Collaborative Learning, Gender Groupings and Mathematics Performance

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Abstract

This study was conducted to find how students perform in class if they work in groups. It also wanted to find out which gender groupings of students facilitate comfortable studies and better academic results. An experimental research design was utilized where the subjects were randomly assigned. The subjects in this study comprised 9 groups: three all-male groups, three all-female groups, and three mixed groups. Using ANOVA, data analysis revealed that the subjects' formative tests mean scores had no significant difference which implies that if subjects were working alone, they obtained more or less similar results. The collaborative learning treatment, where the subjects worked in different gender groups, showed that there was a significant difference in their performance. Specifically, all-female groups obtained the highest mean score followed by mixed groups; this implies that if subjects work with others whom they are comfortable with, their results increase. In the math achievement test, which was taken individually, a significant difference in the mean scores obtained was observed; this level of improvement in their learning which could be attributed to the groups they worked with and learned the concepts with.

Keywords: collaborative learning, gender groupings, math performance

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Introduction

"The development of learning in small groups in higher education has occurred, in part, because of strong evidence indicating that students working in small groups outperform their counterparts in a number of key areas. These include knowledge development, thinking skills, social skills, and course satisfaction" (Davidson, N., & Major, C. H., 2014).

Zurita, Nussbaum and Salinas (2005) pointed out that the composition of participating is one of the most important decisions to be made in a collaborative learning activity. These compositions produce different learning and social interaction results. The ability to change the group member composition in real time and dynamically enables the improvement of learning results and social relationships. Changes in composition also facilitate the analysis of the best criteria to be used in a determined activity.

Some forms of group learning have become more mainstream than others, and these provide a useful direction for faculty to consider as they consider the options. The way children learn can affect how well they learn. There are studies which indicate that boys and girls have different styles for learning, and student success can be linked to learning styles (Hein & Budny, 1999).

Hall (2008) stated that boys' and girls' brains develop differently. While girls develop verbal/linguistic skills early, boys' brains concentrate on spatial and kinesthetic intelligences. Boys need more movement than girls while they learn which often results in discipline difficulties in the classroom.

Roschelle & Teasley (1991) stated that "collaboration may be described as the mutual commitment of members of a small group to coordinate their efforts in order to solve a problem. Furthermore, in such an environment students can acquire new skills, ideas and knowledge by working together to build solutions to educative problems" (as mentioned by Zurita et al., 2005).

Mathews (1992) found that high-ability students prefer cooperative learning in groups of homogeneous ability than those of heterogeneous abilities. This means that students who are academically more inclined prefer to form a group with those who are of equal or great academic inclination rather than being grouped with a student of lower ability (as mentioned by Samsudin, 2006).

It has been shown that male and female students interact with group members differently and that in mixed gender groups males tend to dominate (Guzzetti and Williams, 1996). Therefore it is proposed that using single gender groups will enable female students to more actively participate. This study explored the effect of arranging cooperative learning groups by gender has on the performance of students and their level of active engagement.

In light of this, the researcher was motivated to pursue this study, to find out how the students perform when they work in groups. Moreover, the research sought to determine the ideal groupings for performance.

Statement of the Problem

The study's objective was to find the effects of collaborative learning and gender groupings in the mathematics performance of Bachelor of Elementary Education (BEED) students. Specifically, this study sought to answer the following questions: (1) What is the performance of the students in the following: a) Formative test, b) Collaborative learning activities, c) Achievement test? (2) Is there is a significant difference in the performance of the students in the following: a) Formative test, b) Collaborative learning activities, c) Achievement test?

Hypothesis

The study was guided by the following null hypothesis: There is no significant difference in the students' formative test, collaborative learning activities and mathematics performance between the different gender groups.

Significance of the Study

This study was not conducted to determine if the collaborative learning and gender grouping are the best approaches to teaching. Instead, the results of this research can be utilized by educators to enhance the learning process in a classroom setting.

To the students, findings of this study will beneficial since they should be the focus of any classroom setting. They need to know when and how they can perform better in class. To the teachers, findings of this study will give them ideas to determine how they can make their teaching more effective. To future researchers, findings of the study can be used to validate similar or related studies in the future.

Conceptual Framework

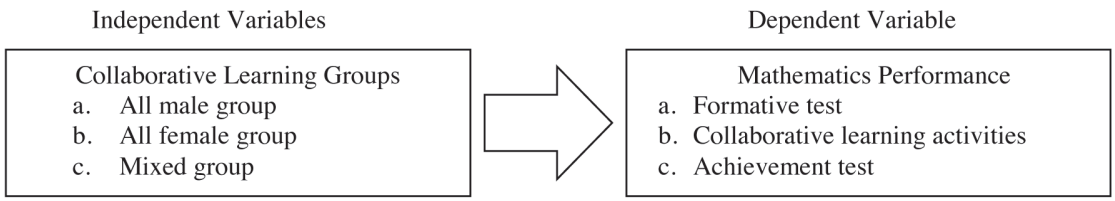

Figure 1 The Conceptual Framework of the Study

Scope and Limitation of the Study

This study was conducted in Eastern Samar State University College of Education during the second semester of School Year 2015 – 2016. The subjects of the study were third year Bachelor of Elementary Education (BEED) students who were enrolled in Math 321.

In interpreting the results of this study, there are several limitations to be considered. These limitations are related to the subjects, the length of the study, and the material used in the course. The subjects of the study were the third year BEED students with a very small number of male students. The instruments used were prepared by the instructor. Another limitation of the study was the length of the experiment. A six – week implementation period was necessitated by some class interruptions.

Related Literature

In a study of students with strong preferences to learning alone or learning in groups, Wallace (1993) found that those preferring to learn alone "evidenced statistically higher mean lesson-test scores than those who were identified as preferring to learn with peers." Wallace suggested the possibility that this result is due to a traditional structure in the classroom, and that the organizational pattern in the classroom had not matched a preference to working with peers. On the other hand, memory research indicates that children remember best by discussing what they have learned in groups, practicing and using what they have learned, and by teaching others (Madrazo & Motz, 2005).

Culbertson (2010) emphasized that females contributed to small mixed gender groups just as they would within the larger mixed gender classroom and that there is a notable difference in the approach each gender takes to learning physics and interacting with others. Male students are more likely to make predictions quickly, avoid questions to which they do not know the answer, provide answers and look for concrete solutions. Female students, on the other hand, tend to raise questions about the content, do not present solutions right away, invite other members of the group to participate, and look to build consensus. It has also been shown that male and female students present their objections to a learning group in very different manners. Males tend to disagree more than females in a learning group. Males require the group members to give evidence to any statement that is made that contradicts their reasoning for a particular phenomenon, whereas female students tend to use an indirect approach by raising questions and stating possibilities to raise their objections (Guzzetti et al., 1996). Furthermore it has been shown that male students tend to ignore the female students' ideas and interrupt females as they try to explain their ideas.

As mentioned by Kowaliw, that there are also studies that show that this method is nonconductive to learning. Peterson, Janicki, and Swing (1981) came to the conclusion that students who receive help from their peers may or may not improve their performance. Harrison and Covington (1981) found that low achieving students are hindered by the fact that they may be holding their group back in a task. When comparing homogeneous male and homogeneous female pairs in cooperative tasks, researchers have come to many different conclusions. Some research has found that male pairs are more effective than female pairs in cooperative learning tasks. Webb (1991) found that male pairs accomplish tasks in the shortest amount of time possible and are very competitive in their tasks. Other research states that female pairs are more efficient in cooperative learning. Cohen (1994) found that the females' work is more deliberate and consistent to make sure that the task is completed and that the fewest amount of mistakes are made.

The conclusion of researchers such as Webb (1991) is that homogeneous pairs outperform heterogeneous pairs. Although boys competed and girls cooperated, both types of pairs still achieved their goal of getting the computer task done effectively. This was not the case with heterogeneous pairs because the male trait of competition and female trait of cooperation kept both children from working together.

In the study of Sonya R. Porter Draper (2004) "The Effects of Gender Grouping and Learning Style on Student Curiosity in Modular Technology Education Laboratories", the overall scores for girl/girl groupings were higher than girl/boy and boy/boy groupings, and scores for girl/boy groupings were higher than boy/boy groupings. A one-way analysis of variance was conducted to evaluate whether the gender grouping means differed significantly from each other. According to the analyses, the F-tests revealed no significant differences in gender groupings. Kowaliw in his study, "Homogeneous and Heterogeneous Gender Pairs, Controlling Behavior, And Achievement on a Cooperative Learning Task", found his hypothesis that homogeneous male and female pairs would complete the task before heterogeneous pairs was incorrect; males took the longest to complete the task. Researchers also disagree as to which type of gender pair works most productively. Culbertson, Condes & Bradford (2010) in their study, "The Effect of Single Gender Cooperative Learning Groups in High School Physics Classes", indicated that the gender gap is reduced when single gender groups are used, without detriment to male students, and that students, on average, prefer single gender cooperative groups.

Methodology

Research Design

This study utilized an experimental research design. It sought to discover the effects of collaborative learning by gender groupings in mathematics performance. The subjects in this study comprised 9 groups: three groups were all male members, another three were all female groups, and the last three were mixed groups with two male and two female members for a total of 18 male and 18 female students.

Research Instrument

The study utilized teacher-made formative tests, collaborative learning activities and an achievement test. A dry-run was conducted and item analysis was done to validate the instrument. The final copy was subjected to face and content validation by a fellow math teacher.

Procedure

An approval to conduct the study was secured from the Dean of the College. Then, series of discussions were followed by gender-grouped collaborative learning activities, formative tests and an achievement test that was administered at the end of the study. The mean was used to find the average of the formative tests, cooperative learning activity outputs and the achievement test. ANOVA was used in comparing the performance of the three collaborative learning groups in their formative tests, cooperative learning activity outputs and achievement test.

Results

Table 1 Formative Test, Collaborative Activity and Math Achievement Mean Scores of the Three Gender Groups

Groups	Formative Test		Collaborative Activity		Math Achievement	
	Mean	Interpretation	Mean	Interpretation	Mean	Interpretation
All male Group	27.00	Average	34.17	Average	41.67	Above Average
All female group	27.67	Average	42.42	Above Average	45.17	Above Average
Mixed group	27.33	Average	38.67	Above Average	43.17	Above Average

Table 1 presents the mean scores of the three gender groups in their formative tests, collaborative activity and math achievement. It shows that the all female groups obtained the highest mean in their formative test at 27.67 and all male groups obtained the lowest mean at 27.00. However, all mean scores are interpreted as average. This implies that students working alone, more or less, obtain similar scores in their individual formative tests.

The table also presents the mean scores of the three gender groups in their collaborative activities. The all-female groups earned the highest mean at 42.42 (above average), the mixed groups obtained a mean of 38.67 interpreted as above average and the all-male groups garnered the lowest mean of 34.17 (average). The result implies that all female groups performed better than the all-male group, while male students working with female students performed better as compared to if they were grouped with fellow male students.

It also reveals the mean scores of the three gender groups in their math achievement test. The all-female group obtained the highest mean of 45.17, as compared to the mixed group that garnered an average score of 43.17 and the all-male group with a mean of 41.67. All groups had an above average performance. Though the means vary, the differences are negligible; all groups performed better at the end of the experiment. The final result of the experiment implies that collaborative learning and gender groupings may have affected the performance of the students in their achievement test.

Table 2 ANOVA of the Formative Test in the Three Gender Groups

Source of Variation	Sum of Squares	Df	MSS	F	Tabular value	Interpretation
Between Columns	169.55	2	84.77	21.55	3.29	Not significant
Within Columns	67.46	33	2.04			
Total	**237.01**	**35**				

Table 2 is the ANOVA table presenting the formative test results of the three gender groups with the computed F value of 21.55 greater than the tabular value of 3.29. This reveals that there is no significant difference in their test results. The result is in consonance with the null hypothesis that there is no significant difference in the formative test results between the three different gender groups. This result implies that if tests are taken individually, the scores of the subjects will not differ significantly.

Table 3 ANOVA of the Collaborative Activity in the Three Gender Groups

Source of Variation	Sum of Squares	Df	MSS	F	Tabular value	Interpretation
Between Columns	2.67	2	1.33	0.35	3.29	significant
Within Columns	125.33	33	3.8			
Total	**128**	**35**				

The ANOVA table presented in Table 3 shows the collaborative activity results of the three gender groups with the computed F value of 0.35 which is less than the tabular value of 3.29. This reveals that there is a significant difference in the results. The result opposes the null hypothesis that there is no significant difference in the collaborative learning activities between the three different gender groups. It implies that students working in different gender groups had a great effect in their collaborative learning outputs.

Table 4 ANOVA of the Math Achievement in the Three Gender Groups

Source of Variation	Sum of Squares	Df	MSS	F	Tabular value	Interpretation
Between Columns	18	2	9	0.32	3.29	significant
Within Columns	910	33	27.58			
Total	**928**	**35**				

Table 4 is the ANOVA table presenting the math achievement test results in the three gender groups with the computed F value of 0.32 which is less than the tabular value of 3.29. This reveals that there is a significant difference in their test results, implying that the students, after having been exposed to collaborative learning and gender group activities, had significantly different mathematics achievement. The result rejects the null hypothesis stating that there is no significant difference in the mathematics achievement between the three different gender groups.

Results and Conclusions

Based on the results, though the three gender groups obtained different means in their formative tests, the differences was very minimal, negligible enough to say that all students under study performs similarly when working individually. In the collaborative learning activities, the three gender groups obtained high differences in their mean, where the all-male groups performed very far from the all-female groups, which can be concluded that female students when grouped together turns out better results than all male students grouped together. The mean scores of the three gender groups in their Math achievement test given after the experimentation, tells that though the all-male group obtained the lowest mean, they still performed very well in their achievement test.

Based on statistics, the following conclusions were formulated; (1) there was no significant difference in the mean scores obtained by the three gender groups in their formative test, probably because the students under study have similar abilities when working individually; (2) there was a significant difference in the mean of the collaborative learning activities in the three gender groups, probably because performance of collaborative learning activities depends on who do we work with; and (3) the mean in the math achievement test of the three gender groups varies significantly due to the effect of the collaborative learning activities.

Suggestions

Based on the findings of the study, the following suggestions are presented: (1) mathematics teachers should know their students before starting the course to enable the former to select and employ an appropriate teaching approach and strategy; (2) teachers should utilize collaborative learning and gender groupings as a teaching approach to improve student learning; (3) school administrators should encourage professors to use other teaching approaches like collaborative learning and gender groupings to make the students the center of the teaching-learning process; (4) school administrators should send instructors and professors to seminars on new trends in education, strategies and approaches; and (5) future researchers should conduct a similar study.

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