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Comparison of cooperative problem-solving of mathematics teaching method with traditional (lecture) method: The case of Awi-zone, Ethiopia

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The aim of this paper is to compare and contrast the cooperative problem-solving strategy and the conventional technique and study their effects on mathematics performance. Various investigations have indicated that students experience mathematics anxiety which is an inclination of pressure and dread that meddles with mathematics learning. This might be ascribed to the encouraging strategies applied in the classrooms. Through the cooperative problem-solving learning strategy, every student in the gathering is dependable to impart insights and work together to take care of a mathematical problem. Then again, the conventional technique is teacher-focused guidance. The quasi-experimental research design configuration was utilized and the samples were assembled into A and B named experimental and control groups respectively. The experimental time frame was five weeks with an all-outnumber of twenty-five hours of exercise conveyance for each group. The experimental group was taught utilizing cooperative problem-solving techniques while the benchmark group was taught utilizing the customary strategy. To find the effects of cooperative problem-solving, it was analyzed using the paired t-test. The study uncovered that the experimental group has a mean score that is essentially higher than that of the benchmark group. The research, for the most part, uncovered that the experimental group performed superior to the benchmark group. The outcomes uncover that students are progressively effective when systematic problem solving on Polya's four stages strategy is joined into cooperative learning. Furthermore, the results suggest that the cooperative problem-solving method leads to better mathematics performance compared to the traditional method. The study, therefore, recommends that the training of mathematics teachers should incorporate the various strategies of presenting mathematical activities to Ethiopian high school students, especially the cooperative problem-solving strategy.

Keywords: cooperative learning, problem-solving, teaching-methods, traditional teaching method and Ethiopia

Mathematics has a basic capacity in students' prosperity and producing a developed country. However, students' scores are decreasing from time to time. Mathematics teaching has consistently been treated as an imperative piece of average instruction and specifically science education. It is accepted that a teaching strategy is essential to any important advancement exertion.

Basically, describing is not instructing and simply listening is not learning (Ali, Hukamdad, Akhter, & Khan, 2010). Again, some learning forms center around the educator, where the students are solely latent data beneficiaries. While in the active learning-focused process, the instructor is just a facilitator or a guide in the point of convergence of present-day frameworks of training. According to (Orhan & Ruhan, 2006) in all-powerful learning forms, the students master as indicated by their own motives and rate.

The varieties of values and qualities concerning mathematics learning bring about various mathematics educational frameworks. The role of teachers is to facilitate students' reasoning skills and learning, therefore, the teacher should attempt to motivate students to learn. To be aware of teaching practice activities done by teachers, we should have enough knowledge about learning and teaching methods. Different teaching methods such as traditional, problem-solving, and cooperative learning have been used in educational systems all over the world.

The method usually used in the context of Ethiopian high schools in general and Amhara regional state (one of the largest provinces in Ethiopia) in particular is the traditional teaching method. Consequently, significantly high numbers of students score below average. For instance, the four National Learning Assessment reports of grade eight students mathematics performance in the Amhara region is not only being very far below from the expected mean fixed nationally by the Ministry of Education for advancement, which is 50 %, but also going down from time to time (National Educational Assessment and Examination Agency, NEAEA, 2013-2017). Furthermore, according to Amhara Education Bureau, by 2016 only approximately 33% of students who took the grade 10 national exam in the region have got the passing mark. According to Hailu and Habtamu (2016), Instructional and Individual Factors are factors that attribute to students' low mathematics achievement in grade 10 and about 35.5% of students scored below grade C.

Little research is done on the interactive effects of cooperative problem-solving of high school students on their performance in mathematics. For example, researchers (Driver, Asoko, Leach, Mortimer, & Scott, 1994) have informed the blend with respect to the two approaches. Schoenfeld (1987) for example, focuses that

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the interaction that happens in small group problem solving impacts the development of self-guideline and beliefs (about mathematics & about one's ability to do mathematics), and that these beliefs, thus, sway students' mentalities and trust in their capacity to do mathematics.

In a critical thinking approach, skill is one that students perceive they had learned (Wismath Shelly, Doug, & Zhong, 2014). As indicated by Chan and Idris (2017) cooperative learning approach is at eaching method that urges students to help each other in a little gathering to accomplish a shared objective. As indicated by Slavin and Slavin (2014) researchers agree that cooperative learning can deliver beneficial outcomes on accomplishment yet differ in the conditions under which the methodology is powerful. For example, the essential component of cooperative learning and working is a positive interdependence (Laal, 2013).

In addition, cooperative problem solving is among the focal current century abilities teachers need their students to develop (Shelly, Wismath, & Doug, 2015). Cooperative problem-solving Strategy in Senior Secondary School improved students' performance (Adeyemo, 2010). Mizukami (1986) stresses that all instructing and learning theories should be considered, analyzed, contextualized and reproved, since it is appreciated that the way where the strategy is tended to or proposed may meet some instructive marvel..

The goal of the research is to check whether the interactive impact of cooperative problem-solving approach improves students' performance scores in mathematics or not.

As one of the independent variables was a problem-solving approach, the different levels of cognitive domains of Bloom's Taxonomy in educational objectives (knowledge, comprehension, application, analysis, synthesis, & evaluation) were utilized. The explanation behind utilizing Bloom's scientific classification is that it takes into consideration an away from to utilizing in the assessment of both a set of assessments and candidates' scores in the assessment, pre-test and post-test, to its standard.

Method

Participants

The participants were 120 grade 11 students from Dangila preparatory school, Awi-zone, Ethiopia. Of these respondents, 60 were in the experimental group class, while 60 others were in the control group class. A short training about cooperative problem solving was given to the experimental group. Students were told about the objectives of the study. Therefore, they were willing to participate in the experiment. Students were on an average of 17 years old. The study was carried out for five weeks.

After interventions were accomplished, both the experimental and control groups were given a post-test, which was similar to the Pre-test.

The product SPSS was utilized to break down data. Students' scores of the experimental group was compared with the control group, where students were shown to conventional instructing techniques.

To choose if treatment was in actuality, comparison of post-test scores between the experimental and control groups were made utilizing paired t-test.

Instrument

The investigation utilized a pre-test and post-test dependent on Cognitive Domains of Bloom's Taxonomy of Educational Objectives (the 1950s) regulated to both the control and experimental groups utilizing the Mathematics Test of Assimilation (MTAS). The four stages of Polya's (1957) problem-solving approach were utilized for handling mathematics problem to solve. Besides, stamping plans (scoring rubrics) was set up by the researchers. The checking plans were made of R (real imprint), S(strategy imprint, forms), and P (precision mark).

Research design

The participants into two groups, experimental (treatment) and control groups were assigned non-randomly, that is, the intact groups were used. The study used a quasi-experimental non-equivalent control group design. Convenience sampling technique was used to select the school and the classes that formed the study sample. To control for teachers' education and experience as sources of internal invalidity, only teachers of equal education and trip were chosen

Results and discussion

An investigation of students' pre-test for the experimental and control groups mean scores of six levels of Cognitive Domains of Bloom's Taxonomy of Educational Objectives thinking abilities was completed in order to check the two groups similarity levels at the beginning and to decide the impacts of cooperative problem-solving approach on students' accomplishment.

Table 1 shows the pre-test scores of the exploratory and the benchmark group. The outcomes demonstrate that the mean score for the experimental group was 26.73 and its standard deviation equal to 1.80 and that of the control group was 26.6 and its standard deviation equal to 1.21. The outcomes likewise show that the contrast between the accomplishment mean scores for exploratory and control groups, $p = 0.376$, are not significant at the alpha degree of 0.05. The difference, the effect size ($d = 0.088$), is much smaller than typical (negligible) using Cohen's (1988) guidelines. This, hence, implies the experimental and control groups were at a similar degree of accomplishment towards the beginning of the study.

Table 1: Pre-test achievement mean scores of the experimental and the control group of six levels of cognitive domains of bloom's taxonomy of educational objectives of reasoning skills

Groups	N	Mean	SD	t-value	df	p-value
Experimental	60	26.73	1.80	-0.893	59	0.376
Control	60	26.60	1.12			

Table 2 shows the post-test achievement mean scores of the experimental and the control group of all the six levels of Cognitive Domains of Bloom's Taxonomy of Educational Objectives reasoning skills. The outcomes show that the mean score for the experimental and control groups were respectively 36.73 and 27.2. The outcomes additionally show that the contrast between the accomplishment mean scores for the experimental and control groups, p =.000, is noteworthy at the alpha degree of 0.05. The difference, the effect size (d = 2.57), is much larger than typical using Cohen's (1988) guidelines.

Table 2: Post-test achievement mean scores of the experimental and the control group of six levels of cognitive domains of bloom's taxonomy of educational objectives of reasoning skills

Groups	N	Mean	SD	t-value	df	p-value
Experimental	60	36.73	1.130	-27.175	59	0.000
Control	60	27.20	2.5			

Discussion

Mathematics achievements

The aftereffects of this study show that cooperative problem-solving approach enhance achievement than the regular instructing technique. The cause for the increase in achievement of students may be the inclusion of cooperative problem-solving strategies, disclosing to their companions and accepting a clarification where the ideas can be effortlessly comprehended. Cooperative problem-solving techniques give more freedom and open doors for students to conjecture and test, draw pictures, discover an example, examine, take care of issues, make arrangements, give thoughts and help one another. As the outcomes clarified, encouraging strategies including the utilization of cooperative problem-solving on one hand and customary strategy, on the other hand, have various results in mathematics instruction. This shows the outcome is in accordance with the way that the three showing strategies which are traditional, problem-solving, and cooperative problem-solving learning depend on the distinctive learning speculations which are behaviorism, cognitivism, and social-constructivism respectively. The outcomes were additionally in accordance with past studies, as announced by certain researchers, for example, Edna Letida Hernandez Garduno (1997) who found that cooperative learning positively affects students' abilities in problem solving and their overall mental picture of mathematics and group work. Likewise, the utilization of cooperative problem-solving is a compelling method for improving mathematics performance (Norwood, 2007). Additionally, researchers (Driver, Asoko, Leach, Mortimer, & Scott, 1994) show that connecting socially in a cooperative setting while at the same time tackling non-routine issues is an amazing methods for developing information and thus a more noteworthy commitment to mathematics performance.

Be that as it may, as indicated by Wismath and Doug (2015) optimal "cooperative learning" on problem solving is profoundly depends on the relation among students, teachers, school administrators etc.

On the other hand, the conventional teaching method is a teacher focused, in this way; little freedom is given to students for conversation, critical thinking, making arrangements and working with peers.

At last, when students tackled a problem, they would regularly again deliver their peers to "question" by contrasting answers and the manner in which that they did.

Conclusion

Cooperative problem-solving approach improves mathematics performance. In this way, instructors in schools, particularly educators who teach mathematics should know about the advantages and significance of cooperative problem solving and consequently changing the act of teacher focused instructing strategies to student focused instructing techniques.

Mathematics instructors should utilize Polya's 4-step problem-solving strategy and cooperative learning elements. In this way, teachers are urged to rehearse these strategies normally and adequately. This study only lasted for five weeks. This means that students are exposed to learning in a very short period of time. Therefore, research should take a longer time span so that the results of this study can be more validated.

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