# RELATIONSHIP BETWEEN CLASS SIZE AND STUDENTS' ACADEMIC PERFORMANCE[1]

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## ABSTRACT

*This study delved into the relationship between class size and students' academic performance at Benguet State University, particularly in the Mathematics-Physics-Statistics Department. Specifically, it aimed to: 1) determine if there is a significant difference in academic performance between students of smaller and bigger class sizes, and 2) determine if there is a significant relationship between class size and students' academic performance. The performance was based on the average of the final grades per class in the general education courses, particularly Information Technology (for the subject Basic Computer Education), Mathematics (College Algebra), Statistics (Priciples and Methods of Statistics), and Physics (General Physics 1).*

*For each teacher in the Department, the final grades in the classes with the biggest and the smallest class sizes were used in determining significant differences in the academic performances of students in bigger and smaller class sizes.*

*Results indicated that in Basic Computer Education (Information Technology), one out of four teachers had a significantly lower students' average grade for the smaller class. In Mathematics, two out of four teachers had a similar trend. In Statistics, one of two teachers had significantly lower students' average grade for the smaller class. For Physics, two out of four teachers had the same result.*

*In contrast, one Mathematics teacher had significantly higher students' average grades in her smaller class. This is also true for one Physics teacher.*

*However, for each of the four subject areas, and using all the classes of each teacher, correlation analyses showed that in general, there was no significant relationship between class size and students' academic performance.*

KEYWORDS: Class size and academic performance, class size, academic performance

## INTRODUCTION

Small class sizes are often considered more advantageous and preferred in an education setting. However, this ideal scenario is almost impossible to achieve, especially for developing countries like the Philippines, because of budgetary constraints and economic realities. Even for State universities and colleges like Benguet State University, educational policies, which are closely linked with economic and budget policies, include requirements of maintaining high teacher-to-student ratio before any increase in the school's budget is approved. This is, of course, understandable because in the Philippines, education is still given a relatively small appropriation in the national coffers. Ramota (2005) reported that for the year 2005, education spending dropped to 14.9 percent of the national budget from 19.3 percent in 1997.

In the general education courses or basic subjects, which are offered in the College of Arts and Sciences, class sizes often range from 40 to 65 students, with an average of 50 students per class.

[1]*Paper presented during the Math Society of the Philippines Annual Convention, Cagayan de Oro on May 21, 2009*

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This statistics is not reflected in the University's teacher-to-student ratio, which is around 1 teacher to 23 students. This figure means that if someone goes to visit any class, the visitor will more or less count around 23 students. However, this would not be so since this ratio is actually distorted due to a number of teachers with administrative functions who handle lesser teaching units or fewer classes, and a number of teachers who do not have teaching load because they are actually researchers with faculty rank.

We Filipinos, have been known to be resilient and "pliant like the bamboo," making use of our resourcefulness to make do with what we have to the best of our ability. Such traits are often exemplified by teachers, who despite their meager salaries and poor classroom conditions, still manage to impart learning to multitude of students. As to the quality of such learning, statistics on our students performance in several achievement tests show discouraging implications.

Therefore, this study aimed to investigate whether or not there is a significant relationship between class size and students' academic performance in Benguet State University, particularly in the Mathematics-Physics-Statistics Department.

The main goal of the study was to investigate the relationship between class size and students' academic performance. Specifically, it aimed to:

1. Determine if there is a significant difference in academic performance between students of smaller and bigger class sizes, along:
    a. Information Technology;
    b. Mathematics;
    c. Statistics; and,
    d. Physics

2. Determine if there is a significant relationship between class size and academic performance, along:
    a. Information Technology;
    b. Mathematics;
    c. Statistics; and,
    d. Physics

The results and findings of the research could be used to improve teaching-learning situations in tertiary classes. Specifically, some implications on the improvement of performance of students in their classes in Information Technology, Mathematics, Statistics and Physics may be inferred when class sizes are considered.

## MATERIALS AND METHODS

The classes handled by the teachers in the Math-Physics-Statistics Department during the first semester of 2007-2008 were used in this study. Analysis dwelt primarily on data on class sizes and the final grades of students in Information Technology, Mathematics, Statistics and Physics.

In the selection of the samples, teachers in the Math-Physics-Statistics Department who had no administrative functions were the ones included. In the comparison of students' academic performance, only classes in the following general education courses were considered: Information Technology (for the subject Basic Computer Education), Mathematics (College Algebra), Statistics (Principles and Methods of Statistics), and Physics (General Physics 1).

For each teacher in the Department, the students' final grades in the classes with the biggest and the smallest class sizes were used in determining significant differences in the academic performances of students in bigger and smaller class sizes. In addition, the data used in determining the relationship between class size and students' academic performance were taken from all the classes in the basic subjects of the teachers in the study.

Frequency count, percentage, range, differences, average, standard deviation, z-test for the difference of two means, and Pearson-product moment correlation coefficient and t-test for correlation were used as part of the descriptive and inferential statistics in the data analyses.

## RESULTS AND DISCUSSION

### Profile of Teacher Respondents

As presented in Table 1, there were two male and two female Information Technology teachers, with an average age of 28 years, the lowest among the teachers' average age in the four subject areas. The standard deviation SD of 0.82 year indicated these four teachers were of similar age. On the average, the Information Technology teachers handled classes with 42 students, ranging from 23 to 59 students in a class. The standard deviation SD of 13.37 students indicated a wide variability in the class sizes handled by the Information Technology teachers.

In Mathematics, one male and three female

teachers were considered. Their average age was 36 years but with a high variability, having a standard deviation SD of 14.95 years. The average class size handled by the Mathematics teachers was 46 students, ranging from 33 to 61 students, with a moderate variability, having a standard deviation SD of 9.78 students.

In Statistics, two female teachers were the respondents. Their average age was 42 years with a standard deviation SD of 19.80 years, which was the highest variability among the teachers' ages in the four subjects areas. The average class size was 32 students. Although this was the lowest average class size for the four subject areas, it had the highest variability, having a standard deviation SD of 13.51 students, which ranged from 18 to 52 students. The variability of the class sizes handled by the Statistics teachers was quite close to the variability of the class sizes handled by the Information Technology teachers.

One male and three female teachers were the respondents in Physics. Their average age was 32 years, with a low variability having a standard deviation SD of 5.91 years. The average class size handled by the Physics teachers was 32 students, ranging from 15 to 42 students. The standard deviation SD of 7.25 students, indicating low variability in the class sizes, is the lowest variability of the class sizes handled by the teachers among the four subject areas.

Table 1. Profile of Teacher Respondents

| SUBJECT AREA | GENDER | | AGE (IN YEARS) | | CLASS SIZE | | |
|---|---|---|---|---|---|---|---|
| | MALE | FEMALE | AVERAGE | SD | AVERAGE | RANGE | SD |
| Information Technology | 2 | 2 | 28 | 0.82 | 42 | 23 to 59 | 13.37 |
| Mathematics | 1 | 3 | 36 | 14.95 | 46 | 33 to 61 | 9.78 |
| Statistics | 0 | 2 | 42 | 19.80 | 32 | 18 to 52 | 13.51 |
| Physics | 1 | 3 | 32 | 5.91 | 32 | 15 to 42 | 7.25 |

**Class Size and Students' Academic Performance in Information Technology**

Table 2 shows the relationship of class size and students' academic performance in Information Technology. For each teacher, the Z-values indicate whether or not there were significant differences in the average grades of students belonging to "small" and "large" class sizes.

Among the four teachers, only the students' academic performance in the classes of Teacher C differed significantly, with a z-value of -6.32. The class sizes were 55 students and 59 students, with students' average grades of 2.26 and 1.89, respectively. The two class sizes had very little difference, merely 5 students. These were both large, that is, with class sizes of more than 50 students. The negative but significant z-value of – 6.32 implied that the students in the smaller class had lower grades in Information Technology compared to the students in the bigger class.

Among the pairs of classes of the four teachers, the pair of classes of Teacher C had the biggest difference in its average grades of 0.37. The two classes of teacher A had the biggest difference in class sizes of 23, but the difference in the average grades of 0.16, was not statistically significant, having z-value of 1.43.

Correlation analysis showed that class sizes were positively, but not significantly correlated with the average grades of the students, with r-value of 0.28 and t-value of 0.95. This means that, generally, in the Information Technology classes, class size and students' academic performance are not related.

**Class Size and Students' Academic Performance in Mathematics**

The relationship of class sizes and students' academic performance in Mathematics (Table 3). Except for Teacher A, the pairs of classes in all the Mathematics teachers, had Z-values greater than 1.96, indicating there were significant differences in the average grades of students belonging to "small" and "large" class sizes.

The pairs of classes in Mathematics, had similar differences in class sizes which ranged from 24 to 28 students. Among the four teachers, only the students' academic performance in the two classes of Teacher A did not differ significantly, with a z-value of 0.85. The class sizes were 36 students and 61 students, with students' average grades of 2.63 and 2.74, respectively. The difference of 0.11 in the average grades was the least among the four pairs of classes.

Table 2. Class Size and Students' Academic Performance in Information Technology

| TEACHER | CLASS SIZE, (N) | AVERAGE GRADE, (AVE) | Z-VALUE | CORRELATION ANALYSIS, N AND AVE |
|---|---|---|---|---|
| A | 27 | 2.45 | 1.43ns | r = 0.28 |
| | 50 | 2.61 | | t-value = |
| *Difference* | *23* | *0.16* | | 0.95ns |
| B | 42 | 2.53 | - 0.83ns | |
| | 55 | 2.44 | | |
| *Difference* | *13* | *0.09* | | |
| C | 55 | 2.26 | **- 6.32sig*** | |
| | 59 | 1.89 | | |
| *Difference* | *5* | *0.37* | | |
| D | 32 | 2.00 | 0.20ns | |
| | 38 | 2.02 | | |
| *Difference* | *6* | *0.02* | | |

** /Z-values/ or /t-values/ greater than 1.96 are significant at 5% level of significance.*

Table 3. Class Size and Students' Academic Performance in Mathematics

| TEACHER | CLASS SIZE, (N) | AVERAGE GRADE, (AVE) | Z-VALUE | CORRELATION ANALYSIS, N AND AVE |
|---|---|---|---|---|
| A | 36 | 2.63 | 0.85ns | r = 0.23 |
| | 61 | 2.74 | | t-value = |
| *Difference* | *25* | *0.11* | | 1.07ns |
| B | 33 | 2.28 | **4.09sig*** | |
| | 61 | 2.73 | | |
| *Difference* | *28* | *0.45* | | |
| C | 35 | 3.03 | **-2.93sig*** | |
| | 59 | 2.52 | | |
| *Difference* | *24* | *0.51* | | |
| D | 34 | 2.77 | **-3.05sig*** | |
| | 60 | 2.40 | | |
| *Difference* | *26* | *0.37* | | |

** /Z-values/ or /t-values/ greater than 1.96 are significant at 5% level of significance.*

For Teacher B, the significant z-value of 4.09 implied that students in the smaller class performed better in Mathematics than those in the bigger class. However, for Teachers C and D, the significant z-values of -2.93 and -3.05, respectively, implied that the students belonging to smaller classes had lower grades in Mathematics compared to those in the bigger classes.

Correlation analysis on the class sizes and the grades of the students in Mathematics showed that class sizes were positively, but not significantly correlated with the average grades of the students, with r-value of 0.23 and t-value of 1.07. Thus, in Mathematics class size and students' academic performance are not related.

**Class Size and Students' Academic Performance in Statistics**

Table 4. Class Size and Students' Academic Performance in Statistics

| TEACHER | CLASS SIZE, (N) | AVERAGE GRADE, (AVE) | SD | Z-VALUE | CORRELATION ANALYSIS, N AND AVE |
|---|---|---|---|---|---|
| A | 18 | 2.31 | 0.28 | 1.26ns | |
| | 26 | 2.46 | 0.43 | | |
| *Difference* | *8* | *0.15* | *0.15* | | r = - 0.57 |
| B | 39 | 2.90 | 0.56 | **- 3.37sig*** | t-value = |
| | 52 | 2.53 | 0.40 | | -1.54ns |
| *Difference* | *13* | *0.37* | *0.16* | | |

** /Z-values/ or /t-values/ greater than 1.96 are significant at 5% level of significance.*

Teacher A had a pair of classes with class sizes differing by 8 students (Table 4). This difference is slightly smaller to that of the classes of Teacher B, which had a class size difference of 13 students. The average grades of the classes of Teacher A differed by 0.15. The students' academic performance in Statistics for Teacher A in the two classes did not differ significantly, with a z-value of 1.26. On the other hand, Teacher B had students in the two different classes with different class sizes whose academic performances differed significantly with a z-value of -3.37. The average grades differed by 0.37. The significant z-value implied that the students in the smaller class of Teacher B got significantly lower grades compared to the students in the bigger class.

Correlation analysis on the class sizes and the grades of the students in Statistics showed that class sizes were negatively, but not significantly correlated with the average grades of the students, with r-value of - 0.57 and t-value of - 1.54. It may be noted that the

Table 5. Class Size and Students' Academic Performance in Physics

| TEACHER | CLASS SIZE, (N) | AVERAGE GRADE, (AVE) | Z-VALUE | CORRELATION ANALYSIS, N AND AVE |
|---|---|---|---|---|
| A | 26 | 2.83 | -6.21sig* | r = - 0.13 t-value = - 0.48ns |
| | 29 | 2.17 | | |
| *Difference* | *3* | *0.66* | | |
| B | 15 | 2.52 | -0.07ns | |
| | 42 | 2.51 | | |
| *Difference* | *27* | *0.01* | | |
| C | 33 | 2.31 | -3.73sig* | |
| | 35 | 2.10 | | |
| *Difference* | *2* | *0.21* | | |
| D | 27 | 1.97 | 4.50sig* | |
| | 38 | 2.67 | | |
| *Difference* | *11* | *0.70* | | |

** /Z-values/ or /t-values/ greater than 1.96 are significant at 5% level of significance.*

r-value for Statistics was the highest among the four subject areas. However, in Statistics, class size and students' academic performance are still not related.

**Class Size and Students' Academic Performance in Physics**

The relationship of class sizes and students' academic performance in Physics is presented in Table 5. Except for Teacher B, the pairs of classes of all the Physics teachers, had Z-values greater than 1.96, indicating there were significant differences in the average grades of students belonging to "small" and "large" class sizes. The classes of Teacher B had the smallest difference in the average grades, which was 0.01, while for the other teachers the difference ranged from 0.21 to 0.70. The negative significant z-values of – 6.21 and – 3.73 for Teachers A and C, respectively, implied that the students in the smaller classes got lower grades in Physics compared to those in the bigger classes. But this is not true for Teacher D, since the z-value of 4.50 implied that the students in the smaller class performed better academically in Physics compared to the students in the bigger class.

Correlation analysis on the class sizes and the grades of the students in Physics showed that class sizes were negatively, but not significantly correlated with the average grades of the students, with r-value of -0.18 and t-value of -0.48. Thus, in Physics classes, class size and students' academic performance are not related.

**CONCLUSION**

In Information Technology, most teachers had students whose academic performance did not differ between bigger and smaller classes. In Mathematics, half of the teachers had lower average grades for their smaller classes, though one Mathematics teacher had higher average grades in her smaller class . In Statistics, one of the two teachers had significantly lower average grades in her smaller class. In Physics, two out of four teachers had a significantly lower average grade for the smaller class. In contrast, one Physics teacher had significantly higher grades in the smaller class. Thus, based on contrasting results, it can be concluded that for each of the four subject areas, differences in the academic performance of students could not be attributed to class size only.

For each of the General Education subjects, particularly, in Information Technology, Mathematics, Statistics and Physics, class size is not related to the academic performance of students.

**RECOMMENDATIONS**

The researchers therefore recommend that further studies be conducted to consider other teacher factors and students characteristics as intervening variables in the relationship between class size and students' academic performance, due to the contrasting results when only class size and students' average grades were included. A similar study may also be done for other general education courses such as those offered in the Departments of Social Sciences, Humanities, Chemistry and Biology.

Another recommendation is for teachers to continuously update and upgrade their teaching prowess, both in subject matter content and in teaching methods and strategies so that no "class size" factor will hamper the teaching-learning process.

Remedial classes, peer tutorials and seminar-workshops on developing study habits could be given to the students so that their academic performance will also improve.

And lastly, since there were teachers whose students' academic performance were better in the smaller than in the bigger classes, class sizes should still be "controlled" and if possible, be kept as "optimally" small.

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