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Effect of Cooperative Learning Approach on Students' Academic Achievement and Motivation at Secondary level

Abstract *This study discovers the effect of cooperative learning (CL) on students' achievement and motivation toward computer science at secondary level. Nonequivalent control group design of Quasi-Experimental Research method was used. Two intact groups i.e. thirty students each, were selected as the sample of the study. Students Team Achievement Division (STAD) method of CL was applied on the experimental group while traditional method (lecture) of teaching was used for control group. Pre-test and post-test were conducted respectively by using teacher made test in computer science. Students' Motivation toward Computer Science Learning (SMTSL) scale was adapted to explore student's motivation toward computer science. This study significantly indicates that the posttest motivation and achievement scores of students were better than the pretest motivation and achievement scores toward computer science learning. The study promotes CL approach for computer science learning, and intervention should be given for a long time period to observe its effectiveness.*

Key Words: Cooperative Learning, Students' Achievement, Students' Motivation, Students Team Achievement Division (STAD)

Introduction

The cooperative learning (CL) is the most widely used and preferred method of teaching (Wolfensberger & Canella, 2015).A method in which the students learn academic content by working together in groups or small groups through shifting and focusing the ideas, is called cooperative learning. The interaction among the students in groups makes possible adaptation to different concepts for the students who have different abilities and different backgrounds (Slavin, 2015; Wyk, 2012). Aziz and Hossain (2010) found that CL is a teaching method that helps the students to learn together in groups to maximize their learning with great interest, motivation and achievements. Johnson and Johnson (2010) revealed that CL is a pedagogical practice, in which the students improve both academically and socially when they have opportunities to interact with others while accomplishing shared goals. Likewise, Kuri (2013) found that cooperative learning has been used as an active learning pedagogy of teaching wherein students exchange their ideas through personal involvement and activities, which helps to improve students' motivation and achievements.

Motivation focuses on the cognition and mental disciplines of students during learning process especially in sciences (Tuan, Chin & Shieh, 2005). Cooperative learning makes positive enforcement, increase motivation and achievement, built communication skill and resolve conflict towards learning and instructions (Gaith, 2003).Students need ample opportunity to interact with each other as well as steady encouragement and support to be motivated to learn as it . helps students for the highest achievement. As, the students engage in their learning efforts, their motivation increases which leads to high achievement. The students .are assigned the groups and given the tasks that require interdependency. Each member of the group becomes accountable for achieving a shared goal. The students are then motivated by the team effort as well as by seeing their own contribution accepted by

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the group and the results proved that a motivated student can achieve the study goals and the objectives. The active exchange of the ideas within small groups not only increase interest among the students but also promotes critical thinking (Abass, 2008). Social Interaction among the students provides opportunities for inspiration, participation and more motivation to groups in working (Slavin, Lake & Groff, 2009).

Cooperative Learning Methods

Methods of cooperative learning are classified into two groups like formal methods of cooperative learning and informal methods of cooperative learning. Formal CL involves group work that generally takes place over several sessions of a class, while informal CL involves the creation of small, ad-hoc groups for students in order to work together for shorter periods of time, usually one lesson (Johnson et al, 2014).

Student Teams Achievement Division (STAD)

Four or five students, with different performance level as low, average and high achievers, represent the group in the method of cooperative learning. Groups are made on the base of mental abilities, locality, gender, ethnic behaviors and intelligence among the group members in which teacher plays his role as facilitator. During the learning process, this approach is divided into three stages; on the first-day the teacher provides instruction according to the subject matter to the whole group. In the second day of learning after providing instructions, the teacher recalls the previous lesson for discussion among the groups. At the last and the third day of learning process, quizzes are given to the individuals by the teacher for discussion. Quiz score of the individuals is collected and counted in which each member of the group contributes to achieve the high scores. The individuals and groups appreciated if they have showed good performance (Lau, Kwong, Chong & Wong, 2014).

Cooperative Learning with Achievement and Motivation

Cooperative learning is a strategy in which small groups of the students participate actively and interdependently in different activities for achieving rewards for leaning. Working together with the highest cooperation and motivation is the primary benefit of cooperative learning (Mashhadi & Gazorkhani, 2015). Cooperative learning increases students' knowledge understanding, confidence and critical thinking skills. Vulnerable Students also feel more comfortable with asking questions from their peers. Due to its clear and effective benefits, scholars advocate cooperative learning for the learning process. The research reports by different scholars, proved the positive results for cooperative learning in different areas. Psychological, social, academic and judgmental aspects are the main features of cooperative learning (Sharan, 2015).There are three basic functions described by Alderman (2008) of motivation as: 1) Stimulating behavior; 2) Giving a particular direction to behavior and 3) Controlling consistency in behavior. Motivation is not a trait of personality and not an instinctive concept of learner but also a construction of the learners' activities and individual learning experiences (Bouffard& Couture, 2013).

The Students' motivation toward computer science measures by the following variables: 1) attitude; 2) perceived goals; 3) perceived needs; 4) Perceived values. Where, attitudes involves the measurement of individuals' behaviors and things, perceived goals include the individuals' aims and goals, perceived needs showed the aspiration of the individuals and perceived values related to the attached values and specific actions of the individuals (ReidReid, 2016). Similarly, Bukunola & Idowu (2012) examined achievement in individually competitive and cooperatively reward-structured environments in two high-school biology classrooms. While both cooperative and competitive techniques obtained significantly higher posttest scores, neither treatment was superior over the other in producing academic achievement. Atta, Jamil, Kundi and Siddique (2013) reported that at the secondary level in Pakistan teaching-learning process is totally based on rote memorization; students are given very less time for active participation and interaction. Sultana and Zaki (2015) revealed that unfortunately, the teaching

methods and strategies adopted by computer science teachers in Pakistan do not take into account the individual differences of the learners. Students are engaged only to listen to their teacher and follow the instructions without being given a chance to actively participate in teaching-learning process (Batool & Perveen, 2012; Najmonnisa & Haroon, 2014).Therefore.it was important to examine the effects of cooperative learning on students' achievement and motivation in computer science at secondary level.

The Objectives of the Study

The objectives of the study were to:

1. Investigate the effect of cooperative learning on students' motivation towards computer science at secondary level.
2. Examine the effect of cooperative learning on students' achievement in computer science at secondary level.

Research Methodology

This study was experimental in nature, as the aim of the research was to examine the effects of cooperative learning on students' motivation and achievement in computer science at secondary level. The intact group was used as a sample of the study. Therefore, design used for this research was, Non-Equivalent Control Group Design of Quasi Experimental Research.

Participants of the Study

Sample of the study was designated from X secondary school of district Lahore, Pakistan. School administration certified to conduct research on two computer science of IX grade sections which were randomly selected from total three computer science IX grade sections in school. These two selected sections again randomly labeled as experimental and control group of the study. Both sections possess 30 students (intact groups).

Research Instrumentation

Pre-test and post-test were conducted respectively by using teacher-made test in computer science to measure the achievement score. 30 multiple-choice questions (MCQs) were included in this test. The test was validated by the assessment and evaluation experts through content validity. Simultaneously, Students' Motivation toward Computer Science Learning (SMTCSL) scale, developed by Tuan et al. (2005) was adapted by the researcher to examine the students' motivation toward computer science. The SMTCSL scale consists of six subscales with 35 statements. The reliability of the scale was Cronbach's alpha 0.706.

Data Collection

Both groups were taught by the researcher for the period of thirty-five (35) minutes on a daily basis for 12 weeks. Both groups were taught in separate classrooms. The seats were arranged in . circle for every subgroup of experimental group. The use of cooperative learning method, classroom regulations, schedule of STAD actions and seating positions among the students was practiced before the treatment of experimental group.

Four Chapters of Computer Science IX grade published Punjab curriculum and textbook board (PCTB), were taught through different teaching methods by the researcher to both groups. Chapters included to teach, were introduction to Computers, computer component, input/ output devices and storage devices. A lesson plan was prepared for the first day lecture. For delivering lesson, lecture method was used on experimental group. Work sheets related with the first day lesson material were distributed among the subgroups of experimental group on second day. The subgroups solved the worksheets together. The teacher provided facilitation if required during students working in their sub groups. The students were informed by the teacher for the quiz competition on the third day. The

students were seated separately in .rows instead of circle arrangement on the third day. Thirty (30) multiple choice questions containing thirty (30) total marks were included in the quiz competition. The same content as experimental group was delivered to the control group in which teacher played a traditional role of teaching. Lecture method was used for the control group. Quiz competition and groups were not arranged for the control group. But similar content delivered to both groups in similar days. Students' Motivation toward Computer Science Learning scale by Tuan et al. (2005) was used to explore students' motivation toward computer science before and after completion of intervention to both groups.

Data Analysis and Interpretation

Part1: Inferential Statistics about Students' Motivation

Table 1. Pre-Test Scores of Students' Motivation Towards Computer Science Between Control and Experimental Groups

	Control Group		Experimental Group		*T*	*df*	*p*
	M	***SD***	***M***	***SD***			
SE	25.80	2.024	30.20	2.188	-8.086	58	0.000
ALS	29.87	1.570	32.73	2.180	-5.844	52.698	0.002
CSLV	18.97	0.765	20.20	3.167	-2.074	58	0.043
PG	9.80	3.089	14.67	3.754	-5.483	58	0.021
AG	12.23	3.607	20.03	2.846	-9.297	58	0.003
LES	16.87	3.830	21.90	4.163	-4.873	58	0.007
OM	113.53	9.321	139.73	7.046	-12.281	58	0.001

Note: SE=Self-Efficacy; ALS=Active learning strategies; CSLV=Computer Science Learning Value; PG=Performance Goal; AG= Achievement Goal; LES=Learning Environment Stimulation; and OM=Overall Motivation.

An independent-samples t-test was conducted to compare pre-test scores of students' motivation towards Computer Science between control and experimental groups. Table 1 shows that there was significant difference between pre-test scores of overall students' motivation and its sub factors (i.e. self-efficacy, active learning strategies, computer science learning value, performance goal, achievement goal, and learning environment stimulation) towards Computer science between control and experimental groups as p value is less than 0.05 and t (58) =-8.086, p (0.000); t (52.698) =-5.844, p (0.002);t (58) =-2.074, p (0.043);t (58) =-5.843, p (0.021);t (58) =-9.297, p (0.003);t (58) =-4.873, p (0.007);and t (58) =12.281, p (0.001) respectively. The mean scores show that students' motivation in experimental group is higher as compared to students' motivation in control group.

Table 2. Post-Test Scores of Students' Motivation Towards Computer Science Between Control and Experimental Groups

	Control Group (30)		Experimental Group (30)		*t*	*df*	*p*
	M	***SD***	***M***	***SD***			
SE	31.17	1.621	30.03	2.710	1.966	47.391	0.055
ALS	16.03	5.229	22.20	4.619	-4.841	58	0.000
CSLV	7.27	1.388	12.90	3.273	-8.679	39.102	0.000
PG	5.97	1.159	12.37	3.891	-8.635	34.108	0.000
AG	7.67	1.561	14.27	4.472	-7.633	35.965	0.000
LES	16.93	3.657	15.77	1.524	1.613	38.779	0.115
OM	85.03	7.467	107.53	13.888	-7.816	44.474	0.000

Note: SE=Self-Efficacy; ALS=Active learning strategies; CSLV=Computer Science Learning Value; PG=Performance Goal; AG= Achievement Goal; LES=Learning Environment Stimulation; and OM=Overall Motivation.

To compare post-test scores of the students' motivation towards Computer Science between the control and the experimental groups, independent-samples t-test was applied. Table 2 illustrates that there was significant difference between pre-test scores of overall students' motivation and its subfactors (i.e. self-efficacy, active learning strategies, computer science learning value, performance goal, and achievement goal) towards Computer science between the control and the experimental groups.as*p* value is less than 0.05 and t (58) =-4.841, *p* (0.000); t (39.102) =-8.679, *p* (0.000); t (34.108) =-8.635, *p* (0.000); t (35.965) =-7.633, *p* (0.000) and t (44.474) =-7.816, *p* (0.000) respectively. The mean scores show that the students' motivation in experimental group is higher as compared to students' motivation in control group.

On the other hand, table 2 also specifies that there was a insignificant difference in the post-test scores of students' perceptions about Learning Environment Stimulation as control group (M=16.93, SD=3.657) and experimental group (M=15.77, SD=1.542) as t (47.391) =1.966, *p* (0.055) and t (38.779) =1.613, *p* (0.115) respectively. The result shows that students' learning environment stimulation scores in experimental group is same as compared to students' learning environment stimulation scores in control group.

Table 3. Pre-Test and Post-Test Scores of Students' Motivation Towards Computer Science Difference in Control Group

	Pre-test control group 30)		**Post-test control group (30)**		***t***	***df***	***p***
	M	***SD***	***M***	***SD***			
SE	25.80	2.024	31.17	1.621	11.166	29	0.001
ALS	14.87	1.570	26.03	5.229	15.079	29	0.000
CSLV	8.97	0.765	17.27	1.388	35.921	29	0.031
PG	9.80	3.089	15.97	1.159	7.296	29	0.002
AG	11.23	3.607	17.67	1.561	7.009	29	0.000
LES	16.87	3.830	16.93	3.657	0.069	29	0.946
OM	87.54	9.321	125.04	7.467	13.528	29	0.000

Note: SE=Self-Efficacy; ALS=Active learning strategies; CSLV=Computer Science Learning Value; PG=Performance Goal; AG= Achievement Goal; LES=Learning Environment Stimulation; and OM=Overall Motivation.

To compare pre-test and post-test scores of students' motivation towards Computer science in control group a paired sample t-test was applied. The table 3 illustrates that there was significant difference between pre-test and post-test scores of overall students' motivation and its subfactors (i.e. self-efficacy; active learning strategies; computer science learning value; performance goal; and achievement goal) towards Computer Science in control group as*p* value is less than 0.05 and t (29) =11.166,*p* (0.001); t (29) =15.079, *p* (0.000); t (29) =35.921, *p* (0.031); t (29) =7.296, *p* (0.002);t (29) =0.069, *p* (0.000); and t (29) =13.528, *p* (0.000) respectively. The mean of students' motivation post test score is greater as compared to students' motivation pretest score.

In contrast, table 3 also shows that there was a significant difference in pretest students' learning environment stimulation scores with (M=16.87, SD=3.830) and posttest students' learning environment stimulation scores with (M=16.93, SD=3.657) of control group toward computer science as t (29) =0.069, *p* (0.946). It indicates that the pretest students' learning environment stimulation score was same as the posttest students' learning environment stimulation score.

Table 4. Pre-Test and Post-Test Scores of Students' Motivation Towards Computer Science Difference in Experimental Group

	Pre-test experimental group (30)		Post-test experimental group (30)		*T*	*df*	*p*
	M	***SD***	***M***	***SD***			
SE	30.20	2.188	30.03	2.710	0.271	29	0.788
ALS	22.73	2.180	32.20	4.619	10.169	29	0.000
CSLV	12.20	3.167	20.90	3.273	9.404	29	0.000
PG	12.67	3.754	14.37	3.891	2.038	29	0.051
AG	14.03	2.846	20.27	4.472	6.307	29	0.000
LES	15.90	4.163	21.77	1.524	6.880	29	0.000
OM	107.73	7.046	139.54	13.888	11.008	29	0.000

Note: SE=Self-Efficacy; ALS=Active learning strategies; CSLV=Computer Science Learning Value; PG=Performance Goal; AG= Achievement Goal; LES=Learning Environment Stimulation; and OM=Overall Motivation.

A paired-samples t-test was conducted to compare pre-test and post-test scores of students' motivation towards Computer science in experimental group. The table 4 demonstrates that there was significant difference between pre-test and post-test scores of overall students' motivation and its subfactors (i.e. active learning strategies, computer science learning value, achievement goal, and learning environment stimulation) towards Computer science in experimental group as t (29) =10.169,*p* (0.000); t (29) =9.404, *p* (0.000); t (29) =6.307, *p* (0.000); t (29) =6.880, *p* (0.000); and t (29) =11.008, *p* (0.000) respectively. The mean of students' motivation posttest score is better than students' motivation pretest score.

Oppositely, table 4 also shows that there was a significant difference in pretest students' self-efficacy and performance goal scores with (M=30.20, SD=2.188 and M=12.67, SD=3.754) and posttest students' self-efficacy and performance goal scores with (M=30.03, SD=2.710 and M=14.37, SD=3.891) of experimental group toward computer science as t (29) =0.271, *p* (0.788); and t (29) =2.038, *p* (0.051) respectively. It indicates that the pretest students' self-efficacy and performance goal scores were same as the posttest students' self-efficacy and performance goal scores.

Part 2: Inferential Statistics about Cooperative Learning and Students' Achievement

Table 6. Pretest Achievement Scores difference between the Control and Experimental Group.

Groups	N	M	SD	*df*	t	*p*
Pre-Test Control group	30	19.80	4.600			
				58	-0.744	0.459
Pre-Test Experiment group	30	19.67	4.689			

Table 6 indicates that there was no significant difference in the pre-test scores of achievements between the control group (M=19.80, SD=4.600) and experimental group (M=19.67, SD=4.689) as p > 0.05t (58) =-0.744, *p* (0.459). The result shows that the students' achievement scores in the experimental group are same as compared to the students' achievement scores in control group.

Table 7. Posttest Achievement Scores Difference Between the Control and Experimental Group

Group	N	*M*	*SD*	*t*	*df*	*p*
Post-Test Control group	30	15.28	6.525			
				-14.310	58	0.000
Post-Test Experiment group	30	21.75	9.680			

p< 0.05

Table 7 indicates that the achievement scores of post test have a significant difference between control group (M=15.28, SD=6.525) and experimental group (M=21.75, SD=9.680) at p < 0.05 and (58) =-14.310, *p* (0.000). It means that cooperative learning method increases achievement of students in Computer science than traditional learning method.

Table 8. Pretest and Posttest Achievement scores difference of Control Group. (N=30)

Control Group	Mean	SD	T	*df*	*p*
Pretest	14.48	5.600			
			-6.347	29	0.000
Posttest	25.70	9.625			

p< 0.05

Table 8 shows that there was a significant difference between achievement scores of control group in pretest (M=14.48, SD=5.600) and post-test (M=25.70, SD=9.625) as t (29) =-6.347, *p* (0.000).It indicates that the achievement scores of students in posttest were better than the achievement scores in pretest.

Table 9. Pretest and Posttest Achievement scores difference of Experimental Group. (N=30)

Experimental Group	M	SD	*t*	*df*	*p*
Pretest	14.87	4.986			
			-13.638	29	0.020
Posttest	25.98	8.960			

p <0.05

Table 9 have result of paired sample t-test indicates that there was a significant difference of achievement scores in pretest (M=14.87, SD=4.986) and (M=25.98, SD=8.960) for experimental group as at p < 0.05 and t (29) =13.638, *p* (0.020). It means that the achievement score of students in posttest was better than the achievement scores in pretest.

Discussion

The present study explored the effect of cooperative learning on students' achievement and motivation in computer science. The study promotes cooperative learning approach for computer science learning. In the field of engineering RocioMaceirasRocio, Angeles & Santiago, (2011) explore the effect of jigsaw method of cooperative learning. After the findings and the result, they proved. positive effect of cooperative learning which leads to active involvement of individuals in learning process. The effect of cooperative learning on students' perception, motivation and achievement towards eleven (11^{th}) class of chemistry was investigated by Shachar& Fischer (2004) in which cooperative learning method of Group investigation was used. Results of this study proved that low and middle achievers increased their perception; motivation and achievement towards chemistry the same way as they decreased their motivation. The results reveal that cooperative learning can increase mathematics achievement. The effect of cooperative learning on eight (8^{th}) class of social studies was explored an experimental study investigated by Parveen &Mehmood (2011).The findings and results for social studies class showed no significant difference in both traditional and cooperative learning. An experimental study with quasi-experimental group design was conducted by Duguryil&, Wude (2013) to investigate the Students' achievement in Biology with their potentials and gender differences by using cooperative learning approaches. Jigsaw and STAD approaches of cooperative learning were used for one hundred and eighty-eight students which were divided into control and experimental groups. Biology Achievement Test (BAT) was used for pretest and posttest. Control group was received traditional approach of

learning while experimental group treated with STAD and Jigsaw method of cooperative learning. The findings and results showed negative significant difference in cooperative learning.CL contributes to both achievement and social harmony and can increase the participation of all students (Abass, 2008).

Conclusion

On the basis of the findings, statistical analysis and conclusions of the study described as: control and experimental groups showed no significant difference in pretest motivation scores. The students were more motivated and showed better performance by using STAD method of cooperative learning than traditional method. The control group showed better motivation level in post-test than the pretest with low effect size and the experimental group showed better in posttest motivation than the pretest with high effect size. In short, cooperative learning method is a very useful tool to boost motivation and improve students 'achievements.

- There was significant difference between pre-test scores of overall students' motivation and its sub factors (i.e. self-efficacy, active learning strategies, computer science learning value, performance goal, achievement goal, and learning environment stimulation) towards Computer science between the control and the experimental groups. The mean scores show that students' motivation in the experimental group is higher as compared to the students' motivation in control group.
- There was significant difference between pre-test scores of overall students' motivation and its subfactors (i.e. self-efficacy, active learning strategies, computer science learning value, performance goal; and achievement goal) towards Computer Science between control and experimental groups. The mean scores show that the students' motivation in experimental group is higher as compared to the students' motivation in control group. On the other hand, there was insignificant difference in the post-test scores of students' perceptions about Learning Environment Stimulation.
- There was significant difference between pre-test and post-test scores of overall students' motivation and its subfactors (i.e. self-efficacy, active learning strategies, computer science learning value, performance goal, and achievement goal) towards Computer Science in control group. The mean of students' motivation posttest score is greater as compared to students' motivation pretest score. In contrast, there was a significant difference in pretest students learn scores and posttest the students' learning environment stimulation scores of control learning environment stimulation toward computer science.
- There was significant difference between pre-test and post-test scores of overall students' motivation and its subfactors (i.e. active learning strategies; computer science learning value; achievement goal; and learning environment stimulation) towards Computer Science in experimental group. On the contrary, there was a significant difference in pretest students' self-efficacy and performance goal scores and posttest students' self-efficacy and performance goal scores of experimental groups toward computer science.

The results reveal that cooperative learning can increase mathematics' achievement. Cooperative learning also enhances understanding and self-confidence. These results would imply that incorporating cooperative learning in the mathematics classroom would enhance the learning of mathematics in secondary schools. Implementation of jigsaw cooperative learning should be reviewed in terms of knowledge and skills of each teacher. In this case, training and continuous professional development is needed for the teachers, and collaboration among teachers should be encouraged through holding regular meetings, both formal and informal. Teachers can learn from each other and can examine the strengths and weaknesses of the instruction that has been implemented, and their experience can be shared with each other to produce better work.

Recommendations

The present study explored the effects of cooperative learning on students' motivation in computer science. The study promotes cooperative learning approach for computer science learning. It was useful and effective technique for different types of students. like high, average and low achievers. Cooperative learning should be used as an elective approach in learning process due to its benefits as like High positive interdependence, High interaction, high quality and quantity of learning experiences and should be used for positive enforcement, to increase motivation, built communication skill and resolve conflict towards learning and instruction. Curriculum development and publishing of textbooks should be based on cooperative learning settings in which students exchange their ideas through personal involvement and activities. The teacher training institutes should arrange trainings for the teachers to use cooperative learning method. The role of teacher should be remained passive during cooperative instructions and provide assistance when needed.

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