

*Full Length Research Paper*

# **Effect of homogenous and heterogeneous ability grouping class teaching on student's interest, attitude and achievement in integrated science**

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The study investigated the effect of homogeneous ability level grouping class teaching and heterogeneous ability class teaching on students' learning outcome in Integrated Science. The sample comprised 60 students in the junior secondary school class 3 randomly selected from 2 schools. In each school, 30 students comprising 15 males and 15 females were selected through stratified random sampling technique. The students were assigned to 3 ability levels of high, average and low using a numerical/word knowledge instrument. 10 students were also selected through purposive sampling technique to each level. Each of the school served as experimental study for homogeneous and heterogeneous ability level grouping class respectively. Four instruments namely achievement test in integrated science (ATIS), science oriented attitudinal scale (SOAS) and science vocational interest inventory (SVII) and students' questionnaire on preference for grouping types were used to collect data for the study. Two general research questions and three hypotheses were raised, tested and analyzed using measurement of central tendency, mean, standard deviation and t-test statistics. The results show that homogeneous ability level grouping is superior for promoting students learning outcome. The reported change in the attitude and interest of the students is in favour of the homogeneous ability grouping class teaching. Recommendations were made based on the findings.

**Key words:** Attitude, stigmatized, achievement, homogenous class, heterogeneous class, gifted students.

## **INTRODUCTION**

Ability grouping, simply put, is the practice of dividing students for instruction on the basis of their perceived capacities for learning. It is the practice of placing students of similar academic level within the same group for instruction. Researchers have struggled for years to find answers to the questions about ability grouping. Does anyone benefit from it? Is anyone harmed by it? Who benefits or is harmed the most? The answer is always clear-cut and often depends on whom you ask and what learning outcomes are deemed important. To many researchers and educators, such as Kulik and Kulik's (1985), Slavin, (1988, 1990) and Veldman and Sanford (1984) ability grouping considered a sensible

response to academic diversity, Kulik and Kulik's meta-analyses and Slavin's best-evidence syntheses address a number of important issues about ability grouping for academic instruction. Issues such as the impact of adult attitudes towards grouping, the role of gifted students as role models for other students, and the impact of grouping on student behavior and teacher expectations are all crucial. To others, the practice has harmful consequences and should be discarded.

Harsher critics of ability grouping say that it is just another form of racial segregation; for when students are divided on the bases of ability grouping; they are also divided by race and economics. But proponents of ability grouping say that the practice increases students' achievement by allowing teacher to better tailor the pace and content of instruction to students needs. The high – ability students maintain interest and incentive in

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homogeneous group but they languished when grouped with the slow- learners while opponent of ability grouping contend that ability grouping not only fails to benefit any student as it also channels poor and minority students to low tracks where they receive a lower quality of instruction than their groups and contributes to a widening of the achievement gap. Emily et al. (2003) studies revealed that if students are grouped homogeneously, there is the fear that low-ability students will be deprived of opportunities to learn and be unmotivated to learn because of peer, personal and teachers' expectations of poor performance. On the other hand Lou et al. (1996) opined that it is unethical to retard the achievement of high-ability students by assigning them to heterogeneous group class settings where they might spend their time instructing other group members rather than learning information they did not already know.

The research on ability grouping, particularly its effects on achievement, is quite extensive, several meta-analysis and research syntheses have been conducted and a number of literature reviews have been published. The results of these reviews could easily make one skeptical but there are areas of consensus as could be seen in the related literature below. Research reports suggest the effect of ability grouping on student achievement depend on the type of grouping arrangement. Melser (1999) measured the self-esteem of gifted students in homogeneous groups and compared them to those working in a heterogeneous group class. The self esteem rating of the two groups differs significantly when compared. While the gifted students working in heterogeneous group increase in self-esteem, the gifted students who work homogeneously and co-operatively had a decrease in self-esteem.

Shield (1995) found that students of all ability exhibited greater academic self confidence in heterogeneous group, while in a meta-analysis by Lou et al. (1996) homogeneous and heterogeneous ability grouping had a differential effect on students learning. It was generally revealed that the homogeneous ability groups achieve more than the heterogeneous group in studies that directly compare the two. On the other hand, Emily et al. (2003) in their study reported that neither homogeneous nor heterogeneous ability grouping class is uniformly superior for promoting achievements of students. Studies identifying specific factors influencing students' leaning outcome in science include attitude and lack of interest in the subject. On attitude, Shaw and Duan (1990) claimed that attitude is the sum total of a person's inclination toward a certain types of object, institution or idea, while Gronlund (1976) put forward that attitude embraces all aspect of personality developments such as individual interest, motives, values, vocational adjustment derived from a vocational pursuit and other major phases of one's daily lives. This means that Gronlund's (1976) submission could be inferred from overt behaviour both verbal and non-verbal, which has implications on the

academic- performances with the subsequent result on the learning difficulty of any student at any educational level. Linn (1992) and Chinwe (1999) noted "poor attitude is an important factor causing failure in science subjects and as such, students in extreme cases developed hatred to the teaching learning process in the school as a whole".

The problem of this study is how best to give the low achievers in science the extra help they would need without dampening the interest and progress of the brighter students in the classroom settings. Research-base information on timely topics magazine (RBITT 2002) refers to two common form of ability grouping:

- (1) Within- class ability grouping, which refers to teachers' practice of dividing students of similar ability in small group and
- (2) The between-class grouping, which refers to schools practice of separating students into different classes, courses or course sequences or curricula tracks based on their achievement.

Students within-class grouping are by ability said to be homogeneously grouped, while students of different ability lump or mixed together in ability classes are said to be heterogeneously grouped. RBITT (2002) reported that within- class ability grouping consistently produces larger gain than the mixed ability group and that the positive effects are slightly greater for low achievers than the average or above average achievers. It is also reported that the cross-grade ability grouping where students are regrouped for teaching across- grade levels and the non-graded plan, where children are divided by performance rather than age, produced greater gain in achievement than the mixed-ability group class. As research and Meta analysis reports both nationally and internationally on this issue a revealed divergence opinion which makes research to this end inconclusive. It is important to know which class settings of ability level grouping (homogeneous or heterogeneous) will be more effective for teaching integrated science students.

The purpose, of this study is to determine which of the grouping methods would produce high effect on students' achievement scores in Integrated Science. It is also to find out whether the attitude and interest of the students to science will be influenced after teaching them in the two types of class settings. To guide the study, 2 questions and 3 research hypotheses were raised.

## Research questions

### Questions

1. What are the performances of the students in the homogeneous and heterogeneous class before and after treatment?
2. What are the reasons for students' preference in

**Table 1.** Table of mean and standard deviation of achievement scores of students in the homogeneous and heterogeneous class before and after treatment.

Mean and S.D of heterogeneous group		Mean and S.D of homogeneous group	
Before treatment	After treatment	Before treatment	After treatment
N Mean S.D	Mean S.D	N Mean S.D	mean S.D
High 10 32.60 10.793	50.30 7.631	10 34.90 5.61	74.90 8.048
Average 10 27.00 7.498	38.70 5.638	10 33.60 7.38	71.00 8.957
Low 10 25.30 7.031	28.70 3.832	10 24.30 6.36	64.70 14.150

support of either of the class grouping type?

### Research hypotheses

Ho<sub>1</sub>: There is no significant difference in the posttest mean scores of students in ATIS among the ability level of the homogeneous and heterogeneous class after teaching.

Ho<sub>2</sub>: There is no significant difference in the mean attitude scores of students of homogeneous ability grouping class and heterogeneous class as measured by SOAS after teaching.

Ho<sub>3</sub>: There is no significant difference in the mean interest scores of students of homogeneous ability grouping class and heterogeneous class as measured by SVII after teaching.

### METHODOLOGY

#### Design

The study is a pretest-posttest and control quasi-experimental 2 x 3 factorial design. The two groups control for the other. The subjects were 60 students from two "junior secondary school classes". The researcher assigned students to three ability levels:

High, average and low using an instrument named numerical ability/word knowledge instrument.

In order to study the effects of ability grouping student were selected through purposive sample technique of 10 students per ability level. The students were placed in two groups. The first group in school "A" consisted of students in homogenous within-class ability level group while the second group in school "B" consisted of the students in a heterogeneous ability level class. Four instruments namely:

Achievement test in integrated science (ATIS), science oriented attitudinal scale (SOAS), science vocational interest inventory (SVII) and students' questionnaire on preference for grouping types were used to collect data for the study. To ensure the face and construct validity of the instruments the four instruments were subjected to screening by experts in test and measurement; the final drafts were based on their comments and suggestions. The reliability of the instruments was established through test-retest method. The instruments were administered twice in an interval of two weeks on 25 students. The scores correlated yielded the reliability co-efficient index of 0.80, 0.65 and 0.86 for ATIS, SOAS and SVII respectively. The procedure was in three stages:

The pretest stage (one week), the treatment stage (six weeks) and the posttest stage (one week).

The students were made to write the pretest in ATIS, SOAS and SVII. Teaching was done to cover the following selected topics in "integrated science" for 6 weeks. Topics:

(A) Element, compound and mixture. (B) Chemical formula and equation. (C) Energy, work and power and (D) Classification of living things.

After teaching in the two different grouping class types (homogeneous and heterogeneous), at the end of the 6th weeks, the two groups took the posttest in ATIS, SOAS and SVII. At the end of the sixth week scores per ability level group in ATIS, SOAS and SVII were analyzed using mean standard deviation and t-test statistics.

### RESULTS AND DISCUSSION

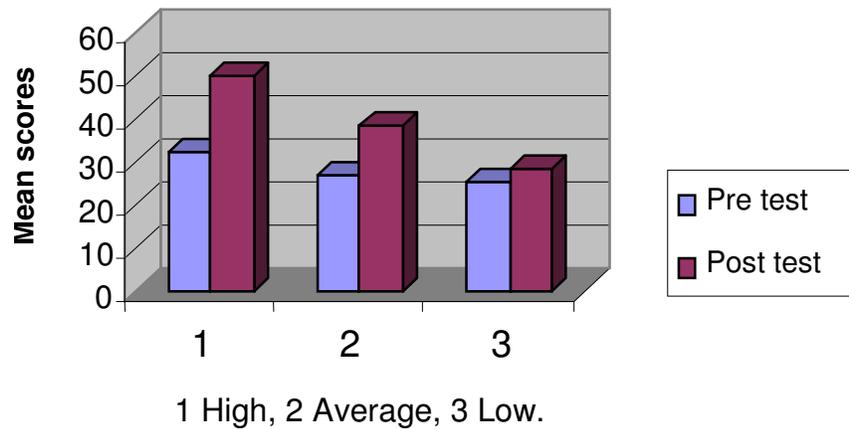
#### Questions

1. What are the performances of the students in the homogeneous and heterogeneous class before and after treatment?

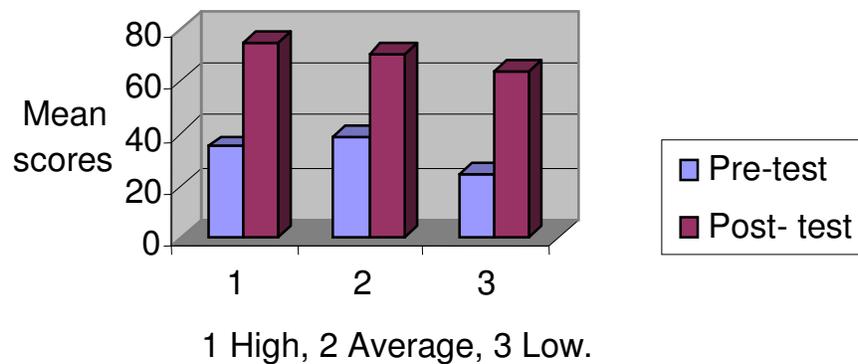
From the Table 1 and Figures 1 to 3 the students' achievement scores in the homogeneous ability level, group class appear to be better than their counterparts in the heterogeneous group class after teaching.

Ho<sub>1</sub>: There is no significant difference in the posttest mean scores of the students in ATIS among the ability levels of the homogeneous and heterogeneous groups (Table 2).

From Table 1 the ATIS mean scores of the above average ability group in the homogeneous grouping class setting was 74.90 and the S.D was 8.05 while the mean score of that of the heterogeneous group was 50.30 and the S.D was 7.63. The t- calculated was 4.724 which is significant at 0.05 critical levels. The mean scores of the average level and below average of the two groups were 71.00 and 64.70, while that of the heterogeneous group were 38.70 for the average level and 28.70 for the below average level. The t-calculated for the average group of the two class setting was 9.631, the t-cal of below



**Figure 1.** Composite histogram showing the pre-test and posttest scores of students among the groups of the two class settings: Performance of students in the heterogeneous ability level class before and after treatment.



**Figure 2.** Composite histogram showing the pre-test and posttest scores of students among the groups of the two class settings: Performance of students in the homogenous ability level class before and after treatment.

average was 7.44 both were significant when compared with the table value of and respectively, hence the null hypotheses are thereby rejected.

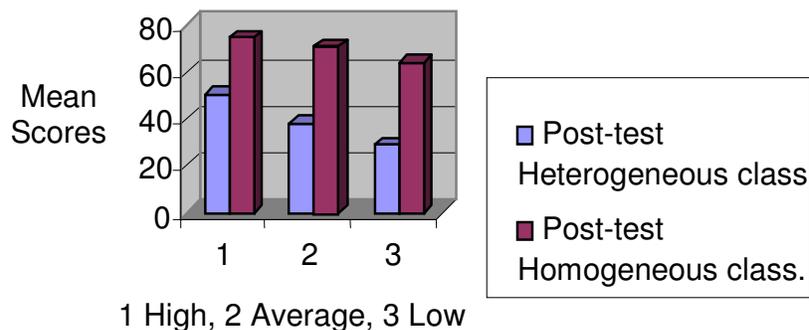
**Ho<sub>2</sub>:** There is no significant difference in the attitude scores of the students among the ability level of the homogeneous and heterogeneous class.

Table 3 shows that the mean score of the homogenous group to be 43.30 and the standard deviation was 6.314. The mean scores of the heterogeneous group was 34.33, the S.D was 8.083, and the t- calculated was 4.788 which is significant at 0.05 alpha level. The null hypothesis is thereby rejected hence there was a significant difference in the vocational interest of the homogeneous group after treatment. Table 4 shows the mean scores of the homogeneous group to be 41.23 and the standard

deviation was 4.423. The mean score of the heterogeneous group was 36.23 and S.D was 5.685. The t-calculated was 4.055 which is significant at 0.05 critical level, there is a significant difference hence the null hypothesis is thereby rejected.

2. What are the reasons for students' preference for either of the class grouping type?

An open-ended questionnaire that students completed after treatment in both the homogenous and heterogeneous group in which both groups gave further information of students' group reasons for preferences and non-preference are evident in their comments after treatment. The responses were summarized as reported in the Table 5. The answer to the questionnaire is in favour of the students' preference for the homogeneous



**Figure 3.** Composite histogram showing the pre-test and posttest scores of students among the groups of the two class settings: Comparison of posttest scores of the heterogeneous and homogeneous ability level class.

**Table 2.** t- test analysis of student scores among the ability level of Homogeneous and Heterogeneous groups after treatment.

Variable	Homogeneous class after treatment			Heterogeneous class after treatment			dff	t-cal	P-value
	N	Mean	S.D	N	Mean	S.D			
Above average	10	74.90	8.048	10	50.30	7.631	18	4.724	significant
Average	10	71.00	8.951	10	38.70	5.638		9.651	significant
Below average	10	64.70	14.150	10	28.70	5.832		7.438	significant

**Table 3.** t-test analysis of SOAS posttest mean scores of homogeneous and heterogeneous group.

Method	N	Mean	S.D	Df	t-cal	t-tab	Result P<0.05
Homogenous	30	43.30	6.314		4.788	1.671	Significant
Heterogeneous	30	34.33	8.083	58			

**Table 4.** t-test analysis of the posttest mean scores of homogeneous and heterogeneous group interest in Integrated Science.

Method	N	Mean	S.D	Df	t-cal	t-tab	Result P <0.05
Homogenous	30	41.57	4.423		4.055	1.671	Significant
Heterogeneous	30	36.23	5.685	58			

ability group class settings. The non-preference responses of (i) and (ii) of the homogeneous group could be attributed to the high achievers in the group. The reasons for non-preference of the heterogeneous group are in favour of the homogeneous ability level class.

## DISCUSSION AND CONCLUSION

The outcome of this study shows that homogenous ability grouping is superior for promoting student achievement in

their different ability level. This support the claim of Lou et al. (1996) that homogeneous and heterogeneous ability grouping had a differential effect on students learning. It is also in line with the research-base information on timely topics magazine RBITT reports of (2002) that within- class homogeneous ability grouping constantly produces large gain in students than mixed ability grouping. It lay to rest the argument of Emily (2003) that neither homogeneous nor heterogeneous ability grouping is superior for promoting academic achievement of students. The reported attitude and interest survey of the

**Table 5.** The table summary for the reasons students had for preferring one grouping situation over the other.

Homogenous group	Reason for preference	N	%	Reason for none- preference	N	%
	(i) I do not feel the whole assignment is our responsibility I can learn from other member of my group.	20	66.7	(i) The more I help the weaker one when together with them, the more knowledge I gain and the more I am challenge to read ahead of them	10	33.3
	(ii) Every one contribute, we all worked together, staying with the less inability group waste time and slow down pace of work.	21	70.0	(ii) I feel relaxed and care-less to read more.	09	30.0

social and emotional effects is also in favour and support of homogeneous group teaching. Students are less stigmatized in a homogeneous ability level class. This contradicts the study of Chisaka University of Zimbabwe, Harare, Zimbabwe and Vakalisa University of South Africa, that ability grouping did not improve teaching or instruction and learning, instead, it encouraged unhealthy social stratification where learners in high ability classes and those in low learning ability classes felt that they had nothing in common even outside their segregated classrooms. It also disagrees with the report of Melsner (1999) that students of all ability exhibit greater academic self confidence and self-esteem in a heterogeneous grouping class; whereas the slow learners and the under achievers are usually stigmatized, uncared for in an heterogeneous grouping class. What this means according to this study is that when students are grouped heterogeneously, there is the possibility that the low achievers and the slow learners will be denied the opportunity to receiving attention from the teacher from the general assumption of the teachers that all is well with all members of the class. Students are also unmotivated to learn because of the personal fear of poor performance. From this study, the average- and low-ability students benefit academically from homogeneous grouping science class settings than the heterogeneous group. Within-class homogeneous ability, grouping helps students to develop positive attitude to science subjects, the school and themselves. The students' interest to learning is also boosted and sustained in the homogenous ability level grouping class. The dominance of evidence does not support the contention that students are academically harmed by grouping.

## RECOMMENDATIONS

The following recommendations are made based on the outcome of the study. The practice of homogeneous or ability grouping is recommended "integrated science" class as it will:

(i) Increase students' achievement in "integrated science".

It also allows teacher to better tailor the pace and content of instruction to students' ability level and needs.

(ii) It is also easier for teachers to teach and manage homogeneous ability level grouping classes.

(iii) In the practice, teacher can provide more repetitive and reinforcement to the low-achievers and an advanced or enhanced level of instruction to the high achievers.

(iv) Low achieving students feel more comfortable and participate more when they are grouped with peers of similar or same ability.

(v) The high achievers have their interest and incentive maintained in a homogeneous group.

(vi) The high achievers languish, and waste off their time when grouped with the slow learners heterogeneously as from the aforementioned responses, the students seem to value their comfort and ability to participate in the group work in the level they belong.

(vii) Homogeneous ability level grouping class helps the teacher to adjust materials and method of instruction to suit the need and level of the students.

(viii) The luxury of time, space and materials involved in individualized instruction is reduced through homogeneous ability level grouping class.

(ix) Students can work at a faster or slower pace without being discouraged within the group of same ability level they belong. This is close to individualized instructional method.

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