



**EFFECT OF ONLINE COOPERATIVE LEARNING ON STUDENTS' ACADEMIC
ACHIEVEMENT AT HIGHER EDUCATION LEVEL**

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Abstract

This study investigated how cooperative learning affected students' academic performance in an online higher education environment. Its specific goal was to find out whether, in comparison to conventional online learning techniques, including cooperative learning activities could improve academic achievement. An experimental control group with a pre-test and post-test design was used. All students enrolled in the Virtual University of Pakistan's Fall semester undergraduate course "Test Development and Evaluation" were included in the population. A sample of seventy-three students was chosen and split into two groups: a control group consisting of 38 participants and an experimental group consisting of 35 individuals. In order to incorporate cooperative learning into the online learning environment, email-based activities were carried out. The purpose of these activities was to promote cooperation and knowledge exchange among the students in the experimental group. Contrarily, the control group followed the typical online learning protocol, finishing the pre- and post-tests but forgoing the cooperative learning exercises. The achievement exam functioned as the pre-test and post-test tool, enabling researchers to evaluate modifications in students' comprehension and knowledge. To compare the gain scores (the difference between pre- and post-test scores) between the experimental and control groups, parametric statistical analysis was used, most especially t-tests. A specified significance criterion of $p < 0.05$ was established.

The outcomes were striking. The results of statistical analysis showed that there was a highly significant difference in the gain scores between the two groups, with a p-value of 0.002. When compared to the conventional online learning strategy used in the control group, this indicates that the cooperative learning activities conducted in the experimental group had a favourable and statistically significant impact on student academic achievement. To sum up, this study offers compelling evidence that using cooperative learning techniques in online learning



settings can greatly improve students' academic performance. These results support the use of cooperative learning strategies by teachers in online learning environments in order to provide their students with a more engaging and productive learning environment.

Keywords: Cooperative learning, e-learning, academic achievement, higher education, online learning.

Introduction

Education is a vehicle for the survival and development of a nation. But many nations, particularly the developing nations, lack resources to expand educational access using the conventional modes of teaching and learning. Some nations are adopting online modes to reach out to the maximum number of learners. Online modes generally provide education to individuals working independently. Whereas globalization requires cooperative redressal of the contextual issues by people. It is need of the time that innovative techniques and styles of teaching and learning are adopted to develop a competent and skilled human resource ensuring quality of education along with providing them opportunities to work cooperatively with social responsibility.

Cooperative learning is one of the strategies to help students to work cooperatively on an assignment, share the responsibility, act in a socially responsible manner, and work for the betterment of the whole group including the individual. John Dewey was considered as the key proponent of learning by doing in early 20th century. Dewey was known as the father of progressive education and proponent of social constructivism (Slaughter, 2009). His theory of social constructivism focused on social interaction among students for active learning by participating in different classroom activities i.e. cooperative learning. Cooperative learning is an activity in which students work decisively and actively in small groups and each member gets equal reward for the group work (Woolfolk, 2001; Johnson & Johnson, 1999).

Cooperative learning is considered a cross curricular activity that helps in achieving highly positive outcomes. It makes it obligatory for students to actively participate in group activity or activities for academic task accomplishment which leads to the learning progress of students in other dimensions. The positive outcomes of cooperative learning include academic achievement of students attained by association and increase in social and personal development (Brown & Ciuffetelli, 2009). Students were fully participating in cooperative learning exhibit collaborative behavior, provide constructive feedback and collaborate with their group members to achieve higher grades in their assessments (Amita, 2006). Brady and Tsay's (2010) found cooperative learning as a dynamic instructional technique that ensures higher academic achievement.

Cooperative learning also helps to enhance learners' intellectual skills and critical thinking skill (Jbeili, 2003). Cooperative learning has five vital principles. Firstly, the students become interdependent on each other for the achievement of common objectives and take advantage of one another's expertise. Second, it is the responsibility of every group member to impart information to other members. The third principle is to support one another collaboratively to learn and foster others to take part in the learning activity as they are struggling to accomplish the group task (Negangard & Sue, 1991). Fourth is to provide equal opportunities for every member of the group to participate in group activity to attain shared outcomes. The last principle is that all group members transfer their knowledge to work together. The most ambitious purpose of cooperative learning is that all students in a group work together to attain common purpose through understanding it and helping each other by sharing knowledge (Webb, 2002). The assessment of activities based on cooperative



learning could be formative or summative where group project could also result in individual scores to ensure active participation of each member in cooperative learning environment (Teed, McDaris, & Roseth, 2021).

Researchers have found cooperative learning effective in contrast to traditional learning. Adyeme and Babatunde (2008) investigated the effect of three teaching strategies including cooperative learning involving 150 secondary school students and empirically found that students taught by cooperative learning technique perform better than other students. Atashian and Zamini (2013) investigated the effectiveness of cooperative language learning involving sixty-one (61) students from secondary school by adopting experimental research and found significant effect on memory of students and social strategy taught by using cooperative learning. Aziz (2010) compared the effect of cooperative teaching and conventional teaching on achievement of mathematics of high school students by employing experimental research design and found that students taught by cooperative learning outperformed the student taught by conventional teaching.

Gaith (2003) investigated the effect of cooperative learning by learning together to improve English as Foreign Language (EFL) for fifty-six (56) high school learners and found statistically significant difference in EFL reading achievement in favor of experimental group. In his evaluation of the impact of cooperative learning on the writing and reading comprehension skills of 128 high school students, Khan (2008) discovered that the experimental group outperformed the control group by a substantial margin. Cooperative learning also evident to enhance satisfaction of students on their learning. Kagan (1994) identified that cooperative learning promotes students' self-confidence to enhance social skills and encourage positive relationships.

E-learning environment is a distinctive web-based application known as virtual learning environment or learning management system (LMS). These applications can be used by teachers as a tool to create and design online courses. For students, these applications are a source of learning and collaborating with others without any restriction of time and space as compared to conventional learning. Many different platforms have been developed since the emergence of the World Wide Web (www) in the early 1990s. Some platforms are focusing on minimizing the cost by delivering content material to the maximum number of students using computer networks or information technology.

The traditional platforms of online learning do not offer opportunities for social learning i.e. learning management system. On the other hand, some platforms have been constructed on the pedagogical principle of social constructionism and constructivism i.e., Moodle, Microsoft team etc. These platforms offer numerous tools to implement these pedagogies in synchronous learning environment among learners, additionally between students and instructors (Asif & Sandhu, 2023; McNeil, Robin, & Miller, 2000). These platforms emphasize the social aspect of learning assuming that knowledge is socially constructed and provide different tools to support communication and collaboration among students participating in group work to attain common goals.

Online learning modes are getting popular for multiple reasons from affordability to flexibility and convenience for the learners. With COVID-19, online learning has gained popularity at an unprecedented speed. All education related envision that online formats of learning are a reality to stay and expand. But the online formats generally allow individual learning. It is felt that with the increasing use of online formats innovations are needed for effective student engagement cooperatively. Research on online cooperative learning is scanty. However, according to Bliss and Lawrence's (2009) analysis of postings made by students and teachers in online mathematics courses, students were more engaged in small group conversations than in the course's overall virtual discussion forum. Cox and Cox (2008) discovered that synchronous and



asynchronous group discussions are an excellent way to integrate the cooperative learning component into distant education in order to achieve positive interdependence, group processing, and individual accountability.

Cooperative learning resulted in high academic achievement of students as compared to competitive and individual learning, and, also when it is applied in different settings (Johnson & Johnson, 1989; Johnson, Johnson, & Stanne, 2000). Kupczynski, Mundy, Goswami, and Meling (2012) with a sample of 54 students in virtual setting found that although the cooperative learning was not more effective in enhancing the academic scores as compared with the traditional formats, but the students perceived it more useful in learning brainstorming, collaboration, communication, engagement, feedback, participation and quality of learning. Tran (2014) found significantly high posttest achievement of students instructed through cooperative learning as compared to the students instructed using lecture-based teaching. Alghani and Alhaja (2021) with a sample of 130 teachers and 40 students found better academic achievement of the student in mathematics using cooperative learning in parallel to the learners taught using traditional method of learning. Kaymak, Kassymbek, Kalamkas, and Saydenov (2021) found cooperative learning significant for the student's achievement.

Virtual University of Pakistan (VUP) is the first Information and Communication Technologies-(ICT) based university providing distance education through online mode. Its Virtual University Learning Management System (VULMS) is being used for all academic activities. Cooperative learning is still not used as instructional strategy by the teachers at VUP due to some limitations of the system discussed further in methodology section. This study aimed to use cooperative learning and measure its effectiveness for students' academic achievement at the undergraduate level in e-learning environment and its usefulness throughout their journey of study.

Objective of the study

1. The study intended to determine the difference between the academic achievement of students taught by cooperative learning and students taught by regular e-learning mode at higher education level. The study also aimed to determine the effectiveness of cooperative learning as a teaching strategy in the context of online teaching learning mode.

Research hypotheses

Following were research hypotheses of the study:

H₀1: There is no significant difference in the gain scores of control group and experimental group using cooperative learning.

H₀2: There is no significant difference in the pre-test and post-test scores of the experimental group.

Significance

The study will be significant for the teachers teaching in e-learning environment to conceptualize and implement cooperative learning strategy for different courses in e-learning environment. This will help to enhance student learning and engaging them in active learning by motivating their use of higher order thinking skills. The study will also be useful in motivating the managers of the ICTs at the VUP and other institutions of online higher education to develop formats at their learning management systems to facilitate the application of online cooperative learning.



Methodology

Research design

A quasi-experimental pre-test post-test control group research design was used for this study. The students that participated in the activities of intervention were taken as the experimental group, while the students who didn't participated in activities of intervention were considered as control group. Pre-test was given to all the students but by the end of the experiment only the participants appearing in the post-test were considered the control group.

The student may learn actively in a new learning experience which is known as novelty effect. According to Clark and Sugrue (1991), for the novelty factor to drop to minimal level requires eight weeks. Therefore, novelty may serve as a confounding variable for studies lasting less than eight weeks, skewing research results to the positive. Chow, Merck and Wu (2016) noted that novelty may also affect how teachers and students engaged in the new technology. So, the duration of the intervention was 16 weeks. Post-test was conducted after intervention.

Population and sample of the study

The Virtual University of Pakistan (VUP) is a fully ICT based university offering all academic programs through online modes. The population of the study comprised of 861 students, registered in the subject "Test Development and Evaluation" for Fall semester at VUP. At invitation by the instructor, 159 students participated in the pre-test, 35 students opted to participate voluntarily in the cooperative learning activities. Other than the experimental group, 38 students of the controlled group contributed to pre-test and post-test which resulted in 73 undergraduate students as sample of the study. The study's low student participation rate was one of its limitations.

Research instrument

A research instrument is of major concern in any experimental result to get true scores and real time data. For this research, an achievement test based on course content comprised of 25 MCQs was developed. It was used before and after intervention of the study for pre-test and post-test respectively. Pre-test was administered before the intervention.

Intervention

Content of the Intervention

Three activities for group work were generated from the whole course, which is 16 units of "Test Development and Evaluation". The tasks included a) development of matching column, b) development of MCQs and c) explanation of rules to considered in the test administration procedure.

Intervention Forum

Virtual University of Pakistan provided a Learning Management System (LMS) for online learning of students. LMS contained three discussion boards. One of the fora was the Moderated Discussion Board (MDB), where students put their queries relevant to the content to be replied to by the instructor. Other students can see the queries, comment on these, but discussion thread on a single theme cannot be initiated by the instructor in MDB. Second forum is the Graded Discussion Board (GDB) where instructor posts a theme/topic for students to answer. The students' answers are not visible to each other, because these are for



grading purposes. Other fora known as Team Discussion Board (TDB) is used to engage students online in an activity as a group simultaneously within given time with no limit on number of students.

None of the forums can be used for cooperative learning to provide students discussion and share with flexibility of time. Thus, the experiment was conducted using email with complete instructions for the activity followed by multiple reminders to students for participation. Students were asked to click ‘reply all’ to reply to any email so that every member of the group could take part in discussion. At the end of the discussion, every participant of the group submitted his/her activity individually and the instructor marked it accordingly. This procedure of conducting cooperative learning in a group but scoring it individually is in line with Teed, McDaris and Roseth (2021). The scores of students were not part of the course assessment so that they may freely participate in the activities for the purpose of learning rather than due to the fear of grades.

Data analysis

The gain scores, which show the difference in performance between pre- and post-test measurements, were analysed by researchers using parametric statistical methods for both the experimental and control groups in order to evaluate the success of the intervention. More specifically, differences within each group were assessed using paired-sample t-tests. Because it compares scores from the same people before and after the intervention, this kind of t-test is suitable. To compare the gain scores between the experimental and control groups, independent-samples t-tests were used. This analysis aids in determining whether there was a statistically significant improvement difference between the two groups as a result of the intervention.

Furthermore, t-tests were utilised to ascertain the statistical significance of the variation in pre- and post-test scores among the experimental group. Statistical significance is shown by an alpha level of 0.05, which is predefined. This indicates that the likelihood that the observed improvement happened by accident is less than 5%.

Results and conclusion

The pre-test was conducted with two purposes- firstly, to find out if the two groups were the same before the intervention and secondly, to use those scores to measure the academic achievement of both groups in the form of gain scores toward the end of intervention period. Table 1 shows that the mean scores of the controlled and experimental groups were almost equal to the pre-test scores, hence there was no significant difference in achievement of experimental group and control group before intervention.

Table 1

Comparison of pretest scores of control group and experimental group.

Group	N	Mean	SD	df	t-value	Sig
Experimental	35	10.57	3.84	66.20	0.231	0.818
Control	38	10.32	5.52			

H0₁: There is no significant difference in the gain scores of the control and experimental group taught through cooperative learning.

The mean scores on the pre-test, post-test and the gain scores of the experimental and control groups are given in table 2.



Table 2

Pretest and posttest scores of students of experimental and control group.

Group	Scores	N	Mean	SD	Gain Scores
Control group	Pre-test	38	10.32	5.52	4.13
	Post-test	38	14.45	5.48	
Experimental group	Pre-test	35	10.57	3.74	7.06
	Post-test	35	17.63	4.49	

The t-test given in table 3 shows that gain scores of students taught by cooperative learning is statistically significantly different from students taught by cooperative learning (M=7.06, SD=4.23) and those taught using regular online strategies (M=4.13, SD=3.36). The gain scores of the experimental group were significantly greater than the gain scores of the control group. The magnitude of difference in mean (mean difference = 2.92, 95% CI: 1.15 to 4.70) was large (eta squared = 0.12). Consequently, the H₀₁: There is no significant difference in gain scores of the control group and the experimental group using cooperative learning is rejected. So, it is concluded that the students taught using online cooperative learning achieve higher scores as compared with those taught using regular e-learning strategies at higher education level.

Table 3

Comparison of gain scores of control group and experimental group

Group	N	Mean Gain Score	SD	df	t-value	Sig
Experimental	35	7.06	4.23	71	3.25	0.002
Control	38	4.13	3.36			

H₀₂: There is no significant difference in the pre-test and post-test scores of the students taught by cooperative learning.

Not only the gain scores of students taught using cooperative learning significantly higher than the students learning under regular strategies, the data in table 4 shows that online cooperative learning is an effective learning strategy. The experimental group's mean score differences in pre and post-test are statistically significant above alpha.000. The magnitude of difference (mean difference = 7.06, 95% CI: -9.05 to -5.06) was large (eta square = 0.4).

Table 4

Difference between the pre-test and post-test scores of the experimental group

Scores	N	Mean	SD	df	t-value	Sig
Pre-test	35	10.57	3.74	68	7.06	0.000
Post-test	35	17.63	4.49			



Discussion and recommendations

The study determined that online cooperative learning is beneficial in enhancing academic achievement of students in contrast to the regular online teaching-learning methods at higher education level. The finding provide support to the research finding by Kupczynski, Mundy, Goswami, and Meling (2012) who found that although the cooperative learning was not much operative in enhancing the academic scores as equated with the traditional formats, but the students perceived it more useful in learning brainstorming, collaboration, communication, engagement, feedback, participation and quality of learning. Other researchers have also found online cooperative learning effective in developing the skills required for a successful societal life (Bliss and Lawrence, 2009; Cox and Cox, 2008; Kupczynski, Mundy, Goswami and Meling, 2012).

Research studies on online cooperative learning are insufficient but the findings of the study are in conformity with research conclusions on cooperative learning in other formats and modes. For example, Johnson and Johnson (1989), Bashir, Ajmal, Rubab, and Bhatti, (2020), and Johnson, Johnson and Stanne (2000) found cooperative learning yielding higher academic achievement of students as compared to competitive and individual learning in different settings. Tran (2014) found significantly high posttest achievement of students instructed through cooperative learning as compared to the students instructed using lecture-based teaching. Alghani and Alhajja (2021) found better academic achievement of the student in mathematics using cooperative learning method in contrast to the students taught using traditional mode of learning. Kaymak, Kassymbek, Kalamkas and Saydenov (2021) found cooperative learning significant for the student's achievement.

The COVID-19 has enforced the use of online learning modes, and it is realized strongly that these modes will remain prevalent even after normalization of the circumstances. The world is rethinking educational formats and modes encouraging more and more innovation. It is therefore, recommended that:

1. In an online learning environment, teachers should be encouraged to use cooperative learning as a teaching approach to help students learn.
2. The VUP and other universities providing online education should innovate formats and platforms to facilitate online cooperative learning.
3. The universities and other institutions providing online education should conduct research on cooperative learning and its effectiveness in various disciplines and at a larger scale. Studies should also be conducted on the efficacy of cooperative learning in enhancing skills or dispositions in the affective domain of educational objectives.

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