OPEN ACCESS

Manuscript ID:
EDU-2026-140411172

Volume: 14

Issue: 4

Month: September

Year: 2026

P-ISSN: 2320-2653

E-ISSN: 2582-1334

Received: 06.07.2026

Accepted: 08.08.2026

Published Online: 01.09.2026

Citation:
Elangovan, K., Saminathan, B., & Muthuchamy, I. (2026). Creativity of Undergraduate Science Students in Relation to their Problem Solving Abilities. *Shanlax International Journal of Education, 14*(4), 155–166.

DOI:
https://doi.org/10.34293/education.v14i4.11172

Creativity of Undergraduate Science Students in Relation to their Problem Solving Abilities

K. Elangovan
Bharathidasan University, India

B. Saminathan
Bharathidasan University, India

I. Muthuchamy
Bharathidasan University, India

Abstract
Humans are equipped with a creative force, but the extent to which they possess it differs from person to person. Creativity is the process by which a person makes something new (a product, solution, work of art, novel, invention, etc.) that has value (Aggarwal 2022). Problem solving is a mental process that comes at the end of a larger problem-solving process, which involves problem identification, sharpening, and obtaining a final goal. Problem solving involves methodical observation, classification, and interpretation. A problem is defined as any scenario in which there is an opportunity to improve things (Sharma 2006). There is a need to foster creativity in undergraduate science students, who will then contribute to the development of problem-solving skills with a scientific mindset. This study investigates the association between creativity and problem-solving ability among undergraduate science students. The study adopted a descriptive survey method involving 160 undergraduate science students selected through simple random sampling. Data were analyzed using Percentage Analysis, Mean, Standard Deviation, Independent Samples t-test, and Pearson Product Moment Correlation. The study's findings show that UG science students have an average level of creativity and problem-solving abilities. A considerable positive association exists between creativity and problem-solving abilities. Male and female UG Science students had similar levels of creativity and problem-solving abilities. The study's findings may be useful for undergraduate science students looking to improve their problem-solving and creative talents. Future research should employ longitudinal and experimental research designs involving larger and more diverse samples to examine additional psychological and educational variables influencing creativity and problem-solving ability.

Keywords: Creativity, Problem Solving Ability, Science Under Graduate Students, Higher Education, Undergraduate Students, Scientific Thinking, Cognitive Skills, India

Introduction

Creativity is widely recognized as one of the most essential competencies for success in the twenty-first century, enabling individuals to generate original ideas, solve complex problems, and adapt to rapidly changing social, scientific, and technological environments. In higher education, creativity is increasingly viewed as a fundamental learning outcome because it supports innovation, scientific inquiry, critical thinking and lifelong learning. Therefore, contemporary educational systems emphasize the development of creativity alongside analytical reasoning and problem-solving skills to prepare graduates for professional and societal challenges. International organizations have also identified creativity as a key competency for sustainable development, innovation, and quality education, highlighting its importance in higher-education curricula and educational policy.

Creativity has been conceptualized in various ways by psychologists and educational researchers. One of the most widely accepted definitions describes creativity as the ability to produce ideas or products that are original and useful. According to Runco and Jaeger (2012), originality alone is insufficient; creative outcomes must possess value or appropriateness within a particular context. This definition has become the standard framework for creativity research and has guided numerous investigations into creative thinking, innovation, and educational practices. Said-Metwaly et al. (2021) stated that creativity has become a fundamental outcome of contemporary higher education because it enables learners to develop original and valuable ideas while responding effectively to unfamiliar academic and professional situations. Modern educational research emphasizes that creativity is not merely an innate characteristic but a competency that can be systematically cultivated through appropriate instructional strategies and supportive learning environments (Urban et al., 2024). Studies have consistently reported that inquiry-based learning, collaborative activities, design thinking, and authentic problem-solving experiences strengthen students' creativity, cognitive flexibility, and innovative capacity, thereby contributing to improved academic performance and lifelong learning (Rodríguez-Silva et al., 2026).

Problem-solving ability is another higher-order cognitive skill that enables individuals to identify, analyze, and resolve unfamiliar situations through logical reasoning, creative thinking, and informed decision-making. Effective problem-solving requires learners to integrate prior knowledge, evaluate alternative solutions, and apply appropriate strategies to achieve the desired outcomes. In science education, problem-solving ability is particularly important because scientific learning involves experimentation, hypothesis formation, evidence interpretation, and application of theoretical concepts to real-world situations. Consequently, creativity and problem-solving are regarded as complementary competencies that enhance students' academic achievement and innovation.

Recent educational research has increasingly emphasized that creativity can be systematically developed through learner-centered pedagogies rather than being viewed as an innate characteristic. A systematic review of educational interventions in higher education found that approaches such as project-based, problem-based, experiential, and collaborative learning consistently enhance students' creative thinking and problem-solving capabilities. These instructional approaches encourage learners to explore multiple perspectives, generate innovative ideas and apply knowledge in authentic contexts.

Recent empirical and review studies have further demonstrated a close relationship between creativity and higher-order cognitive skills. Meta-analytic and systematic review evidence indicates that creativity is positively associated with critical thinking, innovation, and problem-solving, and that educational interventions can significantly strengthen these competencies among university students. These findings suggest that learning environments that promote inquiry, collaboration, and reflective practice contribute substantially to students' creative and analytical development.

Undergraduate science students require creativity and problem-solving abilities not only for academic success but also for scientific research, technological innovation, and professional practice. Science education requires learners to formulate hypotheses, conduct experiments, interpret findings, and solve real-world problems using scientific reasoning. Students with stronger creative thinking skills are more likely to develop innovative solutions, adapt to emerging technologies, and contribute meaningfully to scientific advancement. Therefore, higher education institutions should create learning environments that encourage experimentation, independent inquiry, interdisciplinary collaboration, and reflective thinking to strengthen these competencies.

Although previous studies have established positive relationships between creativity and problem-solving abilities, much of the available research has focused on engineering students, teacher education, or interdisciplinary higher education settings. Comparatively fewer empirical investigations have examined these variables among undergraduate science students in the Indian higher education context using standardized measures

of creativity and problem-solving abilities. This limited evidence highlights the need for further research to understand the relationship between these competencies among undergraduate science students. Accordingly, the present study investigates the creativity of undergraduate science students in relation to their problem-solving abilities and provides empirical evidence that may support improvements in science teaching and learning outcomes.

Significance of the Study

Creativity has long been considered a rare phenomenon, bestowed with divine inspiration and found only in a few exceptional individuals. However, because we are all unique creations, our level of creative capacity varies. Proper education, opportunities for creative expression, and appropriate stimulating environments offered by parents and teachers would all have a substantial impact on creativity. Parents and teachers should identify, exhibit, and develop creativity in undergraduate science students. It is necessary to educate teachers and parents about the true meaning of creativity, the creative process, and methods for fostering it. As a result, there is a need to foster creativity in students, who will then contribute to the growth of creativity in children who will become future citizens of the country. From this perspective, more focus should be placed on finding, conserving, and cultivating creativity in undergraduate science students. Thus, it is critical to study the creativity of undergraduate science students in relation to their problem-solving abilities.

Review of Literature

Li, Cui, and Hagedorn (2026) conducted a systematic review examining the influence of AI-supported learning on creativity, critical thinking, and problem-solving skills in higher education. The review demonstrated that technology-enhanced learning environments significantly improved students' higher-order cognitive abilities when integrated with inquiry-based and collaborative instructional approaches. The authors concluded that effective instructional design and active learner engagement are essential for developing creativity and problem-solving skills.

Rodríguez-Silva et al. (2026) systematically reviewed educational interventions designed to foster creativity in higher-education settings. The review reported that project-based learning, design thinking, interdisciplinary collaboration, and reflective learning consistently enhanced university students' creativity and problem-solving skills. The authors recommend embedding creativity-oriented pedagogies throughout higher education programmes to strengthen innovation and higher-order thinking.

Park, Myszkowski, and Niu (2026) conducted a meta-analysis to investigate the relationship between creativity and critical thinking among students across different educational settings. The findings revealed a moderate to strong positive association between creativity and critical thinking, indicating that students with higher creative thinking abilities also demonstrated stronger analytical reasoning and problem-solving skills. The study recommends integrating creative thinking activities into higher education curricula.

Ikram et al. (2026) conducted a systematic literature review of students' creative thinking abilities by analyzing empirical studies indexed in Scopus. Following the PRISMA guidelines, this review identified major themes, research trends, methodological approaches, and future directions in creativity research. The authors reported that learner-centered pedagogies, collaborative learning, and supportive educational environments consistently enhanced students' creative thinking. They also highlighted the need for more empirical research on creativity in higher education across diverse cultural and disciplinary contexts.

Li, Cui, and Hagedorn (2026) systematically reviewed 67 empirical studies to examine the influence of ChatGPT on university students' critical and creative thinking. The review concluded that artificial intelligence enhanced creativity, metacognitive regulation, and problem-solving when integrated with inquiry-based instructional approaches. However, the authors cautioned that unstructured AI use could reduce critical thinking because of cognitive offloading, emphasizing the importance of a sound pedagogical design.

Park, Myszkowski, and Niu (2026) conducted a three-level meta-analysis to investigate the

relationship between creativity and critical thinking in students. The findings demonstrated a statistically significant positive association between the two constructs and indicated that creativity and critical thinking should be developed together through learner-centered educational practices. The authors also reported that the strength of the relationship varied according to the assessment method used.

Ceballos et al. (2026) systematically reviewed collaborative problem-solving research in mathematics education to identify the instructional design features that promote higher-order thinking skills. The review concluded that technology-supported exploratory tasks, open-ended problems, and structured peer communication substantially enhance reasoning, reflective thinking, and collaborative problem-solving. The authors recommend integrating well-designed collaborative learning activities into higher education to strengthen advanced cognitive skills.

Koçoğlu and Kanadlı (2025) conducted a meta-analytic structural equation modelling study to examine the relationship among creative thinking, critical thinking disposition, and problem-solving skills. The analysis confirmed significant positive relationships among the three constructs and emphasized that learner-centered instructional approaches substantially improve higher-order thinking skills.

Martínez-Peláez et al. (2025) reviewed recent studies that investigated the educational applications of large language models in higher education. The review concluded that artificial intelligence-supported instructional activities significantly enhanced students' creativity, collaboration, critical thinking, and problem-solving skills when combined with active learning strategies.

Corrêa and Mourão (2025) conducted a systematic literature review of creativity in higher education using the Investment Theory of Creativity. After screening more than 1,900 publications, they analyzed 253 empirical studies and found that pedagogical strategies, interactive learning environments, entrepreneurial intention, learner motivation, and classroom climate were the most influential factors in fostering creativity among university students. The review also identified important research gaps and proposed a future research agenda for creativity in higher education.

Zhan, He, and Zhong (2024) conducted a meta-analysis to examine the effects of problem-solving pedagogy on students' creativity by synthesizing empirical studies across different educational settings. The findings indicate that problem-solving instructional approaches have a significant positive effect on creativity, particularly when students engage in inquiry-based learning, collaborative problem solving, and authentic real-world tasks. The authors concluded that structured problem-solving pedagogy effectively promotes creative thinking and recommended its integration into higher-education curricula.

Yu et al. (2024) conducted a meta-analysis to examine the effects of design thinking on student learning in higher education. The findings revealed that design thinking significantly and positively affected creativity, innovation, problem-solving ability, and collaborative learning. The authors concluded that learner-centered design thinking approaches effectively promote higher-order cognitive skills and should be integrated into university curricula to achieve this.

Pisfil Becerra and López Regalado (2024) systematically reviewed research on creative thinking among university students. After reviewing 20 empirical studies, they reported that active, collaborative, project-based instruction, and learner-centered teaching consistently enhanced students' creative thinking and academic performance. The review emphasizes that universities should intentionally promote creativity through innovative instructional strategies and supportive learning environments.

Setiamurti and Kurniawati (2024) systematically reviewed 28 empirical studies published between 2018 and 2022 to identify effective strategies for fostering creativity in higher-education. The review found that project-based learning, collaborative learning, design thinking, and inquiry-based instruction significantly improved students' creativity across various disciplines. The authors recommend embedding creativity-oriented pedagogies within higher education curricula to prepare students for complex professional challenges.

Andreucci-Annunziata et al. (2023) conducted a systematic review of systematic reviews to examine conceptualizations and instructional strategies related to critical thinking in higher education. The review concluded that inquiry-based learning, collaborative learning, reflective practice, and problem-based instruction consistently enhance students' critical thinking and analytical reasoning. The authors emphasized that learner-centered pedagogies provide the strongest evidence for improving higher-order thinking skills in university education.

Lee and Han (2023) conducted a systematic review and meta-analysis examining the effectiveness of design thinking education on university students' creativity and problem-solving abilities. The findings demonstrated that design thinking interventions significantly improved creative thinking, innovation, collaborative learning, and problem-solving performance. The authors recommend incorporating design thinking activities into undergraduate science education.

Jin et al. (2022) conducted a meta-analysis to investigate the effects of problem-based learning on critical thinking in higher education. The findings showed that problem-based learning had a strong positive effect on students' overall critical thinking, critical thinking skills, and critical thinking dispositions. The study further reported that learner participation, instructional duration, and discipline influenced the magnitude of the observed effects, demonstrating the value of problem-based learning in promoting higher-order cognitive development.

Álvarez-Huerta et al. (2022) investigated the relationship between creative confidence, critical thinking disposition, and openness to diversity among higher-education students. The findings indicate that students with stronger creative confidence also exhibit higher levels of critical thinking and cognitive flexibility, both of which contribute positively to problem-solving ability.

UNESCO (2021) highlighted that higher education institutions should cultivate creativity, innovation, critical thinking, and problem-solving as essential competencies for achieving sustainable development and lifelong learning. The report emphasizes learner-centered education, interdisciplinary collaboration, and inclusive pedagogical practices as fundamental strategies for preparing students to address complex global challenges.

Akpur (2020) examined the relationships among critical, reflective, and creative thinking and academic achievement through an empirical investigation involving university students. The findings demonstrated significant positive relationships among the three higher-order thinking skills and academic achievement. The study concluded that creativity and critical thinking complement each other in improving students' problem-solving abilities and overall academic performance.

Critical Review and Research Gap

The reviewed literature consistently demonstrates that creativity, critical thinking, and problem-solving abilities are closely interconnected higher-order cognitive skills that contribute significantly to students' academic performance, innovation, and lifelong learning. Recent systematic reviews and meta-analyses have provided strong empirical evidence that learner-centered instructional approaches, including inquiry-based, problem-based, project-based, and design thinking, collaborative learning, and artificial intelligence-supported learning environments, effectively enhance creativity and problem-solving competencies among university students (Li et al., 2026; Park et al., 2026; Ikram et al., 2026; Ceballos et al., 2026). Likewise, studies by Koçoğlu and Kanadlı (2025), Corrêa and Mourão (2025), Zhan et al. (2024), Pisfil Becerra and López Regalado (2024), Setiamurti and Kurniawati (2024), Andreucci-Annunziata et al. (2023), Lee and Han (2023), Jin et al. (2022), Santos et al. (2020), and Álvarez-Huerta et al. (2022) consistently reported that active learning strategies and supportive educational environments substantially improve students' creativity, critical thinking, and problem-solving abilities. Furthermore, UNESCO (2021) emphasized that these competencies are fundamental for sustainable development and should be integrated into higher education curricula through innovative pedagogical practices. Akpur (2020) also established that creativity, reflective thinking, and critical thinking are positively associated with academic achievement, highlighting the importance of fostering higher order thinking skills among university students.

Despite these significant contributions, several limitations remain in the current body of knowledge. Most recent studies have concentrated on the effectiveness of instructional interventions, artificial intelligence applications, design thinking, collaborative learning, and critical thinking across diverse higher education contexts. Fewer empirical studies have specifically investigated the relationship between creativity and problem-solving abilities among undergraduate science students, particularly within the Indian higher education system. In addition, many previous investigations have been conducted in engineering, medical, or interdisciplinary programmes, whereas research focusing exclusively on undergraduate science students remains limited. Although systematic reviews have identified the importance of creativity and problem-solving as complementary competencies, empirical evidence using standardized psychological instruments to examine their relationship among Indian undergraduate science students is scarce in the literature. Moreover, few studies have explored whether creativity and problem-solving abilities differ across demographic characteristics, such as gender, within this population.

Research Gap

Based on the foregoing review, it is evident that there is a paucity of empirical research examining the relationship between creativity and problem-solving ability among undergraduate science students in India higher education context. Existing studies have largely emphasized instructional interventions, technology-enhanced learning, or critical thinking, while comparatively little attention has been given to simultaneously assessing creativity and problem-solving abilities using standardized instruments among undergraduate science students. Furthermore, empirical evidence from Tamil Nadu, particularly among students studying in Government and Aided Arts and Science Colleges, is scarce. Therefore, this study aims to bridge this gap by investigating the level of creativity and problem-solving ability among undergraduate science students, examining gender differences, and determining the relationship between these two important cognitive variables. The findings are expected to contribute to the existing literature and provide useful implications for science education, curriculum development and innovative teaching practices in higher education.

Objectives of the Study

The aims of this study were as follows:

- To identify the existing level of creativity (both verbal and nonverbal) of undergraduate science students.
- To identify the existing level of problem-solving abilities of undergraduate science students.
- To determine whether any significant difference exists in the creativity and problem-solving ability of UG students with respect to gender.
- To determine the relationship between creativity and problem-solving abilities among UG science students.

Hypotheses of the Study

Based on the objectives, the following hypotheses were formulated.

- The level of creativity among Undergraduate Science Students is not high.
- The level of problem-solving skills among Undergraduate Science Students is not high.
- There was no significant difference in the creativity and problem-solving abilities of UG students with respect to gender.
- There is no significant relationship between creativity and problem-solving skills among Undergraduate Science Students.

Methodology in Brief

The current study employs a survey method (Garrett 2004). The methodological specifics, such as the population sample, tool, data collection approach, scoring mechanism, and statistical methodologies, are provided below.

Sample

The sample of the present study included 160 Undergraduate Students studying B.Sc. in the Government and Aided Arts and Science Colleges of Madurai Corporation City in the academic year 2023-2024. A straightforward random sampling method was used to select the sample. Colleges in and around Madurai were randomly chosen using the directions north, south, east, and west.

Tools Used

The following two tools were used to gather data on the variables considered in this study. 1. Baquer Mehdi's verbal and nonverbal creative thinking test (1996). 2. Sheela DOS in Education at the University of Mysore created the PSAT (Problem Solving Ability Test) in 2002.

Validity of the Instruments

The research instruments used in the present study were standardized tools with established psychometric properties. The Baquer Mehdi Verbal and Nonverbal Test of Creative Thinking (1996) has been widely used in educational and psychological research and demonstrates satisfactory content and construct validity for assessing students' creative thinking abilities. Similarly, the Problem Solving Ability Test (PSAT) developed by Sheela (2002) possesses acceptable content validity and has been used extensively to measure students' problem-solving abilities. Before data collection, both instruments were reviewed by experts in educational psychology and teacher education to ensure their suitability for undergraduate science student use.

Reliability of the Instruments

The standardized instruments adopted in this study possessed satisfactory reliability, as reported by their developers. The Baquer Mehdi Creativity Test has demonstrated acceptable reliability coefficients across different populations, while the Problem-Solving Ability Test (PSAT) also exhibits satisfactory internal consistency and test-retest reliability. As standardized instruments were employed without modification, their established reliability supports the accuracy and consistency of the measurements obtained in the present investigation.

The reliability of the research instruments was established before the main data collection process. A pilot study was conducted using 30 undergraduate science students who were not included in the final sample. The internal consistency of the instruments was estimated using Cronbach's alpha.

Instrument	Number of Items	Reliability Method	Reliability Coefficient
Baquer Mehdi's Verbal and Non-Verbal Test of Creative Thinking	Standardized	Cronbach's Alpha	0.86
Problem Solving Ability Test (PSAT) – Sheela (2002)	Standardized	Cronbach's Alpha	0.89

The Cronbach's alpha coefficients of 0.86 for the Creativity Test and 0.89 for the Problem Solving Ability Test indicate good internal consistency. As both coefficients exceeded the recommended threshold of 0.70, the instruments were considered sufficiently reliable for use in the present investigation.

Data Collection

To evaluate the UG's capacity for innovation and problem-solving, with the assistance of the principals and faculty members of the individual colleges, the instruments were supplied to the scientific students and faithfully administered in strict accordance with the instructions provided in the testing procedure manual.

Statistical Techniques Used

To analyze and interpret the data percentages, a simple arithmetic mean was used. Product-moment correlation and t-tests were used. To examine and explain the data percentages, a simple arithmetic mean was used. Product-moment correlation and t-tests were utilized.

Ethical Considerations

Ethical standards were upheld throughout the study. Permission to conduct the research was obtained from the heads of the selected Government and Aided Arts and Science Colleges before data collection. Participants were informed of the purpose of the study, and their participation was entirely voluntary. Students were assured that their responses would remain confidential and anonymous and would be used exclusively for academic research purposes. No personal identifying information was collected, and the participants were free to withdraw from the study at any stage without any academic consequences.

Participant Consent

Informed consent was obtained from all participating undergraduate science students before the research instruments were administered. The objectives of the study, nature of participation, and confidentiality of the collected information were clearly explained. Students completed the questionnaires only after providing voluntary consent.

Assumptions of Statistical Analysis

Prior to statistical analysis, the collected data were examined for their completeness and suitability. Descriptive statistics were computed to summarize the characteristics of the data, while the assumptions underlying the independent samples t-test and Pearson product-moment correlation, including independence of observations, approximate normality, and linearity, were considered before conducting the analyses. The statistical procedures employed were appropriate for the study objectives and hypotheses.

Analysis and Interpretation of Data

For data analysis and interpretation, the appropriate input, analytical findings, and derived inferences are presented in separate tables, followed by a discussion.

Table 1 The Percentage of the Level of Creativity among the Total Sample

Creativity Level	Number of Students	%
Low	16	10%
Average	106	66.25%
High	38	23.75%
Total	160	100%

According to the data acquired and provided in table -1, 16 (10%) of the 160 students belonged to the low creativity group, 106 (66.25%) had an average level of creativity, and the remaining 38 (23.75%) belonged to the high creativity group. Most undergraduate science students have an average level of inventiveness. As a result, the null hypothesis -1, that the amount of creativity among UG science students is low, was accepted, and it can be inferred that the level of creativity among undergraduate science students is average.

Table 2 Percentage of the Level of Problem-Solving Abilities among the Total Sample

Problem Solving Ability level	Number of Students	Percentage
Low	24	15%
Average	96	60%
High	40	25%
Total	160	100%

Table 2 shows that 24 (15% of the overall sample) had low problem-solving abilities, 96 (60%) had average problem-solving abilities, and 40 (25%) had strong problem-solving abilities. This is because most students have average problem-solving abilities. As a result of accepting null hypothesis 2, which states that the level of problem-solving abilities of undergraduate students is low, it is possible to conclude that the level of problem-solving abilities among UG science students is average.

Table 3 Mean, SD and 't' value for Creativity

Gender	N	Mean	SD	't' value	Significant level (0.05)
Male	78	61.3	4.41	1.20	NS
Female	82	62.2	5.32		

NS-Not Significant at 0.05 level

Table 3 shows that the mean originality scores for men and women are 61.3 and 62.2, respectively, with standard deviations of 4.41 and 5.32. The calculated t-value of 1.20 is less than the crucial t-value of 1.96 at the 0.05 significance level. As a result, hypothesis -4 was accepted, indicating that there is no substantial difference in the level of originality between male and female undergraduate science students. Furthermore, both male and female students had similar levels of originality.

Table 4 Mean, SD, and 't' value for Problem-Solving Abilities

Gender	N	Mean	SD	't' value	Significant level (0.05)
Male	80	49.33	10.48	1.90	NS
Female	80	53.91	13.3		

NS- Not Significant at 0.05 Level

Table 4 demonstrates that the mean problem-solving abilities of males and females are 49.33 and 53.91, with standard deviations of 10.48 and 13.3, respectively. The actual t-value of 1.90 is smaller than the theoretical t-value of 1.96 at the 0.05 level of significance. As a result, hypothesis-5, which states that there is no substantial difference in the level of problem-solving ability between male and female undergraduate students, was accepted. Furthermore, it can be demonstrated that both male and female undergraduate students have similar problem-solving abilities.

Table 5 Relationship between Creativity and Problem-Solving Ability of UG Students

Variables	df	'r'	Effect Size	Significant Level (0.05)
Creativity	158	0.741	Large	Significant
Problem Solving Ability				

Table 5 reveals a statistically significant positive relationship between creativity and problem-solving ability among undergraduate science students ($r = 0.741$, $p < 0.05$). According to Cohen's (1988) guidelines, this correlation represents a large effect size, indicating that creativity has substantial practical significance in explaining students' problem-solving abilities. This finding suggests that students with higher creativity levels are more likely to demonstrate stronger problem-solving skills. Therefore, the null hypothesis stating that there is no significant relationship between creativity and problem-solving abilities was rejected.

Effect Size Interpretation: The obtained correlation coefficient ($r = 0.741$) exceeded Cohen's (1988) criterion for a large effect size ($r \geq 0.50$), indicating that the relationship between creativity and problem-solving ability was not only statistically significant but also educationally meaningful.

Finding of the Study

The key findings are as follows

- The level of creativity among the UG students was found to be average.
- The level of problem-solving abilities among the UG students was found to be average.
- No significant difference was found in the creativity mean score between male and female UG students. Both male and female under graduate students have similar in their level of creativity
- No significant difference was found in the problem-solving abilities of male and female UG students. Both of them have similar in their level of problem-solving abilities
- There is a significant and positive relationship between creativity and problem-solving abilities among under graduate science students

Educational Implications

Creativity is not inherited but rather fostered by pupils. An appropriate learning environment is required to improve divergent thinking and problem-solving abilities. Teachers in higher education must be innovative in teaching courses to increase the creative levels of undergraduate science students, which will help create the same among students in higher education. The current study demonstrated a positive association between creativity and problem-solving abilities. Higher education teachers with poor creativity and problem-solving abilities should be exposed to situations and opportunities that encourage divergent thinking and creativity. Scientific inquiry, deductive and inductive methods, synoptic models, issue solving, and discovery methods should be utilized frequently for autonomous thinking and problem solving. Rediscovering that creative spark within us and among students plays an important role in their study practices, boosting creativity and innovation.

Suggestions for the Study

Suggestions for Teachers

Teachers should create learning environments that encourage creativity, inquiry, and independent

thinking in undergraduate science students. Problem-based learning, project-based learning, experimental activities, brainstorming sessions, scientific investigations, and collaborative learning should be regularly incorporated into science classrooms. Teachers should encourage students to generate multiple solutions to scientific problems, participate in discussions, and engage in reflective-learning activities. The integration of digital technologies, simulations, virtual laboratories, and artificial intelligence-assisted learning tools can further strengthen students' creativity and problem-solving abilities.

Suggestions for Higher Education Institutions

Higher education institutions should develop policies and programs that foster creativity and innovation among undergraduate science students. Colleges should organize workshops, seminars, innovation competitions, science exhibitions, hackathons, and research-based learning activities to promote creative and analytical thinking. Institutions should also strengthen laboratory facilities, digital infrastructure, and interdisciplinary learning opportunities to support such experiential learning. Faculty development programs focusing on innovative pedagogical approaches and twenty-first-century learning skills should be conducted regularly to improve teaching effectiveness.

Suggestions for Curriculum Developers

Curriculum developers should integrate creativity, critical thinking, and problem-solving activities into undergraduate science programmes. Learning outcomes should emphasize inquiry, experimentation, innovation, and the real-world applications of scientific knowledge. Assessment strategies should move beyond traditional examinations by incorporating project work, case studies, research assignments, design challenges, and collaborative problem-solving tasks that encourage higher order cognitive skills.

Suggestions for Educational Administrators and Policymakers

Educational administrators and policymakers should formulate institutional policies that promote creativity-oriented teaching and learning practices in higher education. Financial support may be provided for innovation laboratories, research projects, entrepreneurship programs, and technology-enhanced learning environments. National and institutional initiatives should encourage interdisciplinary collaboration and scientific innovation to prepare students for future academic and professional challenges.

Suggestions for Future Researchers

Future research should use larger samples drawn from different universities and states to improve the generalizability of the findings. Longitudinal and experimental research designs may provide stronger evidence of the causal relationship between creativity and problem-solving abilities. Future studies may also examine additional variables, such as critical thinking, scientific attitude, emotional intelligence, metacognitive awareness, self-efficacy, digital literacy, artificial intelligence-assisted learning, and academic achievement. Comparative studies involving undergraduate and postgraduate students, science and non-science disciplines, and public and private higher education institutions will further enrich the existing body of knowledge.

Limitations of the Study

The present study had certain limitations that should be considered when interpreting the findings. The investigation was confined to 160 undergraduate science students from selected Government and Aided Arts and Science Colleges in Madurai Corporation City, which may limit the generalizability of the results to other geographical regions and academic disciplines. The study adopted a cross-sectional survey design, which prevented the establishment of causal relationships between creativity and problem-solving abilities. Furthermore, the study relied on self-reported standardized instruments, which may have been influenced by respondents' perceptions and response tendencies.

Future Research Directions

Future investigations should include larger and more diverse samples drawn from different universities, states, and academic disciplines

to improve the generalizability of the findings. Longitudinal and experimental research designs may provide stronger evidence regarding the development of creativity and problem-solving abilities over time. Researchers may also examine the influence of variables such as critical thinking, emotional intelligence, metacognitive awareness, scientific attitude, self-efficacy, digital literacy, artificial intelligence-supported learning, academic motivation, and academic achievement on creativity and problem-solving abilities. Comparative studies involving undergraduate and postgraduate students, public and private institutions, and interdisciplinary programs would further enrich the existing body of knowledge.

Creativity and problem-solving abilities are closely interconnected competencies that play a vital role in students' academic success, innovation, and lifelong learning. Strengthening these competencies through innovative teaching practices and supportive institutional environments will help prepare scientifically competent, creative, and socially responsible graduates capable of addressing complex challenges in higher education, professional practice and national development.

Conclusion

This study examined the relationship between creativity and problem-solving ability among undergraduate science students studying in Government and Aided Arts and Science Colleges in Madurai Corporation City. The findings revealed that most undergraduate science students possessed average creativity and problem-solving abilities. Furthermore, no statistically significant differences were observed between male and female students with respect to either creativity or problem-solving ability, indicating that gender does not appear to influence these competencies among participants. Most importantly, this study identified a strong positive and statistically significant relationship between creativity and problem-solving ability, suggesting that students with higher levels of creativity are more likely to demonstrate better problem-solving skills.

These findings emphasize the importance of promoting creativity as an integral component of undergraduate science education. Learning environments that encourage inquiry, experimentation, collaborative learning, scientific investigation, and reflective thinking can significantly enhance students' creativity and their ability to solve academic and real-life problems. The integration of learner-centered pedagogies, problem-based learning, project-based learning, design thinking, digital technologies, virtual laboratories, and artificial intelligence-supported learning environments may further strengthen the higher-order cognitive skills required for success in the twenty-first century. Therefore, higher education institutions should provide opportunities to nurture innovation, independent thinking, and scientific reasoning among undergraduate science students. The findings should be interpreted considering these limitations. The study was confined to undergraduate science students from selected colleges in Madurai Corporation City and employed a cross-sectional survey design. Future studies involving larger samples and longitudinal research designs may provide stronger evidence of the relationship between creativity and problem-solving ability.

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Author Details

K. Elangovan, *Bharathidasan University, India,* ***Email ID****: kilangovan63@gmail.com*

B. Saminathan, *Bharathidasan University, India,* ***Email ID****: saminathan1991@gmail.com*

I. Muthuchamy, *Bharathidasan University, India,* ***Email ID****: imuthuchamy.bdu@gmail.com*