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The Role of Music in Enhancing Memory and Intrinsic Motivation in the Recognition of Chinese Characters among Year 1 Students

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Abstract

Memory and intrinsic motivation are essential elements in language learning, particularly in early education, where foundational skills are developed. This study aims to identify the effectiveness of music in enhancing memory for recognizing Chinese characters and to determine the level of intrinsic motivation among Year 1 students after integrating music into the recognition of Chinese characters. This action research, conducted over first cycle and second cycle, utilized pre- and post-tests and questionnaires in each cycle to collect data from 15 Year 1 students at Chinese Primary School selected through purposive sampling. The data analyses revealed that music effectively enhanced memory for recognizing Chinese characters among Year 1 students, and their intrinsic motivation levels were high after integrating music into character recognition ($t = 9.206$, $p < 0.05$). The study highlights the potential of music as a tool to improve memory retention and foster motivation, particularly in language learning. These findings have significant implications for teaching practices, encouraging educators to adopt music as an innovative and engaging instructional approach to enhance learning outcomes in diverse educational settings.

Keywords: Music, Memory, Intrinsic Motivation, Recognition, Chinese Characters

Introduction

The recognition of Chinese characters is a fundamental yet challenging aspect of learning the Chinese language, particularly for Year 1 students who are at the foundational stage of language acquisition. The Chinese language uses Chinese characters as symbols for written communication, formed by their shape, sound, and meaning, which poses challenges for students when learning the language (Liu, 2006). In this language system, characters function as basic units, while radicals serve as their building blocks. Thus, understanding Chinese characters is crucial for reading in the language. For Year 1 students, who are at the foundational stage of language acquisition, the ability to recognize and differentiate characters is critical for developing reading proficiency and overall language competence (Leong et al. 2011; Shum et al. 2014). However, reading errors caused by the similarity of character shapes are the most common, accounting for 72.4%. For instance, the characters 令 and 今 have similar forms (Jiang, 2004). Research showed that the influence of character

shapes on reading errors is far greater than the influence of phonetics (Jiang, 2004). This problem is compounded by a lack of effective teaching strategies that address the cognitive and emotional challenges students face in memorizing and distinguishing these characters (Li et al., 2022). This challenge is particularly pronounced for young learners, as their cognitive and memory capacities are still developing, making visual recognition tasks more demanding (Wang & Koda, 2021).

Recognizing Chinese characters is one of the main challenges in the teaching and learning (T&L) process of the Chinese language in Malaysia (Lui, 2016). Teachers often do not give serious attention to this issue (Lui, 2016), even though the Standard Curriculum and Assessment Document (DSKP) in the Revised Primary School Standard Curriculum (KSSR 2017) explicitly states that "recognizing Chinese characters is fundamental to mastering reading skills and is a primary focus in the T&L of Chinese language at the primary school level" (Bahagian Pembangunan Kurikulum, 2017). Only 40% of Year 1 students can recognize frequently used basic characters, despite the curriculum explicitly stating that recognizing these characters is fundamental to mastering reading skills in primary education (Li et al., 2022). Teachers often lack innovative methods to address this issue, even though the curriculum emphasizes its importance (Bahagian Pembangunan Kurikulum, 2017; Lui, 2016). This gap in teaching strategies is further exacerbated by the limited availability of resources and training for teachers to implement creative and effective pedagogical approaches (Zhang & Li, 2022).

Music is used as a tool to improve language skills in terms of pronunciation, comprehension, and vocabulary mastery including Chinese (Schmidt and Kallenbach 2019; Macasaquit, 2020; Swain and Lapkin 2021; Rodriguez-Fornells, Llagostera, and Münte 2021; Darcy and Eberwein 2021). Music has also been found to enhance cultural understanding and appreciation of language (Boer and Fischer 2021; Collins 2021). Moreover, music aids verbal memory and impacts emotions (Balch et al. 1992; Balch and Lewis 1996; Blood and Zatorre 2001; Salimpoor et al. 2013). Studies also show that music helps in emotional regulation and stimulates cognitive aspects (Serafine 1988; Peretz and Zatorre 2003; Hanna and MacKay 2011; Biasutti 2015). It is concluded that music has the potential to strengthen language learning while making the process more motivating and socially engaging (Kerekes, 2015). However, the role of music in visual memory remains underexplored (Collins, 2022). This highlights a gap that needs to be addressed, especially in understanding how music can support students' visual memory in recognizing Chinese characters as highlighted by recent reviews on Chinese language learning and music-based pedagogy (Chen and Li 2020; Wang 2021).

For Year 1 students, the transition from recognizing character shapes to remembering and distinguishing them is a critical stage in language acquisition (Zhao et al., 2021). Based on theory of language acquisition (Chomsky, 1965), students need appropriate stimuli to develop their mental systems for structured language recognition and comprehension. Music, as a stimulus that involves both emotional and cognitive elements, can serve as a tool to help students establish connections between character shapes and meanings.

This study is significant for several reasons. First, it addresses a critical gap in the literature by exploring the role of music in enhancing visual memory for Chinese character recognition, a topic that has received limited attention despite its importance. Second, it provides practical

insights for educators, particularly those teaching Chinese, by demonstrating how music can be integrated into the curriculum to improve learning outcomes. Finally, this study has the potential to benefit Year 1 students directly by offering a more engaging and effective approach to mastering Chinese characters, thereby laying a stronger foundation for their future language development.

This study aims to answer the following research questions:
(1) Is music effective in enhancing memory for recognizing Chinese characters among Year 1 students?
(2) What is the level of intrinsic motivation among Year 1 students in recognizing Chinese characters after integrating music into Chinese character recognition?

Literature Review

Learning Chinese Characters

Unlike phonetic alphabets, each Chinese character represents one or more syllables with a specific meaning. This complexity makes learning Chinese characters require significant effort and memory (Shen and Xu, 2018). In terms of a non-phonetic writing system, Chinese characters do not provide direct clues about pronunciation. This means that students must memorize the pronunciation and meaning of each character individually (Liu and Wang, 2020). Since learning Chinese characters heavily depends on visual memory, students must remember and recognize the diverse forms of characters. This becomes a major challenge for students who do not have a strong visual memory (Tang and McBride, 2020). All these studies highlight the need to find interventions to address the challenges in recognizing Chinese characters among students. Research related to interventions for helping with Chinese character learning has mainly focused on understanding the meaning of characters, their pronunciation, and their usage (Chen and Hao 2019; Li and Li 2020). While music has been shown to enhance memory and cognitive performance in other domains (Barrett et al. 2022; Williams et al. 2020), its potential role in addressing the specific challenges of Chinese character recognition remains underexplored. This gap presents an opportunity to investigate how music, as a multisensory and emotionally engaging tool, can support the visual and memory demands of learning Chinese characters.

Music and Memory

The positive effects of music on memory have been demonstrated through various memory tasks, such as vocabulary learning (Chew et al. 2016; De Groot 2006), second language learning (Kang and Williamson, 2013), and word retrieval and recognition (Anderson and Fuller, 2010). The cognitive enhancement through music is also supported by Patel (2008), who found that music activates language processing. However, some studies suggest that music does not necessarily improve memory. Music does not affect short-term memory, but if the background music expresses emotions that match the facial expressions seen, it may positively impact memory encoding and recall (Singh, Mohan and Kathrotia, 2019). Other research also reveals that classical music can only improve emotions but does not affect short-term memory (Giannouli, 2017).

The effect of music on memory can be understood through Baddeley's Working Memory Model (Baddeley, 1974), which explains how the brain stores and processes information. This model suggests that working memory consists of several interacting components, including

the phonological loop and the visual-spatial sketchpad, which process and store linguistic information. In learning, this system helps students remember and process new words (Gathercole and Baddeley, 1993). However, the capacity of working memory is limited, and exposure to excessive information can affect cognitive performance (Sweller, 2005). Therefore, well-designed music can support the memory process by reducing cognitive load and helping students process information more effectively (Moreno and Mayer 2000; Sweller 1988).

Music and Intrinsic Motivation

Intrinsic motivation refers to the internal drive and curiosity that individuals have, which motivates them to engage in activities for the enjoyment and satisfaction derived from the task itself (Smidt and Kraft, 2019). It is an essential element in early childhood development, as it lays the foundation for lifelong learning and achievement. In the context of learning, intrinsic motivation plays a crucial role in ensuring that students are actively and consistently engaged in the learning process (Ryan and Deci, 2000). Intrinsic motivation in learning is enhanced through music, as it provides an enjoyable experience by creating an environment that supports learning through elements like rhythm, melody, and harmony that stimulate positive emotions (Juslin and Västfjäll 2008; Hodges and Sebald 2011; Rickard et al. 2012). Music can not only enhance emotions but also reduce stress, which can hinder students' intrinsic motivation (Cassidy, 2016). By incorporating musical elements in teaching and learning, educators can create a positive environment that encourages students to stay engaged in their learning activities.

In this context, Self-Determination Theory (SDT) explains that fulfilling basic needs such as autonomy, social connectedness, and competence supports intrinsic motivation (Ryan and Deci, 2000). In this study, SDT's basic psychological needs are integrated through musical mnemonics to enhance intrinsic motivation. Autonomy is fostered by allowing students to engage with music-based character recognition at their own pace. Social connectedness is encouraged through group singing and interactive learning, creating a supportive environment. Competence is developed as students experience success in recognizing Chinese characters through structured musical activities, reinforcing their confidence. By addressing these needs, the study aims to enhance students' motivation and engagement in learning Chinese characters. When these basic needs are met, individuals are more likely to engage in activities with intrinsic motivation, doing the activity because they enjoy it, rather than for external rewards (Vallerand, 1997). When these needs are fulfilled, students are more likely to show better learning performance and greater engagement. On the other hand, when these basic needs are neglected, intrinsic motivation can decrease, leading to less interest and engagement in their learning. In the educational context, understanding SDT allows educators to design teaching strategies that support students' autonomy, competence, and connectedness.

Methodology

Research Design

This study uses an action research design based on the Kemmis and McTaggart (1988) model, which involves four main phases: planning, action, observation, and reflection. The study is conducted in two cycles, each comprising all four phases. During the planning phase, the intervention is formulated, including the use of music as a learning aid to enhance memory

for recognizing Chinese characters. In the action phase, the intervention is implemented with Year 1 students. During the observation phase, data are collected using instruments such as tests and intrinsic motivation questionnaires. Finally, the reflection phase is carried out to assess the effectiveness of the intervention and identify improvements before starting the next cycle. This approach helps the researcher understand the changes that occur and adjust strategies based on students' needs and the study context (Kemmis and McTaggart, 1988).

Sampling

The selected population for this study consists of Year 1 students at SJKC Hau Lim in Muar. The sampling method used is purposive sampling. A total of 15 students were chosen because they demonstrated a low proficiency level (TP 1 to TP 4) in Chinese reading skills. A small sample size of 10 to 20 students is adequate for action research, which emphasizes deep reflection on teaching and learning processes (McNiff and Whitehead, 2006). Given time, energy, and resource constraints, action research requires intensive involvement, so a smaller sample size allows the researcher to pay closer attention to each student and the teaching process. All 15 students in the study were informed and gathered in one class for the intervention.

Intervention

Music is used as the intervention for recognizing Chinese characters. The music selected is familiar to children and modified according to the learning needs of Chinese character recognition. The chosen Chinese song is "Two Tigers" (两只老虎). The lyrics are modified to include similar-looking and potentially confusing Chinese characters. These characters are part of the Year 1 Chinese language curriculum. For example, the characters 木 and 本, which are visually similar, are included in the song. The differences between the characters are sung in the lyrics. This intervention will be adjusted based on reflections from each cycle.

Research Instruments

Assessment (Pre-test and Post-test)

The main instruments used in this action research include pre-tests and post-tests, which are conducted before and after the intervention. The test consists of two sections: Section A (Immediate Recall) and Section B (Delayed Recall), which are adapted from the Visual Memory Test based on Snodgrass Pictures (VMT-SP) (Snodgrass and Vanderwart, 1980). The VMT-SP is a neuropsychological instrument for children's visual memory.

In Section A (Immediate Recall), an A4 sheet with 20 Chinese characters is displayed to the participants, who are instructed to observe all the characters on the sheet for 20 seconds. Immediately after, the participants are asked to name all the characters they can remember from the sheet. The researcher records all responses and assigns a score of 1 for each correctly identified character, and a score of 0 for incorrect answers.

In Section B (Delayed Recall), 20 minutes later, participants are asked to name all the Chinese characters they remember from the first sheet. The evaluator records the responses and assigns scores in the same manner as Section A.

A pilot study was conducted to test the validity and reliability of the instruments. The pilot study involved 8 Year 1 students from a Chinese national-type school, demonstrating similar

characteristics to the target population. Cronbach's Alpha was used to test item validity, and the result of 0.932 was interpreted as having high consistency.

Questionnaire

To measure the level of intrinsic motivation, the researcher developed a questionnaire adapted from other researchers to ensure the questionnaire's validity and reliability. The research instrument is the Intrinsic Motivation Inventory (IMI) developed by Ryan and Deci (2000). The questionnaire consists of two sections: Section A and Section B.

Section A includes two items regarding the respondents' background, including gender and grade level. In Section B, the researcher measures the intrinsic motivation of Year 1 students using the Intrinsic Motivation Inventory designed by Ryan and Deci (2000). This instrument contains 14 items across 4 dimensions: four items measure Enjoyment, three items measure Interest, three items measure Value, and four items measure Benefit. The researcher translates the instrument into Malay and Chinese to ensure clear understanding based on local culture. The items are scored on a 1 to 7 scale, with answers ranging from "not true at all" for score 1 to "very true" for score 7 (Duckworth and Quinn, 2009).

A pilot study was conducted to test the validity and reliability of the instrument. The pilot study involved 8 Year 1 students from a Chinese national-type school, demonstrating similar characteristics to the target population. Cronbach's Alpha was used to test item validity, and the result of 0.900 was interpreted as having high consistency.

Method of Study Implementation

Problem Survey

The researcher often finds that students struggle with recognizing Chinese characters, especially when reading sentences and passages. Year 1 students are frequently confused by Chinese logograms, particularly similar-looking characters. As a result, students may make mistakes by misidentifying one Chinese character as another.

Planning

The researcher plans to use music as an intervention strategy to help Year 1 students recognize similar Chinese characters. This plan is based on literature that shows music can stimulate memory and improve learning, especially in children. The music selected for this intervention is “Two Tigers”, chosen because it is familiar to the students. The lyrics were specially modified to include Chinese characters relevant to the lesson and to promote interaction through singing.

Action

Before the music intervention, participants are given a pre-test focusing on immediate recall and delayed recall. The Year 1 students are introduced to the specially modified lyrics to help them recognize Chinese characters. The song used is the familiar and popular “Two Tigers” to ensure that students are comfortable and enjoy the learning activity. The students sing along to the music and engage in the intervention activity by repeatedly singing the song while recognizing the Chinese characters displayed.

Observation

The researcher collects and analyses data to evaluate the effectiveness of the intervention. The pre-test and post-test results are compared to assess the improvement in memory for recognizing Chinese characters. After the intervention, data are collected through a post-intervention questionnaire to assess the intrinsic motivation levels of Year 1 students in recognizing Chinese characters.

Replanning

After reflecting on the first cycle, the researcher introduces percussion instruments as additional learning tools. Instruments such as castanets, tambourines, wooden sticks, and maracas are brought into the classroom. The researcher introduces these percussion instruments and demonstrates how to play them while singing the Chinese character recognition song. The students are divided into four groups, and each group is given a different percussion instrument. The researcher leads each group in playing their instruments while singing the song. Afterward, all groups play their instruments together while singing the song. After two rounds, the groups rotate their instruments. A post-test is conducted after the music intervention.

Data Analysis

SPSS version 27.0 software is used for data analysis. Since the pre-test and post-test data are nominal, the data collected from the pre-test and post-test are analyzed using descriptive analysis. Descriptive analysis involves calculating the mean, standard deviation, and percentages. The mean score is then assessed based on the interpretation table developed by Nardi (2018). The range of mean scores and their interpretation is shown in Table 1. Inferential analysis, including paired sample t-tests and Wilcoxon Signed-Rank tests, is conducted for the pre-test and post-test data. The paired sample t-test is used to assess the mean difference between pre-test and post-test scores, assuming normal data distribution. Alternatively, the Wilcoxon Signed-Rank test is used as a non-parametric alternative to identify differences in pre-test and post-test scores when the normality assumption is not met. The results from both analyses provide statistical evidence of significant differences between the pre-test and post-test scores, helping to determine the effectiveness of the intervention.

For data collected from the questionnaire, demographic data from Section A are analyzed descriptively, as they are nominal data. Descriptive analysis involves calculating frequencies and percentages. For data from Section B on intrinsic motivation, the dataset is analyzed using parametric analysis. The mean score is assessed based on the interpretation table developed by Nardi (2018). The range of mean scores and their interpretation is shown in Table 2. Inferential analysis using a one-sample t-test is conducted for data from Section B of the questionnaire, as the study only evaluates the motivation level after the intervention, without comparison to other groups or previous conditions. The comparison of the sample's average score with the reference value provides insight into the intrinsic motivation level of the sample.

Table 1
Classification of Mean Score Ranges for Pre-test and Post-test Memory in Chinese Character Recognition (Nardi, 2018)

Mean Score	Level
1.00-5.00	Low
5.01-10.00	Medium
10.01-15.00	High
15.01-20.00	Very High

Table 2
Classification of Mean Score Ranges for Intrinsic Motivation Level

Mean Score	Level
1.00-2.99	Low
3.00-4.99	Medium
5.00-7.00	High

Research Findings

Research Question 1: Is music effective in improving memory in Chinese character recognition among Year 1 students?

First Cycle

The results from descriptive analysis show an increase in the mean scores for both immediate recall and delayed recall following the music intervention. The mean score for immediate recall before the intervention was 7.67 with a standard deviation of 2.53, indicating moderate performance. After the intervention, the mean score increased to 11.60 with a standard deviation of 3.44, indicating a high level of performance. For delayed recall, the mean score before the intervention was 4.27 with a standard deviation of 2.37, indicating low performance. After the intervention, the mean score increased to 8.33 with a standard deviation of 3.94, indicating moderate performance. These results demonstrate improvement in both short-term and long-term memory following the music intervention for Chinese character recognition. The detailed results for memory in Chinese character recognition are shown in Table 3.

Table 3
Memory in Chinese Character Recognition in First Cycle

Test Section	Mean (Pre)	Mean (Post)	N	Mean Difference	Standard Deviation (Pre)	Standard Deviation (Post)
Immediate Recall	7.67	11.60	15	3.93	2.53	3.44
Delayed Recall	4.27	8.33	15	4.06	2.37	3.94

Due to the normal distribution of the pre-test immediate recall data ($p=0.945$, $\alpha> 0.05$) and post-test immediate recall data ($p=0.160$, $\alpha> 0.05$), a paired-sample t-test was conducted to examine the difference between the immediate recall scores before (pre) and after (post) the intervention. The results showed a significant difference between the pre- and post-intervention immediate recall scores, with $t(14) = -6.768$, $p< 0.05$ in the first cycle of the

study. This indicates that the music intervention has a significant effect on short-term memory in Chinese character recognition. The statistical results of the paired-sample t-test for the immediate recall test are shown in Table 4.

Table 4
Paired-Sample t-Test Statistics for Immediate Recall Test in First Cycle

		Difference Between Pairs				
		Mean	Standard Deviation	t-value	df	Sig. (2-tailed)
Pair 1	Immediate recall (pre-post)	-3.933	2.251	-6.768	14	<.001

Since the distribution of the pre-post test data for delayed recall is not normal, the Wilcoxon Signed-Rank test was conducted to compare the data collected from the pre and post-tests of delayed recall. Based on Table 5, the results show a significant difference between the pre and post-tests for delayed recall ($Z = -3.063$, $p < 0.05$). This indicates that the music intervention has a significant effect on long-term memory in Chinese character recognition. The statistical analysis results for the Wilcoxon Signed Rank test for the delayed recall test are shown in Table 5.

Table 5
Wilcoxon Signed-Rank Test Statistics for Delayed Recall Test in First Cycle

Test Statistics	Z-value	Asymp. Sig. (2-tailed)
Wilcoxon Signed-Rank	-3.063	0.002

Reflection

The reflection on the implementation of the intervention in Cycle 1 revealed that music was effective in helping students improve both short-term and long-term memory. However, there were weaknesses such as boredom among students due to repetitive singing activities and a lack of interactive elements to capture their attention. The activity was overly focused on singing without other variations, which reduced students' interest. Based on this reflection, several improvements were planned for Cycle 2. Interactive elements such as the use of percussion instruments will be introduced during singing to increase student engagement. Additionally, the selection of music accompaniment with varying tempos is planned to maintain student attention. Variations in activities, such as musical games, will also be included to attract their interest. These steps are expected to enhance both the enjoyment and effectiveness of the music intervention in Chinese character recognition.

Second Cycle

After the modified music intervention was implemented, there was an improvement in both components of the test. In the post-test, the mean score for immediate recall increased to 12.53, with the standard deviation remaining at 3.44, indicating the effectiveness of the intervention in improving students' memory for the immediate recognition of Chinese characters. In the delayed recall test, the mean score also showed an increase to 9.40, with a slight decrease in the standard deviation to 3.52. This reflects an improvement in students'

ability to retain the characters after a period, with better consistency in their performance. The results of the memory in recognizing Chinese characters are shown in Table 6.

Table 6
Memory in Chinese Character Recognition in Second Cycle

Test Section	Mean (Pre)	Mean (Post)	N	Mean Difference	Standard Deviation (Pre)	Standard Deviation (Post)
Immediate Recall	11.60	12.53	15	0.93	3.44	3.44
Delayed Recall	8.33	9.40	15	1.07	3.94	3.52

A paired-sample t-test was conducted to examine the difference between the immediate recall scores before (pre) and after (post) the second cycle intervention. The results showed a significant difference between the pre and post immediate recall scores, with $t(14) = -3.761$, $p < 0.05$ in the second cycle of the study. This indicates that the music intervention had a significant effect on short-term memory in recognizing Chinese characters. The results of the paired-sample t-test for the pre-post immediate recall test are shown in Table 7.

Table 7
Paired-Sample t-Test Statistics for Immediate Recall Test in Second Cycle

		Difference Between Pairs				
		Mean	Standard Deviation	t-value	df	Sig. (2-tailed)
Pair 1	Immediate recall (pre-post)	-.933	.961	-3.761	14	.002

Due to the non-normal distribution of one of the pre-post delayed recall test data, the Wilcoxon Signed-Rank test was conducted to compare the data collected from the pre and post delayed recall tests. The results indicated a significant difference between the pre and post-tests for delayed recall ($Z = -2.877$, $p < 0.05$). This suggests that the music intervention had a significant effect on long-term memory in recognizing Chinese characters. The results of the Wilcoxon Signed-Rank test for the pre-post delayed recall test are shown in Table 8.

Table 8
Wilcoxon Signed-Rank Test Statistics for Delayed Recall Test in Second Cycle

Test Statistics	Z-value	Asymp. Sig. (2-tailed)
Wilcoxon Signed-Rank	-2.877	0.004

In conclusion, the results of the inferential analysis of the pre-post immediate recall and delayed recall tests, using the paired sample t-test and Wilcoxon Signed-Rank test, with $p < 0.05$, indicate that the null hypothesis is rejected. Therefore, it can be concluded that the music intervention was effective in improving memory in recognizing Chinese characters among Year 1 students in the second cycle.

Research Question 2: What is the level of intrinsic motivation among Year 1 students in recognizing Chinese characters after the integration of music in character recognition?

First Cycle

This section presents the descriptive analysis results for the demographic data of the respondents. A total of 15 respondents participated in the survey. The analysis results show that the majority of respondents were female, with 11 individuals (73.3%), while the number of male respondents was 4 (26.7%). In terms of age, due to the purposive sampling method used, all survey respondents were Year 1 students aged 7 years old (100%). The collected demographic data and respondent profiles are presented in Table 9.

Table 9

Frequency and Percentage Table of Respondents

Demographics	Sub-profile	Number	Percentage (%)
Gender	Male	4	26.7
	Female	11	73.3
Age	7 years old	15	100.0
	> 7 years old	0	0.0

Intrinsic Motivation Levels of Students

For the students' intrinsic motivation levels, the mean score for the *Interest* dimension was the highest (M=4.98, SD=1.03), followed by *Value* (M=4.84, SD=0.98), *Benefit* (M=4.75, SD=0.97), and lastly *Enjoyment* (M=4.70, SD=0.87). The overall mean score for intrinsic motivation dimensions indicates a moderate level (M=4.8, SD=0.89). The intrinsic motivation levels by dimensions are shown in Table 10.

Table 10

Intrinsic Motivation Levels by Dimensions

Intrinsic Motivation Dimension	Item Numbers	Mean	Standard Deviation	Level
Enjoyment	1, 3, 4, 7	4.70	0.87	Moderate
Interest	2, 5, 6	4.98	1.03	Moderate
Value	8, 11, 14	4.84	0.98	Moderate
Benefit	9, 10, 12, 13	4.75	0.97	Moderate
Overall Construct (Intrinsic Motivation)	14 items	4.80	0.89	Moderate

A one-sample t-test was conducted to compare the mean score of intrinsic motivation in recognizing Chinese characters after the music intervention with the standard value (M=3.5) on a Likert scale of 1 to 7. Based on Table 11, the results indicate a significant difference between the mean intrinsic motivation score in recognizing Chinese characters after the music intervention, with $t(14) = 5.648$, $p < 0.05$, in the first cycle of the study. This indicates that the music intervention has a significant effect on the intrinsic motivation of Year 1 students in recognizing Chinese characters.

Table 11
Statistical Analysis Results of One-Sample T-Test for Intrinsic Motivation Levels of Year 1 Students After Music Integration (Cycle 1)

	Number of Respondents (N)	Mean Score	Standard Deviation (SD)	t-value	df	p-value	Mean Difference (M-3.5)
Overall Intrinsic Motivation	15	4.80	0.89	5.648	14	0.001	1.3

Second Cycle

After implementing an improved music intervention that included playing percussion instruments, the study participants completed a survey on their intrinsic motivation in recognizing Chinese characters. The mean scores indicate that the overall level of intrinsic motivation among the students was high in the second cycle. Intrinsic motivation was divided into four dimensions. Both the *Interest* and *Value* dimensions recorded the highest mean scores (M=5.20, SD=0.90; M=5.20, SD=0.79), followed by *Benefit* (M=5.17, SD=0.67) and *Enjoyment* (M=5.05, SD=0.71). The descriptive analysis results for intrinsic motivation levels by dimensions are shown in Table 12.

Table 12
Intrinsic Motivation Levels by Dimensions

Intrinsic Motivation Dimension	Item Numbers	Mean	Standard Deviation	Level
Enjoyment	1, 3, 4, 7	5.05	0.71	High
Interest	2, 5, 6	5.20	0.90	High
Value	8, 11, 14	5.20	0.79	High
Benefit	9, 10, 12, 13	5.17	0.67	High
Overall Construct (Intrinsic Motivation)	14 item	5.13	0.69	High

A one-sample t-test was conducted to compare the mean intrinsic motivation score for recognizing Chinese characters after the music intervention with the standard value (M=3.5) on a Likert scale of 1 to 7. Based on Table 13, the results indicate a significant difference between the mean intrinsic motivation score after the music intervention, with $t(14) = 9.206$, $p < 0.05$, in the second cycle of the study. This finding demonstrates that the music intervention has a significant effect on the intrinsic motivation of Year 1 students in recognizing Chinese characters. Therefore, null hypothesis 2 is rejected. The results of the one-sample t-test for intrinsic motivation levels of Year 1 students after the music intervention are presented in Table 13.

Table 13
Statistical Results of One-Sample T-Test for Intrinsic Motivation Levels of Year 1 Students After Music Integration in Cycle 2

	Number of Respondents (N)	Mean Score	Standard Deviation (SD)	t-value	df	p-value	Mean Difference (M-3.5)
Overall Intrinsic Motivation	15	5.13	0.69	9.206	14	0.001	1.63

The analysis of intrinsic motivation data after the music intervention in the second cycle indicates that the intrinsic motivation of Year 1 students was at a high level following the integration of music in recognizing Chinese characters.
Both hypotheses tested in this study were rejected, as shown in Table 14.

Table 14
Conclusion of Hypothesis Testing

Hypothesis		Conclusion
Ho1	Music is not effective in enhancing memory for recognizing Chinese characters among Year 1 students.	Rejected
Ho2	The intrinsic motivation level of Year 1 students is low after the integration of music in recognizing Chinese characters.	Rejected

Discussion

The findings of this study show that music enhances memory in recognizing Chinese characters among Year 1 students. This finding aligns with previous research showing that music significantly improves memory retention in primary school students (Li and Wang, 2020) and music enhances language learning and character recognition in young children (Chen et al., 2021). In the context of this study, music served as a facilitator, helping students associate Chinese characters with specific rhythms or melodies, making them easier to remember. The songs used in the intervention were familiar to the students, making it easier for them to connect the melodies with the Chinese characters. When students listen to familiar songs, they tend to focus more and feel comfortable, which can reduce cognitive load which is supported by Cognitive Load Theory (Sweller, 1988), which suggests that familiar music minimizes extraneous cognitive load by creating a predictable auditory environment. The Arousal-Mood Hypothesis (Thompson et al., 2001) further explains that familiar music evokes positive emotions and reduces stress, enhancing focus and comfort. Additionally, the Familiarity Effect in Music (Peretz et al., 1998) highlights that familiar music is processed more efficiently, requiring less cognitive effort.

Singing activities also created enjoyable learning experiences, stimulating students' intrinsic motivation. The positive emotions generated through singing helped reinforce the association between the characters and melodies, making them easier to retain in the long term. Music, as a repeated stimulus, also supported students in linking new information with prior experiences. In this study, music serves as a repeated stimulus by reinforcing connections between new Chinese characters and students' prior knowledge. For example, familiar melodies are paired with similar-looking characters, helping students recall them more easily. Through repeated singing and rhythmic patterns, students associate new

characters with their existing memory of sounds and structures, strengthening long-term retention. Classical conditioning and repetition theory also support the idea that repeated melodies combined with visual symbols strengthen associative memory (Pavlov 1927; Ericsson et al. 1993b). Music not only supports memory through rhythm but also through other elements such as melody, emotions, or a combination of words and tones, which reinforce retention (Wallace, 1994). In this study, these approaches proved effective when music was used to deliver information about Chinese characters, as the combination of musical elements helped students better recall and identify the characters.

The findings that music effectively enhances memory contrast with some recent studies (Zhang et al. 2022; Jäncke and Sandmann 2021; Kämpfe et al. 2021). The cognitive benefits of music may be more indirect, such as through emotional enhancement or increased arousal, rather than directly contributing to memory improvement (Zhang et al., 2022). In this study, the discrepancy with these findings may be influenced by other factors such as students' abilities, teaching methods, or exposure to music, which also impact the effectiveness of music in recognizing Chinese characters rather than music alone. For example, Jäncke and Sandmann (2021) argue that music's effects on cognition are primarily mediated by emotional and attentional mechanisms, while Kämpfe et al. (2021) highlight that the benefits of music are often task-dependent and influenced by individual differences. These studies suggest that the relationship between music and memory is complex and context-specific, rather than universally direct.

Additionally, the finding that music improves memory differs from studies showing that music negatively affects memory during learning phases but enhances emotions and sports performance (Fassbender et al., 2011). This difference may stem from various factors, such as learning contexts and participant characteristics. In this study, music was used to create musical mnemonics linking rhythm, melody, and lyrics with the Chinese characters being learned. Conversely, Fassbender et al. (2011) used music unrelated to the learning content, which led to reduced memory performance. Furthermore, the participant characteristics in this study involved Year 1 students, who are more inclined toward engaging and fun learning methods.

The findings also show that the intrinsic motivation level of Year 1 students in recognizing Chinese characters was high after the integration of music into learning. This aligns with previous studies, which state that enjoyable learning activities can enhance intrinsic motivation by fulfilling students' basic psychological needs, including autonomy, competence, and social relatedness (Ryan and Deci, 2000). The findings indicate that students’ intrinsic motivation was high after integrating music into learning, as shown by the questionnaire results, where the intrinsic motivation level increased from moderate to high. Additionally, the post-test results showed an improvement in short-term memory and long-term memory. Short-term memory scores increased from an average of 7.67 to 12.53, while long-term memory scores rose from 4.27 to 9.40 after two cycles, demonstrating better character recognition. This suggests that music not only enhanced memory but also created a more engaging and motivating learning experience. These results align with previous studies, as music-based learning fulfilled students' psychological needs by providing autonomy (engaging with music freely), competence (improving recognition skills), and social relatedness (learning through group activities).

Music is also believed to create enjoyable learning experiences, increase student engagement, and promote positive attitudes toward learning (Hallam, 2010). For Year 1 students in this study, music activities were more meaningful as they are more responsive to engaging and enjoyable learning methods. The findings support that music created an enjoyable learning experience, as reflected in the intrinsic motivation questionnaire results. Students reported higher enjoyment and interest, with enjoyment scores increasing from 4.70 to 5.05 and interest scores rising from 4.98 to 5.20 after two cycles. Additionally, observations showed that students actively participated in singing activities, demonstrated enthusiasm during lessons, and expressed excitement in recognizing Chinese characters through music. Their positive attitudes toward learning were evident in their willingness to engage in repeated musical exercises, reinforcing the meaningful impact of music-based instruction for young learners.

However, the findings of this study contradict certain studies suggesting that music can be a distraction in learning. For example, some research suggests that background music may interfere with working memory in young learners, especially when tasks require high cognitive effort (Gonzalez and Aiello 2019; Röer et al. 2021). Additionally, while music can enhance engagement, inappropriate music—such as music with complex rhythms or lyrics—may reduce focus and hinder learning in early childhood settings (Calvert and Tart, 2020). These differences may arise because previous studies often examined the effects of passive background music, whereas this study actively integrated music into learning activities, making it a meaningful tool rather than a distraction. Furthermore, Year 1 students may be more responsive to music-based learning due to their developmental stage, where engaging and interactive methods support attention and memory retention (Williams et al. 2020; Barrett et al. 2022).

The researcher offers alternative interpretations of these findings. The high intrinsic motivation level of students after music integration in recognizing Chinese characters should be interpreted cautiously, as the results may not be solely due to music but also to changes in learning routines such as introducing novelty, interactivity, or multisensory elements, can significantly enhance engagement and intrinsic motivation (Barrett et al. 2022; Williams et al. 2020; Chen et al. 2021). The teacher’s role should not be overlooked, as the creative and enthusiastic implementation of music interventions may have positively influenced students' motivation. Social interaction in music-related activities, such as group singing and playing percussion instruments while singing, may also have contributed to increased intrinsic motivation through enhanced social relationships. However, this effect may only be short-term, reflecting excitement toward new activities without leading to long-term attitude changes toward learning Chinese characters.

Conclusion

The study's findings provide a current perspective on students' learning experiences and generally indicate that integrating music into learning can improve memory in recognizing Chinese characters and enhance students' intrinsic motivation. This study serves as a reference for teachers to use music as an innovative approach to help students master basic language learning skills. It highlights the importance of teachers in fostering students' intrinsic motivation in the classroom and offers guidance to school administrators in designing programs that support music integration into the curriculum.

From an educational policy perspective, the Malaysian Ministry of Education can consider music as a critical component in early childhood curriculum design by integrating music into subjects as a strategy to support language learning. To broaden the application of this study's findings, longitudinal studies are recommended to evaluate the long-term effects of music on memory and motivation. Future studies could explore whether the positive impact of music on learning Chinese characters persists after several months or years. Further research could also involve larger samples beyond Year 1 students or in more challenging learning tasks.

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