Research Article

Project -Based Steam Learning Based on Sound of Green: Empowering Students' Creative Thinking

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Abstract.
This research aims to investigate the ability of teachers in designing sound of green-based PjBL STEAM learning to empower creative thinking skills and to determine the differences in creative thinking abilities in junior high school students. This study emphasizes the assessment of the effectiveness of project-based STEAM learning based on sound of green in empowering students' creative thinking in natural resource processing, involving 162 students in schools in music tourism attraction villages in Ambon city. The study reports that the respondents' results and creativity levels, including fluency, flexibility, originality, and elaboration among students, were excellent. Overall research results indicate that the majority of students are at a good level after being taught with the sound of green-based PjBL STEAM model. The increase in students' creativity with guidance and direction from teachers, especially in the technical, art, and mathematics stages in STEAM, is evident. Initially, many students lacked fluency, flexibility, originality, and elaboration dimensions in detail, resulting in an inability to generate more ideas and provide answers. Consequently, their originality decreased, and they lacked ideas to further elaborate on the given answers. However, findings from several meetings show a significant improvement among students. This is because implementing project-oriented learning models that empower the environment around students enhances every domain of creativity in science subjects. Additionally, the researcher suggests conducting further research on students' creative thinking processes based on the unique advantages of each school's geographical location. Teachers are expected to better understand students' cognitive, affective, and psychomotor abilities, improving students' creative thinking skills in every dimension of creativity according to the geographical conditions of the learners' environment.

Keywords: sound of green STEAM, project learning, creative thinking

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1. INTRODUCTION

Education practitioners in harnessing local natural resources are crucial agents in the conservation and development of natural resources [1]. Science education is expected to develop capacities, credibility, and even interests in preserved local natural resources

[2]. Science learning should utilize appropriate methods to immerse students in real-life situations, where they can observe and prove their knowledge based on existing facts and gain concrete experiences [3].

Science learning that empowers natural resources requires principles and understanding to be applied scientifically and in depth [4]. Thanks to 21st-century skills, students can direct their knowledge across various disciplines such as real-life contexts or socio-scientific problems in finding solutions. Furthermore, with the aid of appropriate technology, 21st-century skills make learning more meaningful and enable individuals to perceive science as part of their own lives [5]. Student-centered learning always involves students in activities requiring rationality, discovery, problem-solving, data collection, application, and communicating ideas The [6].

Introducing environmental, social, and cultural conditions to learners enables them to become more familiar with their surroundings. This aligns with the goals of Sustainable Development as outlined by UNESCO in Sustainable Development Goal 4 (SDG 4), particularly Quality Education, within the Agenda 2030, aiming for "action plans for people and prosperity," ensuring fair quality education and promoting lifelong learning opportunities for all. These goals are inseparable and encompass economic, social, and environmental dimensions (SDG 4, 2019-2022) [7]. Achieving SDG 4, especially Quality Education, in Maluku requires ensuring education that highlights local cultural characteristics, skills, noble cultural values of Maluku, and addresses social and environmental issues, ultimately equipping our learners with basic natural resource management skills as a life skill. Scientific literacy is crucial for students to master. Students can understand the environment, health, economics, and other issues faced by modern society, which heavily rely on technology and advancements in science (Jgunkola & Ogunkola, 2013;Valladares, 2021)This underscores the importance of scientific literacy for students. With scientific literacy skills, students are expected to tackle challenges in the era of globalization, such as rapid technological advancements and scientific developments.

The actual curriculum of educational institutions is developed with the principle of diversification, featuring a new innovation in the field of science education called Sound of Green (SoG), which involves the environment as a learning resource. The Sound of Green approach is one of conservation action approaches, implementing agroforestry patterns and developing local cuisine, aiming towards environmental preservation. Additionally, this approach promotes the economic value of the use of local Maluku plants, utilization of plant waste, learning through nature and music schools, calculation of carbon values from local plant forests, formation of farmer groups, establishment of

creative culinary communities through educational units, and building Ambon city as a music tourism destination Problems [10].

Freedom or autonomy in the Sound of Green learning process in the music attraction village of Ambon city provides guidance to achieve scientific and technological literacy for all, with Sound of Green acting as a bond that unites science, technology, and society together. Constructivism learning theory underlies the Sound of Green approach. Internal conditions involve the enhancement (arising) of student memory as a result of previous learning. Prior learner memory is a new capability component, and its placement together. External conditions include aspects or objects designed or arranged in a learning environment [11]. As learning outcomes, Darling-Hammond et al., (2020) categorizes them into five groups: intellectual skills, cognitive strategies, verbal information, motor skills, and attitudes.

Therefore, it is important to provide materials, activities, and learning resources that will help develop 21st-century individuals. Project-based learning, which emerged as a result of Dewey's emphasis on the importance of applied teaching, has been discussed in the field of education for over a century and implemented in educational institutions since the 1990s (The [13]. PjBL-STEAM is a teaching method that requires students to conduct research in groups within a certain period of time with the help of real-life, complex, and challenging scenarios to solve problems [14]. PjBL-STEAM is a collaborative approach that enables students to construct their knowledge scientifically through teamwork and problem-solving [15], skills in formal or informal educational environments.

Supporting Ambon as a creative music-based city, the Ambon city community of local natural resource processing practitioners has been involved in developing local potential at the village level with the aim of realizing Ambon city as a music tourism village using the Sound of Green approach. They preserve various local wisdoms, which are nothing but local knowledge in the fields of environmental, livelihood, culinary, artistic, and various social life customs in the village. Tourists come to appreciate and understand these various local wisdoms. The role of local natural resource practitioners, who are mandated to preserve local knowledge, can determine the progress of Ambon city's music attraction villages. They are motivated to develop Sound of Green by prioritizing the uniqueness of local natural resources at the village level and reproducing it for the advancement of Ambon city's music attraction villages. They also compete to preserve various local natural resources and even strive to revive local cultures eroded by the currents of modernization and globalization.

The problem in this research is to assess project-based STEAM learning based on Sound of Green that empowers students' creative thinking in Ambon city. Project-based STEAM learning is effective in the learning process. As a result, the effectiveness of students' creative thinking towards scenarios or problems formulated from content on natural resource management is expected to achieve optimal value. Training and empowering activities for teachers to improve the quality of learning have been carried out quite extensively. However, not all teachers can participate for self-development due to various reasons and limitations. The knowledge and creative thinking skills of teachers in Ambon city's music attraction villages are still in need of empowerment through various socializations, training, or seminars, so teachers in this area are still less connected to learning design or other learning activity innovations. The same information was obtained from the survey results of the implementing team in relation to previous research activities and interviews conducted with several junior high school teachers and principals in those schools. Teachers need to be driven to be productive and creative. Therefore, research activities that are a real implementation related to the results or findings of observations conducted so far are important.

Furthermore, it is important for teachers, especially in teaching, to be willing to innovate as part of their professionalism duties. The devices, teaching materials, media, and learning evaluations to be developed are expected to empower students' creative thinking skills in solving problems in their environment, one of which is natural resource management. Natural resources around students are often overlooked, despite having economic value. Teachers face difficulties in finding the right best practices to optimize creative thinking learning. Students are inadequately trained in developing creative thinking skills. Constraints related to student cognitive learning outcomes are still oriented towards low achievement levels, and the development of students' skill aspects is underutilized.

1.1. Research Problems

Several issues faced in the learning process have been identified in most schools in the music tourism attraction villages of Ambon city, including:

How do teachers design PjBL STEAM-based Sound of Green-oriented learning practices to empower creative thinking skills in junior high school students?

How is the creative thinking ability of junior high school students after using the PjBL-STEAM learning model based on Sound of Green?

Are there any differences in the creative thinking ability of students after using the PjBL-STEAM learning model based on Sound of Green?

1.2. Theoretical Study

Maluku, as an archipelagic region within the Wallacea Region, boasts unique and diverse flora and fauna, some of which are locally endemic. Like the Wallacea Region, which is a mix of Asian/Oriental and Australasian/Australian flora and fauna, flora and fauna from both biogeographies are also found in the Maluku Islands as endemic species [9]. Endemism arises due to the isolation of places, creating geographic barriers that separate one species of fauna into one or more subpopulations [16]. Geographic barriers eventually lead to reproductive isolation, causing each subpopulation to develop morphological, physiological, and behavioral characteristics as adaptations to their local environmental conditions [17]. The differentiation occurring within each subpopulation ultimately separates one or more different species from one differentiated species into new species different from their ancestors [18].

Maluku possesses several plant species that play significant roles in the environment, including Bambu Sero (Schizostachyum brachycladum), Bambu Toi (Schizostachyum lima), Bambu Tapir (Gigantochloa sp), Bambu Patong (Dendrocalamus asper), Sukun (Artocarpus communis Fort), Gandaria (B.macrophylla Griffit), Kayu Titi (Gmelina moluccana), and Nangka (Artocarpus integer). These local plants are beneficial as raw materials for traditional musical instrument making, supporting the implementation of Ambon city's mandatory local music education curriculum. These local plants are also part of the Forest City Concept. The Forest City Concept is applied through six principles: 1) conservation of natural resources and wildlife habitats; 2) connectedness with nature; 3) low carbon development; 4) adequate water resources; 5) controlled development (Anti-Sprawl Development); and 6) community involvement in realizing the Forest City [19]. Each principle is elaborated based on criteria and indicators to ensure that each principle is met in development planning.

Supporting Ambon as a based sound of green concept creative city, which is built by combining music and environmental preservation elements, serves as an educational platform for activities, innovation, and creativity. Creativity is a crucial factor in the city's economic [20]. To foster creative behavior in the city's economy, simultaneous support from all elements government, education, economic actors, and the community is required The Collaboration [20]. Creative economic actors make traditional musical instruments in exemplary and non-exemplary schools, study the organology of the

instruments they make, and involve visual design in creating traditional musical instruments by students Problems [10].

The development of modernization reforms in the education sector in Maluku is crucial and strategic for fostering cultural and human civilization development [21]. At the individual level, education helps develop one's potential to become a morally upright, characterful, intelligent, and creative individual [22]. This aligns with the national education goals of Indonesia, which aim to shape Indonesian individuals who are faithful and pious, possess noble character and morals, are intelligent, creative, and have a sense of independence [23]. Therefore, education in Maluku needs to be reformed to realize integrated education covering pathways, systems, goals, curricula, learning processes, locations/regions, and education management [24]. Integrated education carries a mission to produce strong Maluku human resources in faith and piety, moral values and nationalism, mastery of science and technology, and life skills. Functionally, it aims to develop individuals capable of self-development, independent living, entrepreneurship and job creation, and being responsible subjects actively involved in local, regional, and national development [25].

The current curriculum in educational institutions is developed with the principle of diversification, presenting a new innovation in the field of science education known as Sound of Green (SoG), involving the environment as a learning source. The Sound of Green approach is one of conservation action approaches, involving agroforestry patterns and local culinary development. It aims towards environmental preservation and also highlights the economic value of using local Maluku plants, utilizing plant waste, learning through nature schools and music, calculating the carbon value of local plant forests, forming farmer groups, forming creative culinary communities through educational units, and building the Music Tourism City of Ambon [10].

Music education plays a role in shaping character and personality based on local wisdom in the arts and cultural landscape of Ambon City [26]. As a UNESCO City of Music, this innovation is an opportunity to maintain the music ecosystem and preserve traditional music starting from basic education, answering national and international commitments through the Sustainable Development Goals 2030, especially goals 11 (Sustainable Cities and Communities) and 4 (Quality Education) [27].

To realize a new paradigm of differentiated learning focusing on learners, educational institutions must implement stages of planning local music education content and intracurricular assessment. The stages involve: 1) Analyzing learning achievements to formulate learning objectives and the flow of local music education learning objectives, starting from collaborative and unique innovative solutions based on the character

and musical landscape of Ambon City's community; and 2) Diagnostic assessment of the music education curriculum specifically aims to identify or understand the characteristics, competence conditions, strengths, weaknesses of learners' learning models, so that learning can be designed according to diverse learner competencies and conditions (Ministry of Education and Culture Regulation No.719/P/2020). Introducing the environmental, social, and cultural conditions, particularly local plants, to students enables them to become more familiar with their environment. This is in line with the Sustainable Development Goal 4 (Quality Education) by UNESCO, with Agenda 2030 aiming for "action plans for people and prosperity," ensuring fair quality education and promoting lifelong learning opportunities for all. These goals are inseparable and encompass economic, social, and environmental dimensions [28]. Therefore, the development of Sound of Green-based curriculum must include the characteristics of Maluku's local culture, skills, noble cultural values of Maluku, and address social and environmental issues, ultimately equipping our students with basic skills in natural resource management as life skills and creating job opportunities [29].

2. METHOD

Our research study emphasizes the assessment of the effectiveness of project-based STEAM learning based on Sound of Green in empowering students' creative thinking in natural resource management.

2.1. Preliminary Study

Based on the views of several experts, it can be concluded that creativity is an attribute that is inherent in a person, where a person is able to produce something new through a process of changing attitudes because of a motivation to accept newness with the various possibilities that exist to produce a better product [30]. Creativity or creative thinking skills have become important skills for adapting quickly to the changing world of education [31].

2.2. Research Preparations

The steps taken for the development of natural resource differentiation through Sound of Green-based project-based STEAM (Science, Technology, Engineering, Arts, and Mathematics) are as follows: 1. Analysis of school goals and characteristics, 2. Analysis

of learning resources, including research results on differentiation through project-based STEAM, 3. Analysis of student characteristics in the music tourism villages of Ambon, 4. Establishing objectives and content for differentiated learning through project-based STEAM, 5. Determining strategies for organizing the content of differentiated learning through project-based STEAM, 6. Determining strategies for delivering the content of learning, 7. Establishing learning management strategies, and 8. Developing procedures for measuring learning outcomes. Steps (1), (2), (3), and (4) are analysis steps of the learning conditions, steps (5), (6), and (7) are development steps, and step (8) is the measurement step for the learning outcomes of natural resource differentiation through Sound of Green-based project-based STEAM.

The model developed is the Sound of Green-based Project-based STEAM Learning Model. The activity flow is shown in Figure 1.

2.3. STEAM Analysis

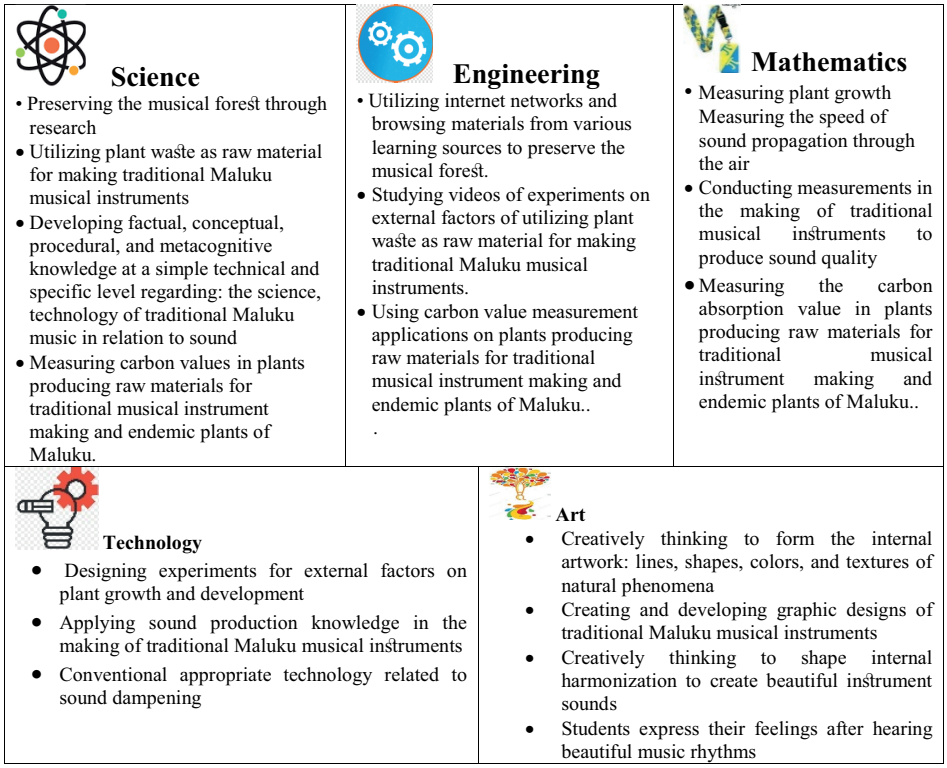

Figure 1: Project-Based STEAM Learning Model Based on Sound Of Green.

2.4. Research Implementation

2.4.1. Population

The population of this study is seventh-grade students in junior high schools in the Music Attraction Village of Ambon City, consisting of 5 schools: SMPN 2 Ambon, SMPN 8 Ambon, SMPN 10 Ambon, SMPN 11 Ambon, and SMPN 15 Ambon, with a total of 775 students. In each school, one class was selected as the research subject, comprising a total of 162 students.

Measurements

Measurement of students' creative thinking as established by Torrance, (1972) and Alabbasi et al., (2022) as shown in Table 2. Each item in this section is given a maximum value of four. The items in this section consist of three items. Therefore, respondents with a very good level of creativity will achieve a maximum score of 16.

TABLE 1: Item Scores Based on Fluency, Flexibility, Originality, and Elaboration.

Creativity Domain	Score	Information
Fluency	0	Students cannot provide ideas/answers.
	2	Students can present one to two ideas/answers.
	4	Students can present three or more ideas/answers.
Flexibility	0	Students cannot come up with ideas/methods.
	2	Students can come up with one to two ideas/methods.
	4	Students can come up with three or more ideas/methods.
Originality	0	Students do not respond/common ideas/lack of originality.
	2	Students come up with moderately unique ideas.
	4	Students come up with highly unique ideas.
Elaboration	0	No addition of ideas from students.
	2	Simple addition of ideas from students.
	4	Outstanding ideas from students.

Table 3 shows the meaning of the median score to determine the level of creativity among students based on [34]. The data is analyzed using frequency, percentage, and median because ordinal data is obtained.

Table 2: Creativity Levels Based on Three Categories.

Marks	Creativity Levels
68-100	Highly Creative (High Level)
34-67	Moderately Creative Material (Moderate Level)
0-33	Less Creative (Low Level)

3. RESULT AND DISCUSSION

3.1. Teacher's Ability to Design Learning Practices Oriented towards PjBL STEAM Based on Sound of Green

STEAM-based PjBL learning is a collaborative approach that emphasizes the relationship between knowledge and skills in science, technology, engineering, art, and mathematics (STEAM) to address problems [35]. STEAM-based PjBL learning is a collaborative approach that can be used in the development of 21st-century skills for learners, one of which is creative thinking skills [36]. In line with this, STEAM-based learning also demands learners to identify a problem, create something to solve the problem, collaborate with classmates to solve problems, as well as communicate effectively and respond to each other's ideas [37]. The goal of STEAM-based learning. PjBL has a positive influence on student learning, especially in science and STEAM education [38].

The role of teachers is significant in triggering students' creativity, as students' creative thinking can motivate high learning enthusiasm, which of course will ease the teachers' tasks [39]. Besides making it easier for teachers to guide students through learning at school, achieving maximum learning outcomes will certainly be easier because students have the initiative and drive from within themselves for maximum achievement [40]. Likewise, students who learn to achieve optimal achievement with guidance from those around them, given that this is a time to seek self-identity, therefore their self-concept tends to be subjective [41]. Previous findings state that focusing on PjBL STEAM in enhancing students' learning creativity, there is a significant improvement from the use of PjBL STEAM in enhancing students' learning creativity in natural resource processing materials [42]. The implementation of Project Based Learning greatly supports students' creativity in the material of natural resource processing concepts [42].

The results of observations analyze the efforts of teachers in enhancing creative thinking in student learning in schools in the music attraction village of Ambon, namely SMPN 2 Ambon, SMPN 8 Ambon, SMPN 10, SMPN 11 Ambon, and SMPN 15 Ambon. Observations of learning practices with PjBL STEAM based on sound of green in each

school focused on only two classes, although all teachers participating in the activity also conducted learning practices. In these observations, the model teacher in one class was observed. Learning with PjBL STEAM based on sound of green is carried out following the scenario prepared by the teacher in the previous learning tools. The average percentage of the implementation achievement of learning with PjBL based on sound of green from the observation results is an average of 90%, as described in Figure 2 in the following graph.

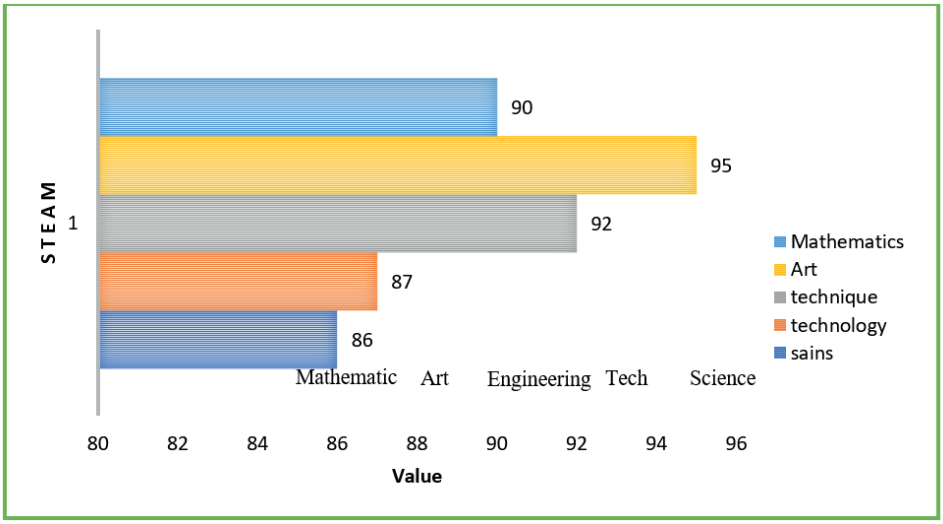

Figure 2: Average Graph of Teachers' Ability in Designing PjBL STEAM Learning Practices Based on Sound of Green.

Figure 2 informs that there are two stages that need to be improved by teachers. Teachers must have specific strategies to enhance students' creative thinking. Approaches that can be considered for use in teachers' efforts to improve the quality of student learning to enhance creative thinking skills during learning activities and in the lives of the students themselves. Creativity is an individual's ability to express ideas or thoughts through creative thinking processes to create something that requires concentration, attention, willingness, hard work, and perseverance [43]. The stages that need to be improved are 1) the science stage in the ability to guide students in identifying scientific information, applying it, and playing a role in finding solutions; 2) In the technology stage, the skill of guiding students to use various technologies, developing, and analyzing technology. Information identification is the first stage or initial step in information literacy [44]. This means that the skill of identifying information needs will be crucial in the information search process [45]. Information identification is a basic skill in improving a person's information literacy. Because science learning emphasizes that the learning process must be scientific, produce scientific products through experiments, and form a scientific attitude [46]. Students must be active in

learning through experiments, observations, and trials. This ultimately forms a scientific attitude that will encourage students to actively maintain the stability of nature to remain good and sustainable [47].

Meanwhile, the other three stages in its application are already good, as in 1) the technical stage (Engineering), which is the teacher's ability to guide students in developing technology with more innovative and creative designs; 2) Art, which is the ability to guide students in developing artistic creativity, nurturing talent, and creating more innovative designs; and 3) Mathematics, which is the ability to guide students in analyzing and presenting ideas, formulations, and solving problems mathematically in their application. Additionally, it was found that learning with PjBL STEAM can encourage students to think at a higher level in the art stage in transforming the internal alignment shaping the sound of instruments into beautiful products that are useful for the wider community. This means that learning with PjBL STEAM greatly helps in developing students' creativity in thinking and innovating to create products that can be used by the community in daily life [48]. Students are motivated to observe various phenomena/issues in their daily living environment that are related to scientific concepts being discussed in the learning process [49].

3.2. The Creative Thinking Ability of Junior High School Students Using the PjBL-STEAM Learning Model Based on Sound of Green in Schools in the Village of Music Attraction, Ambon City.

The students' thought process in project completion requires a learning approach. The approach suitable for the PjBL model is the STEAM approach. The PjBL learning model emphasizes contextual learning through complex activities such as giving students the freedom to explore, plan learning activities, carry out projects collaboratively, and ultimately produce a product [50].

The application of this approach integrates every component of STEAM into project-based learning. Learning using the PjBL model is student-centered pedagogy involving students gaining deeper knowledge through active exploration of real-world challenges and issues [51]. The application of the STEAM approach also encourages students to understand each component of STEAM in learning science to produce a project. The STEAM learning approach integrated into the PjBL model is applied in five learning steps: planning, development, collaboration, and transfer [52]. Each stage of learning using the PjBL model will encourage students to be active and think about completing

the given project, starting with essential questions, developing project plans, preparing schedules, monitoring student and project progress, testing and assessing results, and evaluating experiences [53].

The application of the PjBL model can improve students' learning achievements and creativity, as evidenced by more students asking questions, expressing opinions, and answering teachers' questions. STEAM develops creative thinking skills. Not just memorizing theory from textbooks, students will be encouraged to more actively practice problem-solving based on their understanding. This can encourage children to think logically and prepare them to be more mature in the future. STEAM is a development and renewal where learners can connect knowledge with art and design fields. Skills developed in STEAM can include creativity and innovation, critical problem-solving thinking, communication and collaboration, as well as literacy activities, such as through media, technology, and information [54]. Integrating STEAM into science learning can enhance the meaningfulness of scientific knowledge, making it easier to accept [55]. The creative thinking results shown by students are in Table 2.

Table 3: Results of Overall Analysis of Students' Creativity Levels for Each Dimension in Five Music Tourism Villages in Ambon City.

Category Level	Score	Frequency (F)	Percentage (%)
Very Creative (High Level)	68 -100		
Moderate Creative (Moderate Level)	34 - 67	75	46.3
Less Creative Low Level)	0 - 33	87	53.7
Number of Students and Percentage of Students		162	100
Mean Base / Median Value		80.7	
Overall Creativity level	Less Creative (Low Level)		

Table 2 explains that the average level of students' creative thinking abilities in the implementation of PjBL STEAM learning in general is still low. An approach and model that are in line with the characteristics and needs of students are required so that thinking skills can be cultivated and utilized well, and the learning experience becomes more meaningful. Thinking skills need to be instilled in students with the aim of helping students independently shape cognition, achieve learning effectiveness, and build new knowledge [56]. Therefore, thinking skills are closely related to the learning process. Students who are well and intensively trained by teachers to think have a positive impact on them in educational development [57]. Therefore, it can be concluded that to develop students' thinking skills, they need to be engaged in meaningful learning experiences through problem-solving [58].

STEAM is an integrated learning approach that needs to be considered by teachers, including: 1) encouraging students to think more broadly about real-world issues; 2) problem-solving through innovation and design; 3) the connection between assessment, learning plans, and learning standards; 4) the combination of more than one subject in STEAM and its application in art; 5) collaborative learning environments and process-based learning; and 6) focusing on things that happen in life [59].

STEAM illustrates the role of art in design and science, characterized by the ability to master materials, concepts, and techniques in creating works that are different from each other [60]. Creative thinking skills can lead students to enter into very different perceptions, including different thoughts and perspectives [31]. Creative thinking skills are included in the realm of high-level competencies and are considered a continuation of basic competencies in physics learning, so that students can use very different methods in solving a problem [61]. Creative thinking is related to students' exploration of perception. Creativity in students' needs to be developed because through creativity, it is a prerequisite for survival and well-being and provides its own satisfaction needs [62].

Figure 3: Students' Creative Thinking on Traditional Music Instrument Science Products from Natural Materials. Making musical instruments and then playing them in the form of songs.

Based on the results of implementing PjBL STEAM in the learning process, teachers along with students have been able to produce traditional Maluku music instrument products where students are trained to create musical instrument projects starting from environmental awareness, planting seedlings, maintenance, to their use as traditional musical instruments. Furthermore, students are trained to arrange chord shapes and basic notes and their values in musical notation to develop students' mathematical thinking skills in the form of compositions played. This is the foundation for someone to always position themselves dynamically. Students are also guided to apply their

knowledge of sound production to make bamboo flute instruments. Students are trained to investigate how the pitch of the sound produced by bamboo flutes depends on the length of the air column. Furthermore, students are trained to demonstrate the harmony of two-voice theory on bamboo flute instruments and to demonstrate the creation of simple music compositions in one original piece of bamboo flute performance as a percussion instrument.

Therefore, touches to cultivate new ideas and concepts are always taken as the first step by motivating and stimulating. Motivating means placing the role of the teacher to provide something to discover something 'new' so they must reject a 'single answer'. If a student asks a question, a teacher will provide several possibilities, thus stimulating them to always discover new things [63]. Stimulating means encouraging existing ideas to always b touched and expressed in various forms, ways, and new ideas [64].

The application of STEAM in the art stage has experienced quite significant development over time. The development of creativity and innovation at the art stage continues to be developed according to student needs. This reality breeds various variants of methods in art education. Among these variants is learning that focuses more on the human realm targeted by Maluku music and cultural education, which are: body, taste, and vision [65]. The body of musical art is developed through training in creation (creativity) and discovery and development (innovation) through the creation of traditional Maluku music art [66]. The deepest sense of musical art is aesthetics trained through an understanding of visual elements, colors, tones, and rhythms to develop the system already possessed by students Aesthetic [67]. The vision of musical art is trained through logic, understanding with aesthetic absorption, artistic sense, and the process of creating an artist [68]. Achievement in this realm is done through approaches: definitive, participatory, and exploratory; with fun, unique, creative, innovative, democratic, and initiative learning [69]. The harmonization of these approaches is expected to provide outputs: appreciation, expression, and creation, for students.

3.3. The Difference in Students' Creative Thinking Skills Using PjBL-STEAM Based on Sound of Green

Perbedaan kemampuan berpikir kreatif Siswa menggunakan PjBL-STEAM berbasis Sound of Green yang dilakuka oleh siswa yakni pengukuran nilai karbon pada tumbuhan penghasil bahan baku pembuatan instrumen musik tradisional dan tumbuhan endemik Maluku. Hasil analisis uji ANACOVA, variabel yang dianalisis adalah nilai penguasaan konsep di sekolah SMP Negeri 2, SMP Negeri 10, SMP Negeri 11 dan SMP Negeri 15.

Berdasarkan hasil pengujian statistik ditemukan. siswa pada SMP Negeri 2 mempunyai nilai rata-rata berpikir kritis 80.00, SMP Negeri 10 rata-rata sebesar 77.06, SMP Negeri 11 rata-rata sebesar 63.46, dan SMP Negeri 15 rata-rata sebesar 72.60. Data ditunjukkan pada Tabel 3.

Table 4: Average Creative Thinking Score.

School	Mean	N	Std. Deviation
SMPN 2	80.800	15	7.37951
SMPN 10	77.0667	15	13.72415
SMPN 11	63.4667	15	11.06388
SMPN 15	72.6000	15	8.43293
Total	73.4833	60	12.08794

The next analysis result is the ANAKOVA test between the creative thinking concept of carbon absorption in contextual class context in the control class group using conventional methods showing a value of 14.139 with a significant value of 0.000. Based on the results of further tests using the LSD test, it is known that there are differences in the creative thinking ability among students in the four schools sampled. This difference in critical thinking skills, according to researchers, is also influenced by several factors. Factors influencing critical thinking skills include motivation, intelligence, learning climate, learning models used, combination of technology and learning strategies used, applied learning approaches, students' ability to understand problems, and their ability to exchange ideas and collaborate within study groups [70]. According to the researcher's observations, some conditions that affect creative thinking ability include motivation. Motivation can come from within students and from others [71]. The existence of such activities makes students more interested and active in the learning process and can develop their critical thinking skills. In line with the research conducted, it is known that motivation influences the critical thinking skills of students [72].

The second factor is Intelligence possessed by students influences how their creative thinking abilities. Intelligence is an ability that originates from within students. Intelligence can be defined as the ability of an individual to solve the problems encountered and anticipate future problems [73]. With the increase in students' intelligence, their creative thinking abilities will also increase.

The third factor is the curriculum and learning strategies used in schools can also affect students' ability to think creatively. Curricula and learning strategies that emphasize creative thinking skills can help students practice these skills in real-life situations [69]. The fourth factor is the language factor where students who have better language

skills are more capable of processing information more effectively and making stronger arguments [74]. Another factor is the learning climate, which also affects students' creative thinking abilities, because how the learning atmosphere in the classroom affects students' reception of material [75]. In contextual workbook-based learning, the teaching and learning process will be more enjoyable due to students' involvement in daily life actively in the learning process, thereby developing students' critical thinking skills [75]. The role of teachers is essential in creating a learning climate that can enhance students' critical thinking abilities [56]. According to Sukiman et al, to develop students' creative thinking abilities, teachers must plan their lessons well [76].

The relevance of critical thinking in students is that creative thinking is a universal skill where clear and rational thinking is needed to solve problems. Creative thinking is also crucial in the 21st century where students need to respond to changes quickly and effectively, requiring flexible intellectual skills to analyze information and solve problems [77]. Creative thinking can enhance verbal and analytical skills where clear and systematic thinking allows students to improve their ability to express ideas useful in analyzing text and logical structures to enhance students' creativity in thinking [78].

4. Conclusion

The overall results of the research indicate that there are two stages that need to be improved by teachers: the ability to guide students in identifying scientific information, applying it, and playing a role in finding solutions. The second stage is technology skills, which involve guiding students in using various technologies, developing, and analyzing technology. Most students are at a good level after being taught with the PjBL STEAM model. The level of creativity, including fluency, flexibility, originality, and elaboration among students, is very good. On the other hand, there is a significant difference in students' creative thinking abilities using PjBL-STEAM based on Sound of Green in measuring plant carbon values. Students enhance their creativity with guidance from the teacher. Initially, in detail, many students lacked dimensions of fluency, flexibility, originality, and elaboration, so they could not provide more ideas and could not give answers. As a result, originality decreased, and they had no ideas to elaborate further from the answers given. The majority only learned to provide one or two ideas or answers. The average answers they gave were wrong because their scientific concepts were wrong, and they also did not answer the questions at all. However, based on findings from several subsequent meetings, students experienced a significant increase in creative thinking. This is because teachers began to improve the application of

problem-oriented learning strategies that enhance creativity in every aspect of science subjects. Additionally, researchers also recommend conducting further research on the creative thinking process among students based on the local advantages of each school, based on the financial geographic location of the students. Therefore, it is highly expected that teachers can better understand the cognitive, affective, and psychomotor aspects of students' minds, which may potentially enhance students' creative thinking in all dimensions of creativity.

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