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Implementing Student Teams Achievement Divisions (STAD) learning model in grade 9 Biology and its impact on learning achievement

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ABSTRACT

The purpose of this action research (AR) is to implement the Student Team Achievement Divisions (STAD) learning model as a classroom teaching and learning practice and determine its impact on the learning achievement of grade 9th biology students in one Bhutanese higher secondary school. The study employed a pre-test and post-test one-group quasi-experimental group design as a methodological approach. A total of 31 grade 9 students were purposively selected as the experimental group and received the STAD learning model treatment as an intervention for a month. The group was tasked with STAD learning activities such as drawing and writing activities, quizzes, presentations, group discussions, tests, questions, and answers. The data were collected quantitatively through pre- and post-Biology Achievement Tests (BAT), questionnaires, and qualitatively through focused group interviews. Quantitative data are presented in descriptive statistics (mean and standard deviation) while qualitative data is in thematic analysis. According to the paired sample t-test, the post-test mean score (M=10.98, SD=2.53) increased significantly when compared to the pre-test mean score (M=6.67, SD=2.79), with mean score differences (M=4.30). A descriptive analysis of questionnaires on students' motivation, collaboration, and self-confidence in learning reveals a 'High' degree of perceptions on mean scores and standard deviations; (M=3.99, SD=0.715); (M=4.24, SD=.729); and (M=3.89, SD=0.948) respectively. Qualitative data also indicated positive perceptions of the use of the STAD learning model in biology. Therefore, based on the findings, it is recommended that teachers adopt the STAD model in their classrooms to motivate students and improve their learning achievement.

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INTRODUCTION

Essential parts of the educational system for any nation consist of the school curriculum, teaching pedagogy, and its associated assessments. The Government of Bhutan invests more in the education sector than any other sector because education is the backbone of the development of the country (Ministry of Education and Skill Development [MoESD], 2014). As a result, when situations and times change, there is a need for transition in education, the appropriate curriculum, and a conducive teaching and learning environment. Among all, pedagogical knowledge and assessment are critical for the quality of education (Tenzin, 2017), as they allow teachers to determine the subject matter that each student needs guidance within. The effort has been made in the transition from a conventional approach to a 21st-century-based approach that emphasizes more learning by doing, engagement, student-centered, and collaboration. Bhutan places great importance on institutionalizing relevant and challenging science curricula for all of its school-aged children. According to Tiantong and Teemuangsai (2013), effective teaching and learning must be able to capture more students' attention, cater to various student groups, and place more of an emphasis on skill development, thought processes, and situational management.

Teachers have the leverage to incorporate pedagogical resources from a diverse range of sources into their regular classroom practices in a way that supports students' learning. One method is the Student Team Achievement Division [STAD], a type of cooperative learning model. Through the use of group processes, cooperative learning puts a lot of emphasis on the students by giving them an opportunity to collaborate and achieve things as a group. (Rattanatumma, 2016). Cooperative learning gives students the chance to collaborate on specific assignments. Additionally, in cooperative learning, students must work together to achieve tasks. Small groups of students with diverse levels of ability collaborate to complete shared learning objectives while using the STAD collaborative learning strategy (Tiantong & Teemuangsai, 2013). The majority of studies have demonstrated that the STAD method, which is student-centered and promotes collaborative learning, helps students in achieving better learning outcomes (Maman Hermawan et al., 2020).

The reflections and experiences on teaching Biology at the secondary school level for a decade long, have culminated in poor and below-par performances from students. The average scores have been low with more failures in Science, Technology, Engineering and Mathematics(STEM) subjects overall. Regardless of the diverse efforts put in by teachers to motivate, encourage and promote their learning, increasing the students' learning outcomes is a major challenge for a subject teacher like us. There are many factors associated with the low academic performances of the students. A lack of confidence and less conducive relationship between teachers and students may also have an impact on their performance. Some of the factors that may indicate that student learning is still low include a lack of sense of responsibility for his or her duties, a lack of questions from students, their lack of cooperation in carrying out activities or understanding the lessons, and their lack of asking questions. However, teachers are already applying learning strategies that provide learners to participate and collaborate to maximize their learning outcomes. Besides these factors, some studies carried out in Bhutanese classrooms also show there is a gap in learning in the classrooms. For instance, a study on the implementation of transformative pedagogy in classroom teaching by Dorji et al. (2020) found that some school administrators and teachers still favor traditional lecture methods with the justification that there aren't enough resources, the classrooms are overcrowded, and the curricula are too lengthy to incorporate activities. Additionally, Utha et al. (2016) noted that teacher-centered and syllabus-driven classroom practices predominate in Bhutan. Additionally, in Bhutan, the school-based assessments system is inconsistent (Luyten & Dolker, 2010) whereby the students are evaluated based on their grades undermining their skills and gaps in learning.

Furthermore, there is a notable paucity of empirical research in the area of applying the STAD, a form of cooperative learning model, to the science lessons taken by 9th-grade students in the Bhutanese classroom setting. Researchers used this knowledge gap as inspiration to use the STAD learning model with grade 9 biology students in the classroom and examine its benefits. Researchers will show how this learning model affects students' biology learning achievement through this classroom implementation.

LITERATURE REVIEW

According to Ishtiag et al. (2017) and Ruwang (2017), cooperative learning refers to a range of methods of instruction in which students are divided into mixed-ability groups and collaborate to accomplish a common academic goal. As stated by Ruwang (2017), cooperative learning encourages students to participate in class, encourages them to cooperate with group members and take responsibility for their share of the work, and also helps students develop confidence in their ability to learn. A highly easy-to-use cooperative learning approach is Students Team Achievement Division, which is used in the teaching and learning process. Robert Salvin and his associates at Johns Hopkins University in 1995 developed this model (Nikou et al., 2014; Ishtiag et al., 2017).

The STAD model is one of the simplest methods for getting small groups of students with varying levels of ability to work together in a collaborative environment. There are five steps in the Salvin STAD model: i) diverse groups are formed based on the learner's academic performance ii) The teacher provides instruction iii) Students assist one another in understanding the worksheets and tasks that the teacher provides iv) Students complete individual quizzes without being permitted to assist one another v) High-achieving teams are praised and given tokens and certificates (Ishtiaq et al., 2017). The procedures for implementing STAD in the classroom as explained by Salvin (1995) as cited in the work of Ibrahim and Adnan (2019) are as follows:

1) **Preparation**
   The creation of relevant learning materials for the students is the first stage. The materials can be created by educators, modified versions of textbooks, or other related sources. Then, the students are divided into a few teams. Teachers must take into account students' academic performance as well as their gender, color or ethnicity. Finding the student's overall assessment score or initial base scores is the last step of preparation.

2) **STAD activities**
   Teach: Teachers will begin each activity with a lesson. The opening, development, and guided practice components should all be included in the class presentation.
   Team study: Students will learn the content, work on the exercises, or complete the tasks in their own **groups**. The benefits of group work must be discussed by the teacher.
   Test: Individual quizzes or tests will be given to each student. The outcomes of the test will be analyzed to evaluate whether both teams and individuals have improved overall.

3) Assignation of new teams
   The last procedure will be done after the assessment of activities. This procedure will give low-performance students an opportunity to learn with high-performance students. Team recognition is given in the form of certificates or rewards based on individual improvement scores and team scores.

Additionally, in this type of cooperative learning method, students continue to be encouraged to collaborate in order to improve the performance and accomplishments of their team, even though they are tested separately (Santosa et al., 2019). In addition, the fundamental idea of student teams includes individual accountability, group benefits, and an opportunity for equal accomplishment (Huda, 2013). The process of the STAD learning model within this study is understood to be the technique of organizing the learning activities that provide an opportunity for students to collaborate and help each other to learn within their smaller teams, which comprises the mixed ability of students. Students are then tested through class tests.

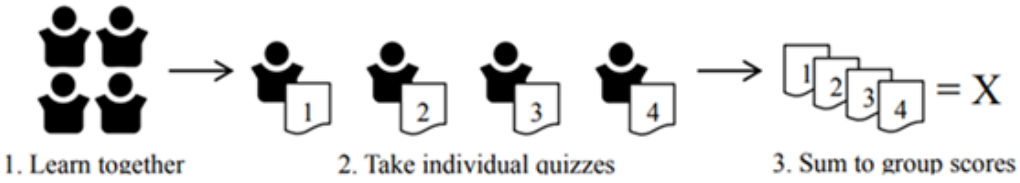

Figure 1. Student Team Achievement Divisions (STAD) technique
[Adopted from Taintong & Teenuangsai, 2013]

There are not many published studies particularly focused on biology teaching and learning through the STAD model. However, several theories and research have proven cooperative learning strategies as one of the effective ways to increase academic performance in their respective courses. The previous studies in this field have commonly indicated and concluded that it is one of the most effective teaching methods to actively engage students, motivate, participate and interact in their classroom learning, few examples (Tiantong & Teemuangsai, 2013; Hermawan et. al., 2020; Yulianto et. al., 2020; Utami, 2019). The significant findings reported from previous studies are that students who are exposed to STAD have improved their learning outcomes, helping students to acquire academic knowledge and skills. Further, it was reported that the cooperative learning method was one of the most effective 21st-century teaching-learning strategies and is believed to have numerous benefits of implying the cooperative method in everyday classroom learning. The implementation of Team Achievement Division (STAD), important cooperative learning method, has been backed by many studies in a variety of subject areas (Ishtiaq et al., 2017). For instance, using this learning model has the potential to improve academic performance and social skills, and it also has the added benefit of helping students understand, retain, and feel better about themselves and their peers as they work together in collaborative groups (Tiantong & Teemuangsai, 2013). Furthermore, working together in a collaborative environment encourages student responsibility for learning. (Tiantong & Teemuangsai, 2013).

The STAD learning model and student learning are positively correlated, according to a number of well-known conceptual works of literature in this field. For an example, Ishtiag et al.'s (2017) study "An Experimental Study of the Effect of Student Teams Achievement Divisions (STAD) on Vocabulary Learning of EFL Adult Learners" revealed a significant difference between the experimental group and the control group ($p=0.002< 0.05$). As such, Yulianto et al.'s experimental study on "the effect of the STAD learning model assisted by the Quizizz media on motivation and learning outcomes in Indonesian History subject class XI" (2020), which used a pretest-posttest control group design, reveals differences in the value of student learning outcomes between the control class and the experimental class with a T-test value of sig. $0.03< 0.05$. Further, in the study by Rattanatumma et al. (2016), the STAD model of cooperative learning student groups achieved high scores on the post-test used to gauge students' problem-solving and learning achievement in mathematics. Furthermore, Nasution and Hafizah (2020) performed a quiz as part of their study, and the results revealed that using a cooperative learning model of the STAD type had improved students' grasp of mathematical concepts. In summary, the use of the STAD model in teaching and learning demonstrated in that earlier research revealed improved learning outcomes, teamwork, and motivation, enhanced communication skills in students who are involved in learning in a team.

In conclusion, the Student Teams Achievement Divisions (STAD) model is one cooperative learning strategy that has been shown to be helpful in raising student engagement and academic performance in numerous studies and research. The STAD model has been shown to improve learning outcomes, advance social abilities, and foster group learning responsibilities. The STAD model and student learning have been positively correlated in numerous empirical research, with variations in learning outcomes between experimental and control groups. These studies demonstrate the advantages of applying the STAD paradigm to a variety of academic disciplines, such as vocabulary development, history, mathematics, and more. In order to further explore the STAD learning model's potential effects on learning, this action research embraces it as a conceptual and methodological framework.

OBJECTIVES OF THE STUDY

The overall aim of this study is to implement the STAD learning model in grade 9th biology students. Within this frame, students were taught and supported to learn with the STAD learning model as a pedagogical tool; and provide empirical evidence-based teaching pedagogical practice for teachers to modify and implement within their teaching practices in the classroom. Further, the objective of the study is to do an analysis of differences in the achievement test-score of students in pre-test and post-test. Based on the research objectives, the following main and sub-research questions were framed:

What is the effect of using the STAD learning model on students' learning achievement in class 9 biology?

1. Is there a significant difference between the pre-test and post-test achievement test scores of students?
2. What are the students' perceptions about learning biology through the STAD learning model?

METHODS

Research Approach and Design

This AR employed one group pre-test and post-test quasi-experimental group design to measure the impact of the STAD learning model in the classroom on learners' learning achievement in biology. Besides this, qualitative aspects like students' engagement and perceptions were collected and recorded. Hence, this AR employed mixed methods one group quasi-experimental design as a research approach and design. This mixing of research methods enables researchers to interpret and deduce the results from both quantitative and qualitative perspectives.

Sampling

This AR followed the purposive sampling technique. Purposive sampling is a type of non-probability sampling in which researchers choose participants for their surveys by using their own discretion (Jordan, 2021). Therefore, this AR involves 31 purposely selected grade 9 'C' students of Baylling Central School as one group quasi-experimental design to administer the intervention. The researchers purposively chose the participants for this study with the intent of focusing on a certain group, fully aware that this group does not accurately represent the whole population and only serves to reflect itself (Cohen et al., 2008). The class was selected because of an equal distribution of male and female students compared to the rest of the class 9 sections in which the teacher-researchers teach. Moreover, the learning abilities of students in this class are comparatively on average than the rest of the students of class nine according to performance from their previous tests and exams. The purposive sampling method is frequently used in small-scale research targeting one or two schools, two or three groups of students, or a particular group of teachers in case of ethnographic research, action research, or case study research (p.113). Hence, this group of students is selected at the convenience of the teacher-researchers currently teaching the subject for this class. The participants were informed about the purpose and their consent was taken into consideration while commencing the study.

Research instruments

Class test (Biology Achievement Test)

In this study, the class test consisted self-constructed questions from the biology textbook's chapter on nervous control and coordination for class 9 students. This test was intended to gauge each student's initial aptitude before getting better over the cycle of action research. The test was written, based on student performance, administered to all students, and the results were compared for data analysis. The average scores of the students were determined, along with any score differences. According to Kara and Celikler (2015), teachers and subject-

matter experts can assess the test to ensure that it is valid in terms of its content. Three ardent researchers and a teacher who teaches biology were consulted to confirm the test's content validity.

The development of a trustworthy instrument for reliable findings is ensured by the alignment of test items with content standards and objectives (Gay et al., 2011). The multiple-choice questions used in this study were made to satisfy all of Bloom's Taxonomy levels. Additionally, pilot tests were administered to grade 10 students who were being taught this content in order to ensure the validity and reliability of the test. The pilot test assisted in improving the test items by identifying sentences with unclear language, selecting the appropriate terminology, and including examples (Wahib & Tamer, 2021).

In order to maintain the validity of the study, the pre-test and post-test achievement assessments of the study are two similar sets of questions that comprise concepts that were restricted to the learning objectives of the lesson presented. Galey et al. (2011) hypothesized that using two separate exams might lead to inconsistent measurement and inaccurate evaluations of students' performance, endangering the test's internal validity. Pre-testing wouldn't be an issue in this study either because there was enough time between the pre-test and post-test.

Questionnaires

The questionnaire as a tool provides no opportunity for the interviewers' bias (Saunders et al., 2003). Moreover, the questionnaire should focus on gathering the right type of information, which should be precise and understandable (Ikart, 2019). This tool was used to study the students' perception and feedback on the STAD learning model in teaching and learning class 9^{th} Biology. The questionnaires were employed once after the intervention to collect the larger students' perspectives of the STAD model which will then serve to improve further classroom implementation. The questionnaire was framed on a five-point Likert scale with the following ratings: Strongly agree = 5; Agree = 4; Not sure = 3; Disagree = 2, and strongly disagree = 1. To maintain the reliability and validity of the questionnaire framed, the scale and items were validated by seeking an experienced researcher's opinion (Younas & Porr, 2021).

Focus Group Discussion

Focus groups and focus group interviews was used as aqualitative technique for data collection. A focus group is made up of people with particular traits that concentrate conversations on a particular issue or topic (Anderson, 2002). According to Dilshad and Latif (2013), a focus group interview fosters an environment for the often-homogeneous group to reflect on the interviewer's questions. Focused group interviews were used for the students after the intervention. For a focused group interview, 1 student from each STAD team was selected and audio recorded their responses to semi-structured interview questions, seeking feedback and benefits of the STAD learning model on their learning.

Research procedures and data analysis

Students were divided into six teams based on their performance in the mid-term examination and pre-test. The teams consisted of mixed-ability of students. Following this, lesson plans were prepared including STAD learning activities such as video lessons, class presentations, worksheets, quizzes, question-and-answer sessions, and tests. After the completion of the lessons, achievement tests, questionnaires, and interviews were administered.

For data analysis, pre-test results using traditional teaching and learning methods serve as the study's independent variable, while differences in respondents' post-test scores following the intervention (using the STAD learning model) serve as the study's dependent variable.

The pre-test and post-test results are used to calculate each student's score. According to Mishra et al. (2019), normal data is the fundamental premise of parametric testing, and normality of the data is a prerequisite for

many statistical tests. Further, according to them), the Shapiro-the Wilk test is better appropriate for samples under 50, and the Kolmogorov-Smirnov test is utilized for n= 50 when the sample size is greater than 50. Data were evaluated using a T-test at a 5% level after a normality test to establish how the data were distributed.

Descriptive analysis, which includes percentages, means, standard deviations, and paired sample t-tests, was conducted using SPSS version 23.0. The data were analyzed categorically under two sub-themes a) students' performance in Pre and post-tests, and b) Students' perceptions of the use of the STAD model. The data obtained from qualitative tools were processed through thematic coding analysis procedures. Thematic analysis was done by reading through the interview scripts to gain a general understanding of the information and focus on its overall meaning; coding or organizing the content to create categories and themes for interpretation into chunks and segments of text. Using the coding to produce a small number of themes or categories into major themes. The relevant quotes and excerpts from the participants were given as relevant findings.

RESULTS

Comparison of pre-test and post-test

To compare the pre-post test results within the group, the paired sample t-test with a 95% confidence interval was used. Pre-test and post-test scores differed significantly, according to the results (Table 1); [t (31) = -11.801, p=.000< 0.05]. The mean scores for the post-test and the pre-test were (M=10.98, SD=2.53) and (M=6.67, SD=2.79), respectively, with a mean score difference of (M=4.30). This finding suggests that, after using the STAD learning model, students' learning achievement in the lesson on nervous control and coordination have significantly increased.

Table 1. Pre-test and Post-test Test Score Differences within the Group

	Mean	N	SD	MD	Std. Err Mean	T	Sig (2 Tailed)
Pretest	6.67	31	2.79	4.30	.36	-11.801	.000*
Postest	10.98	31	2.53				

Significance level of $p=.000^* < 0.05$

Analysis of Students' Perception

The questionnaire consists of 18 statements that were administered to the students after the post-test. All (n=31) students participated to rate their agreement responses. Analysis based on quantitative data indicated that students have overall positive perceptions of the student Team Achievement Division learning approach. Additionally, to examine the perceptions towards the STAD used descriptive analysis (mean and standard deviations). The three themes (factors) were generated such as the student's motivation, collaboration, and competencies (as the independent variable) and the student's achievement test (dependent variable). Further, perceptions were depicted by running an independent t-test and paired sample t-test.

Students' Motivation

Table 2 showed a descriptive analysis of students' motivation with the overall mean scores (M=3.99) and standard deviation (SD=0.715). The participants possess a "High" perception of the practice of the STAD learning approach. The learners' perceptions were interpreted by using the Brown Model scale.

Table 2. Students' Rating on Motivation in learning biology with the STAD model

No.	Statement	Mean	SD	Degree of perception
1	STAD learning approach has helped me better understand complex concepts in Biology.	3.97	.605	Agree
2	This learning approach helps me to acquire knowledge through working in a team	4.19	.872	Strongly Agree
3	This approach helps everyone reach the goal Equally	3.68	.652	Agree
4	Learning Biology is more enjoyable with this approach	4.07	.691	Agree
5	The lesson becomes more interesting with this approach	4.10	.650	Strongly Agree
6	I think this approach makes learning more effective.	4.03	.875	Agree
7	This learning approach motivates me to learn biology	4.35	.661	Strongly Agree
8	This approach enables me to participate in sharing information, making decisions, and solving problems.	3.87	.571	Agree
9	I feel intellectually challenged by this learning approach	3.67	.884	Agree
10	I feel that communication with teachers is made easier with this learning approach	3.93	.691	Agree
	Overall	3.99	.715	Agree

Level of Perception: 0.0-1 Lowest, 1.1-2 Low, 2.1-3Moderate, 3.1-4 High, 4.1-5 Highest: Brown (2010)

The students' collaboration

Table 3 showed the average mean score (M=4.24) and standard deviation (SD=.729), which indicated that participants possess the "Highest" degree of perception in learning Biology using the STAD approach. Therefore, the learners showed a positive collaboration among their groups.

Table 3.Students' rating on Collaboration in Learning Biology with STAD model

No.	Statement	Mean	SD	Degree of perception
1	This approach creates a good relationship among team members.	4.10	.831	Strongly Agree
2	I feel actively involved in all activities through this Approach.	4.03	.706	Agree
3	This approach makes us participate more	4.39	.715	Strongly Agree
4	My team members help me to learn better	4.26	.773	Strongly Agree
5	I like working in a team to learn	4.42	.620	Strongly Agree
	Overall	4.24	0.729	Strongly Agree

Level of Perception: 0.0-1 Lowest, 1.1-2 Low, 2.1-3Moderate, 3.1-4 High, 4.1-5 Highest: Brown (2010)

Self-confidence in Learning

Table 4 showed the overall mean scores (M=3.89) and standard deviation (SD=0.948) of students' increased self-confidence to learn Biology using the STAD approach. Therefore, the data analysis showed that students increased self-confidence when the STAD approach was integrated into teaching and learning.

Table 4. Students' rating on Self-confidence in Learning Biology with STAD model

No.	Statement	Mean	SD	Degree of Perception
1	This learning approach is irrelevant to the content taught in the class.	3.55	.925	Agree
2	I prefer this learning approach used by teachers in the future	4.23	.971	Strongly Agree
	Overall	3.89	.948	Agree

Level of Perception: 0.0-1 Lowest, 1.1-2 Low, 2.1-3, Moderate, 3.1-4 High, 4.1-5 Highest: Brown (2010).

Data analysis from focused Group Discussion

Data obtained by semi-structured interviews were analyzed in order to corroborate the quantitative data responses to the achievement test and survey questionnaires. To maintain confidentiality, the student participants were coded as S1, S2, S3, S5, and S6. The transcripts were manually coded and presented under the main theme of students' perceptions of the STAD model in learning biology.

Increase motivation to learn biology

Students were of the view that the lessons taught through STAD learning activities were fun and interesting. For students, this learning method makes learning more fun and easier than the conventional way of teaching and learning. Students expressed that teaching with various activities encourages and motivates them to learn biology. As S2, S3, and S5 expressed; '*Learning was made easier and more fun, and the quizzes and tests were more interesting. I learned about the nervous system clearly.'* Similarly, S4 voiced out: *"I am able to clear all my doubts and I am getting the concepts of the lesson on nervous control and coordination. This helps me get a passion to learn biology."*

In addition, students expressed that learning in teams has helped them to improve their performance in biology. The STAD learning model enhanced the understanding of the lessons and enhanced interest in learning biology, and students are able to score good marks on tests. S4 mentioned: *"I get low marks in Biology tests but from this learning method, I am able to score better marks on the topic human nervous system".* On the same note, S2 explained; "*Through the quizzes, we could keep the study in our memory for a long time and our friends also helped d us with assignments and I enjoyed the lesson."* The findings from the students' perceptions indicated that the STAD learning model can be used as a teaching and learning tool in the classrooms to encourage, motivate and engage the learners meaningfully in learning.

Increase teamwork and collaboration in learning biology

All the interviewees are of the view that learning biology becomes easier and more enjoyable through teamwork and collaboration. Students expressed that their interest and learning get enhanced through teamwork. When asked to share their learning experiences, S4 opined; "The new learning experiences are more about team works, so I am happy to work in a team.". While learning through teams, students expressed that they are able to communicate well and help each other in learning. As S1 and S5 explained:

"We can communicate well with friends and we come to know that teamwork brings good solutions because we can share our opinions with our teammates, and the lessons on the nervous system are clearer and more understandable. Moreover, teamwork is much better than self-learning because it helps us in expressing our own opinions and can help each other to learn".

Further, students expressed that STAD learning activities keep them actively engaged and provide them the opportunity to participate in learning and also inculcate a sense of learning competition among teams when they are put into teams. (S6). When asked to provide feedback on the use of the STAD model to enhance learning biology, all the interviewees are of the same opinion that teamwork, collaborative group activities, presentations, online and offline quizzes, questions and answers, and presentations through ICT tools would be relevant for them. To put the exact excerpt from the interviewees S3 and S5: *"More teamwork activities and video lessons are needed. It would be better if sir could use more online quizzes through applications of phone and social media".*

DISCUSSION

The finding revealed that the use of the STAD learning model in biology has significantly improved learners' achievement scores on the topic of nervous control and coordination in biology. Statistically, the *paired sample t-test* at a 95% confidence interval reveals that there was a significant increase in the post-test mean score (M=8.95, SD=2.53) as compared to the pre-test mean score (M=6.67, SD=2.79), with mean score differences of (M=2.29). This result is corroborated by the significant findings reported from previous studies that students who are exposed to STAD have improved their learning outcomes, helping students to acquire academic knowledge and skills. For instance, Rattanatumma et al. (2016) reported that the student groups taught through the STAD model of cooperative learning secured high scores in the post-test. Similarly, the results corroborate with Yulianto et al. (2020), who show there are differences in the value of student learning outcomes in the control class with the experimental class with a T-test value of sig 0.03 < 0.05. Significant improvement in students' achievement scores can be attributed to the fact that cooperative learning strategies as one of the effective ways to increase academic performance in their respective courses. Studies indicated that it is one of the most effective teaching methods to actively engage students, motivate, participate, and interact in their classroom learning (Tiantong & Teemuangsai, 2013; Hermawan et. al., 2020; Yulianto et. al., 2020; Utami, 2019).

Analysis of both quantitative data and qualitative data indicated that students have overall positive perceptions of the student Team Achievement Division learning approach. A descriptive analysis of questionnaires on students' motivation shows the overall mean scores (M=3.99) and standard deviation (SD=0.715). The participants possess a "High" perception of the use of the STAD learning approach in biology. Further, the level of perception of the students' collaboration towards the STAD approach in learning indicated a mean score (M=4.24) and standard deviation (SD=.729), indicating that participants possess the "Highest" degree of perception in learning Biology using the STAD approach. Therefore, the learners showed a positive collaboration among their groups. Furthermore, the degree of perception of the self-confidence of participants in the STAD learning approach shows overall mean scores (M=3.89) and standard deviation (SD=0.948). This result showed that through the STAD model, students improve learning outcomes by collaborating with their teammates and increasing their confidence in learning concepts.

According to Ruwang (2017), cooperative learning encourages students to participate in class, encourages them to cooperate with group members and take responsibility for their share of the work, and also helps students develop confidence in their ability to learner. Moreover, the fundamental idea of student teams includes individual accountability, group benefits, and an opportunity for equal accomplishment (Huda, 2013). The qualitative data analysis corroborates the findings of quantitative data for this study. Students have positive perceptions of motivation and collaboration in learning through the STAD learning approach. On the perception of motivation, S3, and S5 expressed; 'Learning was made easier and more fun, and the quizzes and tests were more interesting. Additionally, S4 indicated "*I am able to clear all my doubts and I am getting the concepts of the lesson on the nervous system. This helps me get a passion to learn biology."*

Furthermore, students have positive perceptions of teamwork and collaboration. For example, S1 and S5 opined; "*We can communicate well with friends and we come to know that teamwork brings good solutions because we can share our opinions about lessons with our teammates, and the lessons on the nervous system are clearer and more understandable*. Moreover, students shared that teamwork is much better than self-learning because it

helps us in expressing our own opinions and can help each other to learn. The findings from qualitative interviews corroborate with the quantitative questionnaire analysis.

CONCLUSION

According to the study, there was a mean difference of 4.30 between the pre- and post-test mean scores [t (31) = -11.801, p=.000< 0.05]. It may be inferred from the results that using the STAD learning model as an approach of teaching and learning in the classroom significantly improves students' learning achievement in topic of nervous control and coordination. The use of STAD learning activities engaged students in a team to help each other to achieve a common goal, i.e. learning achievement. Similarly, the analysis of survey questionnaires and focused group discussion data indicated a high degree of positive perception about the impact of the STAD learning model. Therefore, the finding can be concluded that students increased their self-confidence when the STAD approach was integrated into teaching and learning. Further, it can be concluded that the STAD learning approach can be used as an approach for teaching and learning in the classrooms to motivate, encourage, and enhance teamwork in learning biology

However, the implementation of the STAD model in daily lessons for this research may have several limitations. Firstly, the sample size of the participants could be a limitation, as the study involved a specific number of students. This limited sample size may restrict the generalizability of the findings to a broader population. However, it can be used as a baseline for further expansion of study areas. Secondly, the study was limited to a short duration (a month) to carry out the interventions. The results might have been outstanding if interventions were extended for a longer duration. Thirdly, the characteristics of the participants, such as their prior knowledge, learning styles, and motivation levels, could influence their response to the STAD model, potentially affecting the outcomes of the research. Moreover, the research may be susceptible to biases, such as social dynamics within the groups or variations in participation levels among team members, which could impact the effectiveness of the model. Lastly, the implementation of the STAD model may require additional resources and support, such as materials, time, and training, which could pose practical limitations for educators in real-world classroom settings. These limitations should be taken into consideration when interpreting the results and applying the findings of the research.

RECOMMENDATION

The finding of this AR has revealed that students' learning achievement in learning the topic of nervous control and coordination in biology was enhanced after the intervention with STAD learning activities. Further, it revealed that there was a high level of perceptions (motivation, collaboration, and self-confidence in learning) with the use of the STAD learning model in biology. The STAD model is helpful for teachers as it promotes student engagement, fosters collaboration, and teamwork, cultivates a sense of shared responsibility for learning, and enables differentiated instruction. By incorporating the STAD model into their teaching practices, teachers can create an inclusive and supportive learning environment that enhances students' academic achievement and overall learning outcomes in various subjects.

As a result, researchers recommend that biology teachers, as well as teachers in general, are strongly encouraged to adopt and integrate the STAD model into their daily classroom practices. By doing so, they can effectively enhance students' academic achievement and improve learning outcomes in their respective subjects.

REFERENCES

Anderson, N. (2012). Design Thinking: Employing an Effective Multidisciplinary Pedagogical Framework to Foster Creativity and Innovation in Rural and Remote Education. *Australian & International Journal of Rural Education, 22* (2), 43-52. https://eric.ed.gov/?id=EJ993477

Cohen, L., Manion, L. & Morrison, K. (2008). *Research Methods in Education* (6th ed.). Routledge.

Dilshad, R.M. & Latif, M.I. (2013). Focus Group Interview as a Tool for Qualitative Research: An Analysis. *Pakistan Journal of Social Sciences (PJSS), 33* (1), 191-198. https://www.bzu.edu.pk/PJSS/Vol33No12013/PJSS-Vol33-No1-16.pdf

Dorji. K., Tshering, P., Wangchuk, T. & Jatsho, S. (2020). The implication of transformative pedagogy in classroom teaching: A case of Bhutan. Journal of Pedagogical Sociology and Psychology, 2 (2), 59-68. http://www.doi.org/10.33902/JPSP.2020262924

Eliopoulos, G.M., Harris, A. D., Bradham, D.D., Baumgarten, M., Zuckerman, I.H., Fink, J.C., & Perencevich, E.N. (2004). *The Use and Interpretation of Quasi-Experimental Studies in Infectious Diseases. Clinical Infectious Diseases, 38(11), 1586–1591*. doi:10.1086/420936

Fridah, M. (2002). *Sampling In Research.* Research Methods Knowledge Base. http://trochim.human.cornell.edu/tutorial/mugo/tutorial.htm

Gay, L. R., Mills, G. E., & Airasian, P. W. (2011). *Educational research: Competencies for analysis and applications*. Pearson Higher Ed.

Hermawan, M. C., Rosfiani, O., & Febry, S.S. (n.d.). *STAD Type Cooperative Learning Model: An Action in Learning Mathematics*. www.ijstr.org

Ibrahim, I.S. & Adnan, N.H. (2019). Student Teams-Achievement Divisions (STAD) in Enhancing Speaking Performance among English as Second Language (ESL) Learners: A Critical Review. *Creative Education, 10* (12). 10.4236/ce.2019.1012210

Ikart, E. M. (2019). Survey questionnaire survey pretesting method: An evaluation of survey questionnaire via expert reviews technique. *Asian Journal of Social Science Studies*, *4*(2), 1.

Ishtiaq, M., Ali, Z., & Salem, M. (2017). An Experimental Study of the Effect of Student Teams Achievement Divisions (STAD) on Vocabulary Learning of EFL Adult Learners. *Arab World English Journal*, *8*(3), 356–375. https://doi.org/10.24093/awej/vol8no3.23

Jordan, M. (2021, August 26). *Purposive sampling 101*. Alchemer. https://www.alchemer.com/resources/blog/purposive-sampling-101/

Kara, F., & Çelikler, D. (2015). Development of Achievement Test: Validity and Reliability Study for Achievement Test on Matter Changing. *Journal of Education and Practice*, *6*(24), 21-26.

Luyten, H. & Dolkar, D. (2010). School-based assessments in high-stakes examinations in Bhutan: A question of trust? Exploring inconsistencies between external exam scores, school-based assessments, detailed teacher ratings, and student self-ratings. *Educational Research and Evaluation, 16*(5), 421-435. https://doi.org/10.1080/13803611.2010.530437

Maman Hermawan, C., Rosfiani, O., & Febry Susanti, S. (n.d.). *STAD Type Cooperative Learning Model: An Action in Learning Mathematics*. www.ijstr.org

Ministry of Education and Skill Development [MoESD] (2014). *Bhutan Education Blueprint 2014-2024. Rethinking Education*. 1-173. Ministry of Education.

Mishra, P., Pandey, C.M., Singh, U., Gupta, A., Sahu, C. & Keshri, A. (2019). *Descriptive statistics and normality tests for statistical data. Annals of Cardiac Anaesthesia, 22(1), 67–72.* doi: 10.4103/aca.ACA_157_18.

Narzoles, D.T.G. (2015). Student Team Achievement Division (STAD): Its Effects on The Academic Performance of EFL Learners. *American Research Journal of English and Literature. ISSN 2378-9026,*1 (4). AMA International University.

Nasution, M. L., & Hafizah, N. (2020). Development of students' understanding of the mathematical concept with STAD-type cooperative learning through student worksheets. *Journal of Physics: Conference Series*, *1554*(1). https://doi.org/10.1088/1742-6596/1554/1/012035

Nikou, F.R., Bonyadi, A. and Ebrahimi, K. (2014). The Effect of Student Team-Achievement Division (STAD) on Language Achievement of Iranian EFL Students across Gender. *European Online Journal of Natural and Social Sciences, 3* (4). 946-949.

Rattanatumma, T., Practice, V. P.-J. (2016.). Assessing the Effectiveness of STAD Model and Problem-Based Learning in Mathematics Learning Achievement and Problem-Solving Ability. *ERIC*. Retrieved September 9, 2022, from https://eric.ed.gov/?id=EJ1099565

Royal Education Council [REC] (2012). *Annual report 2012*. REC.

Santosa, S., Furda, M., & Nurlaela, S. (2019). STAD Learning Model to Improvement of Activity and Student Learning Outcomes. In *American International Journal of Business Management (AIJBM) ISSN*,2, (10). www.aijbm.com

Tenzin, W. (2017). *Why Competency-based Assessment in Education in Bhutan?* REC. https://www.researchgate.net/publication/328107581_Why_Competency-based_Assessment_in_Education_in_Bhutan

Tiantong, M., & Teemuangsai, S. (2013). Student team achievement divisions (STAD) technique through moodle to enhance learning achievement. *International Education Studies*, *6*(4), 85–92. https://doi.org/10.5539/ies.v6n4p85

Trochim, W. (2002). *What is the Research Methods Knowledge Base?* In Research Methods Knowledge base, 1-34. Cornell University.

Utami, P., Basri, W., & Aisiah, A. (2019). Pengaruh Model STAD Terhadap Hasil Belajar Siswa Pada Mata Pelajaran Sejarah Indonesia. *Pakar Pendidikan*, 17(1), 13-25.

Utha, K., Giri, K., Gurung, B., Giri, N., Kjær-Rasmussen, L. K., Keller, H. D., Willert, S. & Keller, K. D. (2016). Quality of School Education in Bhutan: Case Studies in the Perspective of Gross National Happiness and Assessment Practices. (1 ed.) Aalborg University.

Wahib, M., & Tamer, Y. (2021). Exploring the Effect of the Flipped Classroom Model on EFL Phonology Students' Academic Achievement. *International Journal of Language and Literary Studies*, *3*(2), 37-53.

Younas, A., & Porr, C. (2021). A step-by-step approach to developing scales for survey research. *Nurse Researcher*, *29*(2), 14-19.

Yulianto, I., Warsono, W., Nasution, N., & Rendy A.P, D. B. (2020). The Effect of Learning Model STAD (Student Team Achievement Division) Assisted by Media Quizizz on Motivation and Learning Outcomes in Class XI Indonesian History Subjects at SMA Trimurti Surabaya. *International Journal for Educational and Vocational Studies*, *2*(11). https://doi.org/10.29103/ijevs.v2i11.2746.