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Project-Based Learning Materials to Enhance Creative Thinking in Grade 7 Science

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ABSTRACT

This study explores teachers' perceptions of student creativity across key dimensions, including divergent thinking, originality, flexibility, elaboration, problem-solving, knowledge creation, and affective engagement. The research employed a quantitative survey design, involving all 12 Science 7 teachers from selected schools in the Schools Division of Laoag City. Data were analyzed to assess the validation of intervention materials and evaluate teachers' observations of student creativity. Findings revealed neutral to moderately positive perceptions, with teachers noting student's strengths in brainstorming and enthusiasm for creative tasks, but identified challenges in sustained elaboration, originality, and adaptive problem-solving. These results align with existing literature highlighting the importance of structured pedagogical support, such as project-based learning (PBL), open-ended tasks, and multimodal creative opportunities. Moreover, materials were found to be effective, engaging, and aligned with the Science 7 curriculum, with high credibility and acceptability among experts, despite minor suggestions for improvement. While project-based learning fosters student engagement, its integration—particularly in promoting creative thinking—is hindered by challenges such as rigid curriculum structures, limited instructional time, lack of resources, and student's low reading comprehension skills. The study recommends integrating PBL with iterative feedback, encouraging risk-taking, and incorporating real-world challenges to strengthen creative cognition. By identifying gaps and opportunities in creativity development, this research offers practical strategies for educators and underscores the need for further investigation into long-term approaches for nurturing creativity in classroom settings.

Keywords: Creative Thinking, Project-based Learning, Divergent Thinking, Affective Engagement, Student Engagement

INTRODUCTION AND RATIONALE

The evolving global educational landscape increasingly acknowledges the significance of creative thinking as a vital skill for students. Creativity holds equal importance to literacy in education and deserves the same level of recognition (Robinson, 2011). It is crucial for addressing complex challenges and driving innovation across diverse sectors. In a time marked by swift technological progress and multifaceted societal issues, the capacity for creative thought is not just beneficial but essential. Skills such as analytical reasoning, creativity, and innovation are projected to be among the most in-demand in the future job market (World Economic Forum, 2020). Consequently, educational institutions around the globe must prioritize the cultivation of creative thinking abilities, ensuring that students are adequately prepared for upcoming challenges. Fostering creativity and innovation is vital for students to effectively navigate the uncertainties and complexities of the 21st century (OECD, 2019). Creative thinking, especially divergent thinking, is a fundamental cognitive process that empowers individuals to produce original and valuable ideas, which are crucial for innovation (Runco & Acar, 2012).

Despite the acknowledged importance of creative thinking, traditional teaching methods often fall short in engaging students in ways that stimulate their creative potential. Research indicates that these conventional approaches tend to emphasize rote learning and standardized testing, which can stifle creativity and limit student's ability to think outside the box. Santos et al. (2022) highlight that integrating innovative teaching strategies can significantly enhance student's learning and innovation skills. These strategies often involve hands-on activities, real-world applications, and collaborative projects that encourage students to explore and experiment, thereby fostering a more creative and dynamic learning environment.

The Australian Curriculum (2023) underscores the necessity of cultivating creativity among students, compelling educators to adopt pedagogical approaches that nurture such skills. However, despite these guidelines, many educators encounter challenges in effectively embedding creative thinking into their science curricula. The struggle to incorporate creativity into science education is not unique to Australia but is a global concern, as evidenced by recent international assessments.

The Programme for International Student Assessment (PISA) provides a sobering insight into the state of creative thinking in education. The 2022 PISA Creative Thinking Assessment reveals that the Philippines ranks fourth from the bottom among 64 participating countries, with an average score of merely 14 points, starkly below the OECD average of 33 points. This ranking signals a critical issue: the imperative for educational interventions that specifically aim to enhance creative thinking skills among young learners. The data indicates that only about 3% of Filipino students can achieve the level of creative thinking mastery demonstrated by students in higher-performing countries such as Singapore, which scored an average of 41 points (Philstar, 2024).

These findings underscore a pressing need for targeted educational strategies to improve creative thinking. The present study seeks to address this gap by developing and evaluating innovative teaching materials specifically tailored for Grade 7 science classes.

Objectives of the Study

Generally, this study aimed to develop innovative teaching materials designed to enhance the creative thinking skills of Grade 7 students in science education across selected secondary schools in Ilocos Norte.

Specifically, it sought to:

1. assess teachers' perceptions of the creative thinking abilities of Grade 7 students in science education, focusing on key components such as: divergent thinking, originality, flexibility, elaboration, problem-solving skills, knowledge creation, creative expression, and affective engagement;

2. identify the challenges faced by science teachers in integrating creative thinking activities and strategies into the Grade 7 science curriculum; design and develop innovative teaching materials that address the identified challenges and promote the enhancement of creative thinking skills among Grade 7 science students;

3. validate the developed innovative teaching materials through expert evaluation and feedback from science educators; and evaluate the effectiveness of the developed teaching materials in improving student's creative thinking abilities in science education.

This study is situated at the confluence of educational innovation and the urgent need to enhance creative thinking within science education. The researcher being a Science teacher was motivated to delve into this study because of the need to enhance the creative thinking of Grade 7 students of the Ilocos Norte College of Arts and Trades (INCAT), Ilocos Norte Regional School of Fisheries (INRSF), and Gabu National High School, Ilocos Norte National High School (INNHS), Caoacan High School (CHS), Balatong Integrated School (BIS), San Mateo Integrated School (SMIS), and Buttong Integrated School (BIS) through an innovative material that is aligned to the MATATAG Curriculum in Science 7. MATAG stands for **MA**ke the curriculum relevant to produce competent and job-ready, active, and responsible citizens; **TA**ke steps to accelerate delivery of basic education facilities and services; **TA**ke good care of learners by promoting learner's well-being, inclusive education, and a positive learning environment; and **G**ive support to teachers to teach better. This motivation stems from the observation and experiences of teachers in Science who claims that only few of their learners can execute creative thinking when given project-based activities. The implementation of the new curriculum implies that educators should find a way to enhance their lessons by integrating a unique approach adopted from the instructional design framework. In this study, project-based learning is chosen to be included into the teaching material that will be developed. By leveraging recent research and addressing identified gaps in student performance, it aspires to contribute to the advancement of effective teaching practices that foster creativity in the classroom. The findings of this study have the potential to inform educators, policymakers, and curriculum developers, ultimately leading to more engaging and effective science education.

LITERATURE REVIEW

Assessing Creative Thinking in Students

Creative thinking is increasingly recognized as a vital skill in education, especially in fields requiring innovation and problem-solving, such as science (Beghetto & Kaufman, 2014; Runco & Acar, 2012). Understanding how to effectively assess and foster creative thinking in students is crucial for educational success in the 21st century (OECD, 2019). This review synthesizes recent studies and frameworks that explore the dimensions of creative thinking and their implications for education, highlighting approaches such as inquiry-based learning, project-based learning, and assessment tools like the Torrance Test of Creative Thinking (TTCT) (Robinson, 2011; Runco & Acar, 2012).

Divergent Thinking

Divergent thinking, a key component of creative cognition, involves the mental process of producing a wide range of ideas, solutions, or strategies in response to an open-ended question or challenge. In contrast to convergent thinking, which aims for a single correct solution, divergent thinking emphasizes originality, fluency, flexibility, and elaboration. It promotes the exploration of multiple viewpoints, encourages intellectual risk-taking, and supports the pursuit of unconventional solutions, thus nurturing innovative and expansive cognitive processes (University of Texas Center for Teaching and Learning, n.d.; Edutopia, 2020). Runco and Acar (2008) highlight the significance of divergent thinking in educational settings, asserting that it can be effectively evaluated through tasks that encourage students to generate a variety of solutions to both real and hypothetical challenges. These activities demonstrate a learner's ability to think broadly and adaptively across different contexts. While traditional assessments often emphasize the quantity of responses (fluency), contemporary methods also focus on the quality and originality of ideas. One such technique is the 'Top 2' scoring method introduced by Silvia et al. (2008), where participants select their two most creative responses, which are then assessed based on creativity criteria. This approach has been shown to improve both the reliability and validity of divergent thinking evaluations by prioritizing depth over sheer volume and minimizing scoring bias. Incorporating these assessment techniques into classroom practices not only offers a more precise evaluation of student creativity but also motivates learners to engage more thoroughly with tasks that demand innovative problem-solving.

Originality

Originality is a crucial aspect of creative thinking, characterized by the uniqueness and novelty of ideas generated by students. It entails transcending conventional responses to produce innovative and often surprising solutions. In educational environments, originality signifies a learner's capacity to deviate from traditional thought patterns and tackle tasks with a novel viewpoint. As noted by Torrance (2020), assignments that encourage students to create original outputs—such as crafting imaginative narratives, inventing new tools or products, or suggesting innovative solutions to real-world problems—are particularly effective in fostering and evaluating originality. Assessing originality is vital not only for recognizing creative potential but also for cultivating a classroom atmosphere that promotes innovation, risk-taking, and self-expression. In contrast to rote tasks that typically reward conformity and replication, originality-focused activities motivate students to trust their instincts, embrace uncertainty, and explore unconventional ideas. These experiences are particularly significant in the context of 21st-century education, where the capacity to innovate is increasingly acknowledged as a fundamental skill. When students regularly engage in tasks that value originality, they cultivate the confidence and cognitive adaptability necessary to become effective problem-solvers and creative thinkers in both academic and real-life situations (Torrance, 2020).

Flexibility

A recent article from Edutopia underscores the necessity of fostering flexibility in student's thought processes to equip them for a swiftly changing world. It presents the concept of 'Speed Bumps, Detours, and Parking Spaces' as a means for students to identify when their thinking becomes stagnant and to transition towards a more adaptable mindset. This method encourages students to pause and contemplate challenges ('speed bumps'), alter their plans when needed ('detours'), and take moments to manage their emotions when feeling overwhelmed ('parking spaces') (Edutopia, 2025). The article asserts that flexible thinking is an essential executive functioning skill that allows students to adjust to changes, resolve conflicts, and persist through challenges. By explicitly teaching this terminology and prompting students to generate examples of these mindsets, educators can enhance student's resilience and their ability to accept and apply feedback rather than react defensively or rigidly (Edutopia, 2025). Furthermore, Edutopia advocates for engaging students in creative tasks that necessitate perspective shifts and problem-solving from various viewpoints. For instance, urging students to 'think like an artist' by taking the time to notice the nuances of their surroundings fosters meaningful expression and adaptability. This practice not only bolsters creative thinking but also cultivates resilience in the face of challenges (Edutopia, 2023). Demonstrating flexible thinking language in actual classroom scenarios, such as when facing unforeseen challenges, further aids students in internalizing these competencies. Gradually, students come to perceive challenges as opportunities for development and view feedback as a means for enhancement rather than as criticism (Edutopia, 2025).

Elaboration

Elaboration, which is the process of expanding upon ideas by incorporating details, examples, or explanations, plays a vital role in creative thinking, enriching students' concepts. As noted by TeachersFirst, elaboration entails the ability to add details, bridge gaps, embellish, and respond to inquiries such as 'what else?', making it one of the more approachable dimensions of creativity for learners to cultivate and exhibit. This process allows students to refine their original thoughts and boost their overall creativity by developing more intricate and nuanced concepts. Jackson et al. (2022) highlight that evaluating elaboration can involve prompting students to expand on their initial ideas or solutions, which encourages deeper contemplation and further conceptual development. This method not only showcases students' capacity for expansive thinking but also promotes critical reflection and iterative enhancement of their creative endeavors. Research on creative thinking frameworks, including those found in Creative Problem Solving (CPS) models, recognizes elaboration as a fundamental creative thinking skill alongside fluency, flexibility, and originality. Specifically, elaboration refers to the ability to detail, develop, evaluate, and enrich ideas, which is crucial for transitioning from vague or simplistic notions to well-defined, actionable solutions (Ummah & Yuliati, 2020). This skill aids students in connecting ideas, adding depth, and rendering their creative outputs more significant and effective. Furthermore, educational resources indicate that elaboration can be fostered through instructional strategies that encourage students to provide examples, clarify their reasoning, and build on their initial responses. Offering open-ended tasks with opportunities for 'think time' and choice enables students to practice elaboration by thoroughly exploring and articulating their ideas (Mursky, 2011). Such strategies also encourage risk-taking, innovation, and independent learning, all of which are associated with enhanced creativity.

Problem-Solving Skills

Creative problem-solving (CPS) is the application of creative thinking techniques to identify, analyze, and resolve intricate issues through a systematic and iterative approach. As noted by Tarhan and Acar (2017), evaluating CPS can be achieved by creating tasks that prompt students to dissect a problem, propose various potential solutions, and assess the effectiveness of these solutions, thereby offering insights into their capacity to utilize creativity in real-world scenarios. The CPS framework is frequently viewed as a series of stages that encompass problem identification, idea generation (divergent thinking), idea evaluation (convergent thinking), and planning for implementation. This methodical approach fosters advanced cognitive skills, including critical, creative, and innovative thinking, which are vital for addressing real-life challenges (Academic Publishing, 2023). Assessment techniques for CPS generally involve open-ended problems that motivate students to consider diverse viewpoints and solutions. For instance, students may be tasked with tackling complex issues like climate change or social inequality by conducting research, brainstorming innovative solutions, and subsequently evaluating their feasibility and impact (Kennesaw State University, 2025). Reflective elements, such as essays discussing problem-solving strategies and insights gained, enhance students' metacognitive understanding of their creative processes. Global assessments, such as the OECD's PISA 2012 Creative Problem Solving test, evaluate students' abilities to comprehend and resolve unfamiliar problem scenarios by employing creative strategies, highlighting the worldwide significance of CPS skills in education (OECD, 2012). Research indicates that CPS instructional methods have a beneficial effect on students' creativity and problem-solving skills. For example, experimental studies reveal that students who receive CPS training generate more innovative ideas and exhibit greater elaboration, originality, and flexibility compared to those in control groups (Shen, 2018).

Knowledge Creation

Knowledge creation encompasses the ability to amalgamate information from diverse sources to produce new insights or understandings. According to Sheu and Chen (2018), this can be evaluated by involving students in projects that necessitate researching a topic, synthesizing their findings, and creatively presenting their conclusions, thereby fostering innovative connections among concepts. This aspect of creative thinking highlights the importance of transforming knowledge into original and meaningful outputs rather than merely accumulating information. The OECD's PISA 2022 framework characterizes creative thinking as the skill to generate, assess, and enhance ideas that can result in original and effective solutions, as well as advancements in knowledge, thereby emphasizing the role of knowledge creation in creative endeavors (OECD, 2023). Educational research similarly points out that knowledge creation is a collaborative process where students build upon community knowledge, engage in dialogue, and iteratively refine ideas while coherently integrating authoritative information (Scardamalia & Bereiter, 2022). Practical assessments of knowledge creation frequently involve project-based learning tasks that require students to explore complex questions, synthesize varied information, and convey their findings through creative presentations or artifacts. This methodology promotes a deeper understanding and encourages students to innovatively connect concepts, transcending rote memorization to achieve meaningful knowledge construction (Kinderpedia, 2022; NVACS guide, 2023). Such tasks are in line with frameworks that emphasize critical and creative thinking as vital skills for students to effectively navigate and contribute to a knowledge economy (Australian Curriculum, 2023). In conclusion, knowledge creation as a facet of creative thinking entails synthesizing information, generating new insights, and articulating these insights in innovative manners. Assessments that engage students in research, integration, and creative presentation promote this dimension of learning.

Creative Expression

Creative expression plays a vital role in developing students' overall creative thinking skills by providing diverse ways to communicate ideas, whether through writing, visual arts, multimedia, or performance. The OECD (2021) emphasizes that creative expression enables students to convey their unique perspectives and insights, fostering deeper engagement and originality.

Assessment Approaches include the following: Multimedia Projects: Digital tools allow students to combine various media-such as videos, podcasts, animations, and digital art-to express their understanding creatively. For example, students might create a video explaining a scientific concept or produce a podcast incorporating narrative storytelling and sound design. These projects encourage innovative thinking and adaptability, especially when iterative feedback and revisions are integrated into the process (TAO Testing, 2024). Open-Ended Responses: Allowing students to respond freely to prompts helps evaluate their ability to generate original ideas and think critically. Incorporating visuals like infographics or diagrams can further reveal students' visual creativity (TAO Testing, 2024). Project-Based Learning (PBL): Extended projects culminating in presentations or creative products engage students in authentic tasks that reflect real-world challenges. PBL fosters critical thinking, collaboration, and communication, all essential components of creative expression (Teachersguide, 2024). Performance Assessments: These include debates, artistic performances, or presentations that allow students to demonstrate knowledge dynamically and creatively, catering to diverse learning styles (Teachersguide, 2024). Peer and Self-Assessment: Involving students in reflecting on their creative processes and products encourages metacognition and ownership of learning, deepening their understanding of creativity (Teachersguide, 2024). Use of Rubrics: Clear criteria and rubrics help ensure fair and consistent evaluation of creative work, providing students with transparency about expectations and feedback (Teachersguide, 2024). Adaptive Assessments: Technology-enabled adaptive assessments personalize challenges based on student abilities, encouraging creative problem-solving through multiple pathways and methods of expression (TAO Testing, 2024). Creative assessments enhance student engagement, recognize diverse talents, and promote lifelong learning by making education relevant and enjoyable. They also prepare students for the 21st-century workforce by developing critical skills such as innovation, communication, and collaboration (Teachersguide, 2024; Beghetto, 2019).

Affective Engagement

Affective engagement encompasses the emotional commitment, enthusiasm, and positive outlook that students exhibit towards creative tasks, which play a crucial role in shaping their motivation and creative output. Leggett (2017) highlights that this engagement can be evaluated through self-report tools that measure students' interest, motivation, and enjoyment in creative endeavors. Research demonstrates that students who are emotionally invested in their creative activities are more inclined to generate innovative and original concepts, as positive emotions enhance cognitive flexibility and perseverance. Studies indicate a strong correlation between affective engagement and enhanced academic performance, as well as deeper learning experiences. For instance, a study conducted in 2025 revealed that students exhibiting moderate to high levels of affective engagement achieved significantly better academic results compared to their peers with low engagement, underscoring the critical role of emotional involvement in the learning process (IJIP, 2025). Furthermore, affective engagement is intricately connected to students' readiness to take risks, experiment, and persist in the face of challenges during creative tasks (Watson, 2014). Educational strategies that promote affective engagement typically include reflective assignments, journaling, group discussions, and the integration of the arts, enabling students to form emotional connections with the material and express themselves in meaningful ways (Times Higher Education, 2023; Kennedy Center, 2020). Formative assessment practices woven into creative processes allow educators to observe students' emotional and social behaviors, facilitate understanding through dialogue, and steer them towards deeper engagement (Kennedy Center, 2020). Establishing a supportive and non-threatening learning atmosphere where students feel secure in taking creative risks and receiving constructive feedback significantly boosts affective engagement (Watson, 2014). Additionally, curricula centered on meaning that incorporate affective learning outcomes foster collaboration, diminish the distance between learners and instructors, and enhance student motivation and engagement (Nix, Shelton, & Song, 2022).

The Role of Creative Thinking in Science Education

Creative thinking is increasingly acknowledged as a crucial educational skill, particularly in science, where innovation and problem-solving are essential. This review examines recent research on the significance of creative thinking in science education, focusing on various pedagogical strategies and their effectiveness in enhancing students' creative abilities.

Understanding Creative Thinking in Science Education

Creative thinking refers to the capacity to generate original ideas and solutions through divergent thinking processes (Runco & Acar, 2022). In science education, fostering creative thinking is vital for developing students' abilities to address complex scientific problems and engage in innovative practices. Studies suggest that students with strong creative thinking skills are better at synthesizing information and approaching scientific inquiries from diverse perspectives (Sheu & Chen, 2018). This capability is increasingly important in a world where scientific literacy and innovation are key drivers of societal progress.

Recent research has highlighted a troubling decline in students' creative thinking abilities. For example, Prentice (2020) observed a decrease in creativity across various age groups, characterized by reduced imaginative behaviors and limited verbal expressiveness. This decline underscores the need for educational frameworks that emphasize creativity alongside traditional academic skills. The UNESCO education sector has called for the creation of environments that foster self-expression and the generation of original ideas, recognizing that creativity is both an inherent trait and a skill that can be nurtured through effective teaching practices (Leggett, 2017).

Pedagogical Strategies to Enhance Creative Thinking

Several pedagogical approaches have been identified as effective in promoting creative thinking within science education. One notable approach is Problem-Based Learning (PBL), which emphasizes real-world problem-solving and collaborative learning. Research by Tarhan and Acar (2017) found that PBL significantly enhances students' creative problem-solving skills by involving them in authentic scientific inquiries. This method encourages students to actively explore scientific concepts, leading to a deeper understanding and application of knowledge.

Another effective strategy is the integration of technology in the classroom. Yerrick, Ross, and Molebash (2023) demonstrated that digital video editing technology can boost students' thinking and communication skills in science. By allowing students to create multimedia presentations of scientific concepts, this approach not only engages them creatively but also aids in solidifying their comprehension of complex ideas. Similarly, Potter (2016) highlighted how digital tools can support teacher candidates in expressing their conceptual understanding of science through creative means, underscoring the value of technology in promoting creative thinking.

The Essence of Project-Based Learning

Project-Based Learning (PBL) immerses students in extended, meaningful projects that require them to investigate and respond to complex, real-world questions or problems. Unlike traditional educational approaches that often emphasize rote memorization and passive reception of information, PBL actively engages students in a hands-on, inquiry-driven learning process. This immersive approach fosters critical thinking, collaboration, problem-solving, and creativity (Bey, 2023). By working on authentic projects, students develop deeper understanding and retain knowledge longer because they apply concepts in practical contexts. PBL encourages students to take ownership of their learning, promotes self-directed inquiry, and cultivates essential 21st-century skills such as communication, adaptability, and innovation (Bell, 2010; Thomas, 2000). Research shows that PBL positively impacts student motivation and academic achievement by making learning relevant and engaging. It also supports diverse learning styles and helps students build resilience as they navigate challenges inherent in complex projects (Condliffe et al., 2017).

Evidence from Recent Studies

Current research highlights the positive impact of PBL on creative thinking. Biazus and Mahtari (2022) compared PBL with traditional direct instruction among secondary students, finding significant improvements in creative thinking dimensions like fluency, flexibility, originality, and elaboration. Their study shows how PBL encourages divergent thinking and multiple problem-solving approaches.

Supporting this, Mansyur et al. (2024) introduced a PBL model with the Think-Pair-Share strategy, enhancing creative thinking in education students. Participants in this PBL group scored higher in creativity than those in traditional settings. This model not only engaged students but also promoted innovative thinking.

Khan et al. (2024) examined PBL's broader impact on creative cognition, emphasizing PBL's role in fostering engagement and creative problem-solving. The open-ended nature of PBL projects encourages exploration beyond traditional limits, leading to unique solutions.

The Multifaceted Benefits of Project-Based Learning: A Transformative Approach to Education

Project-Based Learning (PBL), as described by Bey (2023), has become a game-changer in today’s education landscape, providing a lively alternative to the usual teaching methods. By focusing on real-world challenges and encouraging student-led inquiry, PBL promotes deep engagement, critical thinking, and a more meaningful learning experience. This paper delves into the essential features of PBL and showcases how it equips learners for the challenges of the 21st century. One of the standout features of PBL is its focus on real-world relevance. Students tackle genuine problems that mirror the complexities of their lives and communities, sparking authentic curiosity and purposeful exploration. This connection not only boosts motivation but also helps bridge the gap between theoretical knowledge and practical application, making learning more impactful and lasting. In contrast to traditional methods that often steer students toward a single right answer, PBL encourages them to engage with open-ended problems that demand creative and divergent thinking. This approach invites learners to consider various perspectives, come up with innovative solutions, and express their reasoning. Such experiences nurture adaptability, resilience, and original thinking—skills that are crucial for thriving in today's fast-paced world. At the heart of the PBL framework is the belief in student agency. By giving learners the freedom to choose projects that resonate with their interests and passions, PBL cultivates a sense of ownership over their learning journey. This autonomy not only boosts engagement but also fosters essential habits of self-direction, initiative, and accountability—setting the stage for lifelong learning. Project-Based Learning (PBL) really shines when it comes to collaboration, giving students the chance to team up and tackle complex problems together. In these group settings, learners get to hear a variety of perspectives, which helps them hone their communication and interpersonal skills. The whole process of brainstorming, negotiating ideas, and co-creating solutions not only deepens their understanding but also fosters a strong sense of community and teamwork. Another fantastic aspect of PBL is how it encourages sustained inquiry. Instead of rushing to find quick answers, students dive into extended investigations that demand critical thinking and ongoing refinement. This iterative approach reflects real-world problem-solving, where solutions develop through cycles of feedback, reflection, and revision. It helps students cultivate persistence and gain a deeper understanding over time.

Challenges in Fostering Creativity

Despite the promising strategies, several challenges remain in effectively fostering creativity in science education. Siew, Chin, and Sombuling (2017) identified that many educators lack the training and resources needed to implement creative teaching strategies effectively. This gap in teacher preparation can hinder the development of students' creative thinking skills. Additionally, cultural contexts often influence students' willingness to engage in creative activities, with some students feeling constrained by traditional educational norms that emphasize rote learning over exploration and innovation (Santos, 2022).

The literature highlights that creative thinking is a crucial component of science education and can be significantly enhanced through targeted pedagogical approaches such as PBL, technology integration, and inquiry-based learning. However, to fully realize the potential of these strategies, educators must receive adequate preparation and support. Addressing the challenges in fostering creativity requires a collective effort from educational institutions, policymakers, and teachers to create an environment that values and nurtures creative thinking in students.

Research Questions

This study sought to answer the following questions:

1. How do teachers perceive the creative thinking abilities of their Grade 7 students in science education across key areas such as divergent thinking, originality, flexibility, elaboration, problem-solving skills, knowledge creation, creative expression, and affective engagement?

2. What are the challenges teachers encounter when trying to integrate creative thinking activities and strategies into their science curriculum to boost students' creative thinking skills?

3. What innovative teaching materials can be developed to effectively enhance creative thinking skills among Grade 7 students in science education

4. What is the content validity of the innovative teaching materials in Science in terms of: content, format, presentation and organization; and accuracy and up-to-datedness of information?

5. What is the level of acceptability of the innovative teaching materials in Science in terms of: content quality; instructional quality; and technical quality?

Scope and Limitations

This research focused on the development and assessment of innovative educational resources that incorporate problem-based learning techniques to foster creative thinking in Grade 7 science students. The objective was to overcome the shortcomings of conventional teaching approaches, which frequently do not encourage student creativity and involvement, by ensuring the materials were in line with the MATATAG Science 7 curriculum and its performance benchmarks throughout all four quarters. The resources were crafted to facilitate active learning and inventive problem-solving through project-oriented tasks.

It emphasized on the essential aspects of creative thinking—such as divergent thinking, originality, flexibility, elaboration, problem-solving, knowledge creation, creative expression, and emotional engagement—as evaluated by teachers via survey feedback. The research was confined to Grade 7 science educators from selected public secondary institutions in Ilocos Norte, including INCAT, INRSF, Gabu NHS, INNHS, CHS, BIS, SMIS, and Buttong IS, excluding other grade levels or subjects. The study utilized self-reported data, which could be affected by personal teaching methodologies and subjective viewpoints. Furthermore, while external factors like students' socio-economic backgrounds, parental involvement, and school resource availability were recognized, they were not directly analyzed. Nonetheless, the findings provide valuable perspectives on effective science teaching and advocate for the enhancement of instructional practices that nurture creativity in junior high school students.

RESEARCH METHODOLOGY

This research utilized both Descriptive Research and Research and Development (R&D) methodologies to thoroughly meet the research goals. Descriptive research was employed to collect data regarding teachers' views on the creative thinking abilities of Grade 7 students and to pinpoint the obstacles teachers encounter when trying to incorporate creativity into science teaching. By utilizing survey questionnaires and conducting statistical analyses, the study effectively illustrated the current classroom conditions. Following these insights, the Research and Development approach was implemented to design, create, and validate innovative, project-based teaching resources that are in line with the MATATAG Science Curriculum. These resources were subsequently assessed by experts to confirm their validity and acceptability. The combination of these methodologies enabled the researcher to analyze the existing educational landscape while also developing specific instructional materials aimed at addressing the identified deficiencies in fostering creative thinking.

Sampling

The research methodology adopted for this study is descriptive in nature. Total enumeration was employed to get the desired entire population. This method is especially beneficial when dealing with a small and manageable population, targeting specific characteristics, needing comprehensive data, and having the resources to support a thorough approach (Creswel & Creswel, 2018). In this context, the respondents totaling to 12 came from the Ilocos Norte College of Arts and Trades (INCAT), Ilocos Norte Regional School of Fisheries (INRSF), and Gabu National High School, Ilocos Norte National High School (INNHS), Caoacan High School (CHS), Balatong Integrated School (BIS), San Mateo Integrated School (SMIS), and Buttong Integrated School (BIS) who are teaching Science 7 under the MATATAG curriculum.

Table 1: Total Number of Teacher Respondents in Grade 7

School	Sample
Ilocos Norte College of Arts and Trades	3
Ilocos Norte National High School Ilocos Norte Regional School of Fisheries	3 2
San Mateo Integrated School	**1**
Caaocan High School	1

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Balatong Integrated School	1
Buttong Integrated School	1
TOTAL	12

Data Collection

The original survey questionnaire underwent a content validation process to assess its validity and reliability, achieving a Cronbach's Alpha score of 0.8 or higher. Following this validation, a formal request was sent to the Schools Division Superintendent (SDS) for approval. Data collection involved three distinct questionnaires. The first questionnaire gathered basic demographic information from respondents in its initial section, followed by an exploration of various aspects of creative thinking in the second section, which included divergent thinking, originality, flexibility, elaboration, problem-solving skills, knowledge creation, creative expression, and affective engagement. The final section addressed the challenges teachers face in implementing creative thinking strategies. Teacher respondents identified areas requiring intervention based on the lowest mean scores. The other two questionnaires, designed to assess the validity and acceptability of the materials, were adapted from the Learning Resource Management and Development (LRMD) Office of the Department of Education. Five experts, including Education Program Supervisors and Head Teachers in Science, evaluated the content validity of the intervention materials. Meanwhile, the acceptability of the materials was assessed by three master teachers and two key teachers in Science. The three sets of data were analyzed using descriptive statistical methods.

Evaluation of Responses

The data collected from the teacher-respondents was analyzed using a statistical mean and its descriptive interpretation. The statistical mean, also known as the arithmetic mean, is a measure of central tendency that represents the average value in a dataset. It is calculated by summing all the values in the dataset and dividing the total by the number of observations. The mean provides a single value that summarizes the data's center or typical value (Field, 2018).

Range of Scores	Descriptive Interpretation
5	Strongly Agree
4	Agree
3	Neutral
2	Disagree
1	Strongly Disagree

Validation Rating Scale for the Activity Sheets. Validation Rating Scale for the Activity Sheets. This is a 5-point rating scale that was used by the panel of experts to determine the validity and acceptability of the intervention materials across different aspects like content, organization and presentation, illustration/images, design and layout, accuracy and up-to-datedness of information; and content quality, instructional quality, and technical quality, respectively (Marcelo & Baptista, 2023). The scales and the descriptive interpretations are specified below:

Scale	Descriptive Interpretation
5	Very Highly Valid (VHV)
4	Highly Valid (HV)
3	Moderately Valid (MV)
2	Slightly Valid (SV)
1	Not Valid (NV)

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To evaluate the level of acceptability of the material, the following scale was used.

Scale	Descriptive Interpretation
5	Very Highly Acceptable (VHA)
4	Highly Acceptable (HA)
3	Moderately Acceptable (OA)
2	Slightly Acceptable (SA)
1	Not Acceptable (NA)

Moreover, the responses of the teachers along with their challenges in integrating creative thinking skills in their lessons were analyzed using thematic analysis. Through thematic analysis, you can methodically identify the primary challenges that educators encounter when incorporating creative thinking skills into their lessons, offering practical recommendations for overcoming these hurdles.

Tools for Data Analysis

To analyze the data collected from the respondents and evaluators, three statistical tools were used.

The areas of creative thinking skill was evaluated using the tool below:

Range of Scores	Verbal Description
4.50-5.00	Strongly Agree
3.50-4.49	Agree
2.50-3.49	Neutral
1.50-2.49	Disagree
1.00-1.49	Strongly Disagree

On the other hand, the materials that were developed were evaluated as to their validity and acceptability using the following statistical tools:

Level of Validity of the Material

Range of Mean Score	Descriptive Interpretation
4.51-5.00	Very Highly Valid (VHV)
3.51-4.50	Highly Valid (HV)
2.51-3.50	Moderately Valid (MV)
1.51-2.50	Slightly Valid (SV)
1.00-1.50	Not Valid (NV)

Level of Acceptability

Range of Mean Score	Descriptive Interpretation
4.51-5.00	Very Highly Acceptable (VHA)
3.51-4.50	Highly Acceptable (HA)
2.51-3.50	Moderately Acceptable (MA)
1.51-2.50	Slightly Acceptable (SA)
1.00-1.50	Not Acceptable (NA)

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DISCUSSION OF RESULTS AND RECOMMENDATIONS

In this section, the results of the comprehensive data analysis are presented, which aimed to determine which of the areas in creative thinking skills need targeted intervention along with Science 7. The analysis employed statistical means and their descriptive interpretations facilitating a clear understanding of the underlying patterns and trends within the data. Key findings are discussed below. Based on these findings, a series of recommendations are offered, tailored to address the identified issues and enhance the creative thinking skills of Grade 7 students. These recommendations are designed to inform stakeholders and guide decision-making processes for improved outcomes.

Divergent Thinking

The average rating for divergent thinking is 3.46 (Table 2), placing it within the Neutral category (2.51–3.50). This indicates that teachers perceive a certain level of creative thinking in their students, but their views are not overwhelmingly positive. In particular, teachers expressed neutrality regarding students' abilities to generate multiple ideas (M = 3.33) and to suggest ideas that differ from those of their classmates (M = 3.33). These results align with the findings of Runco and Acar (2022), who noted that while divergent thinking is essential for creativity, it often necessitates deliberate support and open-ended tasks to thrive.

Table 2: Assessment of Critical Thinking Skill Along with Divergent Thinking

Indicators	M	DI
Divergent Thinking		
1. can generate multiple ideas or solutions when presented with a problem;	3.33	N
2. demonstrate the ability to think of a wide range of possibilities for a given task;	3.50	N
3. often come up with unique ideas that differ from their peers; and	3.33	N
4. actively participate in brainstorming sessions to explore various ideas.	3.67	A
Composite Mean	**3.46**	**N**

The slightly elevated mean score for students showcasing a broad array of possibilities (M = 3.50) suggests potential for growth. Additionally, teachers acknowledged that students engage actively in brainstorming activities (M = 3.67), which corresponds with the focus on collaborative idea generation found in project-based learning (PBL) frameworks (Khan et al., 2024; Bey, 2023). These findings imply that integrating more open-ended, real-world challenges through PBL could significantly bolster students' divergent thinking capabilities.

Originality

Table 3 shows the average score for originality which stands at 3.25, which falls within the Neutral category, indicating a moderate perception of student creativity by teachers. Neutral evaluations for aspects such as generating novel ideas (M = 3.25) and producing original outputs (M = 3.00) suggest that while originality exists, it is not consistently demonstrated. This observation aligns with Torrance's (2020) assertion that originality tends to be underdeveloped in conventional classroom settings unless it is actively fostered through imaginative and expressive activities.

Table 3: Assessment of Critical Thinking Skill Along with Originality

Originality	M	DI
1. can produce novel and unique ideas or solutions in their work;	3.25	N
2. can create original products or stories that stand out from the norm;	3.00	N
3. are willing to take risks and propose unconventional ideas; and	3.33	N

4. enjoy finding innovative solutions to real-world problems.	3.42	N
Composite Mean	**3.25**	**N**

Moreover, students exhibit a willingness to take risks (M = 3.33) and show enjoyment in creatively addressing real-world challenges (M = 3.42), highlighting an underlying creative potential. These results underscore the importance of inquiry-based approaches and tasks that apply to real-world scenarios in promoting risk-taking and innovation (Tarhan & Acar, 2017; Leggett, 2017).

Flexibility

Teachers rated students' cognitive flexibility with a moderate level of neutrality (M = 3.23) as seen in Table 4. The scores for the ability to adapt thinking (M = 3.17) and modify strategies (M = 3.33) indicate a potential for flexible cognition that has yet to be fully developed.

Table 4: Assessment of Critical Thinking Skill Along with Flexibility.

Flexibility	M	DI
1. can easily adapt their thinking when presented with new information;	3.17	N
2. are comfortable changing their approach or strategy when necessary;	3.33	N
3. can look at problems from different perspectives to find solutions; and	3.08	N
4. enjoy exploring alternative ways of thinking about a topic.	3.33	N
Composite Mean	**3.23**	**N**

This aligns with findings from Edutopia (2023), which emphasizes that engaging students in creative challenges and reflective practices can enhance cognitive flexibility, particularly when they are encouraged to approach problems from various viewpoints. The neutral stance on examining issues from different perspectives (M = 3.08) highlights the necessity for instructional methods that actively promote mental agility and adaptability—traits that are increasingly vital in evolving educational settings.

Elaboration

The average score of 3.17 indicates that although students are capable of building upon ideas, they frequently do so only superficially (Table 5). Teachers expressed a neutral stance regarding students' ability to elaborate on initial thoughts (M = 3.25) and to refine their concepts (M = 3.08), underscoring the necessity for deeper cognitive involvement.

Table 5: Assessment of Critical Thinking Skill Along with Elaboration

Elaboration	M	DI
1. can expand on their initial ideas by adding details and examples;	3.25	N
2. enjoy refining and developing their concepts further;	3.08	N
3. provide in-depth explanations for their ideas and solutions; and	3.08	N
4. take satisfaction in taking their ideas to the next level.	3.25	N
Composite Mean	**3.17**	**N**

Jackson et al. (2022) emphasize that elaboration flourishes when students are afforded opportunities to refine and iterate their ideas, typically facilitated by feedback and revision processes. Engaging in activities that incorporate scaffolding, prolonged inquiry, and revision—elements emphasized in Project-Based Learning (PBL) frameworks (Biazus & Mahtari, 2022)—could help bridge this gap by promoting deeper elaboration and development beyond initial ideas.

Problem-Solving Skill

The average rating of 3.13 indicates a neutral view regarding students' abilities in analytical and creative problem-solving (Table 6). The lowest scores were observed in the areas of analyzing complex problems (M = 3.00) and generating multiple solutions (M = 3.08), which align with the findings of Tarhan and Acar (2017) that highlight the necessity for explicit instruction and practice in real-world scenarios.

Table 6: Assessment of Critical Thinking Skill Along with Problem-Solving Skill

Problem-Solving Skills	M	DI
1. can analyze complex problems and identify key issues;	3.00	N
2. generate multiple potential solutions to a problem;	3.08	N
3. evaluate the effectiveness of their solutions and make adjustments as needed; and	3.25	N
4. enjoy tackling challenging problems and finding creative solutions.	3.17	N
Composite Mean	**3.13**	**N**

Conversely, more favorable indicators such as evaluating the effectiveness of solutions (M = 3.25) and finding enjoyment in problem-solving (M = 3.17) imply that students are open to problem-based and inquiry-oriented learning approaches. These strategies are recognized for their potential to enhance creative problem-solving by involving students in significant exploration (Mansyur et al., 2024).

Knowledge Creation

It is evident in Table 7 that students exhibit a neutral overall mean score of 3.19, indicating their potential in synthesizing information (M = 3.25) and innovatively connecting ideas (M = 3.17). This aligns with the findings of Sheu and Chen (2018), who highlight synthesis as a key aspect of creative knowledge construction. Additionally, students' enjoyment of research (M = 3.00) and their creative presentation of findings (M = 3.33) suggest a level of engagement that could be further enriched through student-led inquiry projects and the incorporation of digital tools (Yerrick et al., 2023).

Table 7: Assessment of Critical Thinking Skill Along with Knowledge Creation

Knowledge Creation	M	DI
1. can synthesize information from various sources to generate new insights;	3.25	N
2. connect ideas and concepts in innovative ways;	3.17	N
3. enjoy conducting research and exploring new topics in depth; and	3.00	N
4. present their findings in creative and engaging ways.	3.33	N
Composite Mean	**3.19**	**N**

Such strategies not only promote the collection of information but also encourage students to reinterpret and articulate it in unique ways, thereby enhancing their understanding and creativity.

Creative Expression

Creative expression received an average score of 3.29 (Table 8). Teachers exhibited a neutral stance regarding students' ability to convey ideas through various media, with a mean score of 3.42, indicating a solid foundation for multimodal learning. The OECD (2021) supports the idea of multiple forms of creative expression, as they allow students to present their distinct viewpoints and contribute to their identity development.

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Table 8: Assessment of Critical Thinking Skill Along with Creative Expression

Creative Expression	**M**	**DI**
1. express their ideas through various creative mediums (e.g., writing, art);	3.42	N
2. enjoy telling stories or creating narratives to convey their thoughts;	3.08	N
3. communicate their ideas effectively using multimedia presentations; and	3.42	N
4. find satisfaction in expressing their unique perspectives creatively.	3.25	N
Composite Mean	**3.29**	**N**

Nevertheless, the lower scores in storytelling (M = 3.08) and in satisfaction with expressing individual perspectives (M = 3.25) suggest that there may be insufficient opportunities for students to develop their personal voice and narratives. To enhance this area, integrating activities such as digital storytelling, performance arts, or visual arts could significantly enrich students' engagement and emotional investment in their creative endeavors.

Table 9: Assessment of Critical Thinking Skill Along with Affective Engagement

Indicators	**M**	**DI**
1. Divergent Thinking	3.46	N
2. Originality	3.25	N
3. Flexibility	3.23	N
4. Elaboration	3.17	N
5. Problem-Solving Skill	3.13	N
6. Knowledge Creation	3.19	N
7. Creative Expression	3.29	N
8. Affective Engagement	3.67	A
Overall Mean	**3.30**	**N**

Affective Engagement

Affective engagement was notably highlighted with an average score of 3.67, placing it within the "Agree" category (Table 9). The students' enthusiasm for creative activities (M = 3.83) and their sense of achievement (M = 3.83) indicate a robust intrinsic motivation, which is crucial for fostering ongoing creativity. Leggett (2017) posits that emotional involvement boosts creativity by enhancing students' sense of agency and self-confidence.

Table 10: Summary of the Assessment of the Components of Critical Thinking Skill

Indicators	**Mean Score**	**Interpretation**
Content	4.57	Very High Validity
Format	4.37	High Validity
Presentation & Organization	4.57	Very High Validity
Design & Layout	4.47	Very High Validity
Accuracy & Up-to-datedness of Information	4.60	Very High Validity
Overall Mean	**4.52**	**Very High Validity**

The slightly lower scores for enjoyment (M = 3.50) and motivation to explore possibilities (M = 3.50) reveal potential areas for improvement. These could be addressed by providing students with greater choice, autonomy, and relevance in their creative endeavors, as highlighted by proponents of project-based learning (Bey, 2023).

Teacher perceptions indicate a predominantly neutral view regarding students' creative thinking skills, as evidenced by the overall mean of 3.30. Among the evaluated aspects, affective engagement (M = 3.67) stood out as the most prominent, suggesting that students exhibit significant emotional investment and motivation during creative activities. Conversely, areas such as problem-solving (M=3.13), elaboration (M = 3.17), knowledge creation (M=3.19), flexibility (M = 3.23), and originality (M = 3.25), received lower ratings, highlighting the need for focused instructional support. However, in this study, all areas were considered in the development of the intervention materials (Table 10).

These results are consistent with existing research, which emphasizes that creativity is not a static, inherent quality but rather a flexible skill that can be developed through deliberate and well-designed teaching methods (Runco & Acar, 2022; Potter, 2016; UNESCO, 2021). The findings underscore the necessity of creating learning environments that not only enhance emotional engagement but also promote divergent thinking, adaptability, and the capacity to elaborate and refine concepts.

Incorporating project-based learning, inquiry-based strategies, and digital resources, as supported by recent research, could significantly bolster students' creative thinking abilities. Furthermore, it is essential for educators to receive adequate training and resources to cultivate a classroom environment that encourages exploration, risk-taking, and the iterative refinement of ideas (Siew et al., 2017; Santos, 2022).

Content Validity

The content validity of the innovative teaching materials was assessed using five key elements. Based on the evaluation, the results show a high to very high degree of validity, as summarized below:

Table 11: Result of the Content Validity of the Innovative Teaching Material

Affective Engagement	**M**	**DI**
1. are enthusiastic about engaging in creative activities;	3.83	A
2. find creative tasks enjoyable and rewarding;	3.50	N
3. are motivated to explore their creative potential; and	3.50	N
4. feel a sense of accomplishment when they complete creative projects.	3.83	A
Composite Mean	**3.67**	**A**

In assessing content validity, the materials were examined based on five essential criteria: Content, Format, Presentation and Organization, Design and Layout, and Accuracy and Timeliness of Information. The average score across these dimensions was 4.52, which is interpreted as indicating "Very High Validity." This score implies that the materials are developmentally suitable, culturally pertinent, and adequately aligned with the learning objectives specified in the curriculum. Notably, the content aspect received high ratings for its suitability for the target age group, absence of conceptual and factual inaccuracies, and its ability to promote higher-order thinking skills. Likewise, the presentation and organization of the materials were deemed coherent and logically structured, effectively leading students from simpler to more complex ideas.

Although the design and layout were also rated very positively, highlighting the effective use of visuals, colors, and formatting to support learning, the "Format" component received a slightly lower score of 4.37, categorized as "High Validity." This may indicate minor opportunities for improvement in aspects such as layout, labeling, or the clarity of certain technical details like spacing and consistency in headings. Nonetheless, the consistently high ratings across all categories reinforce the materials' strong potential for effective classroom use.

Level of Acceptability

The acceptability of the innovative teaching materials was evaluated by another set of five validators, focusing on three major dimensions:

Table 12: Result of the Level of Acceptability of the Innovative Teaching Material

Dimension	**Mean Score**	**Interpretation**
Content Quality	4.68	Very Highly Acceptable
Instructional Quality	4.48	Highly Acceptable
Technical Quality	4.64	Very Highly Acceptable
Overall Mean	**4.60**	**Very Highly Acceptable**

The evaluation of the materials' acceptability, conducted by an independent panel of validators, resulted in an exceptionally positive outcome, achieving an overall mean score of 4.60, which indicates a classification of "Very Highly Acceptable." This assessment focused on three key dimensions: Content Quality, Instructional Quality, and Technical Quality. Content Quality received the highest score, averaging 4.68, signifying that the materials effectively engage students in creative inquiry, foster divergent thinking, and align well with the curriculum. Validators noted that the activities embedded in the materials successfully stimulate curiosity, exploration, and real-world problem-solving.

Instructional Quality was rated at 4.48, which, while slightly lower than the other dimensions, still falls within the "Highly Acceptable" range. This score suggests that the materials provide clear instructions and encourage creative exploration, although there are minor areas for improvement, such as offering additional background information or enhancing scaffolding in certain activities to better support diverse learners. Conversely, Technical Quality achieved a commendable mean score of 4.64, indicating that the materials are visually engaging, devoid of technical issues, and readily accessible in digital formats—qualities that are crucial for contemporary, student-centered learning environments.

Overall, the findings from both the validity and acceptability assessments clearly indicate that the innovative teaching materials are effective and suitable for classroom use. They adhere to high standards in content delivery, are engaging and user-friendly, and closely align with the objectives of the Science 7 curriculum. While minor enhancements in formatting and instructional scaffolding could further improve usability, the materials have been validated as both highly credible and widely accepted by experts in the field.

Challenges Teachers Encounter in Integrating Creative Thinking Activities into their Lessons

Teachers expressed a generally positive outlook on the use of project-based learning (PBL) activities in science education, noting that such approaches can increase student interest and participation. However, a recurring theme across responses was the **difficulty in consistently implementing PBL and creative thinking strategies due to multiple classroom realities.** Among the most cited challenges were the **abstract nature of science concepts, limited time allotments (typically 45 minutes per session), and the rigid structure of the current curriculum,** which prioritizes standardized testing and content coverage over exploratory learning.

Teachers also pointed to **insufficient resources,** including teaching materials and manipulatives needed to support project-based activities. Additionally, many admitted to **limited confidence or training** in facilitating creative activities, particularly in striking a balance between content mastery and student-driven inquiry. The **student’s mindset** was also seen as a hurdle, with many learners more comfortable with structured tasks and hesitant to engage in open-ended or out-of-the-box thinking.

A particularly compelling insight came from one teacher who highlighted the **fundamental issue of students'**

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readiness, especially in terms of literacy and comprehension. The teacher shared:

"Some of the challenges that I think hinders teachers in integrating creative thinking activities and strategies are the ff: readiness of the students and their reading comprehension capabilities. When students are poor in reading and comprehension it becomes hard for them to understand the tasks you are giving to them. Some students cannot even understand basic English instructions. Which consumes time, as teachers will explain it several times paired with several examples just so they could grasp the idea. Also, the availability of materials for the MATATAG curriculum had a great impact as well for teachers in boosting creative thinking skills of students."

This reflection underscores a critical reality in many classrooms: **before creativity and higher-order thinking skills can be nurtured, foundational competencies such as reading comprehension must be addressed**. The language barrier—particularly the challenge of translating instructions into the learner's mother tongue (e.g., Ilocano)—and the time consumed by repeated clarifications further limit teachers' ability to sustain innovative activities. It also highlights the **interconnectedness between learning resources, language accessibility, and pedagogical effectiveness.**

Despite these challenges, teachers acknowledged the value of strategies such as **inquiry-based learning, real-world problem solving, and interdisciplinary approaches** as means to integrate creative thinking into science instruction. There is also a recognition of the need to **create classroom cultures that encourage experimentation, risk-taking, and learning from failure**—hallmarks of both creativity and scientific inquiry.

CONCLUSION

The findings of this research indicate that although seventh-grade students show enthusiasm and emotional involvement in creative science activities, their performance in key creative thinking areas—such as elaboration, originality, flexibility, and problem-solving—remains neutral according to their teachers' assessments. This suggests that despite their emotional engagement, their capacity to consistently exhibit advanced creative thinking is constrained.

The project-based learning materials developed in accordance with the MATATAG Science Curriculum received validation from experts as highly valid and acceptable, indicating a significant potential to enhance creativity when applied in classroom settings. Nonetheless, the study identified various systemic and instructional challenges that impede the effective incorporation of creative thinking strategies. These challenges include insufficient instructional time, inflexible curriculum structures, resource shortages, and students' limited reading comprehension.

Additionally, language barriers and the necessity for repeated instruction further complicate the implementation of creative, open-ended activities. Despite these challenges, the findings emphasize the critical need for ongoing support for educators, improved access to resources, and foundational skill development, especially in literacy—to effectively promote creative thinking in science education.

Recommendations

Based on the results of this research, the following suggestions are made to improve creative thinking in Grade 7 science education:

Educators should incorporate open-ended, project-based learning activities into the science curriculum to encourage divergent thinking, cognitive flexibility, and originality. Engaging students in real-world problem-solving, allowing for multiple solutions, and iterating on their ideas will foster deeper creative involvement.

Regular use of techniques such as structured brainstorming, collaborative group work, diverse perspective debates, and iterative feedback loops can significantly enhance students' elaboration, problem-solving, and adaptive thinking abilities.

Teachers should empower students to choose their topics, design their projects, and select their expression mediums. Utilizing multimodal outputs like podcasts, infographics, videos, or artistic representations can cater to various learning styles and enhance creative expression.

Science instruction should integrate student-driven inquiry supported by reliable online resources and interactive tools to promote knowledge creation and digital literacy. This approach not only nurtures creativity but also develops critical research and synthesis skills.

Schools must enhance students' reading comprehension and language skills, which are essential for effective engagement in creative tasks. Additionally, professional development programs should be established to equip teachers with the skills to design and facilitate creative, inquiry-based science lessons.

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