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Research Paper

Agharmonics: Song-Based Mnemonics on Learners' Academic Performance in Grade 8 Science

Life Adlin Mae G. Espiritu[1], Joey Weng C. Vitug[2], Lilibeth P. Fababe[3], Alexia Mizzy S. Castro[4], Jan S. del Rosario*[5]
Bulacan Agricultural State College, Philippines

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Abstract

The persistent low performance of Filipino students in science, as reflected in international assessments like PISA, highlights significant challenges in science education. This study examined the effectiveness of Agharmonics, a song-based mnemonic strategy, in improving the academic performance of Grade 8 learners in science. Using a quasi-experimental design, the study involved two groups: one exposed to traditional instruction and another taught using validated song-based mnemonics. Researcher-made pre-tests and post-tests were administered, and statistical analyses, including paired and independent t-tests, were used to measure academic gains and compare group performances. Results revealed that both groups started at comparable proficiency levels, but the experimental group demonstrated a significantly higher post-test mean score (M = 26.25) compared to the control group (M = 20.19). A highly significant difference ($p < .001$) was observed within the experimental group's pre- and post-test scores, indicating the effectiveness of the strategy. Learners reported enhanced retention and engagement, particularly in mastering abstract scientific concepts. Findings suggest that Agharmonics is an effective and engaging instructional approach that may be applied more broadly to improve science education outcomes. The study recommends integrating music-based strategies in teaching and further research on their long-term effects across various educational contexts.

Keywords *Action Research; Agharmonics; Audio-visual Learners; Science Education; Song-based Mnemonics*

INTRODUCTION

Science education continues to pose a significant challenge for both learners and educators due to its abstract nature and its strong emphasis on retaining technical concepts and terminology. Many students struggle to grasp and recall complex scientific ideas, particularly when instruction relies heavily on traditional lecture-based methods. This concern is especially evident in a public high school in San Ildefonso, Bulacan, where the majority of Grade 8 learners were identified at the Beginning Proficiency level in science. Such findings underscore the urgent need for innovative and engaging instructional strategies that can bridge learning gaps, foster deeper comprehension, and improve academic outcomes.

Recent studies in STEM education emphasize the importance of employing multimodal strategies that integrate cognitive, sensory, and emotional dimensions of learning. According to Dual Coding Theory (Paivio, 1986) and Cognitive Load Theory (Sweller, 1988), learners retain information more effectively when instruction activates multiple sensory channels, allowing verbal and nonverbal codes to reinforce one another. Music-based learning aligns with these frameworks by combining linguistic elements (lyrics) with auditory cues (melody and rhythm), facilitating dual processing and improving memory consolidation. Moreover, from a Multimodal Learning perspective (Moreno & Mayer, 2019), integrating music helps distribute cognitive effort across auditory and verbal systems, reducing overload and enhancing retention. Empirical evidence supports this claim: Eaton (2020) demonstrated how rhythm and repetition act as powerful mnemonic devices, while Febrina (2023) reported that music-based strategies sustain learners' attention and improve conceptual understanding. Similarly, a recent scoping review by Alhamami et al. (2024) found that mnemonic-based serious games significantly enhance long-term recall

Corresponding author's email: jan_delrosario@basc.edu.ph

through associative and emotional engagement. Collectively, these studies provide theoretical grounding for music-based instruction as a means of strengthening both cognitive retention and affective engagement in science learning.

In response to this pedagogical need, the researchers developed Agharmonics: Song-Based Mnemonics on Learners' Academic Performance in Grade 8 Science. This innovative intervention incorporates essential science concepts into familiar song melodies, thereby blending cognitive processing with auditory and emotional engagement. By presenting key scientific principles through music, Agharmonics aims to strengthen learners' comprehension, retention, and application of knowledge. Moreover, the intervention seeks to make classroom instruction more interactive and enjoyable, reducing learning anxiety while promoting active participation.

Specifically, this study aims to determine the effectiveness of Agharmonics: Song-Based Mnemonics in improving the academic performance of Grade 8 students in science. It seeks to address the following research questions:

1. How may the pre-test results of the control group and the experimental group be described?
2. How may the post-test results of the control group and the experimental group be described?
3. Is there a significant difference between the pre-test results and post-test results of the control group and experimental group before and after the conduct of the study?

LITERATURE REVIEW

Music, by its very nature, can enhance learners' engagement and academic performance by stimulating emotional and cognitive processes that support learning. Cuevas (2019) emphasized that integrating music in instruction serves both motivational and instructional purposes, fostering a positive learning atmosphere. In a more recent study, Do and We (2022) found that songs incorporated into science lessons increased learner engagement, improved recall, and promoted positive attitudes toward learning. Similarly, Booth and Palmer (2024) asserted that music integration aligns with the goals of arts-integrated education, improving performance across disciplines by accommodating multiple learning modalities. These findings are consistent with Paivio's Dual Coding Theory (1971), which posits that information presented through both auditory and visual channels enhances memory and understanding—explaining why musical and rhythmic instruction supports deeper conceptual processing.

Parallel to this, research has shown that mnemonic-based learning effectively strengthens retention and comprehension. Mnemonics work by organizing information into memorable patterns, aiding learners to encode and retrieve knowledge more efficiently (Galang & De Guzman, 2021; Padernal, 2023). Marcos et al. (2024) demonstrated that mnemonic devices increase engagement, creativity, and academic performance, while Babalola (2023) reported that the Mnemonics-Enhanced Tutorial Method (MTM) significantly improves mindfulness and retention among science learners. These findings align with Sweller's Cognitive Load Theory (1988), which suggests that instructional methods minimizing extraneous cognitive load—such as structured, song-based mnemonics—enhance working memory efficiency and facilitate schema formation.

In particular, integrating popular English songs into grammar lessons can significantly improve student motivation and academic performance in English language learning. This approach not only enhances learners' grasp of grammatical concepts but also fosters a more engaging and motivating learning environment. These findings suggest that music can be an effective pedagogical tool for enhancing English language education, particularly in similar educational settings (Casipit et al., 2024). Memory aids, or mnemonics, are techniques used to improve recall and have been extensively researched in education and cognitive science. Additionally, mnemonics help learners learn and retrieve vocabulary more easily, boosting their independence and engagement with the language (Siagian et al., 2023).

Moreover, integrating technology-supported and multimedia learning strategies has proven beneficial in reinforcing scientific concepts. Balangon and Manalastas (2024) revealed that learners exposed to interactive tools, like BrainPop Jr., showed higher retention and post-test performance, supporting the idea that multimodal, song-based interventions may yield similar cognitive benefits. Likewise, Project Write and similar multisensory programs have demonstrated that engaging multiple sensory pathways—visual, auditory, and kinesthetic—strengthens long-term retention, echoing the principles of Constructivist Learning Theory, which emphasizes active, experiential learning through multiple representations of knowledge.

Additionally, studies on language learning reinforce music's educational value beyond science contexts. Casipit et al. (2024) found that integrating popular English songs into grammar lessons enhanced student motivation and comprehension, further supporting the role of music as a universal pedagogical tool that bridges affective and cognitive engagement. Overall, these findings suggest that song-based learning transcends subject boundaries, improving not only content retention but also learner motivation and confidence.

The challenges of retention in today's digital learning environments further justify the need for music-based, mnemonic interventions. De Guzman (2023) noted that the increasing distraction caused by digital devices negatively affects students' attention and academic focus. Waring & Nation (2004, as cited in Petallana et al., 2021) likewise emphasized that the brain naturally forgets unreinforced information, underscoring the need for intentional cognitive strategies to support memory retention. Within this context, song-based mnemonics, as a dual-coded, low-load, and constructivist strategy, offer a meaningful and research-supported solution for sustaining learner engagement and improving long-term academic performance.

In summary, the synthesis of recent studies suggests that combining music and mnemonic devices creates a synergistic instructional approach that supports both engagement and retention. Anchored in Cognitive Load Theory, Dual Coding Theory, and Constructivist Learning Theory, this framework underscores how song-based strategies termed Agharmonics can optimize cognitive processing, foster active participation, and ultimately enhance learners' academic performance in science.

Drawing from the theoretical and empirical foundations discussed above, the present study hypothesizes that the use of *Agharmonics: Song-Based Mnemonics* will significantly improve learners' academic performance in science. Specifically, the study tested the following hypotheses:

H_1: There is no significant improvement in the academic performance of students before and after exposure to *Agharmonics: Song-Based Mnemonics.*

H_2: There is no significant difference in the academic performance of students taught using *Agharmonics: Song-Based Mnemonics* and those taught using the traditional method.

RESEARCH METHOD

Type of Research

The study employed a quasi-experimental method within the quantitative research paradigm to investigate the effectiveness of Agharmonics: Song-based Mnemonics on learners' academic performance in Grade 8 Science. The primary objective was to determine whether integrating song-based mnemonics could significantly enhance students' understanding and retention of scientific concepts compared to traditional instructional approaches. Given the complexity of classroom contexts, a quasi-experimental design was deemed the most appropriate methodological choice. This design allows researchers to explore causal relationships between variables in authentic educational environments where random assignment of participants is often neither feasible nor ethically justifiable.

Like true experimental designs, quasi-experiments aim to establish a cause-and-effect

relationship between the independent variable (use of song-based mnemonics) and the dependent variable (academic performance) (Thomas, 2023). However, what distinguishes the quasi-experimental approach is its flexibility in accommodating naturally existing groups, such as intact classroom sections, without disrupting the flow of regular school instruction. This adaptability is particularly valuable in school-based research, where administrative policies, ethical considerations, and logistical constraints often prevent the random allocation of students to experimental and control groups. In this way, the design not only respects the natural composition of classes but also increases the ecological validity of the findings, ensuring that the intervention is tested under conditions that mirror real classroom experiences.

As Singh (2021) emphasizes, the defining characteristic of quasi-experimental research is that group assignment remains beyond the researcher's control. Despite this limitation, quasi-experiments still enable meaningful and systematic comparisons between treatment and control groups, thereby providing valuable insights into the potential impact of educational innovations. In the context of this study, the use of quasi-experimental methods ensures that the evaluation of Agharmonics is both rigorous and practical, bridging the gap between theoretical research and classroom application. Ultimately, the design supports the broader aim of evidence-based educational research: to generate findings that are not only statistically valid but also pedagogically relevant and adaptable to real-world teaching and learning environments.

Respondents

The Grade 8 learners at a public junior high school at San Ildefonso, Bulacan served as the respondents of the study.

Table 1. Respondents of the Study

Sections	Number of Learners	Group
Molave	36	Experimental
Narra	36	Control

Table 1 shows the respondents of the study. The respondents are learners of the two heterogeneous sections of Grade 8 Narra and Molave, with a total of 72 learners. Grade 8 Molave comprised the experimental group, while Grade 8 Narra comprised the control group.

Data Collection

The data collection procedure was carefully structured to ensure the systematic evaluation of the proposed strategy and its impact on learners' academic performance. To begin with, the researchers sought formal approval from the school head to conduct the study, thereby ensuring that the research aligned with institutional protocols and educational standards.

Following this, the research instrument —a 50-item, researcher-made test —was designed to measure three key constructs: concept mastery, recall, and application of scientific knowledge, competencies aligned with the Most Essential Learning Competencies (MELCs) in Grade 8 Science. The test items consisted of multiple-choice questions that reflected various cognitive levels, based on Bloom's taxonomy. These items were designed to evaluate not only the learners' ability to recall factual information but also their conceptual understanding and ability to apply learned scientific principles in problem-solving contexts.

The instrument underwent a rigorous validation process conducted by three content experts in Science. The validators reviewed each item for content relevance, clarity, and alignment with learning objectives. Additionally, parental or guardian consent was secured through written waivers, which informed them of the study's purpose, scope, and procedures, as well as the voluntary nature of participation.

Prior to the implementation of the intervention, a pretest was administered to both the experimental and control groups to establish baseline data for comparison. This step was crucial in determining the learners' initial academic performance levels and served as a foundation for assessing the effectiveness of the intervention. During the intervention phase, the experimental group received instruction using Agharmonics: Song-Based Mnemonics, which integrated music into science lessons to enhance understanding, recall, and engagement. The control group, on the other hand, continued with the traditional method of instruction, serving as a comparative benchmark.

Following the intervention, a post-test identical in structure and difficulty to the pretest was administered to both groups. The results of the post-test, when compared with pretest data, allowed the researchers to identify significant changes and improvements in learners' academic performance attributable to the use of song-based mnemonics. This systematic pretest–posttest design strengthened the study's capacity to measure both between-group differences and within-group progress over time.

Throughout the entire data collection process, the researchers adhered to ethical standards of educational research. Measures were taken to uphold confidentiality, respect participants' rights, and ensure that all data were collected, stored, and interpreted with integrity. By aligning with established ethical guidelines, the study safeguarded the welfare of learners while maintaining the credibility and trustworthiness of the findings.

Data Analysis

The data collected in the course of the study were systematically organized, tabulated, and analyzed using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS)**.** These tools facilitated both data management and rigorous statistical treatment, ensuring accuracy and reliability in the interpretation of results. In line with Creswell and Creswell (2018)**,** the use of quantitative software tools enhances objectivity and precision in educational research by minimizing human error and allowing for transparent statistical computation.

To evaluate the effectiveness of the intervention, a scoring scale was developed to classify learners' academic performance based on their test scores. Scores ranging from 41–50 were rated as Outstanding (O), 31–40 as Very Satisfactory (VS), 21–30 as Satisfactory (S), 11–20 as Fairly Satisfactory (FS), and 0–10 as Did Not Meet Expectations (DNM). This performance scale provided a standardized framework for interpreting learners' outcomes, consistent with principles of criterion-referenced assessment discussed by Fraenkel, Wallen, and Hyun (2019)**.**

Both pretest and posttest results were subjected to statistical analysis to determine the effect of Agharmonics: Song-Based Mnemonics on learners' academic performance. Descriptive statistics, including the mean, standard deviation, and frequency distribution, were computed to summarize the data and reveal observable patterns in the performance of both control and experimental groups. These measures provided an overview of central tendencies and variability, offering insights into learning gains and group differences (Pallant, 2020).

To test hypotheses regarding the effectiveness of the intervention, two inferential statistical methods were applied. A paired-sample t-test was used to determine whether there was a statistically significant difference between the pretest and posttest scores of the experimental group after implementing the intervention, thereby assessing intra-group improvement. Meanwhile, an independent-sample t-test was used to compare the posttest scores of the control and experimental groups, establishing whether the experimental group significantly outperformed its counterparts taught through traditional instruction. The combination of these tests follows established educational research practices for quasi-experimental designs (Cohen, Manion, & Morrison, 2018).

Table 2. Results of Learners' Scores in the Pre-Test of Control and Experimental Group

	Control Group		Experimental Group	
Range	Frequency	Percentage %	Frequency	Percentage %
41- 50	0	0.00	0	0.00
31-40	0	0.00	0	0.00
21-30	5	13.89	5	13.89
11-20	26	72.22	25	69.44
0-10	5	13.89	6	16.67
Mean	15.47		16.17	
Standard Deviation	4.46		5.37	
Verbal Interpretation	Fairly Satisfactory		Fairly Satisfactory	

Legend: 0-10 - Did Not Meet Expectations, 11-20- Fairly Satisfactory, 21-30 - Satisfactory, 31-40 - Very Satisfactory, 41-50 – Outstanding

The results derived from these analyses served as empirical evidence for evaluating the effectiveness of the proposed instructional strategy and provided quantitative support for its potential as an innovative tool to enhance science learning outcomes.

FINDINGS AND DISCUSSION

This section deals with the presentation, analysis, and interpretation of the gathered data and information including the results of the study Agharmonics: Song-based Mnemonics on Learners' Academic Performance in Grade 8 Science.

Students' Academic Performance Prior to the Implementation of the Strategy

Based on the results of the pretest scores of both the control and experimental groups, it was evident that the two groups were performing at a comparable level prior to the intervention's implementation. The control group obtained a mean score of 15.47, while the experimental group achieved a slightly higher mean of 16.17. Both means were verbally interpreted as Fairly Satisfactory, placing the learners under the Beginning Proficiency level. This finding indicates that the groups had no significant differences in their initial academic performance, thereby establishing a reliable baseline for evaluating the effect of the intervention.

Given the rapid evolution of modern educational settings, it is imperative to move beyond purely traditional methods and integrate creative, student-centered approaches that can actively engage learners. In this context, the comparable pretest results not only confirmed the similarity of the groups prior to the intervention but also highlighted the necessity of exploring alternative pedagogical tools such as Agharmonics: Song-Based Mnemonics to address the shortcomings of conventional instruction and enhance students' academic performance.

Prior to conducting the t-test, the necessary assumptions were checked. The data were found to be normally distributed, the observations were independent, and the variances of the two groups were equal. Therefore, the independent samples t-test was considered appropriate for comparing the performance of the control and experimental groups.

Table 3. Test of Significant Difference on the Pre-test of the Control and Experimental Group

Group	Mean	t-value	p-value	Decision	Interpretation
Control Group	15.47	-0.59	0.55	Fail to reject H_o	Not significant
Experimental Group	16.17				

Legend: p< 0.05 = significant ** = Highly Significant

Table 3 presents the test of the significant difference in the pretest scores between the control and experimental groups. The analysis yielded a t-value of –0.59 and a p-value of 0.55, which is greater than the 0.05 level of significance. Consequently, the null hypothesis was accepted, indicating that there was no significant difference in the pretest performance of the two groups.

The absence of a statistically significant difference confirms that both groups began the study with comparable baseline knowledge in Science. This finding is essential, as it ensures that any subsequent improvement in the experimental group can be more confidently attributed to the intervention rather than to pre-existing differences. In line with the findings of Wang and Zheng (2020), traditional lecture-based instruction has long been observed to yield limited impact on both academic achievement and learner self-efficacy, often resulting in uniform but modest levels of performance. Thus, the similar pretest results of both groups reflect the constraints of conventional teaching methods and emphasize the need for innovative strategies to address gaps in learning.

Establishing equivalence at the pre-intervention stage also strengthens the internal validity of the study. Without this balance, it would be difficult to assess the true effectiveness of Agharmonics accurately: Song-Based Mnemonics, as variations in initial knowledge levels could introduce bias into the results. Therefore, the non-significant difference in pretest scores provides a solid foundation for evaluating the impact of the intervention, reinforcing that subsequent improvements in the experimental group's academic performance can be attributed to the strategy itself.

Students' Academic Performance After the Implementation of the Strategy

Table 4. Post-test Results of Control and Experimental Group

	Control Group		**Experimental Group**	
Range	Frequency	Percentage %	Frequency	Percentage %
41- 50	0	0.00	0	0.00
31-40	1	2.78	12	33.33
21-30	16	44.44	15	41.67
11-20	18	50.00	9	25.00
0-10	1	2.78	0	0.00
Mean	20.19		26.25	
Standard Deviation	5.20		7.08	
Verbal Interpretation	Fairly Satisfactory		Satisfactory	

Legend: 0-10 - Did Not Meet Expectations, 11-20- Fairly Satisfactory, 21-30 - Satisfactory, 31-40 - Very Satisfactory, 41-50 – Outstanding

Table 4 presents the frequency distribution and descriptive statistics of the learners' post-test scores from both the control and experimental groups after the implementation of the intervention program. The control group obtained a mean score of 20.19 with a standard deviation of 5.20, which was verbally interpreted as Fairly Satisfactory. This outcome is consistent with their pretest results, suggesting that the traditional method of instruction had little measurable impact on improving their performance. In contrast, the experimental group achieved a markedly higher mean score of 26.25, with a standard deviation of 7.08, which corresponds to a verbal interpretation of Satisfactory. This clear improvement demonstrates the effectiveness of Agharmonics: Song-Based Mnemonics in enhancing learners' understanding and retention of science concepts.

The results resonate with the findings of Okenyi, Ezema, and Ngwoke (2022), who reported that mnemonic instructional strategies significantly improved pupils' performance in Basic Science compared to conventional teaching methods. Similarly, Ramos (2021) highlighted the positive impact of incorporating music into instruction, noting that different genres of background music, such as Classical, Jazz, and Pop, contributed to enhanced focus and academic performance among

Grade 9 learners in Science. These parallel findings support the present study's conclusion that integrating music-based strategies into instruction can provide a powerful supplement to traditional approaches, particularly in addressing the challenges of abstract and complex subject matter. The study concludes that incorporating background music into science lessons can enhance learners' focus and academic performance.

Table 5. Test of Significant Difference on the Post-test of the Control and Experimental Group

Group	Mean	t-value	p-value	Decision	Interpretation
Control Group	20.19	-4.14	0.000**	Reject H_o	There is a significant difference
Experimental Group	26.25				

Legend: p< 0.05 = significant ** = Highly Significant

Table 5 presents the results of the post-test comparison between the control and experimental groups, clearly demonstrating a highly significant statistical difference. The computed t-value of -4.14, coupled with a p-value of 0.000**, which is far below the 0.05 level of significance, provides strong evidence against the null hypothesis. This statistical outcome indicates that the two groups did not perform equally under their respective instructional approaches. Instead, the experimental group achieved a markedly higher level of performance, exceeding the control group by a mean difference of 6.06 points. Such a difference is not only statistically significant but also educationally meaningful, as it suggests that the instructional strategy employed exerted a substantial influence on learners' academic achievement.

The findings reveal that learners exposed to two different modes of instruction, which is traditional teaching for the control group and the Agharmonics: Song-based Mnemonics strategy for the experimental group developed varied levels of understanding and retention. In particular, the experimental group exhibited a greater improvement in their science performance, underscoring the effectiveness of integrating music and mnemonic devices into classroom instruction. This aligns with long-standing educational perspectives that, when creatively adapted, mnemonic strategies can enhance students' memory, comprehension, and application of knowledge in content-heavy disciplines.

Moreover, the study echoes and extends the conclusions of Pilit et al. (2024), who found that the application of Image-Based Mnemonics (IBM) in science classes significantly improved vocabulary retention and contributed to higher academic performance. Both the current study and the earlier research suggest that mnemonic-based methods do more than aid recall. They also encourage learners to interact with content in a more engaging and meaningful way. By appealing to auditory, visual, and even emotional dimensions of learning, mnemonic strategies provide multiple entry points for understanding complex material.

Overall, these findings emphasize the pedagogical value of incorporating mnemonic approaches such as Agharmonics into science instruction. By accommodating diverse learning styles, promoting active engagement with lesson content, and making abstract concepts more memorable, mnemonic-based teaching can serve as a powerful tool for improving academic outcomes. This study, therefore, contributes to the growing body of evidence advocating for the integration of innovative, student-centered strategies in science education to foster deeper learning and long-term retention.

Students' Academic Performance Before and After the Implementation of the Strategy

Table 6. Test of Significant Difference on the Pre-test and Post Result of Experimental Group

	Mean	t-value	p-value	Decision	Interpretation
Pre-test	16.17	-6.81	0.000**	Reject H_o	There is a significant difference
Post-test	26.25				

Legend: p< 0.05 = significant ** = Highly Significant

Table 6 presents a comparison between the pre-test and post-test results of the experimental group, revealing a highly significant performance improvement. The group obtained a mean score of 16.17 in the pre-test and 26.25 in the post-test, showing a substantial increase. The computed t-value of -6.81, along with a p-value of 0.000**, which is well below the 0.05 level of significance, leads to the rejection of the null hypothesis. This statistical evidence confirms that the instructional intervention had a meaningful effect on the learners' achievement, as reflected in an average gain of 10.08 points. Such a notable improvement suggests that the use of the alternative instructional approach introduced to the experimental group was highly effective in enhancing their academic performance.

The results demonstrate that the experimental group, when exposed to an innovative strategy, achieved significantly better outcomes compared to their baseline performance in the pre-test. This finding resonates with the conclusions of Çolak and Aydın (2022), who observed that mnemonic strategies considerably enhanced learners' academic achievement in the field of social studies, particularly in history. Their study further revealed that mnemonics not only strengthened retention of historical facts but also made the learning process more interactive and engaging. This insight is particularly relevant to science education, which, much like history, requires students to master and recall large volumes of factual knowledge, including scientific vocabulary, formulas, and processes. The present findings suggest that mnemonic strategies can play a similarly transformative role in science classrooms, helping learners overcome the challenges of memorizing abstract or complex information.

In addition to the contributions of mnemonic devices, research highlights the unique role of music in education. Febrina (2023) emphasized that songs provide a wide range of educational benefits, particularly when teaching younger learners, by making lessons more enjoyable, sustaining attention, and motivating students to participate more actively. She argued that songs introduce rhythm and melody into learning, thereby making content easier to remember. In the same vein, the Agharmonics approach, which employs song-based mnemonics, capitalizes on the cognitive and motivational advantages of music. By embedding science concepts in familiar tunes or rhythmic patterns, this strategy not only facilitates retention and recall but also makes the learning process more dynamic and meaningful. Music, therefore, acts as a cognitive scaffold, supporting learners' focus, comprehension, and long-term memory.

Beyond science education, these findings align with similar results across other STEM disciplines. A recent study of Grade 12 STEM students found that combining mnemonic devices, spaced-repetition learning, and brain-training exercises significantly improved memory recall in a General Biology context (Melegrito et al., 2025).

These cross-disciplinary parallels suggest that the benefits of instructional strategies like mnemonic devices and music-based techniques extend beyond Science, enhancing learning outcomes in the broader STEM domain.

Taken together, these results and supporting studies highlight the pedagogical promise of combining mnemonic techniques with music in science instruction. Such approaches respond to the diverse needs of learners, transform traditionally rigid lessons into interactive experiences, and

ultimately foster both academic success and sustained learner engagement. Thus, Agharmonics: Song-Based Mnemonics — in Science instruction not only underscores its effectiveness in this subject area but also supports its potential as an innovative, interdisciplinary tool for improving retention, comprehension, and engagement in various STEM fields.

CONCLUSIONS

Based on the findings of the study, several conclusions were drawn regarding the effectiveness of Agharmonics: Song-Based Mnemonics in enhancing learners' academic performance in Grade 8 Science. The study examined the learners' performance before and after the intervention and compared the results between those taught using the Agharmonics strategy and those taught through traditional methods.

Analysis of the pre-test scores revealed that both the control and experimental groups performed at a comparable level prior to the intervention, indicating that the two groups possessed similar baseline knowledge in Science. This established a reliable starting point for measuring the effects of the strategy.

The post-test results demonstrated that learners in the experimental group outperformed those in the control group after the implementation of Agharmonics: Song-Based Mnemonics. This significant performance improvement confirmed the effectiveness of integrating music and mnemonic devices into science instruction. Learners exposed to the strategy showed enhanced comprehension, retention, and engagement compared to those taught using traditional methods.

In addressing the third question, the t-test results revealed a statistically significant difference between the pre-test and post-test scores of the experimental group, while no significant improvement was noted in the control group. This finding affirms that the observed gains in the experimental group's performance were attributable to the intervention itself rather than to external factors.

The results of the study can be explained through established educational theories. According to Dual Coding Theory (Paivio, 1971), information processed through both verbal and non-verbal (musical) channels enhances memory retention and recall. By combining melody and lyrics, Agharmonics enables learners to encode scientific information through multiple sensory pathways, thereby reinforcing understanding. From the lens of Cognitive Load Theory (Sweller, 1988), the use of rhythmic and melodic patterns helps reduce extraneous cognitive load, making complex science concepts easier to grasp and remember. Additionally, the approach aligns with Constructivist Learning Theory (Vygotsky, 1978), as it fosters active learner participation and collaborative meaning-making through singing, discussion, and peer interaction.

Comparable results have also been observed in other STEM disciplines, where mnemonic and self-paced learning techniques were shown to enhance recall and conceptual understanding among Senior High School students (Melegrito et al., 2025). This consistency across disciplines underscores the broader applicability of multimodal, mnemonic-based approaches in improving learning outcomes within Science, Technology, Engineering, and Mathematics education.

Despite its promising results, the study acknowledges several limitations. The intervention was conducted over a short period of four weeks during the final quarter of the 2024–2025 school year, limiting opportunities to observe long-term effects, limiting opportunities to observe long-term effects. Moreover, the use of teacher-made assessments, while contextually appropriate, may restrict the generalizability of the findings compared to standardized testing instruments. The study was also confined to a single public junior high school in San Ildefonso, Bulacan, which limits its applicability to other educational settings with varying demographics or resources.

Given these limitations, future research should extend the implementation period, employ standardized assessment tools, and include diverse school contexts to strengthen external validity.

Qualitative approaches such as classroom observations, learner reflections, and teacher interviews are likewise recommended to provide richer insights into how Agharmonics influences learner motivation, engagement, and attitudes toward Science.

In conclusion, this study confirms that Agharmonics: Song-Based Mnemonics is an effective, theory-driven instructional strategy that enhances academic performance, promotes engagement, and supports cognitive processing among learners. Grounded in Dual Coding, Cognitive Load, and Constructivist Learning Theories, the approach demonstrates how integrating music into Science education can transform abstract concepts into enjoyable, memorable, and meaningful learning experiences.

LIMITATION & FURTHER RESEARCH

The integration of Agharmonics: Song-Based Mnemonics demonstrated significant effectiveness in enhancing the academic performance of Grade 8 Science learners' academic performance. The use of Agharmonics proved to be an engaging and meaningful instructional tool that improved students' comprehension, retention, and participation, particularly when learning abstract or conceptually challenging topics. Compared to traditional teaching methods, the approach facilitated better test performance and sustained interest, suggesting that integrating music with science concepts promotes both cognitive and affective learning gains. However, certain limitations were noted, such as the brief four-week implementation period during the fourth quarter of the 2024–2025 school year, reliance on teacher-made assessments, and the focus on a single public junior high school. These factors limit the generalizability of findings and the understanding of long-term effects.

In light of these findings and conclusions, the following recommendations are proposed:

First, Science teachers may use Agharmonics (song-based mnemonics) for teaching abstract and memorization-heavy topics. From a Dual Coding Theory perspective, combining lyrics and melody allows learners to encode information through both verbal and auditory channels, enhancing recall and understanding.

Moreover, learners may be encouraged to create their own song-based mnemonics. This process promotes creativity and deeper comprehension, consistent with Constructivist Learning Theory, as learners actively construct knowledge through meaningful engagement and self-expression.

In addition, school administrators may support professional development initiatives, such as seminars and workshops, focused on developing teachers' capacity to design and implement music-based instructional strategies. This aligns with the goal of reducing cognitive load by helping educators design materials that simplify complex information without overwhelming working memory.

Lastly, future researchers should adopt longer intervention periods, utilize standardized assessments, and involve diverse grade levels, school types, and socioeconomic contexts to test the broader applicability of Agharmonics. Future research could also explore how song-based mnemonics influence cognitive load management, motivation, and dual coding processes over time through mixed-method approaches such as classroom observations, interviews, and learner journals.

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