The Impact of Collaborative Learning on Pupils' Attitude and Performance in Earth Geometry: A Case of Kitwe District, Zambia

Evans Musonda[1*], Athanasius Lunjebe[2]

[1]*Mukuba University, School of Mathematics and Natural Science, P.O BOX 20382, Kitwe, Zambia*
[2]*School of Mathematics and Natural Science, Copperbelt University, P.O BOX 21692, Kitwe, Zambia*

Abstract*:-This study was conducted in order to show the impact of Collaborative Learning on pupils' attitude and performance in Earth Geometry by grade 12 pupils in Kitwe Districtexploring the following research questions; (i) Does Collaborative Learning have an impact on pupils' performance in Earth Geometry? (ii) Does Collaborative Learning method have an impact on pupils' performance by gender? (iii)Does Collaborative Learning have an impact on pupils' attitude towards Earth Geometry? The problem of poor performance of the Grade 12 pupils in Mathematics, especially in Earth Geometry has been a thorny issue. To improve the performance in Earth Geometry, a study was conducted on grade 12 pupils of Mukuba Secondary School and Helen Kaunda School of Kitwe District. The study population included 155 pupils from Mukuba and Helen Kaunda Secondary Schools of Kitwe District. The study was based on the three research questions and two hypotheses. The research method used was a Quantitative research. The sample size was 155 pupils comprising 80 male and 75 female pupils. Experimental Design and a Mathematics Attitude Questionnaire were used. The two groups were made from two classes picked at random from 7 classes of Mukuba Secondary School and another pair was picked at random from 6 classes of Helen Kaunda Secondary School. Particularly, 40 pupils were randomly assigned to the Experimental Group and 40 pupils to Control Group from Mukuba Secondary School. Furthermore, 35 pupils were randomly assigned to the Experimental Group and 40 to Control Group from Helen Kaunda Secondary School. These two pair of groups were subjected to pre-test. The Experimental Groups were taught using Collaborative Learning Approach while the Control groups were taught using Conventional Approach. The analysis of data was done using SPSS version 16, considering the mean and standard deviation. Also, the Independent sample t-test was conducted at alpha (α) = 0.05 to analysis the results of the pre-test and post-test scores. The study revealed that there was statistically significant mean difference in the post-test scores for Experimental groups (Mean = 63.3, standard = 16.9) and the Control group (Mean = 48.7, standard deviation = 18.4), p = .000 for Mukuba Secondary School and Experimental groups (Mean = 65.5, standard deviation = 19.8) and the Control groups (Mean = 51.9, standard deviation = 21.2), p = .005 for Helen Kaunda Secondary School. Furthermore, the study showed that there was no statistically significant mean difference in the Pre-test scores for Experimental group (Mean = 26.7, standard deviation = 17.9) and the Control group (Mean = 26.6, standard deviation = 17.2), p = .980 for Mukuba Secondary School and Experimental group (Mean = 24.8, standard deviation = 15.7) and the control group (Mean = 25.2, standard deviation = 15.9), p = .902 for Helen Kaunda Secondary School. The study also revealed that post-test scores mean of female and male pupils were statistically insignificant (P-Value=0.640>$\alpha = 0.05, t = 0.470$).Then analysis of the MAQ indicated that most pupils had a positive attitude towards Earth Geometry and it amounted to 80.7% while 11.3% showed no effect on the attitude after the post-test from both Schools. Therefore, teaching Earth Geometry using Collaborative Learning Approach was found to have a positive impact on pupils understanding of Earth Geometry because of the high marks after its administration. The study further revealed that pupils had challenges in calculation of the surface area between two meridians and the shortest distance between points on the same latitude which are not diametrically opposite but non the less were solved with more emphasis on them.

I. INTRODUCTION

Today's Curriculum in Mathematics prepares students and pupils for their future roles in society by providing them with critical and essential mathematical knowledge and skills. It is also a cardinal tool for the development and improvement of a person's intellectual competence in logical reasoning, spatial visualization, analysis and abstract thought, this is in line with CDC (2013). In spite of the helpfulness of Mathematics and Earth Geometry in particular, there has been a declining pass rates in the subject by many learners in Zambia according to ECZ (2016). The failure rate overall has reduced from 5.47 in 2014 to 5.24 in 2015 according to ECZ (2015). The highest failure rate recorded in Mathematics and Science subjects was averaging 39.12%. The poor performance at School Certificate level in Mathematics and Earth geometry in particular has been an issue of concern to Mathematics Educators, Standards Officers, Examiners and other Stakeholders. In particular, Earth Geometry has been cited to be problematic (ECZ, 2004, 2006,2008 to 2017) as most questions on Earth Geometry were answered wrongly while optional questions were mostly avoided by pupils.

II. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

2. Introduction

The Chapter discussed the findings of the research from the pre-test, post-test and questionnaire which were administered to the pupils in order to find out the impact of Collaborative

Learning on the attitude and performance in Earth Geometry by pupils of Mukuba Secondary School and Helen Kaunda Secondary School in Kitwe District of the Copperbelt province. This Chapter presents data analysis and interpretation of empirical findings of this study. The results were presented using tables and results were preceded by a brief analysis. Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goals of discovering useful information, suggesting conclusions and supporting decision-making.

2.1 General information about the sample

The information presented in this section represents the MAQ responses of 40 pupils from Mukuba Secondary School and 35 pupils from Helen Kaunda Secondary School in Kitwe district. This information was collected with a view to determining pupils' attitudes towards Earth Geometry after being taught by Collaborative Learning Approach. The MAQ inquired more about pupils feeling towards Earth Geometry after the post-tests. Results showed that the majority of the respondents, 40 representing 53.3% were boys from Mukuba Secondary School while 35 representing 46.7% were girls from Helen Kaunda Secondary School.

Tables 2.2.1 and 2.2.3 below shows the descriptive statistics for the pre-tests for Mukuba Secondary and Helen Kaunda Schools respectively. The results showed that the Experimental group had a mean score of 26.7, standard deviation was 17.9 while the Control groups mean score was 26.6, standard deviation was 17.23 for Mukuba Secondary which gave a mean score difference of 0.1. For Helen Kaunda the Experimental group had a mean score of 24.8, standard deviation was 15.7 while the Control groups mean score was 25.2, standard deviation was 15.9 and gave a mean score difference of 0.4. These comparatively small differences in mean scores showed that the Experimental groups and the Control groups were equivalent in abilities.

2.2 Pre-test and post-test results and discussion

Table 2.2.1 Descriptive statistics for the Pre-test for Mukuba Secondary School

Test	Group name	N	Mean	Std. Deviation
Pre-test	Experimental	40	26.7	17.88
	Control	40	26.6	17.23

Table 2.2.2 Descriptive statistics for the Post-test for Mukuba Secondary School

Test	Group name	N	Mean	Std. Deviation
Pos-test	Experimental	40	63.30	16.95
	Control	40	48.73	18.41

Table 2.2.3 Descriptive statistics for the Pre-test for Helen Kaunda Secondary School

Test	Group name	N	Mean	Std. Deviation
Pre-test	Experimental	35	24.8	15.7
	Control	40	25.2	15.9

Table 2.2.4: Descriptive statistics for the Post-test for Helen Kaunda Secondary School

Test	Group name	N	Mean	Std. Deviation
Post-test	Experimental	35	65.5	19.8
	Control	40	51.8	21.2

Tables 2.2.2 and 2.2.4 shows the descriptive statistics for the post-test for Mukuba Secondary and Helen Kaunda Schools respectively. The result showed that the Experimental group had a mean score of 63.3, standard deviation was 16.9 while the Control group mean score was 48.7, standard deviation was 18.4 for Mukuba Secondary which gave a mean score difference of 14.6.

For Helen Kaunda the Experimental group had a mean score of 65.5, standard deviation was 19.8. While the Control groups mean score was 51.9, standard deviation was 21.2 and gave a mean score difference of 13.6. These comparatively large differences in mean scores showed that the Experimental groups achieved higher than the Control groups. These obtained differences were in favor of the Experimental groups with mean scores of 63.3 and 65.5 respectively.

2.3 The Shapiro- wilk normality test

The assumption which was shown before the t-test was that the data collected was normally distributed. The initial step was, therefore, to use the Shapiro-wilk procedure to test for normality. The procedure was done in order to check out that the assumption was not violated. A t-test could only be used effectively if the data investigated is normally distributed.

Table 2.3.1 and 2.3.2 shows the results generated using Statistical Package for the Social Sciences (SPSS) software version 16.

Table 2.3.1 Shapiro-Wilk normality test for Experimental and Control groups from Mukuba Secondary School

	Shapiro-Wilk		
	Statistic	Df	Sig.
Pretest Score	.928	80	.000
Posttest score	.975	80	.112

Table 2.3.2: Shapiro-wilk normality test for Experimental and Control group from Helen Kaunda Secondary School

	Shapiro-Wilk		
	Statistic	Df	Sig.
Pretest Score	.951	75	.006
Posttest score	.959	75	.116

In both cases the normality test showed a Shapiro-Wilk value of more than 0.05. This showed that the data for the post test were normally distributed. It implied that the t-test could be used.

Table 2.3.3: Independent sample t-test for the Experimental and Control group of pre-tests from Mukuba Secondary School

Type of test	t-test for Equality of Means						
	T	Df	Sig.(2-tailed)	Mean Difference	Std.Error Difference	95% Confidence Interval of Difference	
						Lower	Upper
Pre-test equal Variances Assumed	.025	78	.980	.10000	3.922649	-7.71704	7.91704

Table 2.3.4: Independent sample t-test for the Experimental and Control group of pre-tests from Helen Kaunda Secondary School

Type of test	t-test for Equality of Means						
	T	Df	Sig.(2-tailed)	Mean Difference	Std.Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Pre-test equal Variances Assumed	-.124	73	.902	-.45357	3.65773	-7.74343	6.83628

Tables 2.3.3 and 2.3.4represents the independent sample t-test for the Experimental and Control group of pre-tests for Mukuba Secondary School and Helen Secondary School. An independent sample t-test was used to analyse whether there was a significant difference between the mean scores of Experimental group and Control group for the pre-test before administration of the treatment to the experimental group. The tables showed the following for Mukuba Secondary School (p-value = $0.980 > \alpha = 0.05, t = 0.025$) and (p-value = $0.902 > \alpha = 0.05, t = -0.124$) representing Helen Kaunda Secondary School indicating that the difference in the mean scores were not significant. These results illustrated that both the pupils in the Control and Experimental groups were similar in abilities before the treatment was administered. Hence the two groups were equivalent.

Table 2.3.5 Independent sample t-test for the Experimental and Eontrol group of post-tests from Mukuba Secondary School

Type of test	t-test for Equality of Means						
	T	Df	Sig.(2-tailed)	Mean Difference	Std.Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Post-test equal Variances Assumed	3.684	78	.000	14.575	3.95652	6.69816	22.45184

Table 2.3.6: Independent sample t-test for the Experimental and Control group of post-tests From Helen Kaunda Secondary School

Type of test	t-test for Equality of Means						
	T	Df	Sig.(2-tailed)	Mean Difference	Std.Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Post-test equal Variances Assumed	2.868	73	.005	13.66786	4.76495	4.17132	23.16440

Tables 2.3.5 and 2.3.6 represents the independent sample t-test for the Experimental and Control group of post-tests for Mukuba Secondary School and Helen Secondary School. An independent sample t-test was used to analyse whether there was a significant difference between the mean scores of Experimental groups and the Control group for the post-test after administration of the treatment. The tables showed the following for Mukuba Secondary School (p-value = $0.00< \alpha = 0.05, t = 3.684$) and (p-value = $0.005< \alpha = 0.05, t = 2.868$)for Helen Secondary School indicating that the difference in the mean scores were significant for both Schools. These results showed that both the pupils in the Control group and Experimental group were different in terms of abilities after the experimental group were subjected to the treatment. This conclusion is supported by Field (2009), when the P-value is less than the level of significance, set by the researcher, the null hypothesis is rejected and the conclusion is that the two means differ significantly.

Table 2.3.7: Independent sample t-test for male and female pupils

Type of test	t-test for Equality of Means						
	T	Df	Sig.(2-tailed)	Mean Difference	Std.Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Post-test equal Variances Assumed	.470	73	.640	1.98929	4.23280	-6.44667	10.42524

The results in table 2.3.7 above showed that the difference between the post-test mean scores for the male and female pupils were not statistically significant (p-value = $0.640> \alpha = 0.05, t = 0.470$). According to Field (2009),when the P-Value is greater than the alpha value, set by the researcher, the null hypothesis is not rejected and the conclusion is that the two means did not differ significantly . It was determined that the difference in mean scores between the Experimental group from Mukuba Secondary School and Experimental group from Helen Kaunda Secondary School were not statistically significant and P>0.05. Therefore $H_0$was not rejected and this implied that there wasn't a statistically significance mean difference in achievement by gender when pupils were taught Earth Geometry using Collaborative Learning Approach.

It was also possible to determine the magnitude of the effect caused by the treatment.

2.3.8 Effect size

Effect size statistics gives an indication of the differences between the Control group and Experimental group, and not just whether the difference could have occurred by chance, this is in line with Pallant (2005). One way to obtain effect size is to manually compute eta squared since SPSS does not provide eta squared values for t-tests. Eta squared represents the proportion of variance in dependent variable that is explained by the independent variable.

$$Eta\ squared = \frac{t^2}{t^2 + (N_1 + N_2 - 2)}$$

Replacing the appropriate values from the post-test independent t-test output we get;

$$Eta\ squared = \frac{(3.684)^2}{3.684^2 + (40 + 40 - 2)}$$

$Eta\ squared$ =0.148 for Mukuba Secondary School.

$$Eta\ squared = \frac{(2.868)^2}{2.868^2 + (40 + 35 - 2)}$$

$Eta\ squared$ =0.101 for Helen Secondary School.

The guidelines proposed by Cohen (1988) for interpreting Eta squared values are :0.01=small effect, 0.06=moderate effect ,0.14=large effect. For our post-test results we can see that the effect size has a big effect for both Schools.In line with these guidelines, it is clear that the obtained $Eta\ squared\ value$ 0.148 for Mukuba Secondary School and 0.101 for Helen Kaunda Secondary School showed a big effect which could have not occurred by chance. The independent sample t-test was done to compare the post-test for control and experimental groups after administration of the treatment to the Experimental groups for the two schools. There was a statistically significant difference in the post-test scores for Control group (M =48.7, SD = 18.4) and Experimentalgroup (M = 63.3, SD = 16.9); t (78) = 3.684, p = 0.000 from Mukuba Secondary School. The magnitude of the differences in the means were big (eta squared=0.148) for Mukuba Secondary School. There was also a statistically significant difference in the post-test scores for Control group (M = 51.9, SD = 21.2) and Experimental group (M = 65.5, SD = 19.8); t (73) = 2.868, p = 0.005 for Helen Kaunda Secondary School. The magnitude of the difference in the means were big (eta squared=0.101). These results suggested that Collaborative Learning Approach in teaching Earth Geometry had an impact on pupil's performance.

2.4 Frequency and percentage of each response

Table 2.4.1: Pupils from Mukuba Secondary School responses on the perceived reasons on the interest of Collaborative Learning Approach in understanding of Earth Geometry

		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	Frequency	20	10	4	4	2
	Percentage (%)	50	25	10	10	5
2	Frequency	0	0	1	13	26
	Percentage (%)	0	0	2.5	32.5	65
5	Frequency	17	19	3	1	0
	Percentage (%)	42.5	47.5	7.5	2.5	0
7	Frequency	20	13	4	2	1
	Percentage (%)	50	32.5	10	5	2.5
10	Frequency	3	4	4	16	13
	Percentage (%)	7.5	10	10	40	32.5
11	Frequency	23	12	3	2	0
	Percentage (%)	57.5	30	7.5	5	0
	Frequency	15	17	4	2	2
	Percentage (%)	37.5	42.5	10	5	5

Item 1 investigated whether pupils had interest in Earth Geometry. The results showed that 20(50%) strongly agreed, 10(25%) agreed,4(10%) was Undecided, 4(10%) disagreed and 2(5%) strongly disagreed. After carrying out the conversions, the results reveal that 27(75%) pupils agreed and 6(15%) disagreed.

Item 2 investigated whether pupils had no interest in Earth Geometry**.** The results showed that 0(0%) strongly agreed ,0(0%) agreed, 1(2.5%) was Undecided, 13(32.5%) disagreed and 26(65%) strongly disagreed. Using the conversions, the results reveal that 0(0%) agreed and 39(97.5%) disagreed.

Item 5 investigated whether pupils had interest in Earth Geometry. The results showed that 17(42.5%) strongly agreed, 19(47.5%) agreed, 3(7.5%) was Undecided, 1(2.5%) disagreed and 0(0%) strongly disagreed. After carrying out the conversions, the results reveal that 36(90%) pupils agreed and 1(2.5%) disagreed.

Item 7 investigated whether pupils had interest in Earth Geometry. The results indicated that 20(50%) strongly agreed 13(32.5%), agreed 4(10%) were Undecided 2(5%) strongly disagreed and 1(2.5%) disagreed. After carrying out the conversions, the results reveal that 33(82.5%) pupils agreed and 3(7.5%) disagreed.

Item 10 investigated whether pupils had no interest in Earth Geometry. The results indicated that 3(7.5%) strongly agreed, 4(10%) agreed ,4(10%) was Undecided, 16(40%) disagreed and 13(32.5%) strongly disagreed. After carrying out the conversions, the results reveal that 7(17.5%) pupils agreed and 39(72.5%) disagreed.

Item 11 investigated whether pupils had interest in Earth Geometry. The results revealed that 23(57.5%) pupils strongly agreed and 12(30%) agreed, 3(7.5) was Undecided, 2(5%) disagreed and 0(0%) strongly disagreed. Converting the responses of strongly agreed or agree into agree and those for strongly disagree or disagree into disagree, the outcome suggested that 35(87.5%) pupils agreed and (12.5%) disagreed.

Item 15 was used to investigate whether pupils had interest in Earth Geometry. The result indicated that 15(37.5) strongly agreed, 17(42.5%) agreed, 4(10%) were Undecided and 4(10%) disagreed. After carrying out the conversions, the results reveal that 32(80%) pupils agreed and 4(10%) disagreed.

Table 2.4.2: Pupils from Mukuba Secondary School's responses on the perceived Difficulties and challenges of Earth Geometry after using Collaborative Learning Approach

		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
4	Frequency	16	12	4	4	4
	Percentage (%)	40	30	10	10	10
18	Frequency	0	2	3	12	23
	Percentage (%)	0	5	7.5	30	57.5

Item 4 investigated whether pupils had no difficulties and challenges in Earth Geometry. The results showed that 16(40%) strongly agreed, 12(30%) agreed ,4(10%) was Undecided ,4(10%) disagreed and 4(10%) strongly disagreed. After carrying out the conversions, the results reveal that 28(70%) pupils agreed and 8(20%) disagreed.

Item 18 investigated whether pupils had difficulties and challenge in Earth Geometry**.** The results indicated that 0(0%) strongly agreed ,0(0%) agreed ,2(5%) was Undecided ,3(7.5) disagreed and 35(87.5%) strongly disagreed. Using the conversions, the results reveal that 2(5%) agreed and 35(87.5%) disagreed.

Table 2.4.3: Pupils from Mukuba Secondary School's responses on the application of Earth Geometry after using Collaborative Learning Approach in understanding of Earth Geometry

		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
3	Frequency	2	2	4	17	15
	Percentage (%)	5	5	10	42.5	37.5
9	Frequency	20	10	5	3	2
	Percentage (%)	50	25	12.5	7.5	5
12	Frequency	0	2	4	15	19
	Percentage (%)	0	5	10	37.5	47.5
13	Frequency	17	12	8	2	1
	Percentage (%)	42.5	30	20	5	2.5
14	Frequency	2	4	4	12	18
	Percentage (%)	5	10	10	30	45
16	Frequency	23	15	2	0	0
	Percentage (%)	57.5	37.5	5	0	0

Item 3 investigated whether pupils could not apply Earth Geometry in today's world. The results showed that 2(5%) strongly agreed, 2(5%) agreed 4(10%) was Undecided, 17(42.5%) disagreed and 15(37.5%) strongly disagreed. After carrying out the conversions, the results reveal that 4(10%) pupils agreed and 32(80%) disagreed.

Item 9 investigated whether pupils could apply Earth Geometry in other topics**.** The results showed that 20(50%) strongly disagreed, 10(25%) agreed, 5(12.5%), was Undecided, 3(7.5%) disagreed and 2(5%) strongly disagreed. Using the conversions, the results reveal that 30(65%) agreed and 5(12.5%) disagreed.

Item 12 investigated whether pupils could not apply Earth Geometry in other topics and courses. The results revealed that 0(0%) strongly agreed, 2(5%) agreed 4(10%) were Undecided ,15(37.5%)) strongly disagree and 19(47.5%) disagreed. After carrying out the conversions, the results reveal that 2(10%) pupils agreed and 3(85%) disagreed.

Item 13 investigated whether pupils could apply Earth Geometry in the world. The results showed that 13(32.5%) strongly agreed, 17(42.5%) agreed ,4(10%) was Undecided,4(10%) disagreed and 2(5%) strongly disagreed. After carrying out the conversions, the results reveal that 30(75%) pupils agreed and 6(15%) disagreed.

Item 14 investigated whether pupils could not apply Earth Geometry in other topics. The results showed that 2(5%) pupils strongly agreed and 4(10%) agreed, 4(10%) was Undecided ,12(30%) disagreed and 18(45%) strongly agreed. Converting the responses of strongly agreed or agreed into agree and those for strongly disagree or disagree into disagree, the outcome suggested that 6(15%) pupils agreed and 30(75%) disagreed.

Item 16 was used to investigate whether pupils could apply Earth Geometry. The results revealed that 23(57.5%) strongly agreed 15(37.5) agreed ,2(5%) were Undecided and 0(0%) disagreed. After carrying out the conversions, the results reveal that 38(95%) pupils agreed and 2(5%) disagreed.

Table 2.4.4: Pupils from Helen Kaunda Secondary School responses on the perceived reasons on the interest of Collaborative Learning Approach in understanding of Earth Geometry

		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	Frequency	14	10	2	4	5
	Percentage (%)	40	28.6	5.7	11.4	14.3
2	Frequency	0	0	5	13	17
	Percentage (%)	0	0	14.3	37.1	48.6
5	Frequency	17	12	3	1	2
	Percentage (%)	48.5	34.3	8.6	2.9	5.7
7	Frequency	16	13	4	1	1
	Percentage (%)	45.7	37.1	11.4	2.9	2.9
10	Frequency	2	2	4	12	13
	Percentage (%)	5.7	5.7	11.4	34.3	37.1
11	Frequency	13	12	5	2	3
	Percentage (%)	37.1	34.3	14.3	5.7	8.6
	Frequency	15	12	4	2	2
	Percentage (%)	42.9	34.3	11.4	5.7	5.7

Item 1 investigated whether pupils had interest in Earth Geometry. The results showed that 14(40%) strongly agreed, 10(28.6%) agreed, 2(5.7%) was Undecided, 4(11.4%) disagreed and 5(14.3%) strongly disagreed. After carrying out the conversions, the results reveal that 24(68.6%) pupils agreed and 11(25.7%) disagreed.

Item 2 investigated whether pupils had no interest in Earth Geometry**.** The results indicated that 0(0%) strongly agreed ,0(0%) agreed, 5(14.3%) was Undecided, 13(37.1%) disagreed and 17(48.6%) strongly disagreed. Using the conversions, the results reveal that 0(0%) agreed and 30(85.7%) disagreed.

Item 5 investigated whether pupils had interest in Earth Geometry. The results showed that 17(48.5%) strongly agreed ,12(34.3%) agreed,3(8.6%) Undecided,1(2.9%) disagreed and 2(5.7%) strongly disagreed. After carrying out the conversions, the results reveal that 29(82.8%) pupils agreed and 3(8.6%) disagreed.

Item 7 investigated whether pupils had interest in Earth Geometry. The results indicated that 16(45.7%) strongly agreed, 13(37.1%) agreed, 4(11.4%) are Undecided, 1(2.9%) strongly disagreed and 1(2.9%) disagreed. After carrying out the conversions, the results reveal that 29(82.8%) pupils agreed and 2(5.8%) disagreed.

Item 10 investigated whether pupils no had interest in Earth Geometry. The results revealed that 2(5.7%) strongly agreed, 2(5.7%) agreed, 4(11.4%) was Undecided, 12(34.3%) disagreed and 13(37.1%) strongly disagreed. After carrying out the conversions, the results reveal that 7(17.5%) pupils agreed and 39(72.5%) disagreed.

Item 11 investigated whether pupils had interest in Earth Geometry. The results indicated that 13(37.1%) pupils strongly agreed and 12(34.3%) agreed, 5(5.7%) was Undecided ,2(5.7%) disagreed and 3(8.6%) strongly disagreed. Converting the responses of strongly agreed or agree into agree and those for strongly disagreed or disagreed into disagreed, the outcome suggested that 25(71.4%) pupils agreed and5 (14.3%) disagreed.

Item 15 was used to investigate whether pupils had interest in Earth Geometry. The results indicated that 15(42.9%) strongly agreed, 12(34.3%) agreed, 4(11.4%) were Undecided and 4(11.4%) disagreed. After carrying out the conversions, the results reveal that 27(77.2%) pupils agreed and 4(11.4%) disagreed.

Table 2.4.5: Pupils from Helen Kaunda Secondary School's responses on the perceived Difficulties and challenges in Earth Geometry after using Collaborative Learning Approach.

		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
4	Frequency	16	12	2	3	2
	Percentage (%)	45.7	34.3	5.7	8.6	5.7
18	Frequency	0	2	3	12	18
	Percentage (%)	0	5	8.6	34.3	51.4

Item 4 investigated whether pupils had difficulties and challenges in Earth Geometry. The results showed that 2(5.7%) strongly agreed, 3(8.6%) agreed, 2(5.7%) was Undecided, 12(34.3%) disagreed and 16(45.7%) strongly disagreed. After carrying out the conversions, the results reveal that 5(14.3%) pupils agreed and 28(80%) disagreed.

Item 18 investigated whether pupils had difficulties and challenge in Earth Geometry**.** The results indicated that 0(0%) strongly agreed, 2(5.7%) agreed, 3(8.6%) was Undecided, 12(34.3%) disagreed and 18(51.4%) strongly disagreed. Using the conversions, the results reveal that 2(5.7%) agreed and 30(85.7%) disagreed.

Table 2.4.6: Pupils from Helen Kaunda Secondary School's responses on the application of Earth Geometry after using Collaborative Learning Approach in understanding of Earth Geometry

		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
3	Frequency	2	2	0	16	15
	Percentage (%)	5.7	5.7	0	45.7	42.9
9	Frequency	18	10	2	3	2
	Percentage (%)	51.4	28.6	5.7	8.6	5.7
12	Frequency	0	2	4	10	19
	Percentage (%)	0	5.7	11.4	28.6	54.3
13	Frequency	14	12	0	2	7
	Percentage (%)	40	34.3	0	5.7	20
14	Frequency	2	3	3	10	17
	Percentage (%)	5.7	8.6	8.6	28.6	48.5
16	Frequency	18	15	2	0	0
	Percentage (%)	51.4	42.9	5.7	0	0

Item 3 investigated whether pupils could not apply Earth Geometry in today's world. The results showed that 2(5.7%) strongly agreed, 2(5.7%) agreed,0(0%) were Undecided, 16(45.7%) disagreed and 15(42.9%) strongly disagreed. After carrying out the conversions, the results reveal that 4(11.4%) pupils agreed and 31(88.6%) disagreed.

Item 9 investigated whether pupils could apply Earth Geometry in other topics**.** The result indicated that 18(51.4%) strongly agreed, 10(28.6%) agreed, 2(5.7%) were Undecided, 3(8.6%) disagreed and 2(5.7%) strongly disagreed. Using the conversions, the results reveal that 28(80%) agreed and 5(14.3%) disagreed.

Item 12 investigated whether pupils could not apply Earth Geometry in other topics and courses. The results indicated that 0(0%) strongly agreed ,2(5.7%) agreed 4(11.4%) were Undecided ,10(28.6%) strongly disagreed and 19(54.3%) disagreed. After carrying out the conversions, the results reveal that 2(5.7%) pupils agreed and 29(82.9%) disagreed.

Item 13 investigated whether pupils could apply Earth Geometry in the world. The results indicated that 14(40%) strongly agreed, 12(34.3%) agreed ,0(0%) were Undecided, 2(5.7%) disagreed and 7(20%) strongly agreed. After carrying out the conversions, the results reveal that 26(74.3%) pupils agreed and 9(25.7%) disagreed.

Item 14 investigated whether pupils had could not apply Earth Geometry in other topics. The results revealed that 2(5.7%) pupils strongly agreed and 3(8.6%) agreed, 3(8.6%) was Undecided, 10(28.6%) disagreed and 17(48.5%) strongly disagreed. Converting the responses of strongly agreed or agree into agree and those for strongly disagree or disagree into disagree, the outcome suggested that 5(14.3%) pupils agreed and 27(77.1%) disagreed.

Item 16 was used to investigate whether pupils could apply Earth Geometry. The results indicated that 18(51.4%) strongly agreed ,15(42.9%) agreed, 2(5.7%) were Undecided assnd 0(0%) disagreed. After carrying out the conversions, the results reveal that 33(94.3%) pupils agreed and 0(0%) disagreed.

2.5 Discussion and Conclusion

The study revealed that the mean scores for the Control groups post-test were significantly higher than the mean scores for the pre-tests for both Schools. These resultsimplied that the use of Conventional Approach improved pupils' achievement. The mean scores for Experimental groups post-test were significantly higher than the mean scores for the control group. These results, therefore, implied that the use of Collaborative Learning Approach improved pupils' achievement. The mean scores for the Experimental and Control group pre-test were statistically insignificant for both schools. This also implied that the control and experimental group started at the same level. No group was academically superior to the other. The mean for the experimental and control group post test scores were statistically significant. The fact that the control and experimental group started at the

same level, then the difference that was observed between the post-test scores of the two groups was due to the treatment. The Experimental group outperformed the Control group in both Schools. The use of Collaborative Learning Approach was more successful than Conventional Approach. The questionnaire findings also showed that most of the pupils had positive attitude towards Earth Geometry after being subjected to the treatment Collaborative Learning Approach.

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