Effect of Cooperative learning strategies on students' achieve ment in biology at secondary level and its role to address gender issues

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Abstract - *The study examined the effect of two types of cooperative learning strategies (CLSs) including structured CLS [Students' Team Achievement Division (STAD)] and informal CLS on the achievement of biology subject among secondary school students with respect to their gender. The researcher adopted the pretest–post-test experimental design to perform two separate experiments. A total of 63 students of class IX participated in the first experiment and, in the second experiment, 62 students were participated. An instrument, Biology Achievement Test, developed by a researcher comprising of 100 items, was used. Its reliability coefficient was calculated by using K20 method and Cronbach reliability formula, in which the values were found to be 0.67 and 0.83, respectively. The results revealed that both the structured and informal types of cooperative learning instructional strategies enhance students' achievement in biology. The study shows that structured CLS (STAD) as well as informal CLS had no significant effect on students' achievement in relation to their gender, although in both cases, the female students achieved more than their male counterpart. Thus, an implementation of CLS has a step to realize gender equity in the science classroom.*

Keywords: *Achievement; cooperative learning; gender stereotype; Students' team achievement division*

INTRODUCTION

Science especially at secondary level is very important for students of the 21st century. It is not only develop the ability of reasoning, curiosity, creativity, positive attitude and problem solving approach but also it is used as a tool of social change to reduce the gap of unequal divisions in the society. National Curriculum Framework (NCF) [1], focused on three major issues of science education in Indian context. The first major issue is regarding the equity in science education as enshrined in the Indian constitution. Second, science education though develops competence, but fails miserably to promote inventiveness and creativity, and third, it has been the overpowering examination system. Since, the equity issues in science education constitute a major problem for a democratic nation because equity is the fundamental goal of any democratic society. However, thus far, our education system has neglected to address the issue of accessibility and equity in quality science education "for all" adequately. Many pupils get out of schools as "scientific illiterates" or would soon sink into this state. Research studies from several countries in the contexts of the science education report the differential participation and low achievement of students belonging to different socioeconomic, cultural and gender backgrounds [2]. In Indian context gender inequality is prominently observed phenomena. Therefore, it is call of time to explore the every aspect of education like school curriculum, textbooks, teacher behaviour, school climate and pedagogy through gender lens.

"Gender" is socio-cultural concepts while, "sexes" is biological differentiation of boy and girl. The concept of gender is emerges from the " feminism" perspective which believes that inadequate and inappropriate representation of women in personal and public life is important reason for origin of gender studies. Gender refers to masculine and feminine qualities, behaviour patterns, roles and responsibilities. In Indian patriarchal culture men are believed to be superior and more intellectual then female, where men role is bread earner and female is nurturer [3]. Therefore, parents' attitude toward girl education is not very encouraging. Girls are treated as "parayadhan," and most of the parents think is simply a waste of money to invest on the education of these "migratory birds." These traditional beliefs fostering negative attitudes, which limit the family and community support for girls' education. The impact of this thought amplifies as we move higher to lower social class and urban to rural area. Moreover, the gender gap is matter of discourse for all over the world. It refers to the differences between women and men, especially as reflected in social, political, intellectual, cultural, or economic attainments or attitudes. The Global

Gender Gap index was introduced by the World Economic Forum to examine inequality between men and women in areas of Economic participation and opportunity, Educational attainment, Political empowerment, Health and survival. India over all rank is 108 and ranks 139 in terms of economic participation, 112 in educational attainment, 141 in health and survival and 15 in political empowerment (Source: World Economic Forum, 2017). It clearly indicates that wide gender gap exists in educational arena. According to census 2011 literacy rates were 82.14% for men and 65.46% for women. The sex ratio of children attending school is 889 girls per 1,000 boys. There is gender equality in school attendance in urban areas; but, in rural areas, the female disadvantage in education is marked and increases with age [4].

The gender gap exists in education vividly observed in science education. The ideologies and nature of gender stereotype as developed in past century have resulted in the exclusion of women from science for a long time all over the world. In the beginning of past centuries, Women, were barred from education. Later on they were allowed education but were barred entry to universities. The idea prevailed that education would distract women from their natural roles as mothers [5]. Gender gap of education disseminates primarily through schools. In India most of the schools are meant to educate particular sex. Even in coeducational schools, there is separate seating arrangement of boys or girls. Interaction between boys and girls are not considered as normal [6]. Gender Issues in Education, Ganga Saran & Grand Sons, Varanasi). It is commonly observed that Boys are mostly given the task related to authority and leadership. Therefore, the girls' participation in school and teaching-learning process is not encouraged in conventional classroom.

In such a grim situation, teachers' role and her pedagogical skills become paramount. In the view of Gbaje, [7] teachers also maintain gender-stereotypic outlook in their classrooms perceiving science as being difficult for the female students. During their career as teacher educators, researchers observed that parents, teachers, and peers have doubts in academic potential of girls; they blindly believe that girls are less capable in academic abilities than boys and cannot excel in science subjects. Parents of most boys' student borrowed them personal tutor or private coaching for learning of science and mathematics, but only few girls' parents afford this extra investment to educate their girls child. This attitude has a negative effect on girls' participation in science education in a number of ways. Oludipe [8] reported that because of the self-perception resulting from the fixed stereotype carried to school by the students, some girls tend to become nervous on sighting some animals, blood, or even models of some human parts. Thus, our classroom became also place that deepens the gender gap in science subjects. To address gender issues, Utulu [9] clearly mentioned that as an effort to reduce or put a stop to the gender disparity there should be Girls Education Project to develop technical capacity of teachers' pedagogical skills; to create girl friendly environment that enhances the participation of girls and improve their learning outcomes. The teachers must switch to toward some nontraditional pedagogical practices that can bridge the gender gap.

The traditional pedagogical practices which are predominately being practiced in the schools of India, the teacher dominates the class; they mostly use the lecture method, or sometimes use demonstration or some activities to verify the factual knowledge given in the textbook [10]. These methods failed to ensure quality education and equitable accessibility towards quality as according to needof contemporary scenario. Besides, these methods create room for gender stereotypes in the class. This is because the teacher, who dominates the whole teaching–learning process, exhibits gender stereotypes either consciously or unconsciously. For example, calling on boys to help hold instructional aids, clean the board or even to answer questions considered more difficult while girls to answer simpler ones or sometimes left out [11]. These eventually make a girls' lose interest; thereby, discouraging them from full participation in the study of biology [12].

To address the problem related to gender gap in science classroom, teachers require doing strenuous effort. Therefore it need of contemporary situation to incorporate some non conventional method that can enhances students' participation in teaching–learning process, provide equal opportunities to all students irrespective of their gender, to raise their voices and to enhance their self esteem, it can seem possible by using cooperative learning strategies (CLSs) for science education. Hence, the recommendation of the use of the CLS in teaching science subjects was made by the scholars [12-14].Cooperative learning strategies employs that the students working together in small groups to accomplish shared goals [15]. Generally, cooperative groups are heterogeneous especially in terms of achievement of different abilities students, motivation, task orientation and in also in terms of class, gender and culture [16]. In the view of Ebrahim, [17] teachers should encourage to use cooperative learning because it positive affect students' abilities to deal with the needs, diversity, and interpersonal demands of the twenty-first century

and help them deal with science problems successfully.

Wachanga and Mwangi [18] in their study showed no significant differences between boys and girls taught through cooperative learning as compared to boys and girls in the experimental groups instructed through cooperative learning in chemistry. Ajaja and Eravwoke [19] investigated the effect of cooperative learning students' achievements in science with respect to moderating variables such as gender and abilities influences. They found no significant difference between the posttest scores of male and female students. Similarly, Norman [20] and Achor et al. [11] studies indicated that there was no significant interaction between methods and gender on students Biology Achievement Test but girls performed better than boys. The findings of the Haliru [21], study revealed that there is no significant difference between the academic performances of male and female students taught geography using cooperative learning. The study shows that CLS has a neutral effect on gender. While Nawaz et al. [22] suggested that across the gender the self-concept of female was significantly better than the male while there was no difference on academic achievement across the gender. In other words we can say that implementations of these cooperative learning activities in classroom enhances the achievements of boys as well as girls students and cable to bridge the gap between their achievements if already exist due to gender stereotype among them.

In the research study conducted by Kolawole [23] on the effects of competitive and CLSs on the academic performance of Nigerian students in mathematics, he found that boys performed significantly better than girls in both learning strategies. Another study conducted by Adeyemi [24] on the effects cooperative learning and problem solving strategy on the achievement of junior secondary school social studies students; the author reported that the effect of the teaching methods was gender sensitive. These researches are contradictory to aforesaid research reviews. Therefore, reviews shows inconclusive results regarding the effect of CLS with relation gender of the students.

More so, there is dearth of studies in the Indian context on cooperative learning that comprehensively examines the influence of CLS with respect to gender students' on their achievement in biology. Therefore, in present study researcher attempted to investigates the effect of structured and informal both types of CLS on students' achievement in biology. Two methods are separately used because both are quite different from each other and both are found effective methods in different subjects at different levels and ANCOVA had been used to enhance the power of statistical analysis.

METHODS

For the present study, the investigator adopted the "equivalent group pretest–post-test design". Gender and two types of instructional strategies were taken as the independent variables to answer the question of whether there are gender differences in mean achievement scores of Biology as a result of cooperative learning strategies. In this study, the investigator adopted "randomized group" technique for equating the groups. The students were randomly placed into two groups.

R	O1	X	O2
R	O3	C	O4

Where, R – random selection; O1, O3 – pretest scores; O2, O4 – post-test scores; X – experimental group; and C – control group.

The two groups in both of the experiments were equated on the bases of scores on intelligence test and pretest scores on Biology Achievement Test (BAT).

Sample and sampling technique

A total of 63 students of class IX in the first experiment and 62 students in the second experiment were included in the present study. The purposive method of sampling was used by the investigator for the selection of school that must fulfill the objectives of the study and convenient for the investigator. Subjects were randomly assigned into control and experimental groups.

Table-1. The steps involved and the various activities performed in each of these phases are summarized in the table below:

S.No.	Phases	Duration	Activities	
1.	Pre treatment	2 hours	Pre test was administered on all students. After pretest students were randomly assigned into control and experimental group.	
2.			Experimental group	Control group
	Pre Treatment Phase	3 days (2 hours)	Orientation on the cooperative learning process.	--------
	Treatment phase	45 instructional classes	Taught according to lay out plans based on structured CLS (STAD Method and informal method)	Taught by the lecture cum demonstration method covering the same units of biology
3.	Post treatment	2 hours	After treatment both group were subjected for post test.	

Instrumentation

To fulfill the objectives of the present study the following four instruments were constructed by the researcher and used to collect the relevant data:

1. BAT: The data collecting instrument was named as BAT developed by researcher. It consists of 100 items and validated by experts of test and measurement and three experienced biology teacher for face and content validity. The reliability coefficient of test was calculated by using the Kuder–Richardson formula 20 and Cronbach coefficient (split half method of reliability) method, the values were found 0.67 and 0.838, respectively.
2. Layout plans on structured CLS (STAD model) and informal CLS: The layout plans dealing with the theme of organization in living world and cover four units of Class IX NCERT (National Council of Education Research and Training) science textbook include units; Cell: The fundamental unit of life, tissue, diversity in living organisms, Why do we fall ill? The plans included instructional objectives, a list of materials needed, group size, assignment of roles, and arrangement of the room.
3. Worksheet based on the four units of biology: It is designed according to the objectives of layout plans for STAD method of structured CLS as described above.
4. Opinionnaire to assess the perception of students' for cooperative learning: A questionnaire of 15 items was prepared by the researcher to assess the perception and feedback of students toward cooperative learning.

Experimentation

Two separate experiments were carried out to meet the objectives of the present study. Both experiments consisted of three phases, the pretreatment phase, treatment phase and post-treatment phase. Here are some details of the experimentations (Table - 1).

Experiment no. 1

Experiment no. 1 was conducted to achieve the objective no. 1.The total 63 students of class ninth were participated in the study. They were randomly divided into two groups, out of which 32 students comprised the experimental group and 31 students in the control group. One group called as experimental group which is taught by the structured cooperative learning, that is, student team-achievement division (STAD method) and the other group called as the control group is taught by traditional lecture cum demonstration method.

Experiment no. 2

For realization of objectives no. 2, experiment no. 2 was carried out. The total 62 students of class ninth were participated in the study. They were randomly divided into two groups, out of which 30 students comprised the experimental group and 31 students in the control group. One group called as experimental group which is taught by the Informal cooperative learning and the other group called as control group is taught by traditional lecture cum demonstration method.

Treatment

For systematic implementation of STAD in the classroom by researcher developed systematic layout plans and worksheets. All students were divided into four members of mixed ability (1 – high achiever, 2 – average achiever, and 1 – low achiever) and assigned definite role. The teacher has given a brief concept about content and focused the attention of students on the important points of learning. Then provide a single worksheet to each group and instruct them to fill and complete it cooperatively after discussion with each-other. While students are working in groups, the teacher move to each group to observe the activities of students provide motivation, guidance and also help them to resolve the conflict if arises. Here, during her visit to the different group teacher also assess the learning outcome of students. Students earn team points based on how well they scored on the quiz compared to past performance. Individual as well as a good group performance both were considered for final assessment. The team had highest score was declared as winning team and the title of "Biology Star" was given to them.

For the implementation of informal CLS investigators used different type cooperative learning techniques like think – pair share, three step interview, robin round table and most of times Jigsaw was used. In Jigsaw groups, the topics to be studied were segmented in sub topics and member of each group was assigned a particular subtopic of the lesson. All members sharing the same sub topic were formed into expert groups where they discussed their content so as to master and become experts. They finally reconvened where each member explained his unit to other members of his/her group. Unlike STAD, each student took the test without help. The scores of members of the group were summed together to form the group's score which were used to award prizes to the best group.

Data collection

Post-test scores on BAT, responses of students on opinionnaire regarding their perception toward CLS and introspection report of students were collected.

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Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences version 20.0 software (IBM SPSS Inc., Chicago, IL, United States) for the analysis of covariance (ANCOVA). All values were expressed as mean (±standard error). *P* value <0.05 was considered significant in the present study.

RESULTS

Objective no. 1: Effect of structured CLS (STAD) on achievement of in biology subject in relation to gender of students

At the time of starting the experiment, investigator equivate the both the experimental and control group on the basis of their intelligence scores and achievement score at pretest level. The score of male and female students was also matched in both experiment and control group. But their score within the experimental and control group cannot be matched as some of them achieved higher than others. Therefore, to control the error variance, ANCOVA studies were carried out. The use of ANCOVA nullifies the difference of pretest by adjusting scores at a post-test level that increases the statistical power of the test. Two way ANCOVA was used to find out the interaction effect of gender and instructional strategy on students' achievement in BAT. The effect of STAD on students' achievement with respect to their gender has been represented in the following table from tables 2–6.

Table – 2. Descriptive statistics for effect of CLS (STAD) in relation to Gender

Dependent Variable: Post Total Test

Group	Gender	Mean	Std. Deviation	N
Experiment	Male	65.81	10.883	16
	Female	56.12	11.087	16
	Total	60.97	11.874	32
Control	Male	49.94	11.782	17
	Female	49.57	14.086	14
	Total	49.77	12.651	31
Total	Male	57.64	13.777	33
	Female	53.07	12.790	30
	Total	55.46	13.408	63

Table – 3. Two-way ANCOVA for effect of CLS (STAD) in relation to Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	10035.785[a]	4	2508.946	131.114	.000
Intercept	1213.543	1	1213.543	63.418	.000
Pre_Total	7310.691	1	7310.691	382.046	.000
Group	1330.729	1	1330.729	69.542	.000
Gender	93.652	1	93.652	4.894	.031
Group * Gender	25.995	1	25.995	1.358	.249
Error	1109.866	58	19.136		
Total	204924.000	63			
Corrected Total	11145.651	62			

a. R Squared = .900 (Adjusted R Squared = .894)

Table – 4. Estimated Marginal Means (Groups)

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Experiment	60.106[a]	.775	58.556	61.657
Control	50.853[a]	.791	49.269	52.437

a. Covariates appearing in the model are evaluated at the following values: Pre Total Score Test = 18.22.

Table – 5. Estimated Marginal Means (Gender)

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	54.183[a]	.785	52.612	55.755
Female	56.776[a]	.825	55.124	58.428

a. Covariates appearing in the model are evaluated at the following values: Pre Total Score Test = 18.22.

Table – 6. Estimated Marginal Means (Group * Gender)

Group	Gender	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Experiment	Male	59.462[a]	1.141	57.178	61.745
	Female	60.751[a]	1.119	58.511	62.990
Control	Male	48.905[a]	1.062	46.779	51.032
	Female	52.801[a]	1.181	50.438	55.165

a. Covariates appearing in the model are evaluated at the following values: Pre Total Score Test = 18.22.

The table -3 shows that value of gender is $F_{(1,62)}$= 4.894, P = 0.0.031, that is, P< 0.05 indicates that after controlling the residual and previous knowledge there exists a significant difference in overall post-test scores male and female students. This difference is due to the already existing gender stereotype among the students, but not due to interaction any of instructional method with the gender of the students (Table - 3).

The table -5 showing adjusted total post-test scores of male is 54.183 and female is 56.776 clearly indicates that female outperform than male students on BAT. Again table showing the interaction effect of group and gender shows that adjusted post-total BAT score of male students in the experimental group is 59.462 which is significantly higher than scores of male students of the control group and lower than adjusted post-test scores of female of experimental group who scores 60.751 quite higher than the scores of control group female students who scores 52.801. These scores clearly show that female students achieve more while they are taught through structured CLS. Although, the achievement of female students enhanced through CLS, but F value for interaction group and gender is 1.358 at degrees of freedom 1 and 62 and it is not significant at 0.05 level. Since, $F_{(1,62)}$= 1.358, P = 0.249, that is, P> 0.05 revealed that any instructional method has no significant effect on biology students' with respect to their gender.

Objective no. 2: Effect of informal CLS on achievement of in biology subject in relation to gender of students

Two way ANCOVA was carried out to find out the effect of informal CLS on gender of students. The table to analyze the interaction effect of gender with methods of instruction has been represented in Tables 7-11.

Table – 7. Descriptive Statistics for effect of CLS (Jigsaw) in relation to Gender

Dependent Variable: Post Total Test

Group	Gender	Mean	Std. Deviation	N
Experimental	Male	67.67	8.964	18
	Female	68.17	8.590	12
	Total	67.87	8.669	30
Control	Male	49.67	7.800	21
	Female	58.91	12.779	11
	Total	52.84	10.574	32
Total	Male	57.97	12.272	39
	Female	63.74	11.553	23
	Total	60.11	12.241	62

Table – 8. Two-way ANCOVA for effect of CLS (Jigsaw) in relation to Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8253.564[a]	4	2063.391	132.650	.000	.903
Intercept	841.743	1	841.743	54.113	.000	.487
Pre_Total	4140.597	1	4140.597	266.187	.000	.824
Group	1873.104	1	1873.104	120.417	.000	.679
Gender	106.579	1	106.579	6.852	.011	.107
Group * Gender	5.327	1	5.327	.342	.561	.006
Error	886.646	57	15.555			
Total	233181.000	62				
Corrected Total	9140.210	61				

a. R Squared = .903 (Adjusted R Squared = .896)

Table – 9. Estimated Marginal Means (Group)

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Experimental	66.416[a]	.741	64.933	67.899
Control	54.928[a]	.735	53.456	56.400

a. Covariates appearing in the model are evaluated at the following values: Pre Total Score Test = 22.05.

Table – 10. Estimated Marginal Means (Gender)

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	59.302[a]	.635	58.031	60.573
Female	62.042[a]	.828	60.383	63.700

a. Covariates appearing in the model are evaluated at the following values: Pre Total Score Test = 22.05.

Table – 11. Estimated Marginal Means (Group*Gender)

Group	Gender	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Experimental	Male	65.357[a]	.940	63.474	67.240
	Female	67.475[a]	1.139	65.193	69.756
Control	Male	53.246[a]	.888	51.468	55.025
	Female	56.609[a]	1.197	54.211	59.007

a. Covariates appearing in the model are evaluated at the following values: Pre Total Score Test = 22.05.

From table - 8, value of gender is $F_{(1,62)}$= 6.852, P = 0.011, that is, P< 0.05 so, it implies achievement scores of male and female students is differing significantly in overall post-test score this difference is due to their gender attitude already existed in them. However, as we observed that in table - 10 the total post-test adjusted score of girls is 62.042 which is quite higher than male students where the score is 59.402 indicates that female perform better than male students on BAT. While, in table – 11, the scores of male and female students who learned with informal CLS are 65.357 and 67.475, respectively, also revealed that within the experimental group girls perform slightly better than boys. Since, the value of F for interaction effect of methods and group shows $F_{(1,62)}$= 0.342, P = 0.561, that is, P> 0.05 implies that instructional methods have no significant effect on biology students' with respect to their gender.

DISCUSSION

Science education ought to empower students to question the social beliefs, notions and practices that perpetuate social inequality. There exists a huge disparity in science education in terms of gender, socioeconomic class, caste and region. The traditional practices followed in Indian science classroom fail to address these kinds of issues. To achieve creativity and overall national development, teaching strategy that captures interest of secondary school students in science concepts is crucial [24]. Thus, we must quest for some innovative practices that can enhance students' achievement and also inculcate social skills among them to become good citizen of an egalitarian society. Implementation of cooperative learning in science may prove fruitful in this direction that can enhance achievement each and every student also provide opportunities to interact with each-other harmoniously to promote the learning of every member.

In cooperative learning situation, the students learn in small heterogeneous groups, all group members have their definite role and they all participate fully in cooperative learning activities; interact with each other and the boring science lessons become interesting to them. In an experimental study Lau et al. [25] found CLS improve the students' teamwork skills. The study also, indicated that students were willing to help out other team members to achieve a common goal. Group members are positively interdependent on each other to achieve common learning goals and there is face to face promotive interaction among them each member encourages the learning of other member positively. Thus, these components of cooperative learning strongly promote gender equity. In the cooperative learning, classroom provide the opportunity for both boys and girls to participate in the learning activities by giving all of them challenging questions while girls assigned leadership role to increase their confidence [7]. Adesoji and Babatunde [26] also suggest that creating a conducive classroom environment as in a cooperative learning class where, every student has an equal opportunity

for freedom of speech and expression, and participation in learning activities irrespective of gender will bridge the gender gap.

The results of the present study showed that achievement in BAT was significantly higher in both the experimental group to that of the control group. It clearly indicates that cooperative learning improves the achievement scores of male as well female in comparison to traditional lecture cum demonstration method of teaching biology and no significant effect of CLS were found in relation to the gender of the students**.** The results are in agreement with the previous studies as carried out by Wachanga and Mwangi [18] Nwagbo and Chikelu [27], Gardunio [28] and Haliru [21] and Cirila [29] The findings of present study is also supported by the findings of numerous researchers which revealed gender equality in the mean gain in the cooperative learning method [8, 30-32].

The results of the present study revealed that the achievements of male and female students are the almost equal when learned with the informal CLS, here, mean gain of female students is slightly higher than male students. Similar study was carried out by Achor et al., [8] who found that the achievements of male and female students are the same in the Jigsaw cooperative strategy (Informal CLS) but differ slightly in favour of the females taught using STAD strategy (Formal CLS). He further suggested that both of these CLS will encourage the girls to study science and the popular outcry on the low enrolment of girl child in the science and related professions such as medicine, pharmacy, engineer, agriculture and architecture would be put to rest.

Both of these present experiments showed that CLS has a positive effect on all students' achievement irrespective of their gender inequity. Even the school offers coeducation; at the beginning of the experiment, boys and girls feel hesitant, but soon they feel comfortable to work together. Responses of the students on the opinionnaire regarding their perception on cooperative learning revealed that students mentioned that they enjoy such a type of teamwork, group discussions, and group debates and also got a good opportunity for expressing their opinions and develop more friendly relation with their classmates. The feedback from the students was very much encouraging; they said that the teaching of biology is interesting and joyful experience for them, and they also want to learn chemistry and physics in a cooperative learning environment. Girls feel joy and respect in the role of captain. The girls also feel that they got good opportunities to express their views during the group discussion that may contribute to boost their confidence that may be a reason for their good performance. Besides, thus, it was also observed that this CLS is also helpful to develop students' social and communication skills, increase tolerance and acceptance of diversity therefore, filling the gap of gender, and seem a step forward to realize gender equity in the science classroom.'

CONCLUSION

India ranks 112th for gender gap in education sector. This gap is very deepens in case of science education. The patriarchal believes Indian culture also, reflects in every aspect of education and its formal bodies like schools and educational institutions. There is not only segregation of gender based schools and seating arrangement within the coeducational schools. There is also, gender segmentation of subjects. Science and mathematics are considered as hard subjects and "masculine" one, while the subjects of arts streams like history, sociology, home sciences are considered as easy "feminine" subjects. It is common notion in our society that girl can successfully pass out examination with these "feminine" subjects therefore she should choose these subjects and if she chooses science stream; she will become unsuccessful to clear examination. She must choose some easy subject of literature or social science course for graduation. Such type of social and cultural stereotypes, and unsupportive parents' attitudes towards girls' education seem to be a major hurdle to the achievement of equity in science education. Therefore, system, in general, and the teachers in particular have to be sensitive to the issues of gender disparity and classroom must be place to create equal participation of all students in teaching –learning process irrespective of their gender. The traditional classrooms are segregated in terms of seating arrangement, roles and opportunities of boys and girls in learning process. While, the Cooperative Learning classroom provides equal opportunities' to boys and girls for active participation in knowledge construction, and allowed them to interact with each-other. Thus, these methods challenging the normal patriarchal believe and, setup of conventional classroom which has nurtured the existing gender related stereotype in hidden manner.

The present study investigates the effect of structured and informal CLS on students' achievement in biology that revealed both type of CLS enhances achievement of boys as well as girls students. It shows that structured and Informal CLS increases the performance of girls' students slightly over the boys. However, the gender difference was already existed among the participants were

overcome by the implementation CLS. So, that performance of female students had been very much improve in experimental group and lead us to conclude that CLS has significant effect with respect to the gender of students however it fill the already existing gender gap between students by enhancing the performance of girls students.

Educational Implications

Present education system need to use CLS in their classroom and teacher should encourage to use CL in classroom because these strategies ensures active participation of students in their knowledge construction process and to develop interest in biology or other science subjects to make their teaching effective. The Results of the present study will be helpful for the policy makers, teachers, students, parents as well as school authorities. Outcomes of the study showed that cooperative learning can be used as alternative pedagogy in conventional classroom for achieving quality education to all learner types of learner and encourage science learning in females. Cooperative Learning creates conducive and harmonious classroom environment that dominates with compassion, cooperation, friendship and equal participation of all students in learning process. Therefore, CLS promotes learning of all types of students to learn better and faster from their own peer group, than from a teacher irrespective of their gender. Therefore, CLS could address the issues of gender gap in science education and, by incorporating CLS for science learning we can reach toward the goal of quality science education for all.

Conflicts of interest

There are no conflicts of interest.

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