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Tune-in teaching: An advanced organizer mediated sustainable teaching tool

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Abstract

In order to improve secondary school student's engagement as well as understanding of difficult concepts, this study explores the development and implementation of the 'tune-in teaching approach', an advanced organizer-based sustainable teaching tool. The technique uses the Bengali song "*ai meghla dine akala ghore thake na to mon… (On such a cloudy day, the mind doesn't stay inside a lonely room)*" to establish a framework that is metaphorical and consistent with the main idea of weathering processes. Based on the Constructivist Grounded Theory (CGT) approach of Kathy Charmaz and supported by Vygotsky's Social Constructivism and Bruner's theory of instruction, this innovative tool utilizes music and metaphor to promote a deeper level of understanding and positive perception of the learning experience among learners. The findings of the study suggested that there is a more positive perception of the learning experience in geography and high cognitive achievement of the students in the case of the tune-in teaching method, in comparison to the traditional teaching method. The research enhances the fields of educational tool creation and constructivist pedagogy by providing specifics about the theoretical foundations, methodological design, classroom implementation, and expected outcomes.

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1 Introduction

Advance organizer is a pedagogic apparatus that isthmus the gap between what learner's prior knowledge is and what learners need to know (Ausubel, 1968). Advance organizer is an activator that marriage prior knowledge and new knowledge in an integral way and it is an abstract of pertinent proclaimed material presented in advance with the help of text, hypermedia, or graphics (Ausubel, 1968).

Music serves many purposes; some music may intensify the sorrow or joy. Some types of music can be seen of as an aural ornamentation that can change or intensify the tone of an occasion or as a means of producing an energetic impact that improves athletes' performance (Karageorghis et al., 2010). The impact of actively listening to music on visual-spatial intelligence (Gardner, 1987) has been demonstrated by a number of studies (Rauscher, 2002; Magne et al., 2006). Hetland (2000) discovered a strong and reliable connection between learning to make music with spatial reasoning and concluded that learning to make music improves spatial reasoning (Hetland, 2000). It has been demonstrated that the incorporation of music in the classroom greatly influences brain development, academic performance, and practical life skills of children (Yoon, 2000). The lyrics, "*On such a cloudy day, the mind doesn't stay inside a lonely room" in Bengali "ai meghla dine akala ghore thake na to mon…*" (Amarkobita4u, 2021) metaphorically used through tune-in teaching, an advanced organizer tool to teach the concept of weathering of West Bengal Board class IX students. This method tries to connect the student's prior knowledge about their traditional song and use it to learn new geographical concepts. From the film 'Shesh Porjonto' this song is taken. Hemanta Mukhopadhyay is the original singer and music composer, and the lyricist was Gauriprasanna Mazumder (Amarkobita4u, 2021). The study tried to deal with whether tune-in teaching

methodology enhances academic achievement and student's perception of the learning experience in geography in comparison to the traditional lecture-based method of teaching or not. Despite difficulties in matching metaphors with scientific correctness, improved comprehension, positive perception of the learning experience are anticipated results.

Findings of different empirical study of the past decade shows that the song-based pedagogy has a significant effect on students' cognitive and effective aspect. Knott and Thaut (2018) showed that children's verbal memory and ordered recall are much enhanced by musical mnemonics, illustrating the cognitive advantage of melody for learning. Studies conducted in classrooms also indicate improvements in achievement. While Tilwani et al. (2022) demonstrated that songs enhanced learners' vocabulary recognition, form–meaning connection and collocation learning. Paquette and Rieg (2008) discovered that song-integrated literacy classes raised vocabulary and comprehension. Song-based training enhances affective and perceptual factors in addition to performance. Chen et al. (2024) found that music-integrated classes improved understanding, motivation, and self-esteem, whereas Blasco-Magraner et al. (2021) found that music interventions raise emotional engagement and lower stress. But there is limited evidence on the use of song lyrics in geography teaching at the secondary level. The study seeks to fill this gap by evaluating how tune-in teaching influences students' academic achievement and perception of the learning experience in geography.

Therefore, this study was structured around specific research questions, objectives, and hypotheses to determine the instructional value of tune-in teaching as an advanced organizer-mediated sustainable teaching tool in geography. The study sought to ascertain whether a significant difference exists in academic achievement in geography between students taught using tune-in teaching and those taught using traditional teaching methods, as well as whether a significant difference exists in students' perception of the learning experience in geography under the two instructional approaches. Accordingly, the objectives of the study were to examine the effect of tune-in teaching on students' academic achievement in geography compared to traditional teaching, and to evaluate its impact on students' perception of the learning experience in geography relative to the traditional method. In line with these objectives, the study tested the null hypotheses that there is no significant difference in academic achievement in geography between students taught via tune-in teaching and those taught via the traditional teaching method, and that there is no significant difference in perception of the learning experience between secondary-level geography students taught via tune-in teaching and those taught via the traditional teaching method.

2 Theoretical frameworks

2.1 Kathy Charmaz's constructivist grounded theory

According to this theory, students actively create their own knowledge and understanding of the world by engaging in experiences and critically analyzing those experiences (Wertz et al., 2011). Charmaz claims that learning is an active, productive process in which students actively participate in their own journey of learning rather than acting as passive consumers of knowledge. The Bengali song "*Ai meghla dina akla ghora thake na to mon...*" functions as a culturally relevant tool within the tune-in teaching approach, helping students to build their comprehension of weathering processes through cultural and personal connections.

2.2 Vygotsky's social constructivism

Russian psychologist Lev Vygotsky's Social Constructivism highlights the vital role of social interaction in the development of cognition (Vygotsky, 1980). The Zone of Proximal Development (ZPD), which Vygotsky introduced tasks that allow students to substantially expand the boundaries of their learning area. This idea is utilized by the tune-in teaching approach, which promotes group learning and uses scaffolding strategies to assist in the development of students. For example, students benefit from peer conversations and teacher support when they interact with them and discuss the song's lyrics in relation to weathering processes. This helps students to retain and comprehend the concepts of weathering clearly.

2.3 Jerome Bruner's theory of instruction

According to this theory, learners should gradually expand on their prior knowledge through the use of scaffolding and a spiral curriculum (Bruner, 1960). Bruner highlighted the need of structure in instruction, arguing that students are better able to understand difficult topics when the material is presented in an orderly manner. He also advocated for discovery learning, which encourages pupils to conduct independent research and find new material. The song's lyrics are used to significantly expand the students' learning horizon in the tune-in teaching approach, gradually deepening their understanding of the concept of weathering. Students are guaranteed to be able to marry new information with their own cognitive frameworks attributable to this creative and organized approach. A strong foundation for the tune-in teaching approach is provided by the integration of various theoretical views. Social constructivism emphasizes the value of social connections and scaffolding, Constructivist Grounded Theory (CGT) emphasizes the necessity of culturally appropriate materials and active learning, and Bruner's theory of instruction promotes organized discovery learning. Collectively, these theories guide the development and execution of an advance organizer tool that improves student comprehension and engagement while also encouraging a stronger connection with the subject matter through cultural and metaphorical resonance.

3 Methodology

3.1 Research design and purpose

This study employed a quasi-experimental mixed-methods design to examine the effectiveness of tune-in teaching in secondary level geography instruction. The purpose was to determine whether tune-in teaching enhance their academic performance and students' perception of the learning experience in geography and pared with traditional teaching that means lecture-based method of instruction.

3.2 Participants

The experimental study has been completed at Piplon Sri Arabinda Vidyamandir in Burdwan district of West Bengal, India. Twenty students of grade IX were divided equivalently into two groups namely study group (experimental group) and control group on the basis of their prior achievement in geography (class VIII final result) in order to measure the effect of tune-in teaching method. The content of the study was 'weathering' of class IX standard curriculum. The control group was taught through traditional, lecture-based method and the experimental group through tune-in teaching method.

3.3 Development of tune-in teaching approach

The first step involved selecting a song that is culturally relevant and rich in metaphorical content. The Bengali song "*ai meghla dine akala ghore thake na to mon…*" was chosen for its evocative lyrics, which was mapped by imagining different metaphors. This involved developing an imaginary metaphorical word web map (**Figure 1**) that illustrates how each metaphor aligned with a specific weathering process. It is an advanced organizer tool that is tuned-in teaching was created to visually represent the connections between the song's metaphors and the concepts of weathering. The tool also included a detailed graphical explanation of each word metaphor. The teacher will explain this imaginary metaphorical meaning to the students for a better understanding of the concept of withering.

Key terms and phrases that are metaphors for various forms of weathering were found by analyzing the lyrics. The term "Akla" (lonely) could signify the isolation of rock particles during physical weathering, "Meghla" (cloudy) could represent chemical weathering involving water, and "Nimontron" (invitation) could metaphorically describe the biological processes that invite organisms to break down rocks, etc. The song lyrics both in Bengali and English, interdisciplinary intersection, symbolism and detailed metaphorical interpretation of this song "*ai meghla dine akala ghore thake na to mon…*" are given in **Tables 1, 2 & 3**.

Table 1. *Lyrics, interdisciplinary intersections, symbolism and metaphor.*

Lyrics in Bengali	Metaphorical word	Lyrics in English	Interdisciplinary intersection	Exploring symbolism and metaphor
Ai meghla dine ekala ghore thake nato mon kache jabo kobe pabo ogo tomar nimontran ai meghla dine ekla ghore thake nato mon kache jabo koba pabo ogo tomar nimontran yunthi bone oi howa kore shudhu asa yawa yunthi bone oi howa kora shudhu asa jawa hay hayre din jayar bhore andhare bhuban kacha jabo koba pabo ogo tomar nimontran ai meghla dine ekla ghore thake nato mon kache jabo koba pabo ogo tomar nimontran shudhu jhore jharo jharo aaj bari saradin aaj jeno meghe meghe halo mon je udasin shudhu jhore jharo jharo aaj bari saradin aaj jeno meghe meghe holo mon je udasin aaj aami khone khone ki je vabi anmone aaj aami khone khone ki je vabi anmone tumi asbe ogo hasba koba hoba se milon kache jabo koba pabo ogo tomar nimontran ai meghla dine akla ghore thaka nato mon kache jabo koba pabo ogo tomar nimontran.	Meghla (cloudy)	On this cloudy day, my lonely heart does not wish to stay indoors. When will I go close to you, when will I receive your invitation? On this cloudy day, alone—my mind refuses to stay at home. When will I go near you,when will I feel your call? In the forest of youth, the wind moves only back and forth—in the forest of youth, the breeze, only comes and goes. Ah, how the days pass, through morning and darkness— when will I go close to you, when will I receive your invitation? Only the endless drizzle falls the whole day long. As if cloud after cloud has made my mind so restless. Only the endless drizzle falls from morning till night—as if the sky of my mind has grown dim and absent. All day long, every now and then, I drift into deep thoughts. Again and again I wonder, lost within myself—you will come, you will smile, we will meet at last…when will I go close to you, when will I receive your invitation ? On this cloudy day, alone, my heart does not wish to stay inside. When will I go close to you, When will I feel your call?	Geography	Physical and chemical weathering
	Ekla (Lonely)		Literature	Less chances of biological weathering
	Mon (Mind)		Psychology	Weather is very unpredictable like mind
	Nimontron (Invitation)		Literature	Chemical weathering
	Howa (Wind)		Geography	Cause erosion
	Asa Joya (Moves only back and forth)		Literature	Relentless forces of natural agents of erosion like wind
	Bhuban (Earth)		Geography	Change to landscape throughout the world by weathering and erosion
	Kache jabo (Will come close)		Literature	Chemical reaction-chemical weathering
	Jhore jharo jharo aaj bari saradin (All day the rain pours down with a rushing sound)		Geography	High chances of hydration process i.e., chemical weathering
	Meghe meghe (among clouds)		Geography	High chances of biological weather in formation of soil
	Khone khone (again and again)		History	Changes of landscape through erosion
	Milon (Union)		Music	Weathered material/ rock and weathering agent

3.3.1 Coding of the song lyrics

Different coding from the lyrics will identify the core characteristics of the topic weathering. Initial coding extracts the first code directly from the lyrics of the song and suggests possible metaphorical meanings connected to the weathering concept. After that students can understand the core theme of the topic or the petals of the topic, which is to be learned or remembered. They can understand the relationship between different initial codes that represents the metaphorical meaning of the concept of weathering. Not only song lyrics and the metaphorical meaning make them understand the key concept of weathering at the same time it will also increase the engagement and the retention power of the concept they learned with the help of this tune-in teaching method.

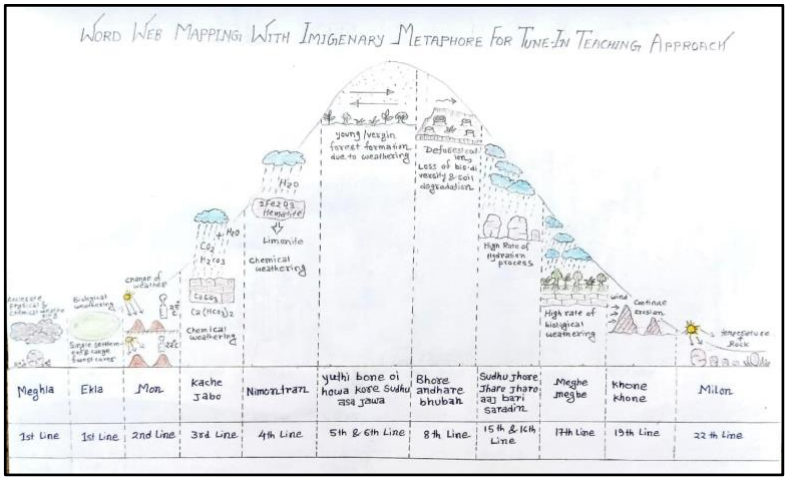

Figure 1. *Word web mapping with imaginary metaphor for tune-in teaching approach.*

3.3.2 Development of lesson plans

To improve student engagement and learning outcomes, Eisenkraft (2003) highlighted the significance of expanding the 5E model (engage, explore, explain, elaborate, and evaluate) to include the "elicit" and "extend" stages. While Bruner (1960) advocated for instructional scaffolding to assist concept comprehension, Vygotsky (1980) advanced collaborative learning in his social constructivism theory. Constructivist grounded theory plays an important part in educational research, as highlighted by Charmaz (2006), who laid the groundwork for the tune-in teaching approach. The 7E model lesson plan's use of a well-known song to introduce the difficult idea of weathering is in line with current theories and methods of education, giving students comprehensive and enjoyable learning. The 7E model lesson plan included the following components like elicit, engage, explore, explain, elaborate, evaluate, and extend. The 7E model lesson plan for the topic weathering is given below.

Topic:

Weathering

Grade Level:

Secondary (Class IX)

Objective: Using the song "*Ai meghla dina ekla ghore thaka na to mon…*" as a metaphorical instrument, students will comprehend the idea of weathering and its types (physical, chemical, and biological).

Table 2. *Metaphorical interpretation of the song.*

Melody, rhymes, lyric and instrumentation	**Harmony**	**Chorus**	**Environmental shadow**
i) Slow and sudden changes of the tempo represent slow and high rate of weathering and erosion process. ii) Rhymes and lyrical structure represent repetitive cyclical aspect of weathering. iii) Lot of musical instruments represents erosion and weathering agents like water, wind temperature, etc. iv) Melody of the song changes represents shape of the land changes through weathering and erosion.	Weather accelerates erosion process that means one is the cause another is the effect.	A repetition of chorus represents erosion as a continuous process.	i) "Yuthi bone howa" (The wind blowing through the virgin forest) represents in the wind as an agent of erosion in virgin land. ii) "Vore andhare vubon" (The world filled with darkness) metaphorically deforestation represents loss of biodiversity and soil degradation. iii) "Meghe meghe holo mon je udasin" (With clouds gathering all around, the heart had become melancholic) here, metaphorically the emotional turmoil represents soil erosion and deforestation acts together over the land surface.

Materials needed:

i) Song lyrics of "*Ai meghla dina akla ghore thaka na to mon*"

ii) Visual aids and word web mapping

iii) Whiteboard and markers

iv) Student handouts

v) Multimedia projector

7E Model:

a. Elicit

Activity: Play "*ai meghla dine akala ghore thake na to mon…*" for the class to start. Invite students to talk on the feelings and ideas the song has stirred up in them. Explain how weathering works and how the song will help them to comprehend this geographical phenomenon.

Purpose: To ignite students' interest in the subject matter.

b. Engage

Table 3. *Coding of the song lyrics.*

Initial code and metaphorical meaning from lyrics to teach concept of weathering	**Categories and subcategories related to initial code which will increase engagement, retention power and understanding of the concept of weathering**	**Core category** **"Music will enhance conceptual clarity of the topic weathering"**
i) Meghla (cloudy)- weather condition leading to physical and biological weathering. ii) Akla (alone)- high vegetation cover and potential for biological withering. iii) Mon (mind)-changeable like weather. iv) Kache Jabo (going to close)- represents chemical reaction like $CO_2 + H_2O = H_2CO_3$ v) Nimontron (invitation)- denotes another chemical reaction like $H_2CO_3 + CaCO_3 = Ca(HCO_3)_2$ vi) Hawa (wind), asa jawa (come & go), knone khone (every moment)- denotes erosion vii) Bhuban (the world)- represents changes of landscape throughout the world by the process of weathering an erosion viii) Meghe meghe (in the clouds), jhore jhoro jhoro bari saradin (raining all day)- denotes high chances of biological weathering and soil formation ix) Milon (combination)- represents marriage between weather material and weathering agent	A) Weathering types i) Physical weathering – cloudy condition. ii) Chemical weathering – chemical reaction, kache jabo, nimontron. iii) Biological weathering – high vegetation cover, ekla. B) Engagement and understanding i) Emotional engagement ii) Cognitive engagement iii) Conceptual understanding or clarity C) Retention i) Memory retention ii) Long-term understanding	Integrated framework Music will enhance concept of weathering along with engagement, understanding and retention power. Theory development Metaphorical thinking in related to overall- i) Engagement Song's metaphor will create high emotional and cognitive engagement. ii) Understanding Metaphorical thinking will boost conceptual clarity. iii) Retention Metaphorical thinking will enhance memory retention, long-term understanding of the concept weathering.

Activity: Discuss each metaphorical representation of the lyrics in relation to weathering processes and the student actively try to create another metaphorical thinking in relation to the word web to understand the whole concept in their own way.

Purpose: To create students' interest and link the song's word web mapping to the scientific concept of weathering.

c. Explore

Activity: Assign each small group in the class a particular kind of weathering (physical, chemical or biological) and then provide word web map (**Figure 1**) to each group for study and give an overview on the weathering type they were allocated.

Purpose: Allows students to work with classmates and do extensive studies on weathering types.

d. Explain

Activity: Each group demonstrate a class presentation on their assigned topic (physical, chemical or biological weathering) with the help of word web mapping (**Figure 1**).

Purpose: To strengthen and elucidate students' comprehension of the many forms and mechanisms of weathering process.

e. Elaborate

Activity: Conduct a class discussion on how weathering affects the landscape.

Purpose: To deepen students' understanding and apply their knowledge to broader environmental contexts.

f. Extend

Activity: Give students a project on how weathering helps erosion.

Purpose: To expand learning outside of the classroom and promote critical thinking and creativity.

g. Evaluate

Activity: Students are asked what is weathering? What are the types of weathering? How this process happened? What are the main characteristics of weathering? Try to create a mind map of weathering process, how withering and erosion are interlinked?

Purpose: Assessing pupils' overall knowledge about weathering process is the ultimate objective.

3.4 Standardizing the instructional tool

3.4.1 Validity of the test results

The validity of the tune-in teaching tool was assessed using the Content Validity Index (CVI) and Inter-Rater Reliability (IRR) (Landis et al., 1977; Lynn, 1986). The CVI was calculated at both the item level (I-CVI) and the Scale Level (S-CVI). The entire instructional process for delivering content through the tune-in teaching approach was demonstrated by the researcher in the presence of three validators: a Techno-Pedagogical Competence Expert, a Pedagogical-Content Competence Expert, and a Technology-Driven Content Competence Expert. After the lesson demonstration, the expert validators were asked to rate all thirty items on a 4-point scale. The I-CVI was determined using Lynn's formula (Lynn, 1986), while the S-CVI was calculated using Landis' expression (Landis et al., 1977). The results of the validity test are presented in **Table S1**.

3.4.2 Inter-rater reliability checking

To ensure agreement between raters, Fleiss' Kappa was calculated (Landis et al., 1977; Fleiss, 1981). The level of agreement is interpreted as almost perfect when $K > 0.8$, substantial when $K > 0.6$, moderate when $K > 0.4$, fair when $K > 0.2$, slight when $K > 0.0$, and no agreement

when K < 0.0. The result of the Inter-Rater Reliability is depicted in **Table S2**. The Fleiss' Kappa value is approximately 0.93, indicating a high level of agreement between the raters. This suggests strong reliability in the ratings provided by the three experts.

3.4.3 Finalizing the tool

Items with low I-CVI have been reconsidered and revised based on expert feedback. It is observed that, The I-CVI, S-CVI and kappa values meet acceptable thresholds. Thus, the designed strategy is reliable and valid for further use. The Fleiss' Kappa value is approximately 0.93, indicating a high level of agreement between the raters. This suggests strong reliability in the ratings provided by the three experts.

3.5 Data collection tool

3.5.1 Standardization of achievement test

An achievement test was developed on the topic weathering to test the effectiveness of tune-in teaching. Items were standardized through expert review (2 geography experts and 2 pedagogy experts), and Content Validity Ratio (CVR) was calculated for selecting the items. After experts' opinion some items are modified. The result is satisfactory; 15 items were selected. Pilot testing was done on 20 students to ensure clarity, content relevance, and feasibility of the test. By feeding the data on SPSS, data analysis software Cronbach's alpha was calculated, and the value is 0.81 (good internal consistency for 15 items).

3.5.2 Validation of perception checklist

Based on the expert feedback, the perception checklist was validated. Face validity was confirmed via pilot testing with six students. Content validity, expert consistency reliability was ensured with the help of five geography experts. After that, the finalization of the tool was prepared. The detailed layout of the research methodology is given in **Figure 2**.

3.6 Application of tools

Two data collection tools that is achievement test and the perception checklist was standardized. After teaching weathering through traditional and tune-in teaching method a test was conducted through standardized achievement tests (**Table S3**) in both control and experimental groups. After that an independent sample t-test was conducted to test the hypothesis 1, that is there is no significant difference in academic achievement in geography between students taught via tune-in teaching and those taught via traditional teaching method.

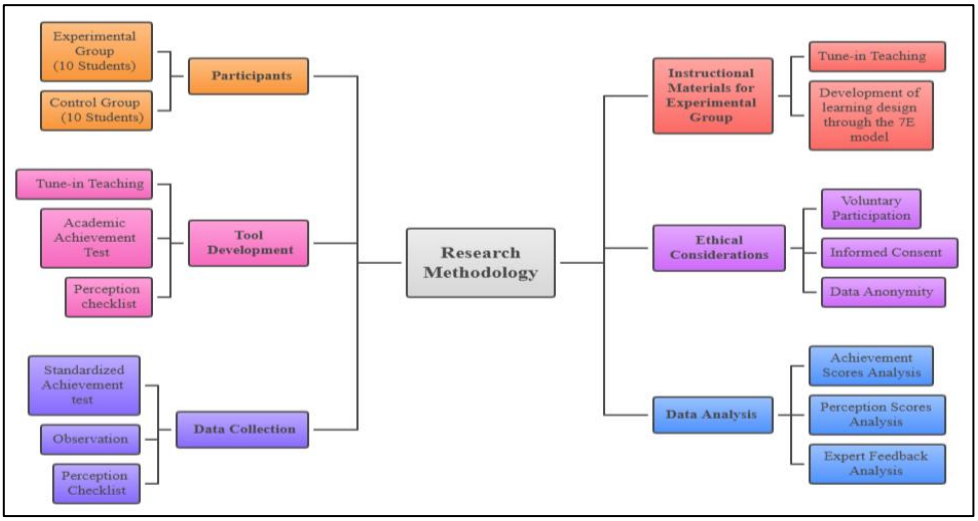

Figure 2. *Layout of research methodology.*

After expert validation of perception checklist (**Tables S4, S5 & S6**), the perception between two control group and experimental group were analyzed to test the hypothesis 2 (there is no significant difference in perception of learning experience between secondary level geography student taught via tune-in teaching and those taught via traditional teaching method) by t-test.

4 Results

4.1 Analysis of the achievement scores

After teaching with the traditional method in the control group and the tune-in teaching method in the case of the experimental group, a standardized achievement test of 15 marks was conducted to test the cognitive achievement among students of both groups about the topic concept of weathering. The achievement scores are as follows: in the control group, a mean of 6.8 ± 1.48, while in the experimental group, a mean of 12.8 ± 1.32 was obtained by the students (**Table 4a**). After that t-test was conducted to test hypothesis 1, that there is no significant difference in academic achievement in geography between students taught via tune-in teaching and those taught via the traditional teaching method. The results showed that there is a significant difference between the achievement scores of the control group, who are exposed through traditional teaching, and the experimental group, who are exposed through the tune-in teaching. So, the hypothesis that there is no significant difference in academic achievement in geography between students taught via tune-in teaching and those taught via the traditional teaching method is rejected.

4.2 Analysis of the perception scores

The perception score of experimental groups taught through the tune-in teaching method is significantly higher (mean score is 13.2 ± 1.03) than the control group (mean score is 9.3 ± 0.95), and the $t_{(18)} = -8.794$, $p < 0.05$, which is significant at the 0.05 level (**Table 4b**). This indicates the rejection of the null hypothesis 2, that there is no significant difference in perception of learning experience between secondary level geography student taught via tune-in teaching and those taught via the traditional teaching method. This indicates the perception of the experimental group, who are exposed through the tune-in teaching method, has a strong positive perception in comparison to the perception of the students who are exposed through the traditional teaching method.

5 Discussion

The results were analyzed to determine the effectiveness of the tune-in teaching methodology. Key findings included increased student achievement, improved understanding of weathering processes. From the second hypothesis testing, it is clear that the perception towards the subject relevance is positive after when they exposed through the tune-in teaching methodology. Challenges and limitations were also identified, such as the difficulty in aligning metaphors with scientific accuracy and the need for adaptive teaching strategies to address

Table 4. *Group statistics of a) achievement, and b) perception scores.*

Group	N	Mean	SD	Std. Error Mean	t-test
a) achievement scores					
Control	10	6.8	1.48	0.47	$t_{(18)} = -9.594$, $p < 0.05$
Experimental	10	12.8	1.32	0.42	
b) perception scores					
Control	10	9.3	0.95	0.30	$t_{(18)} = -8.794$, $p < 0.05$
Experimental	10	13.2	1.03	0.33	

varying student interpretations. According to research on arts-integrated teaching, incorporating music into curricula enhances student engagement, conceptual understanding, and long-term memory (Hardiman et al., 2014). Popular music and carefully designed songs can make spatial and place-based concepts more memorable and motivating for students (Allen et al., 2013; Smiley and Post, 2014). The current study expands this body of evidence by showing that song-based pedagogy improved achievement in geography, positive perception of the subject relevance in geography at the secondary level. This provides educators looking for effective, arts-integrated strategies in geography instruction with empirically supported, curriculum-relevant guidance.

Further studies could explore the scalability of this methodology to other subjects and educational levels. Comparative research could evaluate the effectiveness of the tune-in teaching approach against the traditional instructional approach. Although it can be creative and interesting, there may be drawbacks to the tune-in teaching approach, which uses song lyrics as metaphors to teach ideas like weathering. Not all geographic ideas lend themselves well to this approach, and students may misunderstand the metaphors, which leads to misconceptions. Language and cultural constraints may make teaching more challenging, and students may get more engaged with the music than with the scientific ideas. Subjective interpretations can result in uneven understandings, and the effectiveness of the approach depends on the creativity of the teacher, which might fluctuate. By addressing these issues, we can guarantee that the approach enhances traditional teaching while maintaining its efficacy.

6 Conclusion

The results suggested that there is a high cognitive achievement in the case of the tune-in teaching method, and the perception of the subject relevance is positive in the case of this method in comparison to the traditional teaching methodology. Understanding of weathering processes is improved through the use of metaphors, which make complex concepts more accessible and relatable. The tune-in teaching methodology offers a powerful and effective strategy. Based on the approach in robust educational theories and validating it through systematic coding techniques, this methodology provides a valuable contribution to the field of educational tool development and constructivist pedagogy.

7 Ethical statements

The study adhered to institutional ethical guidelines for human subject's research and participation was voluntary, and students could withdraw at any time and Informed consent was obtained before to the study.

8 Conflict of interest

The authors declare no conflict of interest related to this study.

9 Data availability statement

The data will be made available upon request. Additional data are provided as Supplementary Information at the following link.

10 Author contributions

Mosharaf Hossain Mondal: Conceptualization, data collection, data analysis, software, visualization, and writing original draft. Chandan Adhikary: Methodology, draft editing, and supervision. All authors approved the final version of the manuscript.

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