Effectiveness of Cooperative Learning for Improving Students' Performance in Grade X Biology in Orong Central School

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ABSTRACT

This study investigated the effectiveness of the cooperative learning method in improving the academic performance of Class X students and developing competencies that can be applied across different subjects and real-life situations at Orong Central School. A mixed-method approach was used in the study. The quantitative component involved analysing students' academic achievement before and after the implementation of cooperative learning. Data were collected from 50 Class X students and three teachers. Students' academic results from the second term of 2024 (before the use of cooperative learning) were obtained from school records and compared with their results from the first term of 2023 after the implementation of cooperative learning. The qualitative component included students' and teachers' perceptions of cooperative learning gathered through questionnaires and teacher interviews. The findings revealed that students showed strong interest in collaborating with peers and were actively engaged in the teaching–learning process, rather than relying solely on the teacher. Students reported increased confidence in sharing ideas, presenting group findings, and supporting one another during discussions. Cooperative learning also encouraged students to recognise diverse perspectives, thereby enhancing their critical thinking, creativity, and problem-solving abilities. The study concluded that cooperative learning promotes active participation, effective communication, and collaborative problem-solving among students. It is therefore recommended that cooperative learning strategies be integrated into classroom instruction to enhance students' academic achievement and develop essential life skills.

Keywords: cooperative learning method, biology, learning achievement, education, Bhutan, attitude

CHAPTER I: INTRODUCTION

The primary aim of education at all levels is to facilitate a significant transformation in students (Tebabal & Kahssay, 2011). According to Ayeni (2011), teaching is a procedure that involves inducing positive changes in learners with the intention of achieving specific results. Kibui (2012) contends that while the classroom and societal settings have evolved, instructional approaches have remained unaltered. Interestingly, the recurring substandard academic achievements among most students are inherently tied to educators' utilisation of ineffective teaching techniques to convey information to learners (Adunola, 2011).

With the modernisation of education in Bhutan, the incorporation of science education became part of the educational framework. In 1986, the introduction of the "New Approach to Primary Education" (NAPE) aimed to enhance the primary science curriculum for Classes IV to VI, taking into account the Bhutanese context and emphasising science education grounded in Bhutan's natural and societal surroundings (Ministry of Education (MoE), 2014).

Essential components of science and technology education were integrated into Environmental Studies (ES), which has been taught in Dzongkha from Pre-primary (PP) to Grade 3 since 1994. Additionally, General Science was introduced from Grade 4 to 8. Prior to 1994, science was taught as a unified subject from Grade 4 to 6, and

later became specialised into Physics, Chemistry, and Biology at higher grade levels. However, in 1999 and 2000, the teaching of science in Grades 7 and 8 was separated into distinct disciplines. Subsequently, a comprehensive science curriculum encompassing Biology, Chemistry, and Physics replaced the previous "Science for Class VII and VIII." General Science, incorporating concepts from Physics, Biology, and Chemistry, was introduced as the approach for teaching science for key stages 2 (Grade 4–5) and 3 (Grade 7–8) (MoE, 2014).

Over the past 15 years, there has been a growing shared concern within the Ministry of Education and among global organisations such as the World Health Organisation and UNESCO regarding the quality of education in Bhutan (Ministry of Education, 2017). The World Bank's 2009 report indicated that Bhutanese students demonstrated inadequate mastery of essential skills and deficiencies in crucial abilities such as critical thinking, effective communication, and problem-solving. Similarly, the Royal Education Council & Education Initiatives (REC) (2010) found that students' performance fell short of anticipated grade-level standards for both fundamental and advanced academic proficiencies, and they exhibited deficiencies in communication and critical aptitudes. The primary reason for students' limited progress in learning has been attributed to shortcomings in the teaching methods employed (REC, 2019). The predominant teaching approach across most schools is frontal teaching, in which traditional methods prevail, placing teachers in central, authoritative roles and assuming that knowledge transmission has occurred (REC, 2019). There has been minimal adoption of innovative teaching strategies, such as integrating technology, and limited utilisation of constructivist instructional methods by teachers (Tenzin et al., 2021). This type of education has led to an inadequate grasp of concepts and limited academic achievements (REC, 2019). The observation revealed that students were passive participants, depending on teachers to dictate the content, timing, and approach of learning (Tenzin et al., 2021). Given this situation and the ongoing drive to enhance the standard of education in the nation, Bhutanese classrooms need to transition from an instructional model centred around teachers to one that places the learners at the core of the teaching process.

Research Problem

The effectiveness of the teaching and learning process is deemed acceptable only if it encompasses the entire spectrum of science education objectives spanning cognitive knowledge, affective understanding, and psychomotor skills. Biology, a branch of natural science, presents numerous opportunities for students to engage in activities that foster various scientific skills. Nonetheless, existing attitudes and beliefs held by both students and educators hinder the achievement of these educational aims. Many learners and teachers fail to acknowledge that students might hold preconceived notions about natural phenomena. This issue is particularly pronounced in biology, leading to a common practice among learners to approach the subject as a mere memorisation task for exam success, rather than an effort to grasp concepts.

This predicament was encountered in the teaching of biology to class X students at Orong Central School. Initially, the unit competencies and instructional objectives of the first unit, titled "Molecules to Organism's Structures and Processes," were outlined and discussed with the students. Students collectively argued that organising small groups for learning and revision was unnecessary, contending that biology involved rote memorisation to pass exams. This perspective aligned with traditional teacher-centric methods, emphasising passive reception of information from the teacher and textbooks, inadvertently fostering individualisation and isolation among students, rather than promoting cooperation over competition to enhance learning outcomes.

In the modern era, cultivating STEM skills demands a shift toward student-centred learning. Teachers must update their instructional strategies and approaches, utilising a wide array of exercises and activities to convey concepts within the classroom. This study aims to investigate the efficacy of cooperative learning to align with the implementation of the newly revised National School Curriculum (NSC), introduced in 2022.

Aims of the Study

- To examine the effectiveness of cooperative learning in improving the academic achievement of Class X students in biology at Orong Central School.

- To explore how cooperative learning influences students' engagement, participation, and understanding of biological concepts instead of relying on rote memorisation.

- To determine whether the use of cooperative learning supports student-centred teaching and helps achieve the cognitive, affective, and psychomotor objectives of biology education under the revised National School Curriculum.

Research Questions

1. What is the effect of the CL method on grade ten students' learning achievement in biology?

2. What is the effect of the CL method on grade ten students' perspective toward biology as indicated by their level of interest, understanding, satisfaction and difficulty in learning X biology?

CHAPTER 2: LITERATURE REVIEW

Connotation of Action Research

Research is a vital element for any institution, and a lack of research activities can impede the enhancement of education programs. In Bhutan, with the institution of the Research Department in the Royal University of Bhutan (RUB), a clear research policy for the member colleges is in place. Over time, the concept of action research has evolved in various ways. It is currently often regarded as a tool for enhancing professional growth, placing greater emphasis on teachers than in previous perspectives (Cahyani et al., 2021). Furthermore, it is increasingly being employed to drive school reform, as its focus on individual situations enables a fresh engagement with educational change. (Dorji & Tenzin, 2021) contended that action research underscores the active participation of teachers in addressing classroom issues, with its main objective being the professional development and growth of educators rather than mere knowledge acquisition in the field of education.

Although various research types can be undertaken, action research specifically refers to a systematic investigation undertaken by a teacher, with the intention that the findings will guide and transform their future practices. This research is conducted within the teacher's own environment, involving students and the school, and addresses pertinent educational concerns.

Cooperative Learning Approach

The primary aim of teaching at any educational level is to instigate a fundamental transformation in the learner (Tebabal & Kahssay, 2011). As stated by Ayeni (2011), teaching is a process that entails bringing about positive changes in learners to achieve specific outcomes. To induce change, students must develop dissatisfaction with their existing knowledge and recognise inconsistencies in their perceptions of the world.

Tenzin et al. (2021) argue that while the context of classrooms and society has evolved, teaching methods have remained stagnant. Notably, consistent poor academic performance among the majority of students is fundamentally linked to educators' use of ineffective teaching techniques to convey knowledge to learners (Adunola, 2011). This is particularly pronounced in biology, potentially leading to a perception of biology as a mere repository of facts (Kiarie, 2016).

To enhance knowledge dissemination, teachers should adopt teaching methods aligned with specific objectives and desired outcomes. However, overreliance on lectures to introduce new knowledge and skills should be avoided, as this traditional approach can render students passive and limit their capacity to process new information (Rabgay, 2018). A teaching approach that relies heavily on lectures might inadvertently foster the belief that everything has already been comprehensively understood and that success in exams requires memorisation rather than comprehension.

Thankfully, Vygotsky (1978) asserts that knowledge construction does not happen in isolation but through social interactions with peers. Thus, interactions among learners influence each other's learning. This underscores the

importance of peer-to-peer discussions and communication with teachers to articulate existing notions, clarify understanding, and rectify misconceptions (Ozcan et al., 2012).

Sherab (2013) suggests motivating students to engage by promoting success, emphasizing collaboration over competition, setting high expectations, and posing questions that stimulate interaction. Classroom-based research demonstrates that students can achieve these objectives within cooperative learning groups (Nyandwi, 2017). Consequently, the cooperative learning approach involves organising students into pairs or small groups to learn assigned material (Rabgay, 2018) collaboratively.

Effect of the Cooperative Learning Method

According to Khalid and Azeem (2012), the effectiveness of teaching science hinges on the acknowledgement, addressing, and connection of students' pre-existing ideas, values, and beliefs with their classroom experiences at the outset of an instructional program. The conventional notion that students enter the classroom as blank slates, ready to be filled with new ideas from teachers, is inaccurate (Crider, 2013). They often hold prior notions and conceptions about the world's events and phenomena that might diverge from the intentions of teachers and the scientific community. True learning occurs when students consciously and explicitly link new knowledge with their existing cognitive framework (Dong et al., 2020). This underscores the importance of instructional approaches that build upon the learner's existing knowledge. Therefore, diagnosing learners' pre-existing understanding is vital for educators to plan subsequent teaching activities and facilitate the integration of new material with what students already know.

Cooperative learning is recognised for its active engagement of students in the learning process, aiming to enhance learners' critical thinking, reasoning, and problem-solving skills (Faustino & Muneja, 2020). For instance, it has been established as a link between cooperative learning and increased academic achievement across various skill levels. Importantly, Almashijari (2013) discovered that diverse cooperative learning strategies could assist low-ability students in achieving success, particularly when they faced challenges in traditional classroom settings. Furthermore, investigations by Alrayah (2018) indicated that cooperative learning not only enhanced critical thinking and reasoning but also enhanced retention.

Peer discussions within cooperative learning groups can facilitate meaningful learning by enabling learners to help each other integrate new experiences and information into their existing cognitive structures in a logical, rather than verbatim, way (Nyandwi, 2017). This suggests that cooperative learning is likely to cultivate profound comprehension (Singay, 2020).

The fundamental aim of education, regardless of the educational level, is to bring about substantial change within the learner (Tebabal & Kahssay, 2011). For change to transpire, students need to develop a sense of dissatisfaction with their current knowledge and recognise potential inconsistencies in their worldview (Kiarie, 2016). They must test and refine their existing models and thought processes in familiar contexts that they perceive as authentic, reflective of daily experiences, and within their control. Additionally, students need to align their own understanding of science with the scientific perspective (Campbell, 2015).

To facilitate the effective transmission of knowledge, teachers should adopt teaching methods that align with specific objectives and desired learning outcomes. Numerous studies consistently demonstrate that, when considering factors like long-term retention, the ability to apply knowledge, problem-solving skills, critical thinking, and the cultivation of positive attitudes, small discussion groups yield favourable results (McNally et al., 2017). Interaction among students in cooperative learning groups is both robust and prolonged (Pesman, 2012). Unlike self-directed inquiry, cooperative learning groups foster a gradual assumption of responsibility for each other's learning. Sijali (2017) outlined four essential components: small groups should be structured to foster positive interdependence, involve face-to-face interactions, entail individual accountability, and promote the utilisation of interpersonal and small group skills. Tenzin et al. (2021) argued that if school-taught concepts lack relevance to students' everyday lives, their practical application beyond the school environment might be inadequate.

CHAPTER 3: METHODOLOGY

Research Design

The purpose of this study was to examine the effect of the cooperative learning (CL) method on the mean achievement scores of tenth-grade students in biology and on their attitudes toward the subject, including interest, understanding, satisfaction, and perceived difficulty. To achieve this objective, the study adopted a mixed-method approach.

The qualitative component involved collecting students' and teachers' perceptions of cooperative learning through questionnaires and lesson observation forms designed using a four-point Likert scale. The quantitative component employed an experimental design in which cooperative learning served as the independent variable, while students' test scores and their attitudes toward biology were considered the dependent variables.

According to Kivunja et al. (2017), an experimental design involves assigning participants to different conditions, manipulating one or more independent variables, measuring the effects on dependent variables, and controlling other influencing factors. This study followed this experimental framework by comparing the impact of the cooperative learning approach with the conventional teaching method after a two-week intervention period. The comparison was conducted to determine whether cooperative learning had a significant effect on the mean achievement scores of tenth-grade students and their attitudes toward biology.

The participants in the study were 50 tenth-grade students from Orong Central School. The students were divided into two groups: an experimental group (EG) and a control group (CG). To ensure both groups were comparable in academic ability, students were assigned equally based on their previous test scores.

Two Biology teachers, referred to as Teacher X and Teacher Y, received training from the researcher for one week on the implementation of different stages of cooperative learning (CL) structures. Teacher X was responsible for teaching the experimental group using a cooperative learning approach, while Teacher Y was responsible for teaching the control group using a traditional lecture method. The teacher Z and the researcher observed the lessons conducted in both the experimental and control groups. Although the two groups were taught by different teachers, both studied the same topic, "Chromosome," over eight 50-minute lessons. Before the commencement of the teaching sessions, a pre-test and a pre-survey attitude questionnaire were administered to both groups to collect baseline data on students' academic achievement and attitudes toward biology.

Regarding the treatment procedure, students in the experimental group were first introduced to cooperative learning during the initial classes, as they had no previous experience working in cooperative groups. Teacher X explained the principles and functioning of cooperative learning groups and conducted small exercises to help students become familiar with group work, adjust to collaborative learning, and develop cooperation with their group members. These activities also helped students become acquainted with Teacher X and reduced off-task behaviour. After this orientation, the topic "Chromosome" was taught using various cooperative learning structures. The topic was divided into several subtopics, and each subtopic was taught using appropriate cooperative learning strategies selected to match the lesson's nature and content.

Table 1 presents the list of subtopics and the cooperative learning structures used in the study.

Table 1

Lesson topics and CL structures

Topics	**Cooperative Learning Structures**	**Activity**
Definition & Structure of Chromosomes	Think–Pair–Share	Students first think individually about "Why are chromosomes important?" → pair up to discuss → share with class.

Types of Chromosomes (autosomes & sex chromosomes)	Jigsaw	Divide into expert groups: one studies autosomes, another sex chromosomes. Each group teaches their home group.
Chromosome Morphology (metacentric, acrocentric, etc.)	Gallery Walk	Groups prepare posters of different shapes. Class walks around, reviews, and adds sticky notes with questions.
Karyotype & Banding Techniques	Team Concept Mapping	Groups create a concept map showing how karyotyping helps detect abnormalities. Present maps to the class.
Chromosome Behavior in Mitosis & Meiosis	Role Rotation	Roles: explainer (steps), questioner (why important), connector (real-life example), summarizer (key points). Rotate roles.
Epigenetics & X-inactivation (advanced)	Peer Teaching	Students research in small groups and teach the class with examples (e.g., calico cats).

All lessons conducted in both groups were observed by Teacher Z and the researcher using structured observation forms. These forms were used to record observations related to classroom activities during each lesson. The purpose of the observation form was to examine the extent to which the teaching–learning process reflected a cooperative learning environment. The observation checklist was designed based on the five key principles of cooperative learning and utilized a five-point Likert scale. At the end of the intervention, a post-test and a post-survey attitude questionnaire were administered to both groups to collect data on students' academic achievement and their attitudes toward biology.

Data Collection Instruments

Three research instruments were used for data collection: (1) an achievement test, (2) a perception questionnaire, and (3) a lesson observation form. The achievement test consisted of 30 multiple-choice questions, worth a maximum of 30, on the topic "Chromosome," which was taught to both groups during the study.

To ensure content validity, the test items were reviewed and evaluated by two biology lecturers from Samtse College of Education (SCE) and one senior biology teacher from the school. They confirmed that the questions were aligned with the content and specific learning objectives of the topic "Chromosome" as prescribed in the Bhutanese National School Biology Curriculum.

To establish the reliability of the instrument, the test was pilot-tested in another school, Karmaling Higher Secondary School (KHSS), within the district that was not involved in the study. The reliability coefficient was calculated using Cronbach's alpha. The results showed a reliability coefficient of 0.62 (N = 63) during the pre-test and 0.81 (N = 63) during the post-test. These results indicated that the achievement test was a reliable instrument, and the scores obtained could be used to make valid comparisons and inferences between the groups.

The students' perspective questionnaire was developed using a four-point Likert scale consisting of strongly agree (SA), agree (A), disagree (DA), and strongly disagree (SDA). The questionnaire measured students' perspectives on biology across four key scopes: interest, understanding, satisfaction, and the difficulty level of the subject content. To ensure validity, the questionnaire was reviewed by two lecturers from Samtse College of Education, who had expertise in educational research, and by one senior teacher, who had expertise in action research. After incorporating their suggestions and making the necessary revisions, the panel confirmed that the instrument was suitable for the study.

To determine reliability, the questionnaire was pilot-tested in the same middle secondary school where the achievement test was piloted. The reliability coefficient was calculated using Cronbach's alpha, which yielded a value of 0.81 (N = 63). This result indicated that the instrument was reliable and appropriate for use in the study.

In addition, a lesson observation form was developed based on the five fundamental principles of cooperative learning. The purpose of this instrument was to examine the extent to which classroom lessons reflected a cooperative learning environment. The items under each principle were rated using a five-point Likert scale. The observation forms were used to monitor and evaluate the fourteen cooperative learning lessons conducted in the experimental group.

Data Analysis

Data analysis was conducted in three main areas: (i) test score analysis, (ii) analysis of students' perspectives, and (iii) lesson observation analysis. For the test scores and students' opinion data, means and standard deviations were calculated to summarise the results. A paired-samples t-test was used to assess differences in students' test scores and changes in their opinions before and after the intervention.

The lesson observation data were analysed in relation to the five principles of cooperative learning. For each principle, means and standard deviations were computed. The calculated mean values represented the level of responses on the Likert scale and indicated the extent to which the principles of cooperative learning were implemented during the lessons.

CHAPTER 4: FINDINGS

The data analysis was done in three parts: 1. Test score analysis, 2. Students' attitude analysis and 3. Lesson observation analysis.

Students' Test Score Analysis

Table 2 Comparison of Pre-Post-test of Students' Scores between the Groups (EG and CG)

Test	Group	Mean	Mean Difference	Standard Deviation	Sig. (2-tailed)	Cohen's d
Post-test	Experiment	11.88	5.60	1.10	0.00	4.60
	Control	6.20		1.02		
Pre-test	Experiment	5.90	0.20	1.01	0.25	1.32
	Control	5.70		1.03		

Significant level: >0.05—no significant, <0.05—significant

Cohen's d value: d=0.2-small effect, d=0.5-medium effect, d=0.8-large effect (adapted from Said et al., 2020).

A comparison of pre-test and post-test scores between the groups was carried out using an independent samples t-test, with the mean, standard deviation, and significance value (p) reported in Table 2. This test was conducted to determine whether there was a statistically significant difference between the mean scores of the EG and CG groups.

For the post-test, the mean score of the EG (M = 11.88, SD = 1.10, N = 25) was higher than that of the CG (M = 6.20, SD = 1.02, N = 25), with a mean difference of 5.60. The significance value was p = 0.00, which is below the threshold of $p < 0.05$. Therefore, the null hypothesis of no significant difference was rejected. This finding indicates that the EG achieved significantly higher post-test scores than the CG, demonstrating that students in the EG gained greater conceptual understanding after the cooperative learning method.

In contrast, the difference in pre-test scores between the EG and CG groups was only 0.20, with a two-tailed p-value of 0.25, which is above the $p > 0.05$ threshold. This result suggests no significant difference between the groups at the pre-test stage, indicating that both groups had a similar level of prior knowledge.

The effect size analysis further supported these findings. The Cohen's d value for the post-test comparison between EG and CG was 4.60, reflecting a very large practical effect. Conversely, Cohen's d value for the pre-test comparison was 1.32, indicating only a small practical effect. Together, these results confirm that the intervention had a substantial impact on students' test scores.

Students' Perception Analysis

Table 3 Comparison of Students' Opinion Pre-Post-Survey of EG

		Post-survey		**Pre-survey**		
	Mean	**SD**	**Level of Opinion**	**Mean**	**SD**	**Level of Opinion**
Interest	3.33	0.65	Very High	2.01	0.50	High
Understanding	3.30	0.64	Very High	2.24	0.51	High
Satisfaction	3.60	0.66	Very High	2.31	0.52	High
Difficulty	1.30	0.60	Very Low	3.12	0.61	Very High

Level of Opinion: 1-1.75 Very Low 1.76-2.50 Low 2.51-3.25 High 3.26-4.00 Very High (adapted from Harpe, 2015; Best & Kahn, 2006).

The analysis of students' perception in the EG, presented in Table 3, showed noticeable improvements from pre- to post-survey. The mean scores for interest, understanding, and satisfaction in learning gene expression increased notably after the intervention. At the same time, the perceived complexity of the subject decreased from a very high level in the pre-survey to a very low level in the post-survey. These results suggest that students developed greater interest, deeper understanding, and higher satisfaction with learning Chromosome, while the difficulty level decreased.

Lesson Observation Analysis

Table 3 Means and Levels of perception of teachers' observation

Principles of CL	Mean	SD	Level of Perception
Positive Interdependence	4.51	0.95	Strongly agree
Face-to-face interaction	4.62	1.10	Strongly agree
Individual accountability	3.98	2.1	Agree
Interpersonal and small group skills	4.50	0.97	Strongly agree
Group Discussing	4.10	1.3	Agree

Level of opinion: 0.00-1.50: Strongly agree 1.51-2.50: Disagree 2.51-3.50: Moderate 3.51-4.50: Agree 4.51-5.0: Strongly Agree

Table 3 presents the lesson observers' evaluations of classroom activities in the experimental group (EG). The results of the lesson observation analysis indicate that the teacher observer strongly agreed that the cooperative groups exhibited key characteristics of cooperative learning, including positive interdependence, face-to-face interaction, and group processing. The observer also agreed that students demonstrated individual accountability, as well as interpersonal and small-group skills, during the cooperative activities. These findings suggest that the lessons in the EG were effectively implemented within a cooperative learning environment.

CHAPTER 5: DISCUSSION

The study yielded two major findings. First, the cooperative learning (CL) method significantly improved the academic performance of ninth-grade students in biology. Second, the CL approach positively influenced students' perception toward biology, as reflected in increased interest, better understanding, greater satisfaction, and a perception of the subject as less difficult.

The improvement in academic performance is consistent with previous studies. For instance, a recent meta-analysis found that cooperative learning significantly enhances students' academic performance across subjects, with learners in CL settings outperforming those in traditional instructional approaches (Zhang et al., 2025**).** Similarly, contemporary studies indicate that cooperative learning strategies improve students' cognitive achievement, critical thinking, and overall learning outcomes compared to conventional lecture-based methods **(**Li & Chen, 2025**).**

Several factors may explain the observed improvement in academic achievement. One key factor is the socially interactive learning environment promoted by cooperative learning (CL), which enhances learning effectiveness (Vygotsky, 1978). This environment encourages student interaction, idea sharing, and peer support, all of which contribute to deeper understanding and improved retention of concepts. Recent studies have emphasized that collaborative learning environments significantly enhance students' conceptual understanding and engagement through active participation and peer interaction **(**Gillies, 2020; OECD, 2023**).** Furthermore, research indicates that structured peer discussions and collaborative activities promote higher-order thinking and long-term retention of knowledge **(**Tran, 2024**).** Observational evidence of active participation, group discussions, and peer teaching further supports the role of cooperative learning in strengthening conceptual understanding and memory retention.

Additionally, the non-threatening and supportive classroom environment in CL settings allows students to express ideas freely, clarify doubts, and seek assistance without hesitation. Such interactions enable learners to move beyond superficial understanding and develop a deeper comprehension of the subject matter **(**Gillies, 2020). Equal opportunity for success within groups also contributed to improved performance, as students worked collaboratively with a shared responsibility for learning outcomes, ensuring that all members understood the material.

The second finding, which highlights improved student attitudes toward biology, is supported by recent research. Contemporary studies indicate that cooperative learning (CL) not only enhances academic achievement but also fosters positive attitudes toward learning by increasing students' motivation, engagement, and interest (Buchs et al., 2022**).** Similarly, recent evidence suggests that students in cooperative learning environments report higher levels of enjoyment, satisfaction, and perceived learning than those in competitive or individualistic settings **(**Roseth et al., 2019; OECD, 2023**).** These findings reinforce the role of cooperative learning in creating a more positive and engaging learning experience for students.

The positive shift in students' attitudes can be attributed to the engaging and supportive learning environment created through cooperative learning (CL). Such environments have been shown to promote students' psychological well-being, enhance motivation, and increase interest in learning (OECD, 2023; Gillies, 2020**)**. In contrast to traditional classroom settings in Bhutan, where teaching is often teacher-centred and students have limited opportunities to express ideas (Tenzin et al. 2022), CL provides a more participatory and inclusive approach.

Furthermore, students derived satisfaction from understanding concepts rather than relying on memorization, which enhanced their interest and enjoyment in learning biology. The use of interactive strategies, such as quizzes, group activities, and games, further contributed to a positive learning experience. For example, techniques like Student Teams Achievement Division (STAD) increased student engagement by incorporating group accountability and rewards, making learning both effective and enjoyable.

Overall, the improvement in both academic performance and student attitudes can be attributed to key characteristics of cooperative learning, including its social learning context, supportive classroom environment, equal participation, active knowledge construction, and the reinforcement of learning through discussion. These features were largely absent in the control group, where instruction was predominantly teacher-centred, limiting student interaction and engagement. This lack of an interactive learning environment likely contributed to the minimal improvement observed in students' academic performance and attitudes toward biology.

CONCLUSION

This study revealed that the cooperative learning (CL) approach significantly enhanced the academic achievement of ninth-grade biology students at Orong Central School compared to the traditional lecture-based method. Furthermore, the approach positively influenced students' attitudes toward biology, as reflected in increased interest, greater satisfaction, deeper understanding, and a perception of the subject as less difficult. These findings suggest that the benefits of the CL method are not culture-specific and that it is an effective strategy for improving both academic performance and students' perception toward biology within the Bhutanese school context.

RECOMMENDATION

The findings of this study confirm that the cooperative learning (CL) approach effectively enhances academic achievement and improves students' perception toward biology. Consequently, biology and science teachers are encouraged to adopt CL as an alternative to traditional lecture methods. It is also recommended that in-service and pre-service teacher education programs in Bhutan provide focused training on the CL approach to ensure teachers are well-equipped with effective instructional strategies.

Given the multiple benefits of CL beyond academic performance, it should be promoted as a preferred teaching and learning approach. For broader implementation, education policymakers should develop guidelines and provide reference materials to support teachers in applying CL effectively. This includes integrating CL-focused training into teacher education programs and developing curriculum support resources.

Although CL has been widely studied internationally, research on its effectiveness in Bhutan remains limited. Further studies are needed across other subjects and at different educational levels to strengthen evidence of its effectiveness and inform local educational practices.

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