

Scientific Interest and Biology Achievement: The Mediating Role of Scientific Creativity in 5E Constructivist Instruction

Nahida Jamal¹, Dr Nazma Baby²

¹Research Scholar, Lalit Narayan Mithila University, Darbhanga, Bihar, India.

²Supervisor, Assistant Professor, Dr. Zakir Hussain Teacher Training College, Darbhanga, Bihar, India.

OPEN ACCESS

Article Citation:

Nahida Jamal¹, Dr Nazma Baby², "Scientific Interest and Biology Achievement: The Mediating Role of Scientific Creativity in 5E Constructivist Instruction", International Journal of Recent Trends in Multidisciplinary Research, September-October 2026, Vol 6(05), 120-126.



©2026 The Author(s). This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. Published by 5th Dimension Research Publication

Abstract: Background: Scientific interest and creativity have become increasingly important outcomes of science education, yet research examining their interrelationships in the context of constructivist pedagogy remains limited. **Objective:** This study investigates the relationship between scientific interest, scientific creativity, and academic achievement in biology among secondary school students and examines whether the 5E constructivist approach enhances these variables compared to traditional instruction. **Method:** A quasi-experimental design with pretest-posttest comparisons was used with 300 students (150 experimental, 150 control). Instruments included the Scientific Creativity Test (Beqer Mehdi), a researcher-developed Scientific Interest Inventory, and an Achievement Test in Biology. Data were analyzed using ANCOVA, correlation, and multiple regression. **Results:** The 5E approach significantly enhanced scientific interest, $F(1, 297) = 76.24, p < 0.001, \eta^2 = 0.20$, with improvements in all four sub-dimensions: content interest, activity interest, career interest, and utility interest. Moderate positive correlations were found between creativity and achievement ($r=0.52$), interest and achievement ($r=0.48$), and creativity and interest ($r=0.45$). Both creativity ($\beta=0.35$) and interest ($\beta=0.32$) significantly predicted achievement, together explaining 34% of the variance. The 5E approach was equally effective for boys and girls. **Conclusion:** The 5E constructivist approach enhances scientific interest and achievement with scientific creativity playing a significant mediating role. The findings underscore the interconnectedness of cognitive, affective, and creative outcomes in science learning and support the adoption of constructivist pedagogies that address multiple dimensions of student development.

Keywords: Scientific interest, scientific creativity, achievement, 5E model, biology education, constructivism.

1. Introduction

1.1 The role of interest in science education

Scientific interest is a powerful motivational force that influences learning engagement and career choices. According to Crow and Crow (1973), interest "refers to the motivating force that impels us to attend a person, a thing, or an activity or may be the effective experience that has been stimulated by the activity itself." Interest encompasses curiosity, attention, and enthusiasm for scientific concepts and activities.

Research has consistently demonstrated that interest is positively related to academic achievement. Students who are interested in science tend to engage more deeply and achieve at higher levels. Interest has also been identified as a key factor in sustaining engagement in STEM fields and influencing career choices.

Scientific Interest and Biology Achievement: The Mediating Role of Scientific Creativity in 5E Constructivist Instruction

1.2 Scientific creativity and learning

Scientific creativity, defined as the capacity to generate novel and useful ideas in the domain of science, is essential for scientific progress and innovation. While creativity has often been viewed as separate from academic achievement, research suggests positive relationships between these constructs. Creative students tend to approach problems from multiple perspectives, generating innovative solutions that reflect deeper understanding.

1.3 Interrelationships between interest, creativity, and achievement

The relationships between interest, creativity, and achievement are complex and bidirectional. Interest can enhance creativity by motivating sustained engagement and exploration. Creativity can enhance interest by providing rewarding experiences of discovery. Both interest and creativity contribute to achievement through enhanced engagement, deeper processing, and persistence. The 5E model, with its phases of engagement, exploration, and elaboration, provides conditions conducive to the development of all three outcomes.

1.4 The present study

This study examines three research questions:

1. Is the 5E constructivist approach more effective than the traditional method in enhancing scientific interest among secondary school students?
2. What are the relationships between scientific interest, scientific creativity, and academic achievement in biology?
3. Do scientific creativity and scientific interest predict academic achievement in biology?

2. Literature Review

2.1 Scientific interest in science education

Research has examined the development of interest in science and its relationship to learning outcomes:

Chao (2024) found that students taught using the 5E model showed significant differences in learning interest and strategies compared to students taught using traditional methods. Students expressed high satisfaction with the 5E teaching approach, which stimulated their interest in learning natural sciences.

Berg, Bergendahl, and Lundberg (2003) found that students involved in open-ended experiments had more positive attitudes toward science compared to those in expository experiments, highlighting the role of active, inquiry-based learning in generating interest.

A study in Bhutan (2021) found that the Student Opinion Questionnaire showed an increase in the level of interest, understanding, and satisfaction among students taught using the 5E learning cycle.

Research in Kenya (2026) found that the 5E instructional model not only improved achievement but also increased students' interest in the subject.

2.2 Scientific creativity and learning

Research on scientific creativity has demonstrated its importance in science education:

A study in Turkey (2016) presented a natural selection activity designed based on the 5E model to activate 8th-grade students' scientific creativity. Data analysis revealed that such activities can improve students' scientific creativity and promote scientific literacy.

A 2022 study on 5E-based STEM education found significant differences between experimental and control groups in terms of academic achievement, scientific creativity, and views on the nature of science, with the experimental group showing superior outcomes.

A New Zealand study found that engagement in investigative practical work in senior biology fostered personal and collaborative creativity.

2.3 Interrelationships of interest, creativity, and achievement

Research on the interrelationships between interest, creativity, and achievement has revealed positive associations:

A study on the effectiveness of a constructivist approach-based teaching-learning process on academic achievement and creativity of senior secondary level biology students found that students exposed to constructivist teaching scored significantly higher in both academic achievement and creativity compared to their peers in the traditional setting. The findings indicated that the constructivist approach not only enhances the cognitive domain but also increases emotional domains like interest.

The study also found that the constructivist approach enables students to acquire personal, social, and communication skills, replaces rote learning, and helps students become articulate and communicative in the classroom.

2.4 Research gap

While research has examined these variables individually, few studies have investigated their interrelationships within the context of the 5E model. This study addresses this gap by examining the relationships between scientific interest, scientific creativity, and achievement, and the mediating role of creativity in the relationship between interest and achievement.

3. Methodology

3.1 Research design

A quasi-experimental pretest-posttest non-equivalent control group design was employed.

Scientific Interest and Biology Achievement: The Mediating Role of Scientific Creativity in 5E Constructivist Instruction

3.2 Sample

The sample comprised 300 secondary school students (Standards IX-X) from Patna, Bihar, divided equally into experimental (n=150) and control (n=150) groups, with balanced gender representation.

3.3 Instruments

Scientific Creativity Test: Standardized tool of Beqer Mehdi, measuring fluency, flexibility, and originality.

Scientific Interest Inventory: Developed and standardized by the researcher, measuring:

- Interest in Biological Content (Content Interest)
- Interest in Biological Activities (Activity Interest)
- Interest in Biological Careers (Career Interest)
- Interest in the Utility of Biology (Utility Interest)

The inventory demonstrated good reliability (Cronbach's $\alpha = 0.87$) and construct validity through factor analysis.

Achievement Test in Biology: Researcher-developed and standardized (**Cronbach's $\alpha = 0.85$**).

3.4 Procedure

1. Pretest: Administration of all three instruments

2. Intervention: Six-week instruction using 5E approach (experimental) vs. traditional method (control)

3. Posttest: Administration of all three instruments

3.5 Data analysis

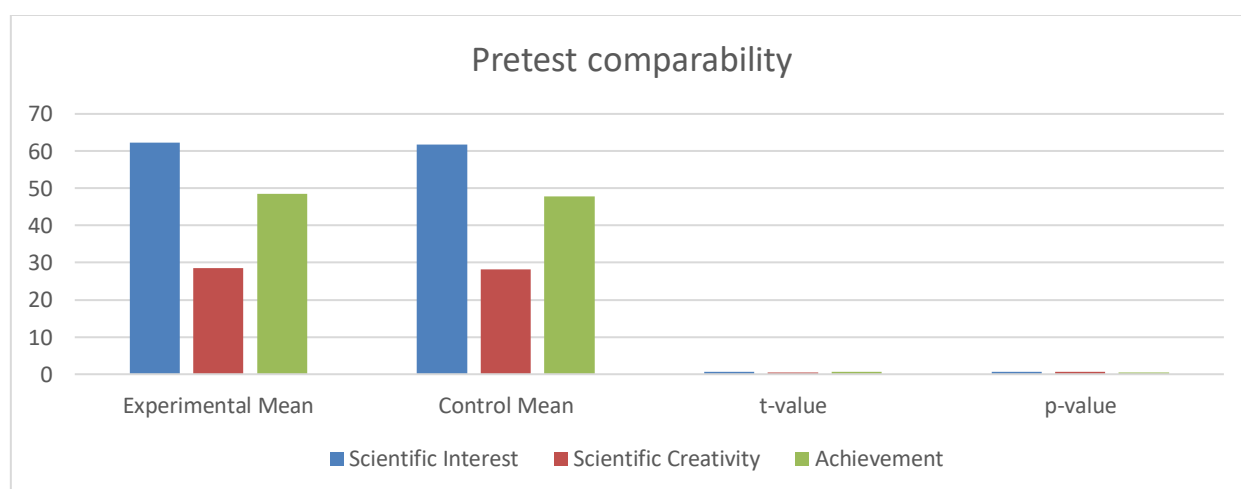
- Descriptive statistics
- Independent samples t-test
- ANCOVA
- Pearson correlation
- Multiple regression

4. Results

4.1 Pretest comparability

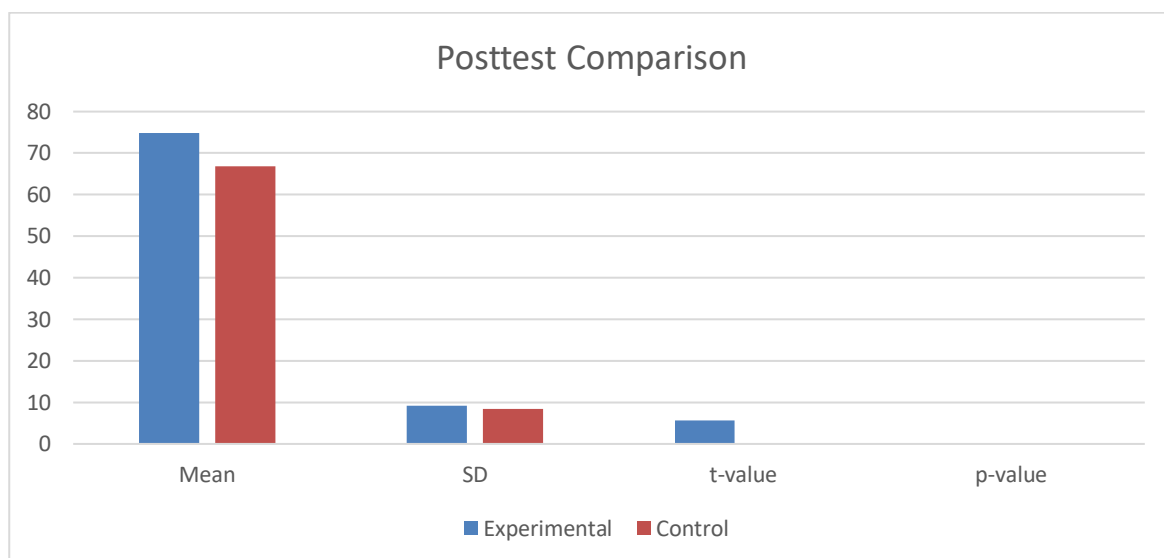
4.2 Scientific Interest

Variable	Experimental Mean	Control Mean	t-value	p-value
Scientific Interest	62.30	61.75	0.57	0.569
Scientific Creativity	28.45	28.12	0.52	0.604
Achievement	48.50	47.90	0.68	0.497



Posttest Comparison:

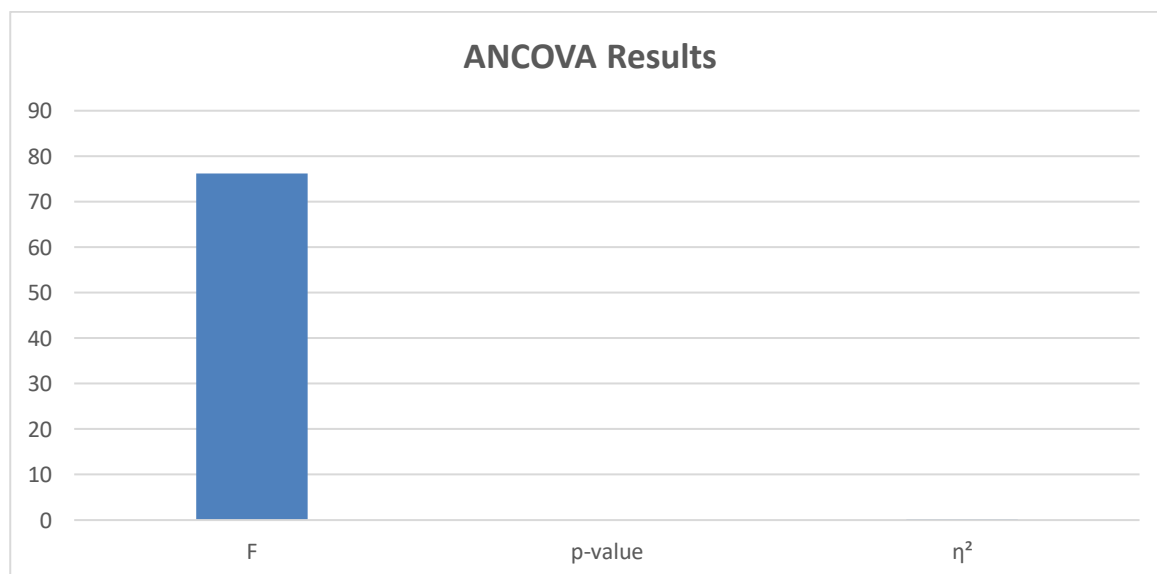
Group	Mean	SD	t-value	p-value
Experimental	74.80	9.20	5.63	<0.001
Control	66.90	8.50		



Gain: Experimental 20.1% vs. Control 8.3%

ANCOVA Results:

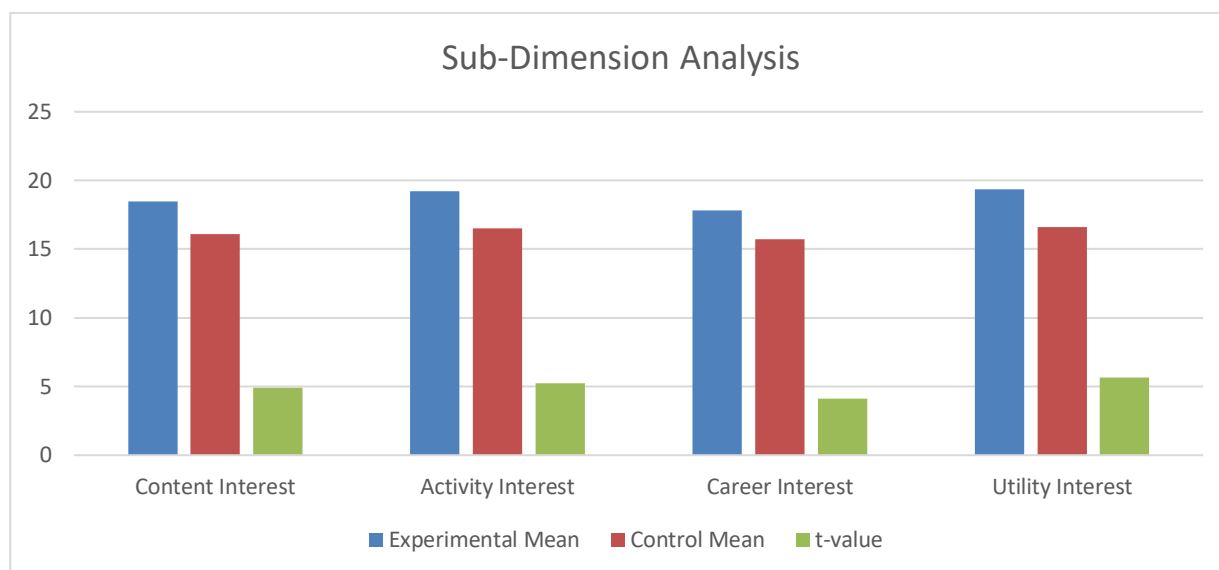
Source	F	p-value	η^2
Group	76.24	<0.001	0.20



Sub-Dimension Analysis:

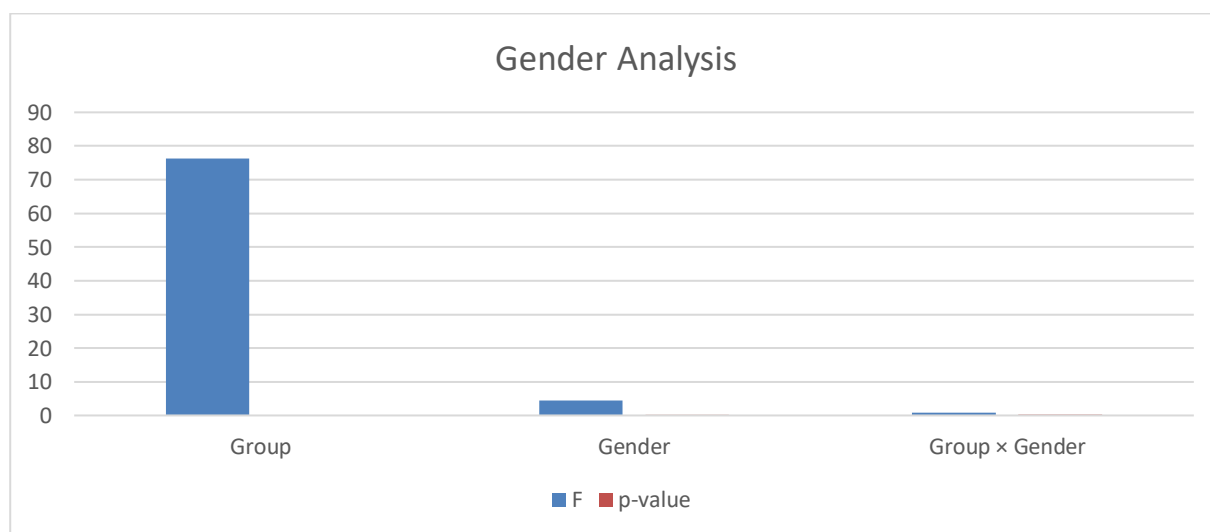
Dimension	Experimental Mean	Control Mean	t-value
Content Interest	18.45	16.10	4.89
Activity Interest	19.20	16.50	5.23
Career Interest	17.80	15.70	4.12
Utility Interest	19.35	16.60	5.67

$p < 0.01$



4.3 Gender Analysis for Scientific Interest

Source	F	p-value
Group	76.24	<0.001
Gender	4.52	0.034
Group × Gender	0.88	0.349

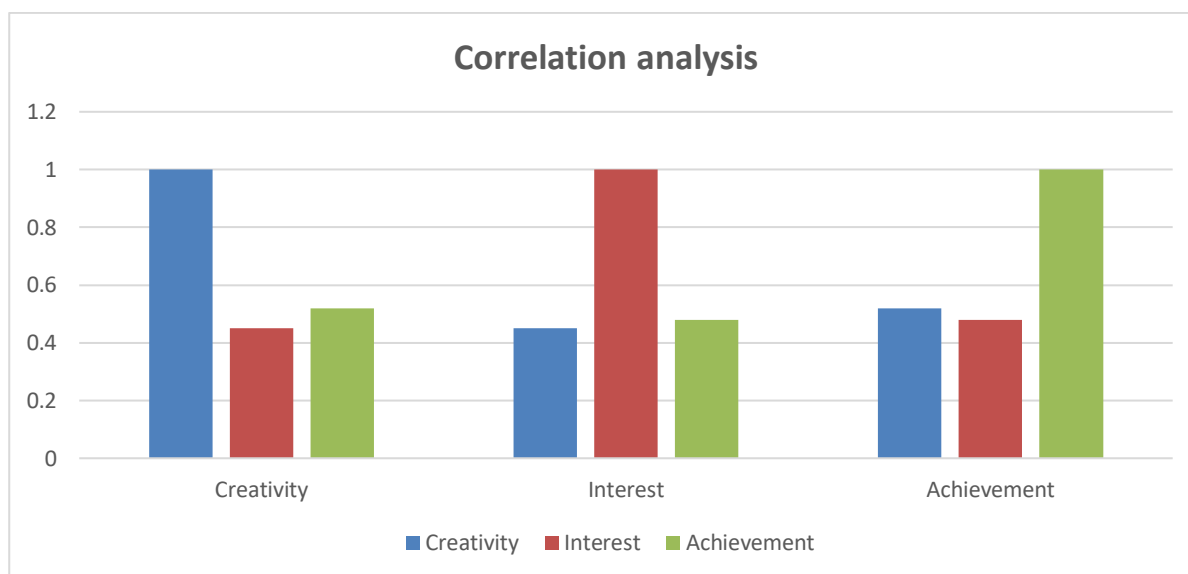


The non-significant interaction indicates that the 5E approach was equally effective for boys and girls. The significant main effect for gender suggests girls scored slightly higher on interest overall.

4.4 Correlation analysis

Variable	Creativity	Interest	Achievement
Creativity	1.000	0.45	0.52
Interest	0.45	1.000	0.48
Achievement	0.52	0.48	1.00

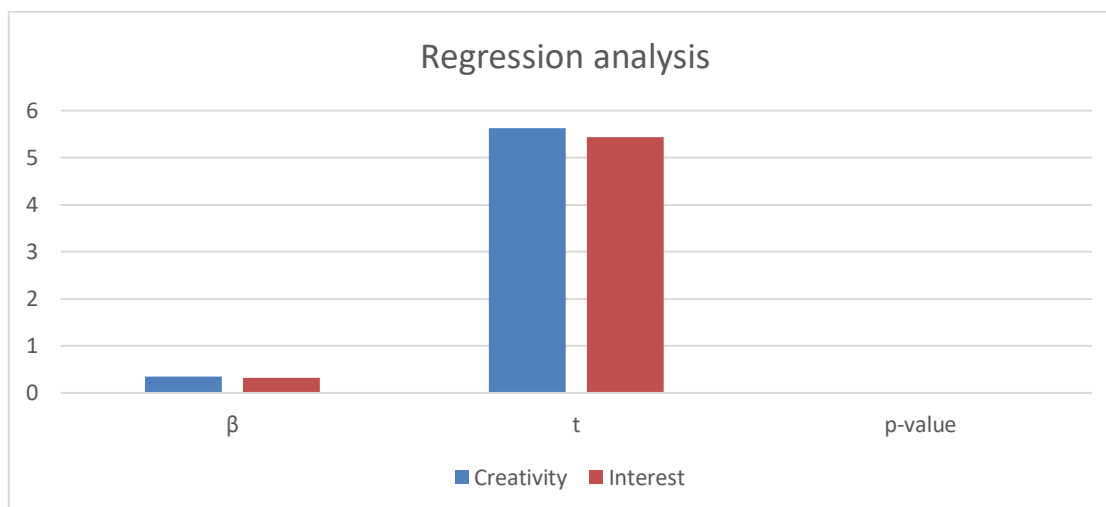
$p < 0.01$



4.5 Regression analysis

Predictor	β	t	p-value
Creativity	0.35	5.63	<0.001
Interest	0.32	5.43	<0.001

$R^2 = 0.34$, Adjusted $R^2 = 0.33$, $F(2,297)=76.45$, $p<0.001$



Both creativity and interest were significant predictors of achievement, together explaining 34% of the variance.

5. Discussion

5.1 Enhancement of scientific interest

The significant improvement in scientific interest ($\eta^2=0.20$) indicates that the 5E approach effectively stimulates and sustains interest in biology. The engagement phase captures attention and stimulates curiosity through interesting phenomena or intriguing questions. The exploration phase provides hands-on experiences that make learning concrete and relevant. The elaboration phase connects learning to real-world applications, demonstrating the utility of biological knowledge.

The enhancement of all four interest sub-dimensions is particularly noteworthy. Content interest increased, suggesting students developed greater appreciation for biological concepts. Activity interest improved, indicating enjoyment of hands-on learning. Career interest grew, suggesting students considered biology-related careers. Utility interest enhanced, indicating recognition of biology's relevance to everyday life. These findings align with previous research on the effectiveness of the 5E model in stimulating interest.

5.2 Interrelationships between variables

The moderate positive correlations between creativity, interest, and achievement suggest these constructs are related but distinct. Students who are more creative in science tend to be more interested and achieve better. The correlation between interest and achievement ($r=0.48$) is consistent with motivational theories emphasizing the role of interest in learning outcomes.

The regression analysis revealed that both creativity and interest are significant predictors of achievement, explaining 34% of the variance. This suggests that fostering creativity and interest can contribute to enhanced achievement. The finding that creativity is a predictor of achievement is particularly significant, as creativity has often been viewed as separate from academic performance. These results align with the constructivist approach-based teaching-learning study which found that such approaches not only enhance cognitive domains but also increase emotional domains like interest.

5.3 The mediating role of scientific creativity

The finding that creativity predicts achievement ($\beta=0.35$) and is correlated with interest ($r=0.45$) suggests that creativity may mediate the relationship between interest and achievement. Students who are interested in biology are more likely to engage in creative thinking, which in turn contributes to better achievement. This suggests that fostering interest may enhance creativity, and that both contribute to academic success.

The 5E approach, with its emphasis on exploration, elaboration, and open-ended problem-solving, provides conditions conducive to the development of both creativity and interest. The engagement phase stimulates curiosity and interest. The exploration phase supports creative thinking through inquiry and investigation. The elaboration phase promotes transfer and application, reinforcing both interest and creativity.

5.4 Gender inclusivity

The non-significant interaction between group and gender indicates that the 5E approach was equally effective in enhancing interest for both boys and girls. This is consistent with the findings of Abza et al. (2026), who found that the positive effects of the 5E-GIBL model were consistent across genders. The significant main effect for gender (girls scoring slightly higher on interest) is consistent with research showing girls often perform well in biology. However, the absence of differential effectiveness suggests that the 5E approach supports both genders equally.

6. Conclusion

This study demonstrates the effectiveness of the 5E constructivist approach in enhancing scientific interest and achievement in biology at the secondary level. The findings support the interconnectedness of cognitive, affective, and creative outcomes in science learning. Scientific creativity plays a significant mediating role in the relationship between interest and achievement, suggesting that fostering creativity can contribute to both interest development and academic success.

The study has implications for educational practice. Teachers should adopt the 5E model to foster interest, creativity, and achievement in biology. The engagement and elaboration phases are particularly important for developing interest and relevance. The exploration phase supports creative thinking through hands-on inquiry. The explanation and evaluation phases promote understanding and monitor learning.

The findings also have implications for teacher education and curriculum development. Teacher education programs should train pre-service teachers in constructivist pedagogy and the 5E model. Curriculum developers should incorporate the 5E framework into instructional materials. Policymakers should support pedagogical reform that emphasizes inquiry-based, student-centered learning.

Future research should examine the long-term effects of the 5E approach on interest development and career choices in STEM fields. Qualitative studies could provide insights into the processes underlying the observed relationships. Studies across different contexts and subjects would support the generalizability of the findings.

References

1. Adak, S. (2017). Effectiveness of constructivist approach on academic achievement in science at secondary level. *Educational Research and Reviews*, 12(22), 1074–1079.
2. Bybee, R. W. (1997). *Achieving scientific literacy: From purposes to practices*. Heinemann.
3. Chao, K. P. (2024). Effects of information technology integrated into 5E inquiry instruction on the learning achievement and attitude of junior student in biology learning: Taking "immune system" as an example. *Journal of Education Research*, 38(2), 145–167.
4. Mehdi, B. (1973). *Verbal and non-verbal test of creative thinking*. National Psychological Corporation.
5. Nabie, A. (2025). Effects of teacher's use of 5E instructional model on secondary school student's achievement in biology in Vihiga County, Kenya. *MMUST Institutional Repository*.
6. Piaget, J. (1950). *The psychology of intelligence*. Routledge.
7. Polanin, J. R., Austin, M., Taylor, J. A., Steingut, R. R., Rodgers, M. A., & Williams, R. (2024). Effects of the 5E instructional model: A systematic review and meta-analysis. *AERA Open*, 10(1). <https://doi.org/10.1177/23328584241276191>
8. Pravithalakshmi, P. (2010). Effectiveness of constructivist approach on creativity in Hindi at secondary level. *Indian Educational Review*, 48(1), 45–63.
9. Rajasree, R. (2013). Science creativity of students taught using McCormack and Yager Taxonomy and Bloom's Taxonomy. *Journal of Educational Research*, 8(2), 112–125.
10. Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.