
Kuadratik x kuasa dua akan dapat graf senyum

X kuasa 3 namanya adalah kubik
Bermula dari bahagian kanan atas
Come on baby remember this
Come on remember this
Tak bisa ku ingat-ingat semua graf ini
Membuat aku ah aku makin pening
Come on baby cuba lagi yeah

Garis lurus graf linear
Kuadratik graf melengkung
Dengan kubik jadi bentuk s
salingan bentuk hiperbola

ini sangatlah mudah (2x)

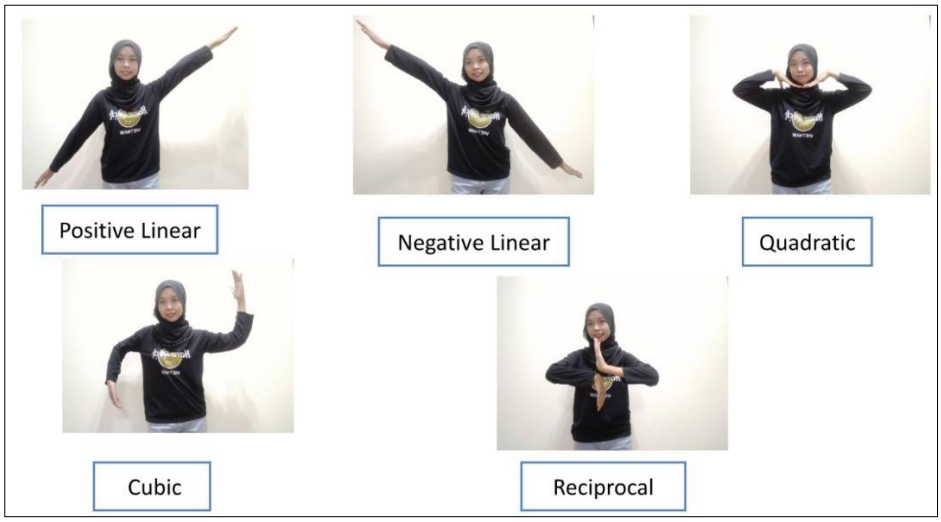
X kuasa 3 namanya adalah kubik
Bermula dari bahagian kanan atas
Come on baby remember this
Come on remember this
Tak bisa ku ingat-ingat semua graf ini

Membuat aku ah aku makin pening
Come on baby cuba lagi yeah
X kuasa 3 namanya adalah kubik
Bermula dari bahagian kanan atas
Come on baby remember this
Come on remember this

Tak bisa ku ingat-ingat semua graf ini
Membuat aku ah aku makin pening
Come on baby cuba lagi yeah
Math easy, math easy(9x)

Students were encouraged to follow the rhythm, sing, and dance along with the student-teachers in a repetitive manner, reinforcing their understanding through active engagement. Throughout the activity, the student-teachers guided the Indigenous students in memorizing the song's rhythm and movements (Figure 3), ensuring that they could recall and apply the learned concepts when responding to feedback exercises. This dynamic and interactive approach aimed to enhance Indigenous students' comprehension and retention of Graph Functions in an enjoyable and culturally relevant manner.

Figure 3 Dance Movements of *Pencuri Hati* Song



FINDINGS AND ANALYSIS

After analysis, the researchers summarised 6 key ideas as presented in Table 1.

Table 1 *Pre-test and Post-test Results*

No.	Item	Percentage strongly agree (%)	
		Pre	**Post**
1	I understand the basic concepts of Graph Functions such as Linear Graphs, Quadratic Graphs, Cubic Graphs, and Reciprocal Graphs	17	83
2	I understand how to calculate the value on the y-axis based on the given equation using a scientific calculator	39	75
3	I understand how to build the x-axis and y-axis according to the set scale	26	88
4	I am aware of the importance of Graph Functions in daily life	45	80
5	The Graph Functions Dancing activity introduces basic mathematical concepts	53	89
6	I consistently practice mathematical exercises	72	91

By conducting this study, the researchers illustrate a significant improvement in students' understanding and engagement with Graph Functions after participating in the Graph Functions Dance activity. The percentage of students who strongly agreed that they understood the basic concepts of Linear, Quadratic, Cubic, and Reciprocal Graphs increased from 17% to 83%, indicating a substantial improvement in conceptual grasp. Students' ability to calculate y-values using a scientific calculator also improved, with strong agreement rising from 39% to 75%, suggesting enhanced computational skills. Understanding how to build the x-axis and y-axis according to a set scale showed the highest increase, from 26% to 88%, demonstrating the effectiveness of the activity in developing spatial and graphical skills. The percentage of students recognizing the importance of Graph Functions in daily life increased from 45% to 80%, showing that the approach helped connect mathematical concepts to real-world contexts. The effectiveness of integrating dance with Graph Functions was evident, as 53% to 89% of students strongly agreed that the activity introduced basic mathematical concepts effectively. Consistent participation in mathematical exercises also improved, with 91% of students strongly agreeing compared to 72% before the intervention, reflecting increased motivation and engagement in learning mathematics.

The results indicate that incorporating music into mathematics lessons significantly enhanced learner outcomes. This coincides with the study from Patinka (2024) and Alghufali (2024) who found that students were able to memorize key concepts of learning through musical experience. Additionally, McLaughlin and Seabrook (2025) agreed the incorporation of body gestures, as knowledge of creative arts, facilitated deeper understanding and retention. Such results highlight that joy in learning can lead to academic success. As music is part of Indigenous community's lifestyle (Ching and Ross, 2015), the national curriculum implemented in Malaysian schools still does not address the practical and socio-cultural needs of the Indigenous community (Noor Hanim et al., 2020) particularly through music and dance. We believe the national curriculum implemented in Malaysian schools is designed to be inclusive and adaptable, aiming to accommodate the practical and socio-cultural needs of the Indigenous community.

CONCLUSION

In conclusion, education for Indigenous communities requires curriculum adaptation, more flexible teaching and learning strategies, culturally relevant learning approaches, and collaboration among all parties to ensure their academic progress and social development continue to be enhanced. It highlights the potential of integrating music into the mathematics curriculum as an effective approach to teaching complex subjects, especially for Indigenous students. This approach not only increases engagement but also provides a model for educators who wish to incorporate creative pedagogical strategies that align with students' cultural backgrounds and learning preferences. By embracing innovative teaching techniques, educators can foster greater motivation, leading to better educational outcomes. These implications suggest the need for further exploration of arts-based learning approaches to make academic content more accessible and meaningful to diverse student populations.

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