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Impact of the Constructivist Approach on Academic Achievement in Science Among Secondary School Students

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Abstract

The study explores the influence of the constructivist teaching approach on the academic performance of secondary school students in science subject within Arunachal Pradesh. Adopting a quasi-experimental design, the research involved 30 Class IX students, designated as the experimental group. This group was taught using the constructivist method based on the 5E Model that is Engage, Explore, Explain, Elaborate, and Evaluate. After the intervention, an achievement test, developed by the researcher, was administered. Statistical analysis indicated no significant differences in academic achievement between boys and girls in the experimental group. The findings suggest that the constructivist approach supports equitable learning outcomes, promoting critical thinking and a deeper understanding of concepts for all students, regardless of gender. The study underscores the importance of integrating constructivist strategies into teaching practices, teacher training programs, and curriculum development to foster interactive, equitable, and effective educational experiences. It also highlights the potential of this approach to improve science education and recommends expanding research to include various subjects and regions for broader applicability.

Keywords: Constructive, Gender, Academic Achievement, Experimental groups.

Introduction

The Indian Education system has undergone transitions in its centuries old traditions from time to time to achieve the highest essence of being educated. The gradual and progressive movement from idealism to pragmatism and finally to naturalism, shows a deliberative movement to bring education near to the

nature within and outside the individual. But these revolutionary changes didn't occur suddenly. It took the efforts of generations of revolutionary educators to bring us to the current stage of education as equal for all.

When we think of education, the image that often comes to mind is a classroom with a teacher, students, and a curriculum. The classroom serves as a space where the teacher's knowledge, values, and confidence are conveyed to the learners. However, traditional classroom practices were typically characterized by a rigid, teacher-centred approach. The teacher imposed strict rules and expectations, which were designed to enforce discipline through fear and compliance. Such an approach proved inflexible, making it difficult for students with diverse backgrounds or disabilities to fully engage. Additionally, the curriculum often failed to keep pace with students' evolving needs, focusing more on memorization rather than promoting higher-order thinking skills. In these traditional models, the teacher was at the centre of the teaching-learning process, while the student took a secondary, passive role. These challenges highlight the shortcomings of an authoritarian classroom management style.

Recent advancements in India's education system have increasingly adopted a student-centred approach, guided by the recommendations of the National Curriculum Framework (NCF) 2005 and the National Education Policy (NEP) 2020. These reforms highlight the teacher's role as a facilitator, positioning students as active participants and key agents in the learning process. The emphasis has shifted towards implementing innovative teaching methods that promote active engagement and critical thinking. Among these strategies, constructivism has gained prominence as a preferred pedagogical approach, prioritizing hands-on, inquiry-driven learning to enhance conceptual understanding and skill development.

The constructivist approach emphasizes that learners construct their own knowledge and understanding of the world through experiences and reflection. This approach moves away from passive reception of information and encourages active learning. Teachers using constructivist methods incorporate real-life examples to help students understand concepts more clearly, providing opportunities for engagement in innovative activities. It fosters a shift from teacher-centred to learner-centred teaching, with the child positioned at the heart of the educational process.

In today's context, education has become a global concern, with a focus on preparing students to cope with emerging challenges and to raise their standards of living. Effective teaching and learning practices are now seen as vital to meeting these demands. For classroom practices to be more effective, there must be a deep understanding of how students learn. Learning is most successful when students are given opportunities to articulate and clarify their ideas. Therefore, pedagogy today demands teaching strategies that encourage student involvement, with a focus on knowledge construction rather than simple knowledge transmission.

Constructivism is a theory rooted in observation and scientific study, emphasizing that individuals build their understanding and knowledge of the world through experiences and reflection on those experiences. It fosters the development of advanced skills, including critical thinking, analysis, evaluation, and creativity. Constructivism encourages the consideration of diverse perspectives, prompting students to reflect, assess their work, and identify the skills they need to acquire based on their learning requirements.

This approach keeps students actively engaged in the classroom, making them active participants in the process of constructing knowledge.

The 5E Model, grounded in constructivist principles, provides a systematic framework to facilitate active student engagement with learning content. This model is composed of five stages: Engage, Explore, Explain, Elaborate, and Evaluate. It enables students to link their prior knowledge with new concepts, investigate their ideas, and deepen their understanding through application and elaboration. This structured methodology supports the construction of knowledge and has gained widespread recognition for its effectiveness in fostering student-centered learning. Furthermore, it promotes the development of essential 21st-century skills, including critical thinking, communication, collaboration, and creativity. By implementing the constructivist-aligned 5E instructional model, both students and educational practices can systematically address these skills to meet the demands of 21st-century education (Booker & Kopp, 2013).

Science, being a compulsory subject in schools, often suffers from a lack of student interest and motivation, which leads to poor academic achievement. In Arunachal Pradesh, the education system is predominantly teacher-centred, focusing on knowledge transmission rather than construction. Traditional teaching methods, often dominated by lectures or direct instruction, leave little room for student engagement. These methods assume that students must accept information passively, without questioning the instructor. This approach has proven ineffective in fostering meaningful learning. With the advent of child-centred teaching-learning approaches, several innovative strategies have emerged to make education more engaging and effective. The constructivist approach stands out as a revolutionary shift, moving the focus from the teacher to the student. The 5E Model of instruction aligns with this shift by attending to various learning theories and learning styles. It provides a clear sequence of steps that encourage students to actively participate in their learning, fostering both individual and collaborative knowledge construction. Each phase of the model contributes to the learning process, ensuring that students are engaged in meaningful activities tailored to their individual needs and learning styles.

Thus, this study seeks to shed light on the current practices in science teaching and, through its findings, provide direction for making the subject more engaging and meaningful for students. Through the adoption of constructivist methodologies, this study aims to support the broader initiative of enhancing science education and creating a more interactive, student-focused learning environment in Arunachal Pradesh.

Objective of the study

1. To examine the impact of the Constructivist Approach on the achievement scores of boys and girls in the experimental group.

Hypothesis of the study

$H_0$1: There is no significant difference in the achievement scores of boys and girls in the experimental group as a result of the Constructivist Approach.

Sample of the study

The sample for the study was drawn from IX-grade students at the government secondary school in Mirku. A total of 30 students were selected, comprising 13 boys and 17 girls.

Table 1.1 Details of distribution of the sample

Group(sample)	Boys	Girls	Total
Experimental Group	13	17	30

Research design

For the present study the researcher has employed a quasi- experimental design.

Variables of the study

Independent Variable: In this study the constructive teaching were taken as independent variable. The Constructivist teaching, which consists of 5 stages: engagement, exploring, explanation, elaborate and evaluate.

Dependent Variable: In this study the Achievement test was taken as dependent variable. It is to be tested whether the independent variable constructivist approach would have an effect on achievement in science.

Tools used in the study

The researcher employed following tools for the present study

1. Lesson plan based on Constructivist Approach: 5E model (Engage, Explore, Explain, Elaborate, and Evaluate) developed by the researcher.
2. Achievement test in science of IX standard developed by the researcher.

Analysis and interpretation

Objective of the Study

1. To examine the impact of the Constructivist Approach on the achievement scores of boys and girls in the experimental group.

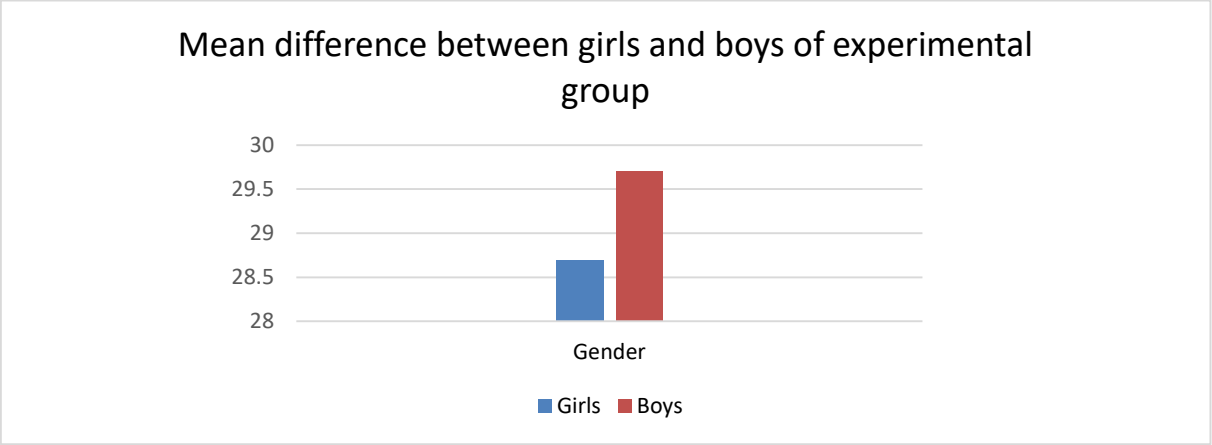
Hypothesis of the study

$H_0$1: There is no significant difference in the achievement scores of boys and girls in the experimental group as a result of the Constructivist Approach.

Table 1.2: Mean, SD and 't' value of Boys and Girls students of experimental group as a result of constructive approach.

Gender	**Mean**	**N**	**SD**	**SEM**	**SE_D**	**t value (computed)**	**t value at 0.05 (tabulated)**	**Remarks**
Girls	28.7	17	4.39	1.066	1.50	0.66	2.05	Not significant
Boys	29.7	13	3.85	1.069				

Graph 1.1: Mean, SD and 't' value of Boys and Girls students of experimental group as a result of constructive approach.



The above table no. 1.2 reveals that the computed 't' value is 0.66 which is less than the critical t-value 2.05 at 0.05 level of significance for df 28. Therefore, the formulated hypothesis *"There is no significant difference in the achievement scores of boys and girls in the experimental group as a result of the Constructivist Approach"* is accepted. It is concluded that there is no significant difference between the Achievement level of Boys (mean=29.7) and Girls (mean=28.7).

Findings

The study found no significant difference in the academic achievement scores of boys and girls as a result of the constructivist approach. The results suggest that both boys and girls in the experimental group performed almost equally on their post-tests. However, a comparison of the mean scores indicates that boys slightly outperformed their female counterparts. This finding suggests that gender does not play a significant role in enhancing academic achievement when using the constructivist approach. Instead, the approach appears to benefit all students equally, regardless of gender.

Educational implications

1. **Academic Implications**: The findings of this study highlight that the constructivist approach fosters equal academic achievement among boys and girls students, suggesting that this teaching methodology can effectively bridge gender gaps in learning. Incorporating such approaches into science education can enhance students' conceptual understanding and critical thinking skills.
2. **Pedagogical Implications**: Teachers should be trained to adopt constructivist methods, such as the 5E Model, to create an interactive and engaging classroom environment. Professional development programs should emphasize the design of lesson plans that encourage exploration, discussion, and reflection among students.
3. **Policy Implications**: Educational authorities in Arunachal Pradesh and similar regions should promote the integration of constructivist teaching strategies in the curriculum. Teacher training institutes should include constructivist pedagogy as a core component of their programs to prepare future educators for 21st-century classrooms.

4. **Societal Implications**: By fostering critical thinking, problem-solving, and collaborative skills, constructivist approaches prepare students to become competent and confident individuals. Such educational reforms can contribute to the overall development of society by nurturing future-ready citizens.

Conclusion

This study emphasizes the effectiveness of the constructivist approach in science education, demonstrating that it equally benefits both boys and girls in terms of academic achievement. The findings validate that gender does not play a significant role in determining academic outcomes when students are exposed to a constructivist learning environment. By engaging students in active knowledge construction, this method encourages deeper understanding and retention of scientific concepts. As education evolves to meet 21st-century demands, the adoption of constructivist methodologies offers a promising pathway to creating inclusive, equitable, and effective learning experiences for all learners.

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