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Impact of Collaborative Learning on Students' Academic Achievement at the Secondary Level

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Abstract: Collaborative learning" is a word used to describe a wide variety of instructional approaches that include students' or students' and instructors' shared intellectual activity. Students generally collaborate in groups of two or more, either to create a product or to gather information, solutions, or interpretations. The study targeted the two groups of Biology students; one group was taught through a collaborative learning method, and the second one through a traditional method. In this way, their academic achievements were to be compared through experimental treatment. Those taught using traditional methods of teaching. Target participants were the secondary school students enrolled in the Biology subject from the tehsil Dhirkot in the district Bagh. The study was conducted at a local high school after getting consent from the authorities. Thirty-eight 9th-grade female students were placed into two groups depending on the results of their pre-test: experimental and control. The pair-random sampling technique was used for this process. The study implemented a pre-test and post-test control group design. The data was analyzed through a t-test. The study found that collaborative learning is more effective than traditional methods for improving the academic achievement of Biology students.

Keywords: Collaborative Learning, Academic Achievement, Secondary Education

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Introduction

Nwosu (2015) describes science as an organized and reasonable approach to comprehending how the universe operates. The scientific method involves testing and analyzing data to get measurable findings. According to Ullah et al. (2018), the scientific method not only seeks knowledge about global opinions and preferences but also aims to question them through study. Biology is a scientific subject matter taught in secondary schools that emphasizes scientific learning. The study of life, or more specifically, plants and animals, is known as Biology. Biology is a vast field that encompasses everything from the intricate chemical processes that occur inside cells to the larger concepts of ecosystems and climate change. The primary goals of secondary school Biology instruction are for students to complete their education with sufficient laboratory experience, an important and relevant understanding, the ability to apply scientific knowledge to everyday situations involving agriculture as well as their own and community well-being, and acceptable and useful structured attitudes. (Cirfat, 2014).

According to Aninweze (2014), biology is a science that helps people survive in every setting. Biology is an essential ability for kids to succeed in any setting. Biology graduates can pursue careers in veterinary medicine, medicine, biochemistry, and microbiology, among other professions. Exploring these topics necessitates a solid understanding of biology. High success can be attributed to various things, including effective instructional delivery. Bichi et al. (2019)

found that effective teaching techniques can significantly improve learning outcomes, including academic accomplishment. Researchers and educational associations, including the Science Teachers Association of Nigeria (STAN), are promoting pedagogical reforms to improve students' knowledge, skills, and achievement in Biology.

Collaborative learning (CL) remains an educational approach for classroom instruction in which pairs of learners work together to address an issue, finish a task, or create a product. Collaborative learning consists of groups of students collaborating to discover meaning, solve problems, or create learning artifacts. Collaborative learning requires students to exchange ideas for mutual learning. Collaborative learning changes the usual student-teacher dynamic into a student-to-student connection within the classroom (Gisbert et al., 2017). As stated by Ivan (2023), collaborative learning improves students' comprehension of subjects, reshapes concepts, and allows them to hear different viewpoints. This method enables learners to enhance their understanding collaboratively by supporting one another throughout the learning process. Group activities in the classroom enhance student memory of content more effectively than studying by oneself (Atman & Durak, 2022).

Student accomplishment is the extent to which a learner has met their educational objectives for either the short or long term. Achievement refers to the standardized collection of experiences gained by students at the end of their learning journey. It represents the successful completion of a significant task after extensive efforts (Ugwu, 2023). As stated by Ezenwosu & Nworgu (2013), student success in school learning activities is influenced by what they learn in class, laboratories, and fieldwork.

Problem Statement

In Bagh AJ&K tehsil Dhirkot secondary schools, it is normal for the teacher to lecture the class orally without interacting with the learners. Academic achievement and deeper understanding depend on collaborative learning possibilities, which are usually limited by this old approach.

Objective of the study

To find out the difference in the mean score of students taught Biology using a collaborative learning strategy and those taught using a traditional method.

Hypothesis

Ho1: The experimental and control group pre-test scores of students did not differ significantly.
Ho2: The experimental group's pre- and post-test scores of students did not differ significantly.
Ho3: The experimental and control group post-test scores of students did not differ significantly.

Significance of the study

The study's significance, according to the researcher, is to help Biology teachers build an interesting, challenging, and relevant learning environment that will increase students' interest and motivation, encouraging unity among students using small group collaborative learning techniques. This study highlights the value of collaborative learning for students in terms of not only academic accomplishment, but also important 21st-century abilities, including resolving issues, communication, and cooperation. Collaborative learning is an imperative aspect of their education because these skills are necessary for success in the classroom and in their future employment.

Review of Literature

Theoretical Background

Collaborative learning is rooted in the constructivist literature, including the works of Jean Piaget and Lev Vygotsky. Piaget (1926, 1950) acknowledged that the learning environment influenced students' growth; however, this was not crucial to his theory of learning. He believed that interacting with peers in a classroom environment increases learning by exposing pupils to diverse intellectual perspectives. This exposure allows students to reflect on their opinions and viewpoints in relation to those of other group members. Piaget believed that cooperative work creates cognitive conflict, which promotes cognitive progress. This study applies the social constructivism theory of Vygotsky (1978) to better understand the challenges that both students and instructional staff experience in advanced education. The purpose of this investigation was to enhance the researcher's knowledge of new perspectives and problems (Amineh, 2015). Fayaz et al. (2023) define social constructivism as a collaborative learning approach that involves students engaging, discussing, and exchanging knowledge. As stated by Lashari & Umrani (2023), social constructivism theory

suggests that individuals learn best when they collaborate, communicate, and work on projects together. As stated by Imran et al. (2024), collaboration among students, instructors, and peers fosters a common knowledge of the world. Facilitators guide student groups via activities that promote peer learning. This theory aims to promote collaborative learning by encouraging students to solve problems, expand their knowledge, and gain a better understanding of a topic.

Theory of Cognitive Learning

Learning is a way of creating beneficial adjustments in the neurological system or behavior," according to cognitive learning theorist (Piaget,1952). Through absorption and adaptation, this learning takes place. Learning is the process by which a student acquires, moves forward with, and retains or accepts knowledge. Learning is an acknowledged point of view that enables the learner to acquire knowledge, adopt behaviors, and adopt attitudes through observation.

Group Dynamics Theory

The team is a fully cooperative object in which relationships between group members can transform. According to Johnson et al. (1984), cooperative group work involves members relying on one another to complete tasks, creating a dynamic whole in which changes in one member led to changes in others. Additionally, each member's strengths, knowledge, and skills motivate other members to achieve the expected goals.

Social Cognitive Theory

Bandura (2000) and Lave and Wenger (1991) describe cooperation as group members' mutual interrelated reliance in their combined capacity to attain desired objectives. Individuals work together to attain goals that they couldn't accomplish on their own. The core component of this idea is the formulation, guidance, and provision of conceptual structures that result in understanding the material that has been studied, also known as a basic structure. In an ideal situation, the learner would revise, practice, and explain their knowledge to a collaborator. This enhances memory retention and integration with previous information (Wittrock, 1992).

Collaborative Learning

It is vital to explain the term collaboration before describing collaborative learning. It is when individuals work together to address an issue in a coordinated manner. Collaborative learning, "an approach to education where students at all levels of achievement interact in teams to achieve the same objective," Gokhale (1995). In addition, Lakkala (2007) demonstrated that students are active participants in collaborative learning who exchange ideas, work through issues, use a variety of information sources, and generate knowledge. Each member of a group contributes to the group's success while engaging in collaborative activities. To accomplish shared learning objectives, group members collaborate. Daniels & Walker (2001) assert that this kind of learning works well in situations that are challenging and complicated. As a framework, it emphasizes education, comprehension, and the creation of solutions for the issue. Additionally, this kind of instruction places more emphasis on "talking with" than "talking at." With this kind of instruction, students converse, debate, and ultimately create solutions for the issue. Arguments, questioning, and active listening occur during the conversation. The Greenwood Dictionary of Education defines collaborative learning as a form of classroom instruction in which learners collaborate to develop an important task or examine a significant question. In essence, it is a catch-all term for a wide range of learning experiences, from smaller collaborative assignments to further specialized group work. Collaborative learning is demonstrated by a collection of students deliberating on a lecture or a shared task. Zarei and Gilani (2013) describe collaborative learning as the mutual involvement of individuals participating in a concerted effort to tackle a challenge jointly or a circumstance in which multiple individuals study or seek to understand anything collectively and resolve an issue. Barkley et al., (2014) defined collaborative learning as working with other people.

Methodology

This Research was quantitative in nature, focusing on gathering and evaluating numerical data pertaining to student academic accomplishment. It follows an experimental research design, using the pre-test post-test control group

design, where students are split into 2 groups: The treatment group, that was engaged in collaborative learning, and a control group, which was not. Both groups take a pre-test before they receive the treatment, and a post-test is conducted after the intervention to measure the impact of collaborative learning on academic achievement.

Population and Sampling

The study's population was all secondary school Biology students registered in the tehsil Dhirkot of the district Bagh, AJ&K. Creswell (2012) describes sampling as "the method of choosing individuals from a population to contribute in a way that ensures the chosen participants are representative of the entire population. In this study, 38 ninth-grade students of Read Foundation High School, Riyala, were chosen as a sample. All the participants were randomly separated into 2 groups (19 in each). One group was randomly allocated to the treatment group, and the other was the control group.

Instrumentation

In this study, the researcher used a teacher-made test as an instrument. The test covered the 3 levels of Bloom's taxonomy (knowledge, comprehension, and application). This test was drafted from the 9th-grade Biology textbook. The pre-test was carried out prior to teaching with the collaborative method, while the post-test was performed after treatment, which involves instructing the students using collaborative techniques. There are thirty multiple-choice objective questions in the test, each with four alternatives and one correct response.

Validity

According to Golafshani (2003), validity and reliability refer to the instrument's ability to measure what it is supposed to evaluate. The supervisor and MPhil specialist in Biology was face validating the research instrument, and a table of specifications was used for content validation to make sure the item covers the initial 3 levels of the Bloom taxonomy of educational purposes.

Reliability

Reliability shows how well an assessment tool produces consistent and stable findings (Taherdoost, 2018). To evaluate the reliability and clarity of the self-constructed multiple-choice achievement test, a pilot study was held prior to giving the final test to the students. A pilot study was conducted by the researcher with 15 ninth-grade students from Government High School Karnota, Ghaziabad (AJ&K). To estimate reliability, the Cronbach alpha was applied to the data collected during pilot testing. According to Cronbach's Alpha, the reliability was 0.72, which is within the range that is considered appropriate for teaching tools.

Procedure

Students are assigned to the treatment and control groups in this design by a random approach using a pretest. A total of 38 pupils from Class 9th were chosen to participate in this experimental study. By using the paired random sampling procedure, both groups were created. According to the pretest results, these groups were equalized. The pupils' scores on the pretest were listed properly. If the first two students received the same scores, a matched pair was created. With these matched pair participants, the students were later split into experimental and control groups. There were 19 students in the experimental group and another 19 in the control group.

Results

Table 1

Significance of the difference between the mean Achievement Scores of the Control and Experimental Groups on the Pre-test

Group	N	Mean	SD	DF	t-value	Sig-level	P-value
Experimental	19	11.32	3.449	36	-0.409	0.05	0.685
Control	19	11.79	3.691				

Table 1 compares the pretest results of students in the experimental and control groups (t=-0.409, p>0.05). Students in EG (M = 11.32, SD = 3.449) and CG (M = 11.79, SD = 3.691) had no significant difference in average scores. Therefore, prior to starting the real treatment, the experimental and control groups looked nearly similar. As a result, the null hypothesis (The experimental and control group's pre-test scores of students did not differ significantly) is accepted.

Table 2

Significance of the difference between the Mean Achievement Scores of Experimental Groups on Pre-test and post-test

Group	N	Mean	SD	Mean difference	t-value	Sig-level	P-value
Pretest	19	11.32	3.449	10.63	9.521	0.05	.000
Posttest	19	21.95	3.792				

In comparison to the pre-test, the experimental group's scores in the post-test were significantly higher ($t = 9.521$, $p < 0.05$), as seen in Table 2.

Table 3

Significance of the difference between the Mean Achievement Scores of Controls and Experimental Groups on the Post-test

Group	N	Mean	SD	Mean difference	t-value	Sig-level	P-value
Control	19	17.16	3.09	4.79	4.264	0.05	.000
Experimental	19	21.95	3.792				

The post-test revealed a statistically significant difference between the two groups, favouring the experimental group as evidenced by an independent sample t-test result ($t=4.264$, $P=.000$)

Discussion

The study found that compared to the traditional teaching approach, the collaborative learning strategy had a more favorable impact on the academic achievement of pupils in Biology. According to an extensive amount of research, CL strategies are one of the best teaching methods for raising student accomplishment (Johnson et al., 2014; Gillies, 2016). The experimental study's results support this viewpoint by demonstrating that students given the CL approach performed better than those who were instructed in regular lecture techniques in terms of mean post-test scores. Similarly, Yaduvanshi and Singh (2019) found that students taught with CL performed better on the Biology Achievement Test (BAT), especially in cognitive areas including knowledge, understanding, and application in contrast to their class fellows who were instructed using traditional approaches. However, Premo et al. (2018) also highlighted that although cooperative involvement increased, without other motivating elements, it did not immediately result in greater accomplishment. It would appear from this that cooperative learning, when planned to promote interdependence, gives students more chances to talk, solve problems, come up with solutions, share ideas, and help one another, which improves biology student outcomes (Geletu, 2022). The results match the results from earlier studies. Molla and Muche (2018) discovered that pupils who received instruction via CL approaches performed better on biology post-tests in comparison to those who were taught conventionally. Denbel (2018) also discovered that CL increased students' performance in mathematics at secondary school when compared to the conventional lecture approach. Geletu (2022) demonstrated that the CL method improves students' academic performance in Biology at the knowledge, understanding, and application levels. In addition, Namusoke and Rukundo (2022) discovered that CL (group work) practices had a statistically significant effect on students' academic achievement in English language classrooms at common primary education institutions.

Recommendations

i. There are just 38 pupils in the study's sample. A bigger sample size may be used in upcoming research to examine additional data about the benefits of cooperative learning.
ii. This study looked at how academic success was impacted by three collaborative techniques: jigsaw, think-pair-share, and fishbowl. However, there are over a hundred approaches to collaborative learning. These learning strategies may be suitable focuses for future studies.
iii. The impact of the above-mentioned collaborative strategies on academic accomplishment was examined in this study; there may be several significant aspects of learning that need further investigation. Thus, more studies on these areas may be carried out.
iv. The research was carried out for female students. It would also be beneficial to offer similar research that was conducted at a male school.
v. This study only assessed the students' academic achievement; additional studies will be required to determine the value of collaborative learning for additional dependent variables, such as academic motivation for different courses, peer relationships, attitude toward subjects, self-esteem, and social skills.

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