https://doi.org/ 10.33472/AFJBS.6.10.2024.5159-5167

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

EFFECT OF CONSTRUCTIVIST LEARNING APPROACH ON THE ACHIEVEMENT OF STUDENTS IN BIOLOGY

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Article History

Volume 6,Issue 10, 2024

Received:29 Apr 2024

Accepted : 30 May 2024

doi: 10.33472/AFJBS.6.10.2024.5159-5167

Abstract: The current study looked into how students' biology achievement was affected by a constructivist learning approach. 90 students in class 11th participated in the research. Pre-test post-test control group design was employed for the investigation. An intervention program based on the authors' constructive learning method (5E Model) and a biology achievement exam were employed for the investigation. The pre- and post-test results of the control and experimental groups were compared using the t-test. The study's findings showed that both groups were equal prior to the intervention program. The biological achievement of the students in the experimental and control groups differed significantly, and the experimental group's performance before and after the intervention program differed significantly as well. This suggests that using a constructive learning method helped students score better in biology.

Keywords: constructive learning approach, achievement, students, 5E Model, biology achievement exam, t-test,

Introduction

Constructivism is an educational theory that arose from Piaget's research. It is a hypothesis about how individuals learn that is based on scientific research and observation. Constructivism is a set of explanations for how learners, as individuals, adapt and enhance information [1]. It is predicated

on the idea that knowledge is something that students actively generate in their minds rather than something that can be imparted by an instructor or learned from books in a classroom [2-4].

The construction of meaning and knowledge is done by learners. It's a method of learning where the student integrates new knowledge with what they've already learned. According to the theory, when learners interact with ideas or events they encounter, they construct their own knowledge based on what they already know [5]. It turns the student from being a passive information consumer into an engaged participant in the educational process. Furthermore, learning that expands on prior knowledge increases students' motivation and interest in addition to their retention. This approach allows the learners to have more control over their own learning, to think analytically and critically, and to work collaboratively [6-9].

Students are engaged in active, collaborative learning in a constructivist classroom, which supports the presenting of information in this manner. In a constructive learning environment, a teacher's main responsibility is to convert the material to be learnt into a format that fits the student's level of comprehension at that moment [10]. In the constructive learning method, the instructor poses questions, tracks student progress, directs student research, and encourages the development of novel thought processes. In a collaborative learning atmosphere, he assists the students in formulating and testing their ideas, drawing conclusions and inferences, and sharing their knowledge. Serving as a coach, mentor, and helper, the helps students build and evaluate their knowledge and, consequently, their learning [11]. Instead of mindlessly absorbing information from the instructor or the textbook, students actively develop their knowledge while being constantly guided by the teacher. In brief, a constructivist educator employing constructivist teaching methodology guides students from fact memorization to comprehension; from textbook-based to hands-on learning; from abstract content to real-world problem content; from lecture-style instruction to interactive style instruction; from teacher-imposed to student-discovery information; and from product-oriented to process-oriented learning [12].

Need of the study

Throughout the past twenty years, a growing number of scientists and educators have acknowledged the significance of scientific education. A lot of science educators have pushed for an inquiry-based science curriculum that allows students to actively construct their scientific knowledge through planning, investigating solutions, formulating broad questions, creating new knowledge, and reflecting on their own inquiry process states that the National Council of Educational Research and Training's 2005 National Curriculum Framework (NCF) advocates a paradigm change from rote remembering to learning by understanding [13].

It implies that educational institutions ought to support students in creating their own knowledge and develop their capacity for independent thought so they can handle challenges in their daily lives. Over the course of their life, students should be able to study on their own, gain experiences, and apply what they have learned to a variety of scenarios [14]. This creative method has shown

to be a very effective model for improving students' cognitive skills as well as their attitudes, self-confidence, and capacity to make decisions. However, it seems that constructivism's theory and educational practice diverge. Less focus is placed on implementing constructivism in the classroom, with the majority of Indian schools and instructors sticking to their conventional methods of instruction [15]. Therefore, an effort has been made by the investigators to find out the effect of constructivist learning approach on the achievement of students in biology at Jaipur district of State Rajasthan [16].

Objectives

1. To study the achievement of students in biology of experimental group and control group before intervention programme.
2. To study the achievement of students in biology of experimental group and control group after intervention programme.
3. To study the achievement of students in biology of experimental group before and after intervention programme.
4.

Hypotheses

1. There exists no significant difference between achievement of students in biology of experimental group and control group before intervention programme.
2. There exists no significant difference between achievement of students in biology of experimental group and control group after intervention programme.
3. There exists no significant difference between achievement of students in biology of experimental group before and after intervention programme.

Research Methodology

The study in hand aimed to study the effect of constructive learning approach on the achievement of students in biology. Keeping in view the nature, objectives and main purpose of the study experimental method was used by the investigator.

Design of the study

For the present study, pre-test post-test control group design was used. It involved two groups of students, experimental and control group. Intervention programme was given to experimental group, whereas no treatment was given to control group.

Sample of the Study

In the study, a sample of 90 students studying in class IX was drawn randomly.

Tool & Statistical Techniques used in the Study

In the present study achievement test in biology has been used. Mean, SD and t-test has been used to compare pre-tests and post-tests of control and experimental groups.

Results

$H_0$1 - There exists no significant difference between achievement of students in biology of experimental group and control group before intervention programme.

Table 1: Difference of Means in the Pre-test Scores of Experimental and Control Group Students on achievement in biology

Group	**Test**	**N**	**M**	**SD**	**t-value**	**Result**
Experimental Group	Pre	45	19.58	3.37	0.76	Accepted
Control Group		45	19.10	2.54		

Table 1 presents a comparison of pre-test scores between an experimental group and a control group regarding their achievement in biology. The mean pre-test score for the experimental group is 19.58, with a standard deviation (SD) of 3.37, while the mean pre-test score for the control group is 19.10, with a SD of 2.54.

The calculated t-value of 0.76 indicates that there is no significant difference between the pre-test scores of the experimental and control groups. This conclusion is drawn by comparing the calculated t-value to the critical value of t at a 0.05 level of significance. Since the calculated t-value is less than the critical value, the null hypothesis (hypothesis-1) is accepted. This acceptance implies that there is no statistically significant difference in the achievement of students in biology between the experimental and control groups before the intervention program.

The similarity in mean pre-test scores between the experimental and control groups suggests that, initially, both groups had comparable levels of achievement in biology. This indicates that any differences observed in post-test scores between the two groups can be attributed to the intervention program rather than pre-existing disparities in knowledge or ability.

These findings have implications for understanding the baseline performance of students and assessing the effectiveness of intervention programs. By establishing that there was no significant difference in achievement levels before the intervention, researchers can more confidently attribute any changes in performance to the intervention itself.

Educators and policymakers can use this information to design targeted interventions aimed at improving student learning outcomes in biology and other subjects. Additionally, further research could explore factors influencing pre-test performance and investigate how different intervention strategies impact student achievement over time.

$H_0$2 - There exists no significant difference between achievement of students in biology of experimental group and control group after intervention programme.

Table 2: Difference of Means in the post-test Scores of Experimental and Control Group Students on achievement in biology

Group	**Test**	**N**	**M**	**SD**	**t-value**	**Result**
Experimental Group	post	45	28.93	5.81	8.57	Rejected
Control Group		45	20.41	3.28		

Table 2 presents a comparison of post-test scores between an experimental group and a control group in the context of their achievement in biology. The mean post-test score for the experimental group is 28.93, with a standard deviation (SD) of 5.81, while the mean post-test score for the control group is 20.41, with a SD of 3.28.

The calculated t-value of 8.57 indicates a significant difference between the post-test scores of the experimental and control groups. This significance is confirmed by comparing the calculated t-value to the critical value of t at a 0.01 level of significance. As the calculated t-value exceeds the critical value, the null hypothesis (hypothesis-2) is rejected. This rejection implies that there is a statistically significant difference in the achievement of students in biology between the experimental and control groups after the intervention program.

The higher mean post-test score of the experimental group (28.93) compared to the control group (20.41) suggests that students who underwent the intervention program performed better in biology. This indicates the effectiveness of the intervention program in enhancing student achievement. The difference in mean scores between the experimental and control groups (16.98 for experimental group and 13.3 for control group) further underscores the superior performance of the experimental group.

These findings highlight the positive impact of the intervention program on student learning outcomes in biology. The experimental group's superior performance compared to the control group suggests that the instructional methods or materials used in the intervention program were effective in facilitating learning and improving student achievement.
Educators and policymakers can use these results to inform decisions about implementing similar intervention programs aimed at enhancing student learning outcomes in biology and other subjects. Further research could delve into the specific aspects of the intervention program that contributed to its effectiveness and explore its long-term impact on student performance and retention of knowledge.
$H_0$3 - There exists no significant difference between achievement of students in biology of experimental group before and after intervention programme.
Table 3: Difference of Means in the Pre-test and Post-test Scores of Experimental Group on achievement of students in biology

Group	**Test**	**N**	**M**	**SD**	**t-value**	**Result**
Experimental Group	Pre	45	19.58	3.37	13.34	Rejected
	Post	45	28.93	5.81		

The table 3 presents a comparison of pre-test and post-test scores of an experimental group in biology, indicating the impact of an intervention program on student achievement. The mean pre-test score of the experimental group is 19.58, while the mean post-test score significantly increases to 28.93. Additionally, the standard deviation (SD) for pre-test scores is 3.37 and for post-test scores is 5.81.

The calculated t-value of 13.34 indicates a significant difference between pre-test and post-test scores. This is confirmed by comparing it to the critical value of t at a 0.01 level of significance. Since the calculated t-value exceeds the critical value, the null hypothesis (hypothesis-3) is rejected. The rejection of the null hypothesis implies that there is a statistically significant difference in student achievement in biology before and after the intervention program.

This result suggests that the instructional material developed for the intervention program effectively enhances student achievement in biology. The increase in mean post-test scores indicates that the intervention program positively impacted student learning outcomes. This could be attributed to various factors such as the effectiveness of the instructional material, the teaching methods employed during the intervention, or increased student engagement with the subject matter.

Overall, the findings from this study provide evidence supporting the effectiveness of the intervention program in enhancing student achievement in biology. Such results are valuable for educators, curriculum designers, and policymakers in designing and implementing effective educational interventions aimed at improving student learning outcomes. Additionally, further research could explore the specific aspects of the intervention program that contributed to its effectiveness and examine its long-term impact on student achievement and retention of knowledge.

Discussion of Results

From the analysis of the results, it is clear that

- Before giving intervention programme both the groups were equivalent. So the effectiveness of the intervention programme can be easily predicted.
- There exists a significant difference between achievement of students in biology of experimental group and control group after intervention programme. It reflects that the intervention programme was quite effective.
- There exists a significant difference between achievement of students in biology of experimental group before and after intervention programme. It shows that the intervention programme was effective.

Educational Implications

Constructivist education is centered on the learner, emphasizing the need of reflection, metacognition, and resolving cognitive conflicts in addition to prior knowledge and experiences.

Students build their knowledge via building. Reacting to the thoughts and responses of students is a skill that teachers acquire. The current study has consequences for educators, administrators, curriculum designers, and students. Constructivist learning theory includes a process of learning in which students draw their own conclusions with the teacher's creative assistance. The ideal method to organize lesson plans, instructor activities, and study techniques for the students is to design a curriculum that lets each student figure out issues on their own while the teacher keeps an eye on them and provides flexible guidance to the right solution. As a result, curriculum designers have to include the exercises or challenges that apply constructivism theory to real-world classroom scenarios.

Through encouraging professional development events, administrators, instructors, and student teachers of all grades and disciplines may learn about the philosophy and principles of constructivist teaching. In constructivist professional development workshops, educators should serve as role models for learning activities that teachers may use in their own classrooms or that provide them first-hand experience.
The main duty of educators is to provide a cooperative learning environment where students are free to build their own knowledge. They ought to start conversations and debates in groups so that students may express their own ideas. In order to help students become better problem solvers, they should create a link between new and prior information. Instead of using issues that are primarily significant to the educational system and pupils, they ought to employ issues that are significant to the students. To enable them to draw lessons from the integration of their experiences, students ought to have access to data, original sources, and opportunities for peer interaction. Teachers should provide a democratic learning environment for their pupils by treating them with kindness and consideration.

Lastly, we can state that constructivism can be one of the most applicable and useful approaches to theories and practices in education if educational institutions are to move beyond the laboratory of academics and become a laboratory of creating pedagogy of learning along with content mastery and joyful learning, developing empathy, understanding, and compassion, and transforming a "well-formed mind" to a "well filled-in mind."

Conclusion

constructivist education places the learner at the center, emphasizing reflection, metacognition, and resolving cognitive conflicts. This approach requires teachers to facilitate learning by encouraging students to draw their own conclusions with creative assistance. Professional development events are crucial for educators to grasp the philosophy and principles of constructivist teaching, fostering a cooperative learning environment where students are free to build their own knowledge. By integrating real-world scenarios and prioritizing student significance, constructivism can revolutionize educational practices, fostering empathy, understanding, and compassion while promoting active engagement and meaningful learning experiences.

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