Does Smaller Class Size Affect Student's Performance In Basic Statistics Class? An Empirical Study

Felix U. Kamuche, (Email: fkamuche@morehouse.edu), Morehouse College

ABSTRACT

The objective of this study was to determine whether smaller class size, defined as fewer than 20 students in Business Statistics class influence grades earned in the course. The investigator hypothesized that there is a positive relationship between class size and performance, which is measured by grade earned in the course. The study revealed a positive relationship between performance and class size. The results also indicated that the groups that were in the smaller classes performed better on tests than the control groups that were in the larger classes. Furthermore, the study revealed that although there was a positive correlation between performance and class size, simply reducing class size does not guarantee significant increases in performance for all students.

INTRODUCTION

*T*heory and research have shown that smaller classes offer instructors the chance to devote more time to each student so as to improve their learning. In this study, smaller class size is defined as fewer than 20 students while larger class size is defined as more than 35 students (Kamuche 2005a). Most people including the students, faculty, administrators, and educators think that college or university students are better served in smaller classes than in larger classes. Indeed, the topic of class size and its effects on student performance have been researched time and again in elementary and secondary education (Kamuche 2005b; 2005c; Keil and Partell, 2004; Raimondo et al 1990). A few, however, have examined the effects at college or university level. Nevertheless, a few studies have dealt with statistics courses (Arias and Walker, 2004; Kamuche 2005d; and Keil and Partell 2004). Studies indicate that class size effects vary with courses within a discipline (Raimondo et al 1990; and Tyler, 2000). This study tries to build on that work, specifically to assess the impact of class size on student performance among Basic Statistics students. How to ensure that the students are maximizing their learning is the foundation for this study. For many parents, educators, instructors and administrators of educational institutions, smaller class size is an apparently infallible prescription for improving student performance (Finn and Achilles, 2003). Fewer students mean more individual attention from the instructor, fewer students to distract each other, calmer classrooms, and subsequently, higher test scores (Finn and Achilles, 2003: 1). To evaluate the above theory, the following literature review and theoretical framework were used.

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Review of related literature in the field of institution organization indicates that theories and methods concerning effectiveness of class size reduction are abundant and diversified. From twentieth century to the present, an extensive number of studies have been completed in attempts to provide meaningful analyses that meet the ideals in this field of study. However, these studies have continued unabated. For example, several recent studies have contributed significantly to the research knowledge about class size and student performance (Arias and Walker, 2004; Asadullah, 2005; Bonesronning, 2003; Bonesronning, 2004; Borland, Dobbelsteen et al 2002; Driscoll et al 2003; Dustmann et al 2003; Finn and Achilles, 2003; Hanushek and Raymond, 2005; Hill, 1998; Iacovou, 2002; Johnston et al 2003; Kronholz, 2002; Krugger, 2003; Murdoch and Guy, 2002; Ohtsubo and Masuchi, 2004;

Raimondo et al 1990; Robison, 2002; Scheck and Kinicki, 1994; Sigo, 2003; Smith, 2004; Stoddard, 2003; Tam and Bassett, 2004; Zuckweiler et al 2004;). These research findings point more toward the beneficial effects of smaller class size. Researchers have used various analytical methods from the reviews of already existing research studies to draw conclusions (Kamuche and Ledman 2005; Robison, 2002). A major conclusion is that smaller class size is related to increased student performance. For example, in a smaller class size setting, due to the small number of students, teachers are able to work one on one with the students. It provides teachers with the individual attention they need for each student. This way teachers are able to know which students need extra help in understanding the subject matter. When teachers know the needs of their students they will be able to help them with that extra instructional support they need to help them overcome their course problems. When students see and realize that teachers are there to help them, then they will know that the teachers are there for them to do well and succeed in life.

Furthermore, students in smaller class setting seem to achieve better than those in larger class setting because teachers in smaller classrooms have the time to go around and check students' work while the work is still going on. This is because corrections given at the most appropriate time seldom leave one's memory. In this way students will be able to understand immediately what they are doing wrong and make immediate corrections. Smith and Glass (1979) published comprehensive analyses combining the results of 77 empirical studies pertaining to the relationship between class size and achievement. Overall, they found that smaller class size was associated with better performance at all grade levels (Tyler, 2000).

Murdoch and Guy (2002) compared test results of students who were in the smaller classes with the control group who are in the larger classes. They found significantly higher scores for students who were in the smaller classes and concluded that class size influence learning performance. The mean scores for these students were significantly higher than for students in the group who were in the larger classes.

Arias and Walker (2004), in one of the published studies of class size and performance, reported on a study of dental students. They concluded that smaller class size had a beneficial and significant influence on student performance. They further found that the positive effects on performance increased as class size was reduced. Asadullah (2005) also examined effects of class size on student performance in Accounting and Economic courses. He found that smaller classes were a determinant of student performance. These studies clearly suggest there is added value to students who were in smaller classes. If students who are in the smaller class size outperform those who are in the larger classes, it seems reasonable to conclude that something is occurring as a result of students who are in the smaller classes. Therefore, the investigator hypothesized that students who are in smaller classes, will not only perform better on tests but will also understand the subject matter better. Thus, these conclusions lead to the primary objective of this study. If the ultimate goal is to increase student performance, the question is, can student performance in Basic Statistics be improved as a result of smaller class size?

Therefore, the hypotheses for the study include:

H1: Students who are in the smaller classes will perform significantly better on tests.
H2: Students who are in the smaller class size will earn higher grade in the course and understand the subject matter better.
H3: Students' test performance will correlate with the grade earned in the course.

RESEARCH METHOD

Sample

The sample in this study is made up of the students in the investigator's classes over two academic years. The typical enrollment in the classes was thirty-five students per class section with two or more sections being taught each semester. The total enrollments in the Basic Statistics courses each year ranged from 105 in the second and third years to 140 in the first year. The total enrollment for the Morehouse College was approximately 3000 students during the years of this study.

Data Collection

College policies required faculty to maintain complete and accurate students' enrollment/attendance and tests records. These records served as the data sources for this study. The final year of data collection was fall semester 2005. The sample size was 350 students.

Procedures

Students' enrollment records were maintained during the study years. To test student performance, the students in the course were given the same treatments (faculty, syllabus, texts, course preparation materials, and tests) for all years of the study. By using the same instructor for all sections, the author controlled the variations in instruction, lecture material, topic coverage, and students' abilities. Since multiple-choice method is an objective test in a quantitative subject such as Basic Statistics the possibility of grading bias is minimized. The class size was reduced and results compared with the control group in larger classes. The experimental group (N = 180) was in a smaller class size whereas the control group (n = 170) was in a larger class size. The investigator measured the strength of linear relationship between grades earned and class size and vice versa. For data analysis, linear regression and correlation were used. Regression equations were obtained using grade as a function of class size. Great attention was paid to the coefficients of correlation and their significance, impact multipliers and their significance, sample size, and p-values.

Data Analysis

Regression and correlation analysis were used to measure the strength of the linear relationships, and also to measure the impact of class size on student performance. The t-tests were used to determine if there was a difference in the mean test performance between and within treatments. Hypotheses one through three were tested using regression and correlation analysis to measure the strength of the linear relationships. Hypotheses one, two, and three were also tested using t-tests to determine if there was a difference in the mean test performance between and within treatments.

RESULTS

The results of correlation analysis are shown below. H1: Relationship between smaller classes and test performance was .72. That correlation suggests a strong linear relationship between smaller class size and student test performance. H2: Relationship between smaller classes and grade earned in the course was .68, again suggesting a linear relationship between smaller class size and their ability to demonstrate learning of the course material. H3: Relationship between test performance and grade earned in the course was .79, again suggesting a strong linear relationship between student test performance and grade earned in the course. The results of this study were significant for all three hypotheses questions at the .05 level. Thus, the relationship in the three hypotheses were statistically significance and very relevant for this study. The t-tests, which were used to compare, mean test performance between and within treatments showed no significant differences.

Discussion

This study provides evidence that faculty may possibly wish for smaller class size for their students. The high correlation between smaller class size and test performance clearly suggests that smaller classes are quite relevant to student performance in Basic Statistics. Clearly, the author can say smaller class size cause better performance. Further study of the correlation between class size and student performance is needed in different courses, especially in light of the findings for this study. These findings clearly suggest that small class size is important in learning basic statistics. The results of this study also suggest that smaller classes are important for student learning. Figure 1 below is an illustration of the relationship between class size, test performance, and grades earned in the course based on this study. The figure illustrates that both test performance and grades earned in the course are better when class size is smaller.

Figure 1:   Kamuche's Model Of Student Performance
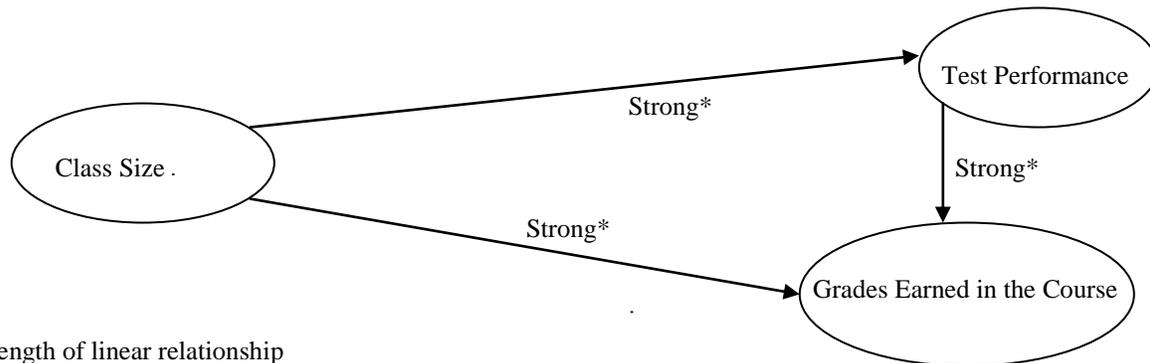
*Strength of linear relationship

It should be noted again that findings of this study were based on a sample of students in Basic Statistics courses. The quantitative nature of these courses is such that they lend themselves to objective tests with precise answers. Further studies are needed to verify that the findings are consistent across disciplines.

CONCLUSIONS

This study adds to the literature by providing results of an empirical investigation of smaller class size. There is no doubt that small class size can deliver lasting benefits, especially for the Basic Statistics students. Reducing class size to below 20 students lead to better student performance. However, it is not a cure-all for low academic achievement, and it may not always be the best use of scarce resources. Smaller class size requires a considerable commitment of funds. In weighing the advantages and disadvantages of smaller class size, instructors and educators will want to measure the costs of smaller class size against other assessment tools such as student reflection, projects, or service learning.

ACKNOWLEDGMENTS

REFERENCES

1.   Arias, J. J. and Walker, Douglas, M., (2004). Additional Evidence on the Relationship between Class Size and Student Performance. *Journal of Economic Education, vol. 35, no 4,* (Fall): 311-330.
2.   Asadullah, M. Niaz (2005). The Effect of class Size on Student Achievement: Evidence from Bangladesh. *Applied Economics vol. 12, no 4,* (March): 217-222.
3.   Bonesronning, Hans (2003). Class Size Effects on Student Achievement in Norway: Patterns and Explanations. *Southern Economic Journal, vol. 69, no 4,* (April): 952-966.
4.   Bonesronning, Hans (2004). The Determinants of Parental Effort in Education Production: Do Parents Respond to Changes in Class Size? *Economics of Education Review, vol. 23, no 1,* (February): 1-10.
5.   Borland, Melvin V. et al (2005). An investigation of the effect of Class Size on Student Academic Achievement. *Education Economics, vol. 13, no 1,* (April): 73-84.
6.   Dobbelsteen, S., Levin, J., and Oosterbeek, Hessel (2002). The causal Effect of Class Size on Scholastic Achievement: Distinguishing the pure Class Size Effect from the effect of Changes in Class Composition. *Oxford Bulletin of Economics & Statistics, vol. 64, no 1,* (February): 17-39.
7.   Driscoll, D., Halcoussis, Dennis, and Svorny, Shirley (2003). School District Size and Student Performance. *Economics of Education Review, vol. 22, no 2,* (April): 193-202.
8.   Dustmann, C., Rajah, N., and Van Soest, Arthur (2003). Class Size, Education, and Wages. *Economic Journal, vol. 113, no 485,* (February): 30-64.

9.   Finn, Jeremy D. and Achilles, Charles M., (2003). Class Size: Counting Students Can Count. *American educational Research vol. 1, no 2,* (Fall): 1-4.

10.   Hanushek, Eric A. and Raymond, Margaret F. (2005). Does School accountability Lead to Improved Student Performance? *Journal of Policy Analysis & Management, vol. 24, no 2,* (Spring): 297-328.

11.   Hill, Mary, Callahan (1998). Class Size and Student Performance in Introductory accounting Courses: Further Evidence. *Issues in Accounting Education, vol. 13, no 1,* (February): 47-65.

12.   Iacovou, Maria (2002). Class Size in the Early Years: Is Smaller Really Better? *Education Economics, vol. 10, no 2,* (December): 261-291.

13.   Johnston, Ann D. et al (2003). Measuring Excellence. *Maclean's, vol. 116, no 46,* (November): 26-35.

14.   Kamuche, Felix U. (2005a). Do Weekly Quizzes Improve Student Performance? *Academic Exchange Quarterly, vol. 9, no. 3,* (Fall): 188-193.

15.   Kamuche, Felix U. (2005b). Student Perceptions of Two State Universities in Texas: A Comparative Analysis. *College Student Journal, vol. 39, no. 3,* (Fall): 411-434.

16.   Kamuche, Felix U. (2005c). Organizational Effectiveness: An Empirical Study. *Academic Exchange Quarterly, vol. 9, no. 1,* (Spring): 74-88.

17.   Kamuche, Felix U. (2005d). Do Learning & Teaching Styles Affect Student's Performance? An Empirical Study. *Journal of Business and Economic Research, vol. 3, no.9,* (September): 35-40.

18.   Kamuche, Felix U. and Ledman, Robert, E. (2005). Relationship of Time and Learning Retention. *Journal of College Teaching and Learning*, *vol. 2, no 8,* (August): 25-28.

19.   Keil, Jack and Partell, Peter J. (2004). The Effect of Class Size on Student Performance and Retention at Binghamton University. Office of Budget & Institutional Research.

20.   Kronholz, June (2002). For Florida Schools, Size Is a Big Deal. *Wall Street Journal – Eastern Edition, vol. 240, no 72,* (October): A4.

21.   _____, (2002). Size doesn't Matter. *Report/Newsmagazine - National Edition, vol. 29, no 17,* (September): 53-57.

22.   Krugger, Alan B. (2003). Economic Considerations and Class Size. *Economic Journal, vol. 113, no 485,* (February): 34-64.

23.   Murdoch, Brock and Guy, Paul, W. (2002). Active Learning in Small and Large Classes. *Accounting Education, vol. 11, no 3,* (September): 271-283.

24.   Ohtsubo, Yobsuke and Masuchi, Ayumi, (2004). Effects of Status Difference and Group Size in Group Decision Making. *Group Processes & Intergroup Relations, vol. 7 no 2,* (April): 161-173.

25.   Raimondo, Henry J. et al (1990). Introductory Class Size and Student Performance in Intermediate Theory Courses. *Journal of Economic Education, vol. 21, no 4,* (Fall): 369-382.

26.   Robison, Jennifer (2002). Does Overcrowding Mean Undereducation? *Gallup Poll Tuesday Briefing,* (December); 1-4.

27.   Scheck, Christine L. and Kinicki, Angelo J. (1994). The effect of Class Size on Student Performance: Development and Assessment of a Process Model. *Journal of Education for Business, vol. 70, no 2,* (November): 104-112.

28.   Sigo, Shelly (2003). Florida Debt Report Could Help Spell End to Class-Size Mandate. *Bond Buyer, vol. 346, no 31784,* (December): 32-35.

29.   Smith, Karen, H., (2004). Implementing the "Marketing You" Project in Large Sections of Principles of Marketing. *Journal of Marketing Education, vol. 26 no 2,* (August): 123-137.

30.   Smith, M. L. and Glass, G. V. (1979). Meta-analysis of research on class size and achievement. *Educational Evaluation and Policy Analysis, vol. 1, no. 2*: 2-16.

31.   Stoddard, Christiana (2003). Why has the number of Teachers per Student risen while Teacher Quality has decline? The role of Changes in the Labor Market for Women. *Journal of Urban Economics, vol. 53, no 3,* (May): 458-482.

32.   Tam, Mo Yin S. and Bassett Jr., Gilbert W. (2004). Does Diversity Matter? Measuring the Impact of High School Diversity on Freshman GPA. *Policy Studies Journal, vol. 32, no 1,* (Fall): 129-144.

33.   Tyler, Jarvis J. (2000). Class Size and Teacher Effects on Student Achievement and Dropout Rates in University-Level Calculus. Up: T. Jarvis' Calculus Page.

34.   Zuckweiler, et al (2004). Methodologies to Determine Class Sizes for Fair Faculty Work Load in Web Courses. *International Journal of Distance Education Technologies, vol. 2, no 2,* (April/June): 46-59.

NOTES