

Developing and Evaluating a Rhythm Reading Practice Kit: A Study on Learning Outcomes and Music Learners Satisfaction in Music Education Using Quantitative Analysis

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(Received: September 10, 2024; Revised: October 13, 2024; Accepted: November 15, 2024; Available online: December 1, 2024)

Abstract

This study presents the development and evaluation of a rhythm reading practice kit aimed at improving rhythm comprehension and overall student satisfaction in music education. The kit was specifically designed for students in the Western Music and Vocal Education Studies Program at Rajamangala University of Technology Thanyaburi and Nawaminthrachinuthit School, Horwang, Nonthaburi. It includes progressive exercises across multiple time signatures, enabling both guided classroom uses and self-directed practice. A quantitative research approach was adopted, utilizing pre-test and post-test assessments to measure academic improvement in rhythm reading skills, coupled with a satisfaction survey to gauge student perceptions. Findings revealed a statistically significant increase in students' post-test scores, with university students achieving a mean improvement of 18.35 points and high school students 15 points. The paired samples t-test results indicated strong significance at the .05 level, underscoring the kit's positive impact on rhythm reading proficiency. Furthermore, the student satisfaction survey highlighted high levels of approval, particularly in areas such as instructional clarity, content alignment, and ease of use for independent learning. These results suggest that the rhythm reading practice kit not only enhances students' rhythm skills but also supports their engagement and enjoyment of the learning process. The study concludes with recommendations for future research, suggesting potential digital integrations to increase accessibility and considering adaptations to address a broader range of musical skills beyond rhythm. The findings contribute to the field of music education by providing evidence of the kit's effectiveness and promoting its use as a tool to foster comprehensive rhythm education in diverse educational settings.

Keywords: Music Education, Rhythm Reading Practice Kit, Music Learners Satisfaction, Academic Improvement, Quantitative Analysis

1. Introduction

Music education significantly enhances children's cognitive, social, and physical development. Research links music engagement to improved cognitive abilities, social skills, and physical coordination. Cognitively, music education boosts executive functions (EFs) and academic achievement. Studies show that long-term music programs positively impact EFs and short-term memory, emphasizing its importance for at-risk children with limited access [1]. Research also highlights its role in fostering critical thinking and reflective skills crucial for cognitive development [2]. Music training enhances children's cognitive control, with increased engagement in cognitive tasks among musically trained children [3], aligning with findings that music-related tasks improve cognitive and social outcomes in underprivileged youth [4]. Music education also fosters emotional intelligence and social skills. Studies reveal it enhances emotional recognition and regulation, vital for socio-emotional learning [5]. Culturally relevant music programs improve social and academic outcomes, especially for students from disadvantaged backgrounds [6].

Collaborative music-making promotes teamwork and communication, critical for social interactions [7]. Physically, music activities such as singing and playing instruments develop fine motor skills and coordination [8]. This is particularly important during early childhood, where music and play drive holistic development. Music therapy techniques further support emotional and social skill development, highlighting music's physical and therapeutic

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DOI: <https://doi.org/10.47738/jads.v5i4.471>

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benefits [9]. Thailand's music education faces challenges due to a lack of specialized rhythm-reading practice kits, limiting students' ability to independently master rhythm, a key musical skill emphasized by the National Education Act for lifelong learning and cultural heritage [10]. Effective rhythm tools tailored for self-study and classroom use could address this gap, providing structured learning opportunities and enhancing rhythm comprehension. Resource scarcity, compounded by budget constraints, impacts access to diverse musical genres and quality rhythm instruction, which is essential for developing melody, harmony, and dynamics [11], [12].

Rhythm training also supports cognitive skills, such as language development and reading comprehension, highlighting the need for rhythm-focused tools in under-resourced schools [13], [14]. The dominance of lecture-based teaching restricts interactive lessons, but rhythm kits offer hands-on practice, improving skills and teamwork [15]. Tools like the Takadimi system are underutilized due to limited practice materials [16], underscoring the need for adaptable kits that promote systematic practice with visual aids and percussion tools, enhancing musical fluency and accommodating diverse skill levels [17]. Culturally relevant rhythm tools deepen students' connection to Thai heritage, align with educational goals for cultural pride, and foster inclusive environments blending traditional and contemporary music [18], [19].

The study aims to develop a rhythm reading practice kit tailored to the needs of Thai music students, addressing gaps in rhythm learning resources through structured exercises of increasing complexity. Covering various time signatures like 2/4, 3/4, 4/4, and 6/8, the kit offers a comprehensive foundation in rhythm reading, with visual aids and step-by-step exercises to engage even beginners [11], [13]. The kit supports both individual and group learning, encouraging repetitive, interactive activities that enhance motor skills, timing, and coordination [8], [20]. The study further evaluates the kit's effectiveness through pre-and post-tests, tracking students' progress in rhythm skills and overall music performance, with a focus on quantitative analysis for empirical evidence [14], [21]. This approach aligns with research linking rhythm training to cognitive improvements like language processing and memory retention [1], [3]. Student satisfaction with the kit is also assessed via a survey, providing insights into ease of use, engagement, and perceived effectiveness. Positive feedback and satisfaction are key for motivating sustained learning, with user feedback informing future improvements to better meet students' needs and preferences [5], [17]. This comprehensive approach aims to create an effective, engaging, and adaptable rhythm reading resource.

2. Literature Review

2.1. Educational Goals in Thailand and Music's Role

The National Education Act (NEA) of Thailand, enacted in 1999, underscores lifelong learning, creativity, and cultural heritage as core educational pillars, aiming to foster personal and professional growth amid globalization and socio-economic change [22], [23]. Lifelong learning promotes continuous skill development, encompassing formal and informal education to adapt to diverse community and knowledge contexts [24], [25]. Creativity is emphasized, encouraging innovative teaching to cultivate critical thinking, self-expression, and problem-solving [24]. Cultural heritage education is integral, instilling identity and respect for diversity [26], [27], aiming to create culturally aware, responsible citizens [28]. Music education aligns with these NEA goals by fostering creativity and cognitive skill development. Music classrooms offer unique spaces for self-expression, exploration, and innovative thinking, supported by educators who encourage creative processes like composition and performance [29], [30], [31]. This creative focus prepares students for societal challenges, promoting adaptive thinking. Music education also preserves cultural heritage by integrating traditional Thai music with global genres, nurturing cultural identity and intercultural respect [18]. Students connect with their communities, supporting NEA's goal of cultural competence. Furthermore, music serves as a powerful tool for personal expression, enabling students to explore and communicate their identities, enhancing emotional sensitivity and self-confidence [32], [33]. Through music, NEA's vision for nurturing well-rounded, socially competent individuals is effectively realized.

2.2. Importance of Rhythm in Music Learning

Rhythm is a crucial element in music education, serving as the core for various musical activities and enabling the development of musical and non-musical skills. Effective instruction often utilizes tools like songs, practice kits, and multimedia resources to teach rhythm, promoting accuracy and expressiveness through activities such as tapping and

clapping. These exercises enhance timing, coordination, and the internalization of rhythmic patterns, foundational for instrumental performance and ensemble participation [34]. Beyond music, rhythm training positively impacts executive functions, such as memory and attention, improving academic and personal development [35]. Research highlights rhythm's role in cognitive development, with rhythm perception enhancing phonological awareness and literacy skills, contributing to language learning and improved grammar and vocabulary acquisition [36], [37]. Rhythm-based interventions also bolster phonemic awareness, laying a strong foundation for literacy [38]. Rhythm's influence extends to mathematics, fostering skills like timing and pattern recognition relevant to arithmetic and mathematical operations [39]. Educational theories, such as the Kodály Method and Dalcroze Eurhythmics, emphasize rhythm's foundational role. The Kodály Method uses folk songs and rhythmic exercises to enhance language skills and auditory processing [40], while Dalcroze Eurhythmics combines movement and music, promoting coordination, emotional expression, and cognitive growth [41]. Both methods highlight rhythm's multifaceted benefits, demonstrating its essential role in musical proficiency and holistic development.

2.3. Existing Rhythm Learning Tools and Research Gaps

A review of current rhythm learning tools highlights key limitations in resources available for developing rhythm reading skills, especially within the context of Thai music education. While rhythm reading remains a foundational skill, existing tools often lack specificity in addressing diverse time signatures or offering progressive learning structures. Many practice kits focus predominantly on standard rhythms, such as 4/4 or 3/4, and offer limited exposure to more complex patterns like 5/4 or 7/8, which are essential for building versatile musical skills [42]. This narrow focus restricts students' ability to adapt to varied musical styles. Additionally, available rhythm education tools tend to prioritize guided classroom use, offering little support for self-directed practice. Without structured materials and feedback mechanisms, students often struggle to engage in meaningful independent rhythm practice, limiting their ability to progress [43]. Movement-based methods, like Dalcroze Eurhythmics, have proven effective for holistic rhythm learning but may not address the specific demands of precise rhythm reading, which relies on visual and auditory recognition of rhythmic symbols [44]. Research emphasizes the necessity of incorporating various time signatures and progressive difficulty levels in rhythm training to build adaptability and proficiency [45], yet many existing tools fall short of these goals. Additionally, the narrow focus of rhythm tools in Thai music education predominantly covers traditional or classical music while lacking emphasis on contemporary global styles [46], [47]. Addressing these gaps with specialized rhythm reading kits that offer structured, diverse exercises could enhance students' rhythm skills and broader musical fluency [48].

3. Method

3.1. Population and Sampling

This study's population consisted of 175 undergraduate students from the Bachelor of Education Program in Western Music and Vocal Education Studies at the Faculty of Fine and Applied Arts, Rajamangala University of Technology Thanyaburi, alongside 100 students focused on Western music within the art learning group at Nawaminthrachinuthit School, Horwang, Nonthaburi. These students offered a diverse representation within the music education discipline, providing meaningful insights into the rhythm reading practice kit's effectiveness. The focus on music students allowed for targeted exploration of rhythm education within a population undergoing rigorous musical training. To ensure the study's relevance, purposive sampling was utilized, selecting 20 undergraduate students from Rajamangala University and 10 high school students from Nawaminthrachinuthit School.

3.2. Development and Quality Assessment of the Rhythm Reading Practice Kit

The rhythm reading practice kit was developed through a structured approach to meet high-quality standards. This included a comprehensive study, content analysis, and design tailored to music education needs, focusing on enhancing students' rhythmic skills. A rigorous evaluation process involved content and media experts who provided feedback and guided refinements in two review rounds. Three music education experts assessed the kit on criteria like accuracy, difficulty, organization, visual alignment, and learning enhancement. As summarized in table 1, all aspects received "Excellent" ratings, averaging 4.93 with minimal variation (S.D = 0.26), confirming the kit's academic rigor, suitability, and effectiveness in supporting rhythm learning.

Table 1. Expert Quality Assessment of the Rhythm Reading Practice Kit Content

Item	$\bar{x}$	S.D	Quality level
1. The content is accurate and has academic value.	5.00	0.00	Excellent
2. The rhythm reading practice kit has difficulty and ease suitable for students.	5.00	0.00	Excellent
3. Organize content easily for students to understand.	4.67	0.58	Excellent
4. The picture of the note corresponds to the content.	4.67	0.58	Excellent
5. Overall content increases the experience for students.	5.00	0.00	Excellent
Overall Average	4.93	0.26	Excellent

Table 2 presents the results of the quality assessment of the rhythm reading practice kit's media design, as evaluated by three experts in music education. The assessment focused on five key criteria: alignment of media with the kit's objectives, consistency with the content, clarity, appropriateness of format and note size, and overall interest level.

Table 2. Expert Quality Assessment of the Rhythm Reading Practice Kit Media Design

Item	$\bar{x}$	S.D	Quality level
1. Design media to meet objectives	5.00	0.00	Excellent
2. Consistent with the content	5.00	0.00	Excellent
3. Clear meaning	4.67	0.58	Excellent
4. Appropriateness of the format and the size of the note	4.67	0.58	Excellent
5. Overall interestingness	5.00	0.00	Excellent
Overall Average	4.87	0.32	Excellent

The experts rated the alignment with objectives and content consistency of the rhythm reading practice kit as excellent, both earning perfect scores of 5.00 with no variability (S.D = 0.00), reflecting a strong consensus on its effectiveness in meeting educational goals and integrating instructional content. Clarity and format appropriateness scored slightly lower at 4.67 (S.D = 0.58), indicating minor differences in expert opinions, though still within the Excellent category, showing that the media elements were well-designed for student use. The kit's engagement level also achieved a perfect score, highlighting its effectiveness in capturing student interest. With an overall average score of 4.87 (S.D = 0.32), the rhythm reading practice kit's media quality was rated as Excellent, demonstrating its alignment with educational objectives and capacity to engage students. After multiple rounds of expert evaluation and refinement, the kit was optimized for rhythm instruction, adhering to pedagogical principles and supporting student engagement and skill development. It was deemed ready for classroom use, offering a robust tool for enhancing rhythm reading skills. Figure 1 illustrates the kit's visual elements, with a circular instructional tool showcasing various time signatures (3/4, 2/4, 4/4, 6/8, 9/8, and 12/8) in a vibrant color scheme, designed to deepen students' rhythm understanding.

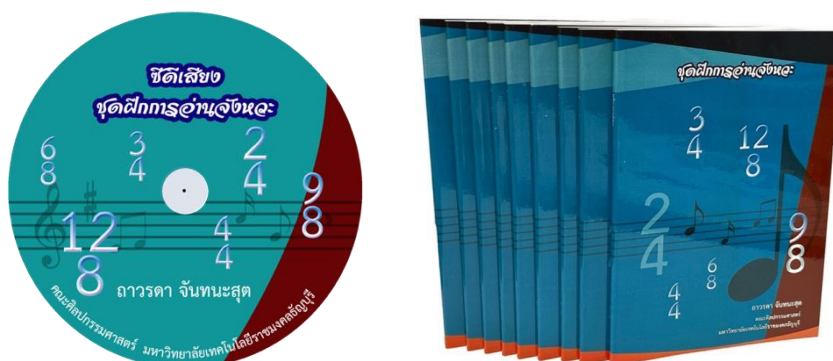


Figure 1. Visual Elements of the Rhythm Reading Practice Kit

3.3. Research Instruments

This study utilized three primary research instruments: the Rhythm Reading Practice Kit, an Academic Achievement Test, and a Satisfaction Questionnaire. The Rhythm Reading Practice Kit aimed to enhance rhythm reading skills systematically, progressing from basic to advanced levels with exercises featuring diverse rhythmic patterns and time signatures such as 2/4, 3/4, 4/4, 6/8, 9/8, and 12/8. Content was organized progressively, supported by visual aids,

explanations of musical symbols, and practice questions, while an accompanying audio CD facilitated auditory practice. Music education experts validated the kit's content, achieving an Item-Objective Congruence (IOC) score of 0.5 or higher. The Academic Achievement Test, comprising 10 questions aligned with the kit, evaluated students' mastery of rhythm reading skills, including note values, rhythmic notation, and complex patterns like dotted rhythms. The test underwent item analysis to ensure appropriate difficulty (0.40 - 0.75) and discrimination power (above .20), with a Kuder-Richardson 20 reliability coefficient of 0.784. The Satisfaction Questionnaire assessed students' perceptions of the kit through 10 items on a 5-point Likert scale, covering clarity, content presentation, ease of self-study, and emotional engagement. Experts validated each item's content, achieving an IOC score of 0.5 or higher, with a Cronbach's Alpha coefficient of 0.662, ensuring reliable measurement of student satisfaction and informing potential kit improvements.

3.4. Data Collection and Analysis

Data for this study were collected using three primary instruments: the Rhythm Reading Practice Kit, an Academic Achievement Test, and a Satisfaction Questionnaire, providing quantitative insights into participants' rhythm reading skills and satisfaction with the kit. Statistical methods, including mean, standard deviation, and a paired sample t-test, were employed to analyze the data. The mean and standard deviation highlighted trends and variability in students' rhythm performance and satisfaction levels, while the t-test assessed the significance of changes in performance before and after using the kit. This approach allowed for a comparison of pre-test and post-test scores, evaluating the overall improvement in students' rhythm reading proficiency. A significance level of $p < 0.05$ confirmed whether improvements were statistically meaningful, demonstrating the practice kit's impact on rhythm skills. Data from the Satisfaction Questionnaire provided further insight, with mean and standard deviation calculations for each item covering aspects like instruction clarity, ease of use, and enjoyment.

4. Results and Discussion

4.1. Academic Achievement

The analysis of academic achievement was conducted by comparing the pre-test and post-test scores of students who used the rhythm reading practice kit. The data indicated a significant improvement in students' rhythm reading abilities after using the kit. Among the 20 students from the Western Music and Vocal Education Studies Program at Rajamangala University of Technology Thanyaburi, the average pre-test score was 24.05, with a post-test mean score 42.40. Table 3 provides a detailed breakdown of the pre-test and post-test scores for the 20 students in the Western Music and Vocal Education Studies Program. The data reveal a substantial improvement in rhythm reading skills after the students utilized the rhythm reading practice kit. The pre-test scores had a mean of 24.05, indicating a baseline level of rhythm proficiency prior to exposure to the kit. Following the intervention, the post-test scores rose to a mean of 42.40, reflecting a notable increase in student performance with a mean difference of 18.35 points. This improvement in scores underscores the effectiveness of the rhythm reading practice kit in enhancing students' abilities.

Table 3. Pre-Test and Post-Test Scores of 20 Students in the Western Music and Vocal Education Studies Program

No.	Pre-test 50 marks	Post-test 50 marks	Difference (D)	Difference (D2)
1	25	45	20	400
2	22	42	20	400
3	27	42	15	225
4	26	38	12	144
5	25	45	20	400
6	22	40	18	324
7	22	42	20	400
8	24	41	17	289
9	25	45	20	400
10	25	45	20	400
11	22	42	20	400
12	22	40	18	324
13	25	45	20	400

No.	Pre-test 50 marks	Post-test 50 marks	Difference (D)	Difference (D ²)
14	25	45	20	400
15	22	42	20	400
16	26	38	12	144
17	25	45	20	400
18	24	41	17	289
19	25	45	20	400
20	22	40	18	324
Total	481	848	367	6,863
mean	24.05	42.40		
SD	1.669	2.458		

A paired samples t-test assessed the effectiveness of the rhythm reading practice kit by comparing pre-test and post-test scores of 20 students in the Western Music and Vocal Education Studies Program. Results indicated a significant mean improvement of 18.35 points, with a standard deviation of 2.60 and a standard error mean of 0.58. The 95% confidence interval for the difference ranged from 17.13 to 19.57, confirming the consistency and substantial nature of the score increase. The t-value of 31.549 and a p-value of .000 verified statistical significance at the .05 level, demonstrating that the rhythm reading practice kit effectively enhanced students' rhythm reading abilities. Additionally, [table 4](#) illustrates pre-test and post-test scores of 10 students from Nawaminthrachinuthit School, Horwang, Nonthaburi, who used the rhythm reading practice kit. The table details individual score differences (D) and squared differences (D²). Pre-test scores averaged 24 with a standard deviation of 2.108, reflecting the students' initial proficiency. Post-test scores rose to a mean of 39, accompanied by a reduced standard deviation of 1.054, indicating a marked improvement in rhythm reading skills.

Table 4. Pre-Test and Post-Test Scores of 10 Students in the Nawaminthrachinuthit School

No.	Pre-test 50 marks	Post-test 50 marks	Difference (D)	Difference (D ²)
1	26	38	12	144
2	22	40	18	324
3	22	40	18	324
4	26	38	12	144
5	26	38	12	144
6	22	40	18	144
7	26	38	12	144
8	22	40	18	324
9	22	40	18	324
10	26	38	12	144
Total	240	390	150	2,160
Mean	24	39		
SD	2.108	1.054		

The average difference of 15 points between pre-test and post-test scores indicates a notable improvement in student performance, supported by a sum of squared differences totaling 2,160, reflecting consistent growth among participants. The post-test score increase, coupled with a relatively low standard deviation, suggests that the rhythm reading practice kit positively and uniformly impacted this group of high school students' rhythm reading skills. These results emphasize the kit's potential as a valuable rhythm education tool for diverse educational levels. Analysis of the paired samples t-test for 10 students from Nawaminthrachinuthit School, Horwang, Nonthaburi, revealed a significant mean difference of 15 points, with a standard deviation of 3.16 and a standard error mean of 1.00. The 95% confidence interval for the mean difference ranged from 12.74 to 17.26, highlighting consistent improvement. A t-value of 15.000 with 9 degrees of freedom and a p-value of .000 confirmed statistical significance at the .05 level, demonstrating the kit's effectiveness in enhancing rhythm reading abilities through significantly higher post-test scores. The variation in post-test scores observed across different groups, with university students showing slightly greater improvement due to their extensive musical backgrounds, suggests that prior experience influences the extent of enhancement. However, both university and high school students exhibited substantial gains, demonstrating the kit's adaptability and broad applicability. The significant gains between pre-test and post-test scores validate the kit's role in improving rhythm

reading proficiency, supporting its use in fostering broader musical development and educational progress. This consistent improvement underscores the effectiveness of the rhythm reading practice kit as a valuable educational tool.

4.2. Student Satisfaction

The analysis of student satisfaction with the rhythm reading practice kit indicated high satisfaction across various aspects of the tool. Table 5 presents the results of student satisfaction with the rhythm reading practice kit, focusing on two areas: the kit's design and usability, and its perceived benefits. Students rated the clarity of the kit's explanations highly, with a mean score of 4.80 and a standard deviation of 0.41, categorizing it as excellent. Additionally, students appreciated the presentation of content, which received a mean score of 4.75 (SD = 0.44). The illustrations included in the kit were also highly rated for their alignment with the content, scoring 4.80 on average (SD = 0.41), reflecting the effectiveness of the visual aids in enhancing understanding. The overall satisfaction with the kit's instructional quality and design aspects was rated at 4.72, indicating an excellent level of satisfaction.

Table 5. Student Satisfaction Ratings for the Rhythm Reading Practice Kit

Aspect	Evaluation Items	$\bar{x}$	S.D	Satisfaction Level
The rhythm reading practice kit	1. Clear explanation	4.80	0.41	Excellent
	2. Presentation of content	4.75	0.44	Excellent
	3. The note is clear.	4.90	0.31	Excellent
	4. Illustrations correspond to the content.	4.80	0.41	Excellent
	5. Can be used for self-study easily.	4.35	0.59	Good
	Mean	4.72	0.43	Excellent
Benefits	1. Able to apply the knowledge gained	5.00	0.00	Excellent
	2. Have freedom to study and acquire knowledge.	4.85	0.37	Excellent
	3. Useful for further study	4.75	0.44	Excellent
	4. Can make you feel comfortable while studying.	4.50	0.69	Good
	5. Satisfied with receiving more knowledge	4.80	0.62	Excellent
	Mean	4.78	0.42	Excellent
	Mean (Overall)	4.75	0.425	Excellent

Students expressed satisfaction with the rhythm reading practice kit's potential for self-study, which received a slightly lower mean score of 4.35 (SD = 0.59), categorized as good. This indicates that while the kit is generally suitable for independent use, there may be opportunities to further enhance features that support self-directed learning. Nevertheless, the clarity of musical notes and the effective alignment of illustrations with content were highly valued, contributing positively to the overall user experience. The perceived benefits of the kit were similarly rated highly by students. The ability to apply knowledge gained from the kit to other musical contexts achieved the highest satisfaction rating, with a perfect mean score of 5.00, emphasizing its practical relevance in fostering broader musical development. Students appreciated the autonomy to explore content at their own pace, which garnered a mean score of 4.85 (SD = 0.37), and found the kit useful for supporting future music studies, with a mean of 4.75 (SD = 0.44). These ratings underscore the kit's role in enhancing student independence and sustained engagement in rhythm learning. Overall, the rhythm reading practice kit achieved an average satisfaction score of 4.75 (SD = 0.425), indicating excellent participant satisfaction. High scores across most items highlight the kit's effectiveness in delivering clear, relevant, and engaging content, affirming its potential as a valuable resource for rhythm education. These findings suggest that the kit successfully meets students' needs, fostering both immediate learning outcomes and long-term musical growth.

4.3. Impact of the Rhythm Reading Practice Kit

The rhythm reading practice kit developed in this study aligned well with best practices and quality standards in music education, achieving an efficiency ratio of 88.80/90.25, which exceeded the expected criterion 80/80. This high level of performance can be attributed to the kit's systematic design, which involved comprehensive content analysis, targeted instructional design, and alignment with learner needs. The results demonstrated that the kit was effective and suitable for improving students' rhythm reading skills. Furthermore, the kit underwent quality evaluations by content and media experts, ensuring that it met high educational content and usability standards, supporting its implementation as a reliable learning tool in rhythm education. The structured approach in developing the kit, which included a progression from simple to more complex rhythm exercises, enabled students to build rhythm skills incrementally. This

design is consistent with music teaching theories emphasizing the importance of scaffolding learning experiences for skill development. As such, the rhythm reading practice kit met the quality criteria and facilitated meaningful learning outcomes for students, indicating its potential as a valuable resource for rhythm education programs.

4.4. Comparison with Prior Research

The findings of this study align with previous research on educational kits aimed at enhancing specific musical skills, such as the study by Watchakorn Sarakhaweerakul, which developed a kit for Ponglang music practice and reported efficiency scores of 88.85/96.07, surpassing similar criteria. Similarly, this rhythm reading kit achieved a high satisfaction rating from students, suggesting that the kit's systematic structure and clear instructional content contributed to positive learning experiences. Previous studies have shown that educational kits designed for self-paced learning and practical skill enhancement, such as the classical guitar practice kit discussed by Watcharawit Norapan, often receive high satisfaction ratings as they provide hands-on engagement and support self-directed learning. The advancements presented in this study also include a broader application for rhythm reading skills, encompassing a range of time signatures and rhythmic patterns essential for comprehensive music education. Unlike previous kits focused on single instruments or specific musical styles, this rhythm reading kit provides versatile practice materials suitable for various educational contexts. Consequently, this research contributes to the body of knowledge by offering a resource that can be adapted to different musical curricula, thereby extending the application of rhythm kits beyond traditional practice frameworks.

4.5. Implications for Music Education

The high satisfaction ratings and the demonstrated effectiveness of the rhythm reading practice kit suggest that rhythm kits can be integrated successfully into music education curricula. Incorporating such kits into classroom instruction provides students with guided and independent practice opportunities, fostering greater engagement with rhythm reading and enhancing overall musical proficiency. The success of this kit implies that rhythm-based educational tools can play a significant role in curriculum design, promoting active learning and facilitating the acquisition of rhythm skills in a structured yet flexible manner. Moreover, this study's results highlight the importance of using well-designed educational tools that align with best practices in music pedagogy. Music educators could adopt rhythm reading kits as supplementary resources to support classroom instruction or as standalone tools for individual practice. Given the kit's alignment with student-centered learning and its ability to facilitate incremental skill development, there is strong potential for its wider adoption in music education programs, which could ultimately enhance student learning outcomes and satisfaction.

5. Conclusion

The study confirmed the rhythm reading practice kit's effectiveness in improving students' rhythm skills and satisfaction. Significant gains in rhythm abilities were evident from pre- and post-test comparisons among both university and high school participants. High satisfaction ratings highlighted the kit's instructional clarity, content relevance, and learning alignment, indicating its value in fostering meaningful engagement in music education. The kit's structured, progressive design enabled incremental skill development, boosting students' confidence and motivation. This tool supported rhythmic development and broader music goals, emphasizing the need for specialized resources in targeted instruction. For rhythm reading, the kit effectively built foundational skills necessary for individual and ensemble proficiency. Music educators are encouraged to incorporate similar kits for structured skill-building. Future studies could develop kits for melody reading or ear training, incorporating digital features for accessibility. Educational tools like this kit are vital in promoting independent study and learner-centered instruction, enriching students' musical journeys and fostering a lifelong appreciation for music.

6. Declarations

6.1. Author Contributions

Conceptualization: T.C.; Methodology: T.C.; Software: T.C.; Validation: T.C.; Formal Analysis: T.C.; Investigation: T.C.; Resources: T.C.; Data Curation: T.C.; Writing Original Draft Preparation: T.C.; Writing Review and Editing: T.C.; Visualization: T.C.; The author has read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6.3. Funding

This research was supported by the Science, Research and Innovation Promotion Fund, Thailand Science Research and Innovation (TSRI), through Rajamangala University of Technology Thanyaburi (FRB66E0801) (Grant No.: FRB660012/0168).

6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] S. J. Holochwost, C. B. Propper, D. P. Wolf, T. M. Willoughby, K. R. Fisher, J. Kolacz, V. V. Volpe, and S. R. Jaffee, "Music education, academic achievement, and executive functions," *Psychology of Aesthetics, Creativity, and the Arts*, vol. 11, no. 2, pp. 147–166, 2017, doi: 10.1037/aca0000112.
- [2] C. A. D. Villamizar, "The importance of music education in the development and performance of executive functions," *Preprints*, vol. 2021, no. 2, pp. 1–10, 2021, doi: 10.20944/preprints202102.0195.v1
- [3] M. E. Sachs, J. Kaplan, A. D. Sarkissian, and A. Habibi, "Increased engagement of the cognitive control network associated with music training in children during an fMRI Stroop task," *PLOS One*, vol. 12, no. 10, pp. 1–29, 2017, doi: 10.1371/journal.pone.0187254.
- [4] B. Ilari, P. R. Keller, H. Damásio, and A. Habibi, "The development of musical skills of underprivileged children over the course of 1 year: A study in the context of an El Sistema-inspired program," *Frontiers in Psychology*, vol. 7, no. 1, pp. 1–10, 2016, doi: 10.3389/fpsyg.2016.00062.
- [5] J. Váradi, "A review of the literature on the relationship of music education to the development of socio-emotional learning," *Sage Open*, vol. 12, no. 1, pp. 1–10, 2022, doi: 10.1177/21582440211068501.
- [6] J. Doyle, "Cultural relevance in urban music education," *Update: Applications of Research in Music Education*, vol. 32, no. 2, pp. 44–51, 2014, doi: 10.1177/8755123314521037.
- [7] I. Swart, "Benefits of music education to previously disadvantaged South African learners: Perspectives of music teachers in the greater Tshwane metropolis," *International Journal of Music Education*, vol. 38, no. 1, pp. 52–65, 2019, doi: 10.1177/0255761419868151.
- [8] E. T. Mulenga, T. Yan, and D. Teng, "Contemporary problems and solutions for early childhood music education in Zambia," *International Journal of Visual and Performing Arts*, vol. 3, no. 1, pp. 53–61, 2021, doi: 10.31763/viperarts.v3i1.340.
- [9] G. M. Treceño, "The use of music therapy techniques as an educational tool: A systematic review," *Research Studies in Music Education*, vol. 46, no. 2, pp. 230–256, 2023, doi: 10.1177/1321103x231192370.
- [10] Office of the Basic Education Commission, National Education Act 1999 and amendments, additions (No. 3) 2010. Bangkok: Office of the Prime Minister, 2010.
- [11] V. Laovanich, Y. Chuppunnarat, M. Laovanich, and S. Saibunmi, "An investigation into the status of Thailand's music education systems and organisation," *British Journal of Music Education*, vol. 38, no. 2, pp. 131–144, 2020, doi: 10.1017/s0265051720000327.
- [12] J. Chaiya, "The development of curriculum content for the study of undergraduate applied trumpet in Thailand," *Malaysian Journal of Music*, vol. 10, no. 1, pp. 12–24, 2021, doi: 10.37134/mjm.vol10.1.2.2021.
- [13] J. L. Reifinger Jr., "Teaching pitch notation–reading skills," *General Music Today*, vol. 33, no. 3, pp. 21–28, 2019, doi: 10.1177/1048371319891419.

-
- [14] M. Huss, J. P. Verney, T. Fosker, N. Mead, and U. Goswami, "Music, rhythm, rise time perception and developmental dyslexia: Perception of musical meter predicts reading and phonology," *Cortex*, vol. 47, no. 6, pp. 674–689, 2011, doi: 10.1016/j.cortex.2010.07.010.
- [15] W. Suwanphithak, "Problems and expectations of students regarding the management of learning in the subjects of Thai music theory and history within the Thai undergraduate music education curriculum," *Malaysian Journal of Music*, vol. 12, no. 2, pp. 1–17, 2023, doi: 10.37134/mjm.vol12.2.1.2023
- [16] J.-W. Cha, "The Takadimi system reconsidered: Its psychological foundations and some proposals for improvement," *Psychology of Music*, vol. 43, no. 4, pp. 563–577, 2014, doi: 10.1177/0305735614528063.
- [17] K. Hollingsworth, "The effects of length of instruction on rhythm-reading learning and retention on second-grade students," *Update: Applications of Research in Music Education*, vol. 41, no. 3, pp. 12–21, 2022, doi: 10.1177/87551233221087878.
- [18] N. Chandransu, "Integrating multicultural music education into the public elementary school curricula in Thailand," *International Journal of Music Education*, vol. 37, no. 4, pp. 547–560, 2019, doi: 10.1177/0255761419855827.
- [19] L. Williams and S. Trakarnrung, "Thai pre-service music educators and their future in music education and its role in society," *International Journal of Music Education*, vol. 34, no. 1, pp. 74–89, 2015, doi: 10.1177/0255761415584297.
- [20] I. Tierney and N. Kraus, "Evidence for multiple rhythmic skills," *PLOS One*, vol. 10, no. 9, pp. 1–14, 2015, doi: 10.1371/journal.pone.0136645.
- [21] L. Przybylski, N. Bedoin, S. Krifi-Papoz, V. Herbillon, D. Roch, L. Léculier, S. A. Kotz, and B. Tillmann, "Rhythmic auditory stimulation influences syntactic processing in children with developmental language disorders," *Neuropsychology*, vol. 27, no. 1, pp. 121–131, 2013, doi: 10.1037/a0031277.
- [22] K. Petchot, "The right to education for migrant children in Thailand: Liminal legality and the educational experience of migrant children in Samut Sakhon," in *Migrant Children in Thailand*, vol. 2013, no. 6, pp. 307–323, 2013, doi: 10.1007/978-3-642-28012-2_17.
- [23] N. H. Rostam, N. H. Ahmad, N. S. A. M. Murshid, R. N. M. Attas, N. E. Rahmat, and A. Othman, "A legal analysis of stateless children and their rights to education in Malaysia: A comparative study with Thailand," *International Journal of Academic Research in Progressive Education and Development*, vol. 11, no. 3, pp. 1–10, 2022, doi: 10.6007/ijarped/v11-i3/14899.
- [24] G. W. Fry and H. Bi, "The evolution of educational reform in Thailand: The Thai educational paradox," *Journal of Educational Administration*, vol. 51, no. 3, pp. 290–319, 2013, doi: 10.1108/09578231311311483.
- [25] S. Prommak, "Feasibility of using community-based learning in Thai EFL instruction," *PPJ*, vol. 2021, no. 2, pp. 21–45, 2021, doi: 10.58837/chula.ppj.36.2.
- [26] O. Batmaz, "Examination of primary school teachers' opinions on cultural heritage education in life science lesson," *Journal of Computer Education Research*, vol. 11, no. 22, pp. 429–446, 2023, doi: 10.18009/jcer.1241337.
- [27] A. Lobovikov-Katz, A. Moropoulou, A. Konstanti, and K. C. Lampropoulos, "Heritage preservation education for the general public – The role of hands-on education," *Technical Annals*, vol. 2022, no. 1, pp. 290–308, 2022, doi: 10.12681/ta.32179.
- [28] M. Ginzarly, C. Houbart, and J. Teller, "The historic urban landscape approach to urban management: A systematic review," *International Journal of Heritage Studies*, vol. 25, no. 10, pp. 999–1019, 2018, doi: 10.1080/13527258.2018.1552615.
- [29] D. Kokotsaki and D. P. Newton, "Recognizing creativity in the music classroom," *International Journal of Music Education*, vol. 33, no. 4, pp. 491–508, 2015, doi: 10.1177/0255761415607081.
- [30] E. E. Sovansky, M. B. Wieth, A. Francis, and S. D. McIlhagga, "Not all musicians are creative: Creativity requires more than simply playing music," *Psychology of Music*, vol. 44, no. 1, pp. 25–36, 2014, doi: 10.1177/0305735614551088.
- [31] H. Shihong and L. Yang, "Perception of classical music: Development of creativity and musical experience in middle music schools," *Culture and Education*, vol. 35, no. 3, pp. 663–698, 2023, doi: 10.1080/11356405.2023.2223469.
- [32] T. K. Sutawi, "Three characters moulded in music education," *Harmonia: Journal of Arts Research and Education*, vol. 18, no. 2, pp. 197–207, 2019, doi: 10.15294/harmonia.v18i2.12431.
- [33] L. Huang, "The impact of China economic policy uncertainty on CSI 300: An analysis of the mediating effect of investor sentiment," *Advances in Economics, Management and Political Science*, vol. 51, no. 1, pp. 41–49, 2023, doi: 10.54254/2754-1169/51/20230608.
- [34] N. Sokatiyanurak, *Classical music: Important terms*. Bangkok: Chulalongkorn Publishing House, 2007.

-
- [35] U. Frischen, G. Schwarzer, and F. Degé, "Comparing the effects of rhythm-based music training and pitch-based music training on executive functions in preschoolers," *Frontiers in Integrative Neuroscience*, vol. 13, no. 1, pp. 1–10, 2019, doi: 10.3389/fnint.2019.00041.
- [36] N. Politimou, S. D. Bella, N. Farrugia, and F. Franco, "Born to speak and sing: Musical predictors of language development in pre-schoolers," *Frontiers in Psychology*, vol. 10, no. 1, pp. 1–9, 2019, doi: 10.3389/fpsyg.2019.00948.
- [37] R. L. Gordon, C. M. Shivers, E. A. Wieland, S. A. Kotz, P. J. Yoder, and J. D. McAuley, "Musical rhythm discrimination explains individual differences in grammar skills in children," *Developmental Science*, vol. 18, no. 4, pp. 635–644, 2014, doi: 10.1111/desc.12230.
- [38] J. P. Sousa, M. Martins, N. Torres, S. L. Castro, and S. Silva, "Rhythm but not melody processing helps reading via phonological awareness and phonological memory," *Scientific Reports*, vol. 12, no. 1, pp. 1–10, 2022, doi: 10.1038/s41598-022-15596-7.
- [39] A. Holliman, C. Wood, and K. Sheehy, "The contribution of sensitivity to speech rhythm and non-speech rhythm to early reading development," *Educational Psychology*, vol. 30, no. 3, pp. 247–267, 2010, doi: 10.1080/01443410903560922.
- [40] S. Swaminathan and E. G. Schellenberg, "Musical ability, music training, and language ability in childhood," *Journal of Experimental Psychology: Learning, Memory, and Cognition*, vol. 46, no. 12, pp. 2340–2348, 2020, doi: 10.1037/xlm0000798.
- [41] W. T. Anderson, "The Dalcroze approach to music education," *General Music Today*, vol. 26, no. 1, pp. 27–33, 2011, doi: 10.1177/1048371311428979.
- [42] V. Bégel, I. D. Loreto, A. Seilles, and S. D. Bella, "Music games: Potential application and considerations for rhythmic training," *Frontiers in Human Neuroscience*, vol. 11, no. 1, pp. 1–10, 2017, doi: 10.3389/fnhum.2017.00273.
- [43] S. Holland, A. Bouwer, and O. Hödl, "Haptics for the development of fundamental rhythm skills, including multi-limb coordination," in *Advances in Music Education*, vol. 2018, no. 11, pp. 215–237, 2018, doi: 10.1007/978-3-319-58316-7_11.
- [44] J. Habron, "Dalcroze eurhythmics in music therapy and special music education," *Australian Journal of Music Therapy*, vol. 8, no. 2, pp. 1–10, 2016, doi: 10.56883/ajmt.2016.331.
- [45] D. Matthews, V. A. Ubbes, and V. J. Freysinger, "A qualitative investigation of early childhood teachers' experiences of rhythm as pedagogy," *Journal of Early Childhood Research*, vol. 14, no. 1, pp. 3–17, 2014, doi: 10.1177/1476718x14523745.
- [46] M. Baughman, "An examination of methods used to teach practice strategies in the college voice studio," *Update: Applications of Research in Music Education*, vol. 35, no. 2, pp. 15–22, 2016, doi: 10.1177/8755123315593325.
- [47] N. Chansitthichok, A. Charanyananda, and N. Pidokrajt, "Educational partnerships towards long-term music education projects in Thailand," *Malaysian Journal of Music*, vol. 8, no. 1, pp. 96–107, 2019, doi: 10.37134/mjm.vol8.6.2019.
- [48] I. Lappe, L. J. Trainor, S. C. Herholz, and C. Pantev, "Cortical plasticity induced by short-term multimodal musical rhythm training," *PLOS One*, vol. 6, no. 6, pp. 1–8, 2011, doi: 10.1371/journal.pone.0021493.