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RESEARCH PAPER

Effect of Collaborative Learning Strategies on Student's Science Achievement at the Elementary Level

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ABSTRACT

The purpose of the study is to examine the effects of collaborative learning strategies on student science achievement. The study was experimental in nature. The Nonequivalent Control Group Design was applied to conduct the study. All the students of grade eight of district Sheikhupura were the population of the study. The sample consisted of eighty students enrolled in grade eight, selected through simple random sampling technique by belting from two public secondary schools of district Sheikhupura. Eight grade science test developed by the Punjab Examination Commission (PEC) 2018was used by the researcher to collect the data from the sample. Collaborative learning strategy (Jigsaw) was used during Intervention. The duration of the intervention was twenty-six weeks and the full book of General Science was taught to the students. The data were analyzed by using statistical package of social sciences (SPSS) version 22. Mean score, Standard Deviation, independent sample t-test and ANOVA were applied. Results indicated that collaborative learning strategies have a significant effect on student science achievement. The results of the study were likely to help teachers, administrators and policy makers in improving the quality of teaching and learning of Science at the elementary level

Introduction

Meeting up is the start, keeping together is progress and collaboration is achieved (Dillenbourg, 1999). Collaborative learning is an umbrella term for a variety of educational methodologies, including joint scholarly exertion by

students and teachers together. For the most part, students are working in groups of two or more, commonly looking for understanding, solutions, or implications, or creating a product. Collaborative learning activities vary widely, but most focus, on students' investigation or use of the course material, not just the teacher's presentation or clarification of it (Smith & McGregor, 1992).

At their best, collaborative classroom animate the both the teachers and students. In the most credible of ways, the collaborative learning process models what it means to question, learn and comprehend working together with others. Collaborative learning demand responsibility, diligence and affectability, yet the outcome can be a community of students where everybody is free to join, take an interest and develop (Escudero and Sabirón, 2000).

In collaborative actions, students unavoidably experience differences, and should grapple with reorganizing and working with it. Building the capacities with regards to enduring or resolving differences, for building understanding that respects all the voices in a group, for caring how others are getting along these capacities are urgent parts of living in a community. Development of collaboration, community building, and administrative aptitudes are real and significant classroom objectives, not simply extra-curricular ones (Willis, 2007).

Webb's (1991) announced that the impact of collaborative learning on student achievement relies upon the nature of the collaborations among them. Lou, Abrami, and d'Apollonia, (2001) who investigated the distinctions in achievement and attitudes at all grade levels of education, inferred that "on average, students learning in little groups in classrooms accomplished significantly more than students not learning in little groups" (p. 439).Webb (1991) found that the students who worked in groups on computational math issues scored significantly higher than comparable capacity students who worked individually.

Zakaria and Iksan (2007) accepted that collaborative learning is the basis in the conviction that learning is best when students are effectively engaged with sharing thoughts and working cooperatively to finish academic assignments. Achievement for teacher and students the same is thought to be a rare respect, which one works for alone, in competition with peers. This suspicion of the shortage is the platform for norm referenced grading, or "evaluating on the curve," a method that implements separation among students and erodes the trust on which collective learning is assembled. (Escudero & Sabirón, 2000).

Research Hypotheses

$Ho_{1:}$ There is no significant difference between pretest and posttest score of students' science achievement among elementary level students of the control group.

Ho_2: There is no significant difference between pretest and posttest score of students' science achievement among elementary level students in the experimental group.

Ho_3: There is no significant difference in pretest score of students' science achievement between control and experimental group at the elementary level.

Ho_4: There is no significant difference in posttest score of students' science achievement between control and experimental group at the elementary level.

Literature Review

In collaborative learning situations, students are not just taking in new information or ideas. They are creating something new with that information and ideas (Morgan, 2003). In collaborative actions, students unavoidably experience differences, and should grapple with reorganizing and working with it. Building the capacities with regards to enduring or resolving differences, for building understanding that respects all the voices in a group, for caring how others are getting along these capacities are urgent parts of living in a community (Willis, 2007).Following collaborative learning strategies, widely used in classrooms.

Think-Pair-Share. Think-pair-share is one of the most widely recognized sorts of working collaborating learning. (1) The instructor offers a conversation starter, best one requesting examination, assessment, or blend, and gives students about a moment to thoroughly consider a fitting reaction. This "figure time" can be spent composition, moreover. (2) Students at that point go to an accomplice and offer their reactions. (3) During the third step, study reactions can be shared in a four-man learning group, inside a bigger gathering, or with a whole class during a follow-up discussion. The caliber of discussion is improved by this technique, and all students have a chance to learn by reflection and by verbalization (Johnson & Smith, 1998).

Three-Step Interview. Regular as an ice-breaker or a group building exercise, this structure can likewise be utilized additionally to share data, for example, theories or responses to a film or article. (1) Students structure dyads; one student meets the other. (2) Students switch roles. (3) The dyad joins with a subsequent dyad. This four-member learning group at that point examines the data or experiences gathered from the underlying paired interviews (Kagan, 1989).

Jigsaw. The faculty member separates a task or subject into four sections with all students from each learning group volunteering to move toward becoming "specialists" on one of the parts. Expert groups at that point cooperate to ace their fourth of the material and furthermore to find the most ideal approach to help

other people learn it. All experts at that point reassemble in their home learning groups where they show the other gathering individuals (Johnson, 1994).

Numbered Heads Together. Members from learning groups, typically made out of four people, make note of: 1, 2, 3, or 4. The instructor offers a conversation starter, typically truthful in nature, yet requiring some higher directive thinking abilities. Students talk about the inquiry, verifying that each group part knows the settled upon the answer. The instructor calls a particular number and the colleagues initially assigned that number during the make note of reacting as group spokespersons. Since nobody realizes which number the teacher will call, all team members have a personal stake in understanding the proper reaction (Sharan, 2011).

Round Table. Round Table is a collaborative learning technique that enables students to evaluate earlier learning, review data and practice relational abilities. The steps are: ***1. Write:*** Each student writes one (or two or 3) sentences about a given topic (or this could be a response to an inquiry) on a bit of paper. ***2. Share.*** The paper is passed around to one group part at once. Each group part reacts recorded as writing. ***3. Summarize.*** When the first is restored, the students peruse the remarks from the group and offers what the aggregate feeling of information disclosed in the group about the topic (or question) (Johnson and Johnson, 1986).

Thinking Aloud Pair Problem Solving (TAPPS). This problem-solving, collaborative structure was presented by Lochhead and Whimbey (1987) as a way to support critical thinking aptitudes by verbalizing to an audience one's critical thinking musings. Students are matched and given a progression of issues. The two students are given explicit jobs that switch with every issue: Problem Solver and Listener. The listener solver peruses the issue, so anyone might hear and talks through the answer to the issue. The audience pursues the majority of the issue solver's means and gets any mistakes that happen. For the listener to be compelling, the individual in question should likewise comprehend the thinking procedure behind the means. This may require the audience to pose inquiries if the problem solver's manner of thinking ends up vague. The inquiries posed, be that as it may, ought not control the problem solver to an answer, nor should they expressive feature a particular mistake, but to remark that a blunder has been made (Slavin, 1995).

Concept Mapping. Concept mapping is a collaborative learning method that permits students working in groups as a method for delineating the associations that exist between terms or ideas canvassed in the course material. The technique is:

1. Students compose terms from the seminar on an enormous bit of paper.

2. Lines are attracted associating individual terms to demonstrate the connections between terms. The greater part of the terms in an idea guide have various connections.

3. Building up an idea guide requires the students distinguish and sort out data and to set up important connections between the snippets of data (Sharan, 2011).

Talking Chips, Fish Bowl, Note Talking Pairs, Send-a-Problem, Buzz Group, Learning Cell, Drill-Review Pairs are also collaborative learning strategies used in classrooms.

Rationale for Collaborative Learning.

The study of CL has strong pedagogical and theoretical support (Storch, 2007). Generally, CL is found in:

1. **Provide More Language Practice Opportunities.** This point of view is profoundly bolstered by the traditional technique as a way to augment students' language practice openings, as students cooperate to satisfy a shared objective by utilizing the essential language aptitudes (Long and Porter 1985; Harmer 1991).

Researchers, for example, Long and Porter (1985) and DI Nitto (2000) guarantee that one principal cause students' low accomplishment of numerous students is basically because of the lacking time they need to rehearse. Long and Porter in the early1980s have found from the observational proof, showing that in a 50-min class, the normal time assigned for every understudy is just 30-Sec (Long and Porter 1985).Xi et al. (2007), Zhang (2010) relate to the early discoveries, guaranteeing that the circumstance is progressively genuine in huge classrooms in China when there is a pressing requirement for students to build up their oral aptitudes. CL, in this manner, builds the all-out individual practice time by masterminding students into little groups where additional time can be distributed and more turns of the discussion can be figured it out.

2. Improve the Quality of Students Talk. Ohta (1995, 2000) expects that collaborative oriented talk gives more opportunities to create language in a useful way. Zhang clarifies that, especially in a traditional study hall, talk is started by the teacher in a counterfeit setting, while CL can be utilized to make a social setting that emulates reality. It enables students to deliver as far as the amount, yet in addition the nature of discourse by drawing in themselves in mentioning, explaining, and arranging discussion during CL.

3. Create a Positive Learning Climate. As per Barfield (2003), learning is an enthusiastic and mental experience somewhat. Absence of self-assurance will influence students' learning (Jiang, 2009). DI Nitto (2000, p. 182) further contends that "an open field is an unsupportive and unpleasant condition."

It appears that the traditional focused structure of the classroom commits students frightful of making errors or losing face out in the open, and they are "powerless against what they may see as analysis and dismissal" (Brown 1994, p. 174). This is, notwithstanding, not the situation in CL, as it offers students a lot nearer and progressively open to feeling without being viewed by the entire class or the teacher (Jiang 2009). It liberates the students from "necessity for precision no matter what" and encourages students' "entrance into the more extravagant and all the more pleasing arrangement of connections in little gathering collaboration, in which a progressively agreeable and safe condition can be in this manner made" (Long & Porter 1985, p. 212). Delucchi (2006) reports that students occupied with CL exercises can trade differing sentiments because of the low-tension circumstance and this prompts progressively successful learning.

DI Nitto (2000) further cases that CL takes into consideration the arrangement of implications and hence the students' understanding is reshaped. These enhancements will happen in a positive full of feeling circumstance of learning.

4. Promote Social Interaction. Jiang (2009) affirms that "the most ideal approach to figure out how to connect is through communication itself." CL gives students a phase to associate with their companions in a psychologically agreeable and secure circumstance. Also, students can build up their cognitive learning and intelligent abilities. During the time spent finishing the CL errands, students are presented with new thoughts and data from alternate points of view and methodologies through talking about, addressing, and arranging forms, which thusly encourage the students' perception and disguise of basic ideas. Their ability and open aptitudes will be improved also.

5.Allow for Critical Thinking. Taking an interest in CL makes students progressively basic in their reasoning (Gokhale, 1995). Maesin et al. (2009) contend that the probability of critical reasoning is managed by the learning conditions and the instructing approach utilized. In Gokhale's (1995) examination of the viability of individual versus collaborative learning in improving drill-practice abilities and critical reasoning aptitudes, the outcomes uncover that students taking part in CL performed essentially better contrasted and the individuals who concentrated separately. This is on the grounds that CL empowers basic thoroughly considering the problem-solving process (Johnson et al. 2000). At the end of the day, CL cultivates the improvement of critical considering abilities dialogue, explanation and the assessments of peers' suppositions.

In a comparable vein, Hussain (2004) explored CL and demonstrated that students can grow and extend their imagination to consider inventive thoughts. Gokhale (1995) along these lines presumes that, if the learning reason for existing is to upgrade students' basic reasoning and critical thinking abilities, CL is more gainful than individual learning in this regard. Be that as it may, there are as yet

another extra advantages steady to CL, for example, cultivating students' obligation and autonomy. Ellis (2003) proposes that, by working with a wide scope of peers, social and cognitive abilities can be gained and these aptitudes will thusly help students in performing individual undertakings. Studies have additionally shown that there are helpful impacts on students' intrinsic motivation (Long & Porter 1985; Dörnyei 1997; Johnson & Johnson 1999, b; Jones & Issroff 2005).

CL additionally upgrades students' presentation (Cantwell and Andrews 2002; Gupta 2004) and advances long lasting learning aptitudes (Boud et al. 1999). Notwithstanding these perceived benefits, CL is viewed as ready to elevate students' confidence just as increment students' self-assurance (Slavin 1995, 1996). As indicated by Jiang (2009), CL enables students to assemble more prominent certainty and confidence than will happen in a focused learning classroom and this will prompt expanded endeavors in learning and more prominent ability to go for broke in learning.

Essential Components of Collaborative Learning

Kagan (1992) features four principle components of CL: synchronous cooperation, positive reliance, singular responsibility and equivalent investment. As opposed to the conventional, traditional classroom where one individual talks at any given moment, more often than not the teacher who does a large portion of the talking, CL gives dynamic support to every one of the students simultaneously. The structure of the traditional classroom limits students in rehearsing the learning abilities (McGroarty, 1989).

What's more, students are given explicit guidelines in CL exercises, for example, rewording, outlining, explaining, or demonstrating understanding or contradiction, which are all valuable to the language obtaining process. Positive relationship happens when gathering individuals need to rely upon one another to accomplish the undertaking. Students cooperate to help one another and guarantee that all have taken on the materials. In finishing the assignments, every individual from the gathering feels responsible for his very own and friends' learning and makes a functioning commitment to the gathering, and consequently every individual student adds to learning fulfillment. At long last, as support is a piece of the learning procedure and a significant component for students' prosperity, students' in CL along these lines learn by interfacing way the materials and peers and every student has an equivalent chance to take part all the while and in the last result of an action (Kagan, 1992).

Collaborative Learning Structure

The structures utilized in CL differ, just as variety among them. As ahead of schedule as the 1980s, Kagan (1989) called structured approach way to deal with examining CL is to a great extent dependent on creation, examination, and orderly utilization of structures. The justification for the utilization of structures in CL is

that they enable instructors and students to learn and embrace different social communication arrangements. CL structures, as the name recommends, allude to the substance free methods for sorting out the social connection in the classroom. They include a progression of steps, which recommend practicing at each progression. As per Kagan (1989), Slavin (1999) and Olsen and Kagan (1992), structures might be utilized more than once with practically any topic, different in evaluation levels and at different focuses on an exercise plan. The utilization of structures in CL advances the scholastic advancement of students with many subject matters, and shows a solid tie between what students do and realize. Every one of the structures has various capacities and spaces of handiness and help the two teachers and students to arrive at the learning goals in a progressively effective manner. Subsequently, teachers who make them comprehend and can utilize a scope of structures can plan different sorts of CL undertakings and productively produce explicit scholastic, intellectual, and social results of learning.

Further, Kagan and Kagan (1992) accentuate that the utilization of CL structures, works in the four primary components of CL referenced already of synchronous collaboration, positive reliance, singular responsibility, and equivalent interest. In addition, one key segment of the structured approach is class building, requiring teachers and students to co-construct the social learning air in the classroom in order to be certain and steady as could be expected under the circumstances, with the points of acclimating and setting up shared help. The utilization of structures likewise requires a need to change the administrative style of teachers in a CL classroom, where students are offered authorization to talk and cooperate (Kagan and Kagan 1994). Accordingly, the utilization of CL structures in the present examination means to make powerful exercises that draw on and improve the learning of the students. Also, the traditional teaching class has consequently been moved to more student-centered learning.

Table 1 shows a sample of CL structures used in the present study, including the adapted and self-designed ones.

Table 1
Review of the CL Structures used During the Teaching Intervention

Structures adapted	**Brief description**	**Academic and social functions**
The concept of Development		
Think-pair- share	Students think for themselves on a topi provided, first on their own to reach consensus and share with other peers a then the entire class	Express opinions, inductive and deductive reasoning; enhancing participation and involvement
Three-step-interview	Students interview each other in the group, first one-way, and then the othe Each share the information they learnec in the interview	Sharing and getting acquainted with peers, enhancing participation, developing listening, speaking, and communicative skills
Multifunctional		
Co-op Co-op	Students work in groups toproduce a	Learning and sharing complex materia

	particular CL product to share with the whole class, each makes a contribution the completion of the task	(multiple sources), developing analysi synthesis, conflicts resolution and presentation skills
Communication		
Match-mine	Students attempt to match the arrangements from two columns with c student reads the items and other other respond, using oral communication onl	Vocabulary development, role-taking ability, communication skills
Mastery of Knowledge		
Role-taking	Students each performs a role in a situational context and makes the dialo with peers	Developing listening, speaking, communication skills and memorizing facts
Finding differences an making comparisons	Students compare and contrast the similarities and differences based on th understanding of and familiarity with t topic provided	Understanding and differentiating ide and concepts; developing analysis and synthesis skills; enhancing skills in making suggestions

Material and Methods

The study was experimental in nature. The Nonequivalent Control Group Design was applied to conduct the study. The population of the study consisted of all the students enrolled in public secondary schools of district Sheikhupura in grade 8th

Table 2
Public Secondary School in District Sheikhupura

Sr No	Schools	No of Schools	No of Students in 8th grade
1	Male	85	11649
2	Female	83	12254
3	Total	168	23903

The sample of the study consisted eighty students enroll in grade eight, selected through simple random sampling by belting technique from two public secondary schools of district Sheikhupura. The students of Government Girls High School A were considered group A (experimental group) and students of Government Girls High School considered group B (control group). The total number of students enrolled in school A and B were respectively 110 and 57. The cumulative total number of students enrolled in both Govt. Schools was 110+57=167, from which 40+40=80 students were selected for the study through simple random sampling by belting technique.

The researcher adopted the test developed by Punjab Examination Commission (PEC) 2018. The test was comprised 112 MCQs item, four versions. All the items were selected for the test, but after discussion with supervisor and senior Ph. D scholars 10 items were excluded due to the similarity of context, the remaining items were 102. After pilot tests two items were also excluded and the final test comprised of 100 MCQs items. After finalizing the items, the items,

distractor analysis, difficulty index, Discrimination Index was measured, its summary is presented below;

Table 3
Summary of Item Analysis: Difficulty Index and Discrimination Index

Poor Item	Good Item	Very Good Item	Excellent Item
15	47	24	13

The following table showed the reliability of the test:

Table 4
Reliability of The Science Achievement Test, Pre, Post and Pilot Test

Pre-test			Post-test			Pilot-test		
N	Items	α	n	Items	α	n	Items	α
80	100	0.702	80	100	.814	19	100	0.786

Results and Discussion

Table 5
Summary of ANCOVA: Effect of Intervention On Physics, Chemistry, Biology and Computer Science Post Test Scores, Physics, Chemistry, Biology and Computer Science Pre-Test Scores as Covariate

Tests of Between-Subjects Effects						
Dependent Variable: Physics Post						
Source	Type III SS	df	Mean Square	F	Sig.	η^2
Intercept	11060.991	1	11060.991	77.658	.000	.502
Physics pre-test	362.093	1	362.093	2.542	.115	.032
Group (Control, Experiment)	6331.498	1	6331.498	44.453	<.001	.366
Error	10967.252	77	142.432			
Total	195171.696	80				
Intercept	19101.877	1	19101.877	211.305	.000	.733
Chemistry pre-test	91.588	1	91.588	1.013	.317	.013
Group (Control, Experiment)	5620.791	1	5620.791	62.177	.000	.447
Error	6960.754	77	90.399			
Total	183452.709	80				
Intercept	19303.943	1	19303.943	136.587	.000	.639
Biology pre-test	792.339	1	792.339	5.606	.020	.068
Group (Control, Experiment)	164.163	1	164.163	1.162	.285	.015
Error	10882.466	77	141.331			
Total	189277.344	80				

Intercept	65244.542	1	65244.542	116.212	.000	.601
Computer science pre-test	567.087	1	567.087	1.010	.318	.013
Group (Control, Experiment)	4132.813	1	4132.813	7.361	.008	.087
Error	43229.788	77	561.426			
Total	235625.000	80				

Note. df=difference=variation between sample means

The data were analyzed by using statistical package of social sciences (SPSS) version 22. To answer the research questions, Mean score, Standard Deviation, independent sample t-test and ANOVA were applied. Results indicate that there was a significant difference between physics control and experimental groups, post-test scores, F (1,77) = 44.453, p = <. 001. While there was a significant difference between chemistry control and experimental groups, post-test scores, F (1,77) = 62.177, p = <. 001. Whereas there was no significant difference between Biology control and experimental groups, post-test scores, F (1,77) = 1.162, p = >. 05. While there was a significant difference between computer science control and experimental groups, post-test scores, F (1,77) = 7.361, p = <. 008

Collaborative learning represents the most deliberately organized end of the collaborative learning continuum. Characterized as "the instructional utilization of small groups so that students can work together to maximize their own and each other's learning. The purpose of the study was to examine the effect of collaborative learning strategies on student's science achievement in public elementary level. Findings indicate that there was statistically significant effect of collaborative learning strategies on student's science achievement in public elementary level.

Collaborative classroom cultures can effect on students learning and execution. Some new research recommends that groups supported the surer individuals. Switching up groups can help counter this issue (Clifford, 2018). Lou et al. (2001) detailed a significant correlation between student-student interaction and most prominent accomplishment achieved with regards to the undergraduate distance education courses. In a similar vein, Bernard et al. (2009) were keen on three sorts of connection treatments (for example student-student, student-teacher, and student-content). They found an unequivocal connection among collaboration and scholastic execution in distance education that improved student learning. The student-student cooperation developed as the most significant group among the three. Webb (1993) found that the students who worked in groups on computational math issues scored significantly higher than comparable capacity students who worked individually. Lou, Abrami, Spence, Poulson, Chambers, and d'Apollonia, (1996) who investigated the distinctions in achievement and attitudes at all grade levels of education, inferred that "on average, students learning in little groups in classrooms accomplished significantly more than students not learning in little groups" (p. 439)

In Pakistan, overwhelmingly deductive method for educating is utilized by one teacher in the classroom that uses a procedure of transmission of information, instead of a procedure of concept construction. In general teacher teaches from a textbook without relating the ideas to everyday life. By and large, they start lessons with dictating formulae and asking students remember those formulae so as to solve the question. Teachers by and large don't collaborate with colleagues to talk about ideas or teaching methodology (Mirza & Iqbal, 2014).

Conclusion

The purpose of the study was to examine the effect of collaborative learning strategies on student's science achievement in public elementary level. Collaborative learning is the bases in the believe that learning is most effective when students are actively involved in sharing ideas and working collaboratively to complete academic assignments. Furthermore, to find demographics and socioeconomic status of students can influence their collaborative learning strategies on their science achievement and social skills.

Findings indicated that there was a significant effect of collaborative learning strategies on students' science achievement at the elementary level. The results of the study revealed that there was a significant effect of collaborative learning strategies on students' social skills at the elementary level. The results concluded that collaborative learning strategies on students' science achievement and social skills in public elementary level. It was identified that there was no statistically significance difference in scores of overall physics, chemistry, biology and computer science of pre-test of control group and experimental group.

It was identified that the effect of collaborative learning strategies on students' chemistry, physics and computer science post test scores were statistically significant difference for experimental group. It was identified there was no statistically significance difference in overall pre and post-test of the biology score for the control group and the experimental group. It was identified that there was a statistically significant difference of experiment group post-test scores of collaborative skills and non-collaborative skills. It shows that there was no significant effect of demographic scores on collaborative learning strategies on students' science achievement and social skills at the elementary level.

Recommendations

On the basis of results, the following recommendations were made:

1. In this study the effect of collaborative learning strategies was observed on science achievement. In future, researchers can use these strategies to measure their effect on other subjects like, mathematics, social sciences etc.

2. The participants of this study were elementary students in future primary and students can be the subject.

3. Future research should use the other strategies of collaborative learning to find their effect on student's achievement.

This study should be further extended to other districts and private institutions

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