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# Performance of the Senior High School Students Using Groupings in General Physics 2

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**Abstract**
There has been a long standing debate whether students performed better when placed in homogeneous or in heterogeneous group; hence, this study determined the effects of groupings, homogeneous and heterogeneous groups, on the performance of grade 12 Science, Technology, Engineering and Mathematics (STEM) strand students. Students were first classified as low-ability students and high-ability students based on the result of their mental ability test. Then, they were divided into three sections namely low-ability homogeneous group, mixed -ability or heterogeneous group and high-ability homogeneous group. The experimental method of research was used in the study. Descriptive statistics and t-test were used in treatment of the data. Result of their mental ability test scores showed that majority of the students were classified as average. The posttests' performance revealed that high-ability students performed significantly better when put in heterogeneous group than in homogeneous group. But, there is no significant difference in the posttests' performance of low-ability students in homogeneous and heterogeneous groups. The following recommendations are, however, offered. Guidance office should administer mental ability test or placement test which will be the basis in sectioning the students. Also, for classroom-based group activities, teachers should mix the high-ability and low-ability students because this will help the high-ability students to master the lesson because they were given more opportunities to teach their peers. This study recommends the conduct of a further study on the effects of grouping in performance of the students.

**Keywords –** Groupings**,** Homogeneous Group, Heterogeneous Group, General Physics 2

## INTRODUCTION

Science is an intellectual activity carried on by humans that is designed to discover information about the natural world in which humans live and to discover the ways in which this information can be organized into meaningful patterns. A primary aim of science is to collect facts (data). An ultimate purpose of science is to discern the order that exists between and amongst the various facts (Gottlieb, 1997).

Science has been considered as one of the major subjects in the Philippine educational system and includes the fundamental aspect of both physical and life sciences. Physics, as part of the Science Education Curriculum, is one of the most interesting fields. Physics is considered as the most fundamental of all sciences for all other sciences derive from basic principles of forces, motion, electromagnetism, and thermodynamics. The study of Physics is important because it is one of the most fundamental sciences (Montoya, 2009 as cited by Soriano, 2014).

A major goal for physics teacher is to develop students' ability to observe, integrate, analyze, interpret, summarize information and apply what they have learned. This can be better achieved

if students are learning in groups of their peers and friends because they appreciate learning from other members of the classrooms. Most of the time, physics teachers use group experiments and laboratory activities to give students challenging and engaging learning activities. However, the question on how to group students whether, homogeneous or heterogeneous, represent some of the most difficult and frustrating challenges facing educators today to achieve the best learning outcomes.

Classroom teachers are responsible for finding ways to teach material in a manner that reaches a diverse set of students effectively and productively. Tracking and ability-grouped classes are designed to account for these differences by matching a student's needs with appropriate instruction (Pare, 2004).

As a basis on how students will be group, American psychologist John Bissell Carroll (1993) defines aptitude as the potential ease of learning particular skills or knowledge. Aptitudes are inferred through the observation of an individual's current skills or knowledge, generally through ability tests.

There has been a long lasting debate as to whether students perform better in a homogeneous group, where students are grouped according to ability, or in a heterogeneous (mixed-ability) group Oddo (1994). Several researchers have found that student attitudes are more positive when placed in homogeneous groups because they are not afraid to take risks. These researchers believe that if students are grouped with other students at their own level, they will have positive self-concepts (Kulik, 1982)[6]. However, ability grouping may be effective only if teachers adjust both teaching methods and teaching materials to pupils of different ability groups. (Žakelj, 201 2). Moreover, Kerkhoff (1986) concluded that there were positive effects of ability grouping on academic achievement, but his analysis has been criticized by Slavin (1990) as cited by Ireson et al. (1999).

As cited by Oddo (1994), other researchers believe that students have negative attitudes when placed in homogeneous groups because they are given labels. A large advantage of heterogeneous grouping is that student labels are likely to diminish. Research supports the belief that low-ability students tend to have low self-concepts and negative attitudes.

It is interesting to note the effect of students' grouping on the teaching-learning process given the preceding scenarios. This factor that affects all learning areas including Physics was the reason why the researcher, being a Physics teacher for four years wants to conduct a study which will determine the performance of students in homogeneous and heterogeneous grouping.

## OBJECTIVES OF THE STUDY

The study focused on the following aspects: (1) mental ability of the grade 12 STEM students; (2) performance of the low-ability and high-ability in homogeneous and heterogeneous groups; (3) difference in performance of the low-ability and high-ability grade 12 STEM students in homogeneous and heterogeneous groups.

## MATERIALS AND METHODS

The study made used of experimental research design. It is research which has the purpose to find the cause-effect relationship among variables in a control condition (Sugiyono, 2010). With this design, participants will be grouped according to their mental ability test scores.
The assigning of the ability groups of the students depended on the result of the mental ability test administered by the guidance counselor of PSU Bayambang campus. Groups one to three refer to low-ability group (homogeneous), mixed-ability group (heterogeneous), high-ability group (heterogeneous), respectively.

With this design, the three intact Grade 12 STEM Strand sections will be grouped in General Physics 2 subject based from their mental ability test scores. And each group took the same set of post-tests every end of a chapter for a total of four chapters. The post-tests' performance of the homogeneous and heterogeneous groups for low ability and high ability students were compared.

The subjects of the study were the 118 Grade 12 STEM Strand students of Pangasinan State University – Integrated Schools - Senior High School Department that are enrolled during the Academic Year 2018 – 2019, Second Semester. The students were divided into three sections where there were 40 students in low ability (homogeneous), 40 students in mixed-ability (heterogeneous), and 38 students in high-ability (homogeneous). The researcher himself taught the three sections in General Physics 2 and focused on the topics Magnetic Induction, Light as an Electromagnetic Wave, Geometric Optics, Interference and Diffraction.

The instrument that was used to identify the mental ability grouping of the students was based the upon 100-item general mental ability test scores by G. Jimenez et al. Test questions range from questions measuring foundation skills to questions measuring critical thinking processes and strategies which cover general information, natural sciences, mathematics, language, and abstract reasoning.

The instruments used to measure the performances of the students were the researcher made post-tests that was given after each chapter. These are 30-item multiple choice types of tests were based on the Table of Specifications. The post-tests was submitted for a content validation by six licensed Physics teachers wherein three are from PSU – Bayambang Campus, two from DepEd and one from University of Pangasinan who are at least Master of Arts Degree holder/expert teachers, major in Science or Physics.

## RESULTS AND DISCUSSION

The presentation of data is in accordance with the specific objectives, to wit: (1) mental ability test performance of the grade 12 STEM students; (2) level of performance of low-ability and high-ability grade 12 students STEM in General Physics 2 under homogeneous group and heterogeneous group; (3) significant difference between the performance of homogeneous and heterogeneous groups for low ability and high ability grade 12 STEM students.

### Mental Ability Test Performance of the Grade 12 STEM Students

Table 1 shows the mental ability test performance of the grade 12 STEM students. The mental ability test performance of the grade 12 STEM strand students is described by the use of frequency count, percentage, mean, standard deviation, skewness and kurtosis.

Table 1. Mental Ability Test Performance of the Grade 12 STEM Students

| Mental Ability Test Scores | f | % | Mean | Sd | Skewness | | | Kurtosis | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Sk | Se | D | Ku | Se | D |
| 21-40 | 10 | 8.5 | 53.69 | 8.34 | -.397 | .223 | ND | -.113 | .442 | ND |
| 41-60 | 81 | 68.6 | | | | | | | | |
| 61-80 | 27 | 22.9 | | | | | | | | |
| Total | 118 | 100.0 | | | | | | | | |

**Legend:**

| | | | | | |
|---|---|---|---|---|---|
| Mental Ability Level of Performance Score | 0 – 20 Very Low | 21-40 Low | 41-60 Average | 61-80 High | 81-100 Very High |

f = frequency % = percentage Sd = standard deviation Sk = skewness
Se = standard error Ku = kurtosis D = description

Table 1 shows the mental ability test performance of the grade 12 STEM students most of the respondents have the scores between 41-60 which is 68.6% of the respondents, only 8.5 percent of the respondents belongs to 21- 40 and 22.9 % belongs to 61-80 . The mean score of their mental ability scores is 53.69 and a standard deviation of 8.34. The skewness of the mental ability performance is -.397 which is skewed to the left or negatively skewed. This reveals that there are more high scores above the mean score. While, the kurtosis is -.113 which reveals that fewer scores on the tails of the distribution. Moreover, the mental ability performance of the grade 12 STEM students is normally distributed.

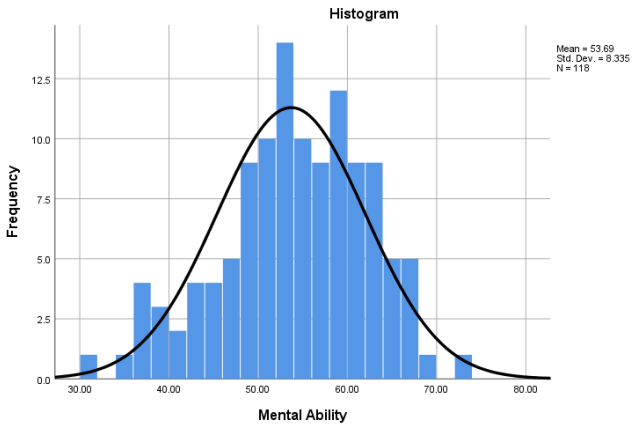


Figure 1. Graph showing the mental ability test performance of grade 12 STEM students.

**Performance of the Grade 12 STEM Students according to their Groupings**

In this section, Tables 2.a and 2.b shows the performance of Grade 12 STEM students according to their groupings. The mean scores, maximum and minimum scores, standard deviation, skewness, and kurtosis were used to describe their performance. Information about the low ability and high ability students' scores are presented in Tables 2.a, 2.b, 3.a and 3.b.

Table 2.a Post-test Level of Performance of the Low-ability Grade 12 STEM Students

| | Post-test 1 | Post-test 2 | Post-test 3 | Post-test 4 | Total |
|---|---|---|---|---|---|
| **Homogeneous** | | | | | |
| Mean | **12.90** | **14.42** | **10.85** | **13.40** | **51.58** |
| Std. Deviation | 2.91 | 3.86 | 3.25 | 3.89 | 9.63 |
| Skewness | -.100 | -.331 | .226 | .199 | -.136 |
| Std. Error of Skewness | .374 | .374 | .374 | .374 | .374 |
| Descriptive Equivalent | ND | ND | ND | ND | ND |
| Kurtosis | -1.005 | .688 | -.848 | -.581 | -.312 |
| Std. Error of Kurtosis | .733 | .733 | .733 | .733 | .733 |
| Descriptive Equivalent | ND | ND | ND | ND | ND |
| Minimum | 7 | 3 | 5 | 7 | 29 |
| Maximum | 18 | 22 | 17 | 22 | 71 |
| **Heterogeneous** | | | | | |
| Mean | **13.85** | **15.20** | **10.80** | **12.90** | **52.75** |
| Std. Deviation | 2.92 | 4.71 | 3.07 | 3.16 | 8.77 |
| Skewness | -.341 | -.197 | .185 | .146 | -.199 |
| Std. Error of Skewness | .512 | .512 | .512 | .512 | .512 |
| Descriptive Equivalent | ND | ND | ND | ND | ND |
| Kurtosis | -.620 | -.136 | -.659 | .539 | -.288 |
| Std. Error of Kurtosis | .992 | .992 | .992 | .992 | .992 |
| Descriptive Equivalent | ND | ND | ND | ND | ND |
| Minimum | 8 | 5 | 6 | 6 | 34 |
| Maximum | 18 | 23 | 17 | 19 | 67 |

**Legend:**

| | | | | | |
|---|---|---|---|---|---|
| Mental Ability Level of Performance Score | 0 – 24 Very Low | 25 – 48 Low | 49 – 72 Average | 73 - 96 High | 96 – 120 Very High |

It is shown in table 2.a that low-ability students in heterogeneous group performed better in post-test 1, 2 and total. On the other hand, low-ability students in homogeneous group post-tests 3 and 4, out of the 120 post-test items in the four post-tests given to the grade 12 STEM students, low-ability grade 12 STEM students got a total mean score of 51.57. While, low-ability in

heterogeneous groups got a slightly higher total mean score of 52.75 and both means are classified as average.

Since low-ability in heterogeneous group is mixed with high ability, this allowed them to collaborate with students who have higher mental ability which resulted to a better score than that low-ability in homogeneous group. According to Vygotsky (1978), social interaction is optimal for children's cognitive development when collaborating with someone of higher ability. Also, Saleh et al. (2005)[12] main results indicate that low-ability students achieve more and are more motivated to learn in heterogeneous groups. This is consistent with the study of Zhang, Chen and Wang (2014)[13] wherein when low performers are integrated with higher performers, the academic performance of the low performers is significantly improved, while the proficiencies of the higher performers are sustained and not compromised.

Table 2.a also reveals that standard deviations of the total mean score for low-ability students in homogeneous and heterogeneous groups are 9.63 and 8.77, respectively. It also shows that the shape of the distribution of all the scores in each group is normally distributed based from the computed skewness and kurtosis.

Table 2.b Post-test Level of Performance of the High-ability Grade 12 STEM Students

| | Post-test 1 | Post-test 2 | Post-test 3 | Post-test 4 | Total |
|---|---|---|---|---|---|
| **Homogeneous** | | | | | |
| Mean | **15.87** | **17.08** | **13.05** | **16.08** | **62.08** |
| Std. Deviation | 3.35 | 4.00 | 2.62 | 4.49 | 10.58 |
| Skewness | -0.523 | 0.5 | 0.12 | 0.089 | 0.349 |
| Std. Error of Skewness | 0.383 | 0.383 | 0.383 | 0.383 | 0.383 |
| Descriptive Equivalent | ND | ND | ND | ND | ND |
| Kurtosis | 0.045 | 0.417 | -0.096 | -0.009 | -0.396 |
| Std. Error of Kurtosis | 0.750 | 0.750 | 0.750 | 0.750 | 0.750 |
| Descriptive Equivalent | ND | ND | ND | ND | ND |
| Minimum | 8 | 9 | 8 | 5 | 45 |
| Maximum | 22 | 26 | 19 | 24 | 84 |
| **Heterogeneous** | | | | | |
| Mean | **17.55** | **18.70** | **15.85** | **16.95** | **69.05** |
| Std. Deviation | 2.68 | 4.18 | 4.51 | 4.27 | 11.61 |
| Skewness | -.714 | -.615 | .541 | -.483 | -.172 |
| Std. Error of Skewness | .512 | .512 | .512 | .512 | .512 |
| Descriptive Equivalent | ND | ND | ND | ND | ND |
| Kurtosis | .655 | -.202 | 1.683 | .074 | -.443 |
| Std. Error of Kurtosis | .992 | .992 | .992 | .992 | .992 |
| Descriptive Equivalent | ND | ND | ND | ND | ND |
| Minimum | 11 | 10 | 8 | 7 | 49 |

| | | | | | |
|---|---|---|---|---|---|
| Maximum | 22 | 25 | 28 | 24 | 91 |

**Legend:**

| | | | | | |
|---|---|---|---|---|---|
| Mental Ability Level of Performance Score | 0 – 24 Very Low | 25 - 48 Low | 49 – 72 Average | 73 - 96 High | 96 – 120 Very High |

Table 2.b reveals that high-ability in heterogeneous group has a better scores in all the post-test given to them. High-ability students in homogeneous group have a total mean score of 62.08 while those in heterogeneous group have a total mean score of 69.05. Both means for homogeneous and heterogeneous are classified as average.

Johnson, Skon, and Johnson (1980)[14] also found that high-ability students developed more sophisticated reasoning strategies when working in heterogeneous groups than in homogeneous groups as they had more opportunities to teach others.

Furthermore, the table shows that the standard deviation of total mean score of high-ability students in homogeneous groups is 10.58, while the scores of high-ability students in heterogeneous groups are more spread with a standard deviation of 11.61. The total mean score of those in homogeneous is positively skewed which means there are more scores below the mean while those in heterogeneous is negatively skewed which means there more scores above the mean. Both of the scores have negative kurtosis or having light tail.

**Difference in the Performance of the Grade 12 STEM Students**

In this section, table 3.a and 3.b shows the difference between the performance of homogeneous and heterogeneous groups for low ability and high ability grade 12 STEM students. The result of the same ability group but different grouping I compared and analyze using t-test. The computed mean per post-test and total were compared at 5% level of significance.

Table 3.a Significant Difference between the Performance of Homogeneous and Heterogeneous Groups for Low-ability Grade 12 STEM Students

| Performance | Low-ability | Mean | Mean Difference | t | Sig. |
|---|---|---|---|---|---|
| Post-test 1 | Homogeneous | 12.900 | -0.950 | -1.188 | 0.242 |
| | Heterogeneous | 13.850 | | | |
| Post-test 2 | Homogeneous | 14.425 | -0.775 | -0.636 | 0.529 |
| | Heterogeneous | 15.200 | | | |
| Post-test 3 | Homogeneous | 10.850 | 0.050 | 0.058 | 0.954 |
| | Heterogeneous | 10.800 | | | |
| Post-test 4 | Homogeneous | 13.400 | 0.500 | 0.534 | 0.596 |
| | Heterogeneous | 12.900 | | | |

| | | | | | |
|---|---|---|---|---|---|
| Total | Homogeneous | 51.575 | -1.175 | -0.473 | 0.638 |
| | Heterogeneous | 52.750 | | | |

The mean score of the low-ability students were compared using t-test and it failed to reject the null hypothesis. There is no significant difference between the mean score of low-ability learners in homogeneous and heterogeneous groups. While the study of Zhang, Chen and Wang (2014) wherein when low performers are integrated with higher performers, the academic performance of the low performers is significantly improved, while the proficiencies of the higher performers are sustained and not compromised.

Table 3.b Significant Difference between the Performance of Homogeneous and Heterogeneous Groups for High-ability Grade 12 STEM Students

| Performance | High-ability | Mean | Mean Difference | t | Sig. |
|---|---|---|---|---|---|
| Post-test 1 | Heterogeneous | 17.550 | 1.682 | 2.075 | 0.043 |
| | Homogeneous | 15.868 | | | |
| Post-test 2 | Heterogeneous | 18.700 | 1.621 | 1.425 | 0.163 |
| | Homogeneous | 17.079 | | | |
| Post-test 3 | Heterogeneous | 15.850 | 2.797 | 2.556 | 0.017 |
| | Homogeneous | 13.053 | | | |
| Post-test 4 | Heterogeneous | 16.950 | 0.871 | 0.725 | 0.473 |
| | Homogeneous | 16.079 | | | |
| Total | Heterogeneous | 69.050 | 6.971 | 2.240 | 0.031 |
| | Homogeneous | 62.079 | | | |

Table 3.b presents the difference between the performance of high-ability students in homogeneous and heterogeneous groups in the topics Magnetic Induction, Light as an Electromagnetic Wave, Geometric Optics, Interference and Diffraction. It can be noticed that the mean scores of those in heterogeneous group is always greater than those in the homogeneous group. Moreover, the t-value for post-test 1, 3 and total are 263.0, 219.5 and 242.5, respectively which correspond to less than 0.05 level of significance. This implies that there is a significant difference on the performance of the grade 12 STEM students.

Webb (1991) found that high-ability students in heterogeneous groups tended to adopt the role of teacher or leader and provide more elaborated explanations to other group members, especially the low-ability students. Johnson, Skon, and Johnson (1980) also found that high-ability students developed more sophisticated reasoning strategies when working in heterogeneous groups than in homogeneous groups as they had more opportunities to teach others.

## CONCLUSION AND RECOMMENDATION

Based on the findings of the study, the following conclusions were drawn.

1. The grade 12 Science, Technology, Engineering and Mathematics (STEM) strand students have diverse level of performance in mental ability test. Majority of them are classified under average.
2. Both low and high-ability grade 12 STEM students from heterogeneous have higher total mean score than those in the homogeneous groups.
3. The high-ability grade 12 STEM students in heterogeneous group performed significantly better than those in the homogeneous groups.

With the conclusions drawn as bases, the following recommendations are given.

1. The guidance counselor should identify the mental ability of students which would be the basis of school heads in sectioning the students.
2. The students should be sectioned heterogeneously because this type of grouping benefits both the low and high-ability students.
3. High-ability students should be mixed with low-ability students for them to have more opportunities to teach their peers and improve their mastery of the topic.

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