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EFFECT of COOPERATIVE LEARNING METHOD on STUDENTS' ACADEMIC THEORETICAL KNOWLEDGE

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Abstract: Aim of this study is to analyze effect of jigsaw method and to decide its effectiveness on students' academic achievement. For that purpose students who are studying at elementary science education program are distributed into two groups through true experimental design. Factors threaten the internal validity are either eliminated or reduced to minimum value. Data analysis of distributions, parametric and non-parametric tests are done to answer research question. Further analyses are also done to investigate gender factor in the study. Research revealed that cooperative learning method did not have effect on increasing students' academic theoretical knowledge achievement. It is also revealed by the study gender has no effect on academic achievement. However it is also concluded that research itself reveals importance of establishing meaning between experiment sessions and academic relationship for the students.

Keywords: cooperative learning, jigsaw, students, teaching, instruction

Introduction

Researchers try to find ways to enhance learning and increase students' awareness on their environment. For that purpose either new models are being created or the ones exist are being tested continuously to make them operate more efficiently (Daud, Omar, Turiman and Osman, 2012). Purposes of those studies are mostly to raise individuals as analytical thinkers who have science literacy. Active learning methods are widely used for that purpose and it has many successful outcomes such as long-term retention of knowledge, critical thinking abilities, engage more deeply on ongoing processes (Hidayat, Patel and Veltri, 2012). Active learning fosters critical thinking strategies, increase to know purpose and better decision making approaches. This is achieved through critical thinking attributes which are reasoning, inference, interpretation, knowledge and open mindedness. Importance of critical thinking strategies dates back to Socrates since then it occupies itself within most educational context and concepts (Tedesco – Schneck, 2013). Instructors give students handouts, home works to

increase critical thinking abilities, however it also should be noted that to foster critical thinking strategies it is also necessary to ask students appropriate questions which could help students to correlate academic and daily knowledge (Shieh, Chang and Tang, 2010). Some other studies show that students tend to act based upon their experiences and that also includes their teaching styles if they become teachers. Thus to provide students opportunities they can use will also increase their non academic attitudes including social skills (Tang, Wong and Cheng, 2012). Such attributes of active learning also create opportunities to researchers to manipulate active learning methods. Such a manipulation could happen to turn out as a new method such as done by Doymus (2007). Nevertheless this also helps educators to have opportunities to use new techniques and help their students to increase their academic success along with social skills and critical thinking strategies. Being in peer groups also create chances to gain different aspects of knowledge through other people, which is done through communication. Active learning supports diversity, increases students' retention. In fact having many positive outcomes made active learning methods to get more attention even from national agencies. Its flexibility enabled researchers or instructors to use the methods in different environments for different or common purposes (Prunuske, Batzli, Howell and Miller2012).

Purpose of the study

Purpose of this study is to determine effect of Jigsaw technique on prospective elementary science teachers' academic theoretical knowledge.

Materials And Method

Research design and Sample

This study is carried out with 60 students who are studying at elementary science education department at first grade. Study is done through true experimental design. Students who are taking chemistry laboratory course are given a pre-test which aims to determine students' academic knowledge level at their current status. Reliability analysis of pre-test is done and questions lowering the reliability omitted from the test. Pre-test (PT) consist of 20 questions and Cronbach's Alpha of reliability for pre-test is determined as 0,625. Students distributed to the groups through s-shaped distribution method so that it is ensured that both groups are at equal levels of academic knowledge. After that groups are selected randomly as experimental (Jigsaw) group and control (Traditional) group. For internal validity same instructor worked with both groups. Five experiment topics are selected for laboratory course

and same experiments are carried out by both groups. Each week an experiment is carried out by students and students were given a quiz whose questions were related to both theoretical and experimental knowledge of the experiment topics.

Data Analysis

Pre-study data analysis

To determine sample characteristics Shapiro-Wilk's test ($p>0.05$), visual inspection of the histograms, normal Q-Q plots and box plots of the exam scores were investigated and it is found that distributions are approximately normal for both control and experiment groups, with a skewness of -0,338 (SE = 0,481) and a Kurtosis of -0,255 (SE = 0,935) for Control Group. A skewness of -0,054 (SE = 0,441) and a Kurtosis of -0,945 (SE = 0,858) for Experiment Group. A Shapiro-Wilk's test is run for Normality for both control and experiment groups. Test results turned out as 0,560= p > 0,05 for control group and 0,460 = p > 0,05 for experiment group. This explains that distribution of PT is homogeneous for both groups. A Levene's Test is run across the groups and homogeneity of variance is found as 0,948 > p= 0,05. Since the all assumptions are satisfied an independent t-test is run result is shown in Table 1.

Table 1. Independent t-test for groups

Pre-test	n	X	sd	t	p
Traditional	23	8,70	3,350	-0,446	0,657
Experiment	28	9,11	3,213		

Data in Table 1 implies that Experiment group's mean is higher than Traditional group and that difference is 0,41 points. T-test's result shows that this difference is not significant statically (p=0,657 > 0,05). That case supports the idea that students' distribution to groups is random and groups are homogenous with respect to each other in terms of academic knowledge.

Mann Whitney U test for gender

To determine sample characteristics Shapiro-Wilk's test ($p>0.05$), visual inspection of the histograms, normal Q-Q plots and box plots of the exam scores were investigated. Analysis on sample characteristics done for gender. A Skewness of -0,104 (SE = 0,512) and a Kurtosis of -0,999 (SE = 0,992) for boys; a Skewness of -0,265 (SE = 0,421) and a Kurtosis

of -0,306 (SE = 0,821) for girls. Shapiro-Wilk's test for normality turned out as 0,558 > p = 0,05 for boys and 0,496 > p= 0,05 for girls. Since violations are done; Non-parametric Mann-Whitney U test is run for gender and results are shown in Table 2. Mann-Whitney U test indicated that difference between genders is not significant statistically, U = 274,5; p = 0,491 > 0,05. That case supports the idea that gender distribution to groups is random and groups are homogenous with respect to each other in terms of academic knowledge.

Table 2. Mann Whitney U test for gender

Pre-test	n	Mean Rank	Sum of Ranks	p
Boys	20	24,23	484,50	0,491
Girls	31	27,15	841,50	

Post-study data analysis

Groups did the experiments which were pre-set by the researchers. Every week, students were given a quiz related to both theoretical and experimental knowledge on the covered experiments. After the study an achievement test (AT) is prepared. All the questions asked are related to experiment topics done in the laboratory and it aims to determine academic knowledge level of the students related to the topics which were investigated experimentally. After reliability analysis through Cronbach's Alpha method, questions lowering reliability omitted from achievement test and leaving test with 21 questions with a reliability value of 0,711.

To determine sample characteristics Shapiro-Wilk's test (p>0.05), visual inspection of the histograms, normal Q-Q plots and box plots of the exam scores were investigated and it is found that distributions are approximately normal for both control and experiment groups, with a skewness of 0,411 (SE = 0,421) and a Kurtosis of 0,537 (SE = 0,821) for Control Group. A skewness of 0,301 (SE = 0,434) and a Kurtosis of -1,250 (SE = 0,845) for Experiment Group. For further analysis, Shapiro-Wilk's test is run for both control and experiment groups and obtained statistical difference is 0,577= p > 0,05 for control group and 0,043 = p < 0,05 for experiment group. This explains that distribution of PT is not homogeneous for both groups. A Levene's Test is run across the groups and homogeneity of variance is found as 0,824 > p= 0,05. Since not the all assumptions are satisfied Mann-Whitney U test is run for groups (Table 3).

Table 3. Mann Whitney U test for groups

Post-test	n	Mean Rank	Sum of Ranks	p
Traditional	31	29,29	908,00	,577
Experiment	29	31,79	922,00	

Mann-Whitney U test indicated that difference between groups is not significant statistically, U =412; p = 0,577 > 0,05.

For further analysis effect of gender differences are also investigated within the experiment group. For that purpose Shapiro-Wilk's test (p>0.05), visual inspection of the histograms, normal Q-Q plots and box plots of the exam scores were investigated and it is found that distributions are not normal for both girls and boys groups, with a skewness of 0,493 (SE = 0,637) and a Kurtosis of -1,106 (SE = 1,232) for boys. A skewness of 0,167 (SE = 0,550) and a Kurtosis of -1,548 (SE = 1,063) for Experiment Group. For further analysis, Shapiro-Wilk's test is run for both boys and girls and obtained statistical difference is 0,073= p > 0,05 for girls and 0,185 = p > 0,05 for boys. This explains that distribution of PT is not homogeneous for both genders. A Levene's Test is run across the groups and homogeneity of variance is found as 0,496 > p= 0,05. Since not the all assumptions are satisfied Mann-Whitney U test is run for groups (Table 4).

Table 4. Mann Whitney U test for genders within experiment group

Post-test	n	Mean Rank	Sum of Ranks	p
Boys	12	11,92	143,00	,100
Girls	17	17,18	292,00	

Mann-Whitney U test indicated that difference between groups is not significant statistically, U =65; p = 0,100 > 0,05. In that case it may be assumed that new educational method introduced to education environment has nearly similar effects on both genders.

Discussion And Conclusion

Literature on cooperative learning methods mostly report increase in academic achievement as one of the outcomes of the method. There are various researches which reports better academic performance when model is applied with proper instruction. Although in this study experiment group did better than control group with a difference 0,41

for PT and 2,5 for AT, still those values are not significant statistically. However it also should be noted that not having a statistical significance in fact could enlighten another aspect of research which is its implication on construction of meaningful learning. Although AT questions are related to experiment topics the questions asked were not experiment related but instead questions were assessing theoretical aspects of covered topics. It is clear that students were unable to comprehend the relationship of experiment topics with theoretical topics. As a result students were not be able to construct meaning between two concepts thus failed to perform to show the meaning of knowledge which were build by themselves through experiments. This situation in fact is one of the approvers of Constructivist theory arguments. Constructivist theory claims that every student should construct meaning of knowledge through their experience thus questions asked should be related to their experience. It is clear from the study that students cannot comprehend and correlate the relationship of theoretical and experimental knowledge.

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