Association of Math Test Scores to Methods of Instruction

Based on Gender, Ethnicity and Socioeconomic Status

Is there a significant difference in scores based on methods of instruction and assignment of teaching among students at Harmony Creek Middle School based on gender, ethnicity and socioeconomic status?

By

R. Goode

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Arkansas State University
Abstract

The purpose of this study was to determine if there was a significant difference in math scores as a result of methods of instruction and assignment of teaching of students at Harmony Creek Elementary School based on gender, ethnicity and socioeconomic status. Test scores were provided for all students grouped by teacher, gender, ethnicity and whether the student receives a free or reduced priced lunch.

The ANOVA and t-test: two-sample assuming equal variances for independent means were used to determine if there was a significant difference in the mean test scores in math as a result of method of instruction and teaching assignment among all students and based on gender, race, and socioeconomic status.

The t-test and ANOVA test revealed that all students and those classified based on gender, race, and socioeconomic status who were taught using the standard based method achieved significantly higher test scores than students being taught using the direct instruction method.
Math Scores and Methods of Instruction

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Introduction

Math scores at Harmony Creek Middle School have been a concern for several years and the school is looking for ways to improve test scores in the classroom. To achieve this goal the school site is providing professional development activities to the three teachers who teach math at the school. There currently is not a uniform way in teaching math at the site. Two of the teachers apply a standards-based method of instruction in their classroom. The other teacher utilizes a more traditional method of teaching in the classroom. Classes are not currently grouped on the basis of ethnicity, gender socioeconomic status, or academic ability.

The school board is considering adopting a uniform method of teaching math as well as grouping of students in the classroom based on ethnicity. The math teachers at the site disagree about which type of instruction results in the best math scores and if one teacher excels more with a particular group of students compared with another.

Research has shown that the majority of American children gain a better understanding of mathematics and develop as critical thinkers when taught in a standards-based classroom. Research also shows that traditional methods of teaching provide better procedural skills but do not help students to become better problem solvers. In addition, research also indicates that assigning students of one ethnicity to a teacher of the same race does not result in a significant increase in test scores.

In this paper the test scores of all math students at Harmony Creek Middle School will be studied as a whole and according to race, gender, and socioeconomic status. It is
hypothesized that there is no relationship between the method of instruction and test scores for students as a whole and classified into groups based on gender, ethnicity and socioeconomic status. It is also hypothesized that there is no relationship between teacher assignment and test scores based on ethnicity.

**Review of Literature**

There have been many studies focused on the effectiveness of grouping students according to their abilities in the classroom. Ross, Smith, Lohr and McNelis (1994) found when students were separated into groups based on standardized test scores they observed no difference in method of teaching and classroom procedures between the higher achieving and remedial classes. They concluded that, “the between-class tracking programs employed forfeits the potential advantages that smaller, homogeneous classes provide for employing adaptive teaching methods” (117). They also concluded that, “the inherent disadvantages of such tracking systems, namely, isolation of low achievers from higher achievers, reduced student self-esteem, and less cognitive stimulation” (117).

Slavin (1987) found similar results concerning the effectiveness of ability and student achievement grouping. Slavin found no evidence that the assignment of students to self-contained classes according to ability is beneficial. He does state that teachers should use ability grouping methods within their own classroom that have shown to be effective.

There have been several studies conducted analyzing the effects of grouping students based on race. Lleras and Rangel (2009) concluded that African American and Hispanic students learn less over time if they are placed in lower groups for instruction compared to non-grouped students. They also concluded that the negative effects of lower group placement for African Americans and Hispanics are much greater if the
Math Scores and Methods of Instruction

students are also in low ability classrooms (299). Hoffer (1992) found similar results when examining grouping and student achievement in science and mathematics in middle schools. He found there is a minimal positive effect when placing higher achieving students together in the same class. He also concluded that grouping the lower students had a severe negative effect on their abilities in the classroom. Hoffer (1992) ultimately concluded that ability grouping minimally benefits the advanced students while harming the lower achieving students.

Research has also been conducted on the effectiveness of standards based instruction in the classroom. For example, Thompson (2009) found that standards based instruction focused on instruction strategies (practice), student achievement (performance), and teacher professional development (preparation) improved student learning in math and science. In addition, the Technology Assistance Program (1998) discussed the importance of implementing a constructivist learning theory (standards based instruction) approach into the classroom. The researchers concluded that the constructivist approach matches the way students learn, it accommodates individual needs and it prepares learners for the workplace.

**Procedures (Methods)**

To compare the effectiveness of both methods of teaching (Direct Instruction vs. Standards based instruction) the researcher used the t-test: two-sample assuming equal variances. To analyze whether one particular ethnicity excelled with one teacher compared to others the researcher used the ANOVA test.

The data analyzed contained 72 students being taught using the direct instruction method by Ms. Ruger. Standards based teaching was implemented by Smith and Wesson.
Math Scores and Methods of Instruction

and both teachers have 72 students each (total of 144). The data was analyzed and compared by the researcher to determine if there was a significant difference in test scores among students being taught using the direct instruction method vs. standards based instruction. The researcher was able to compare the data using the t-test: two-sample assuming equal variances.

The researcher analyzed the test data to determine if there was a significant difference in test scores among students based on gender, ethnicity and socioeconomic status being taught using the direct instruction method vs. standards based instruction. The researcher was able to analyze the data using the t-test: two sample assuming equal variances.

Lastly, the report analyzed whether there was a significant difference in student test scores based on ethnicity and teacher assignment. These groups were analyzed using the ANOVA test.

Results and Analysis

The total amount of students being taught using direct instruction method was 72 and the number being taught using standards based instruction was 144. The mean for students being taught by direct instruction was 67.92% and the mean for students being taught by standards based instruction was 73.98%. The t-statistics was 14.6 and the critical value was 1.97. The t-statistics is much larger than the critical value allowing for the researcher to reject the null hypothesis.

The number of males taught using direct instruction method was 32 and the number taught by standards based instruction was 64. The mean for male students being taught by standards based instruction was 73.67% and the mean for male students being
taught by direct instruction was 68.47%. The t statistic is 7.4809 and the t critical value is 1.99. The t statistic is larger than the critical value allowing for the researcher to reject the null hypothesis.

The number of females being taught using direct instruction method was 40 and the number taught by standards based instruction was 80. The calculated mean score for female students in standards based classrooms was 74.23% and the mean score for female students in the direct instruction class was 67.48%. The t statistic is 13.664 and the t critical value is 1.98. The t statistic is larger than the critical value allowing for the researcher to reject the null hypothesis.

The number of white students being taught using direct instruction method was 29 whereas the number being taught using standards based instruction was 58. The calculated mean test score for white students in standard based classes was 73.74% and the mean for white students in the direct instruction based classroom was 67.93%. The calculated t statistic was 8.271 and the t critical value was 1.99. The t statistic is larger than the critical value allowing for the researcher to reject the null hypothesis.

The number of African American students being taught using the direct instruction was 18 and the number being taught using standards based instruction method was 36. The calculated mean test score for African American students in standard based classes was 73.44% whereas the calculate average for African American students in the direct instruction class was 68.94%. The t statistic is 5.079 and the critical value is 2.007. The t statistic is larger than the critical value allowing for the researcher to reject the null hypothesis.
Math Scores and Methods of Instruction

The number of Asian students being taught using the direct instruction method was 3 and the number being taught using standards based instruction was 6. The calculated mean test score for Asian students in standard based classes was 75.17% whereas the calculate average for Asian students in the direct instruction class was 66.33%. The t statistic is 6.085 and the critical value is 2.364. The t statistic is larger than the critical value allowing for the researcher to reject the null hypothesis.

The number of Hispanic students being taught using the direct instruction method was 22 and the number being taught using standards based instruction was 44. The calculated mean test score for Hispanic students in standard based classes was 74.57% whereas the calculate average for Hispanic students in the direct instruction class was 67.27%. The t statistic is 11.73 and the critical value is 2.00. The t statistic is larger than the critical value allowing for the researcher to reject the null hypothesis.

The number of students receiving free or reduced lunch being taught in the direct instruction class was 48 and the number being taught using the standards based instruction was 96. The calculated mean test score for students receiving a free or reduced lunch in standard based classes was 73.91% whereas the calculated average for students receiving free or reduced lunch in the direct instruction class was 67.92%. The t statistic is 11.805 and the critical value is 1.98. The t statistic is larger than the critical value allowing for the researcher to reject the null hypothesis.

The number of students paying full price for lunch being taught in the direct instruction class was 24 and the number being taught in the standards based classes was 48. The calculated mean test score for students paying full price for lunch in standards based classes was 74.13% whereas the mean score for students paying full price for lunch
Math Scores and Methods of Instruction

in the direct instruction class was 67.92%. The calculated t statistic is 8.517 and the critical value is 1.99. The t statistic is larger than the critical value allowing for the researcher to reject the null hypothesis.

The number of white students in Ruger’s class is 29, the number in Wesson’s class is 29 and the number in Smith’s class is 29. The calculated white students score in Smith’s class was 73.104%, the calculated white students score in Wesson’s class is 74.38% and the calculated white students score in Ruger’s class is 67.93%. The MS within groups was calculated to be 9.373563. The calculated Q value comparing Smith and Wesson was 2.24, the calculated Q value comparing Smith and Ruger was 9.10 and the calculated Q value comparing Wesson and Ruger was 11.34. The Q value was determined to be 3.40 based on the number of groups and degrees of freedom. The q value comparing Smith and Wesson is below 3.40 allowing for the researcher to accept the null hypothesis. The Q value comparing Smith and Ruger and Wesson and Ruger are both above 3.40 allowing for researchers to reject the null hypothesis.

The number of African American students in Ruger’s class is 18, the number in Wesson’s class is 18 and the number in Smith’s class is 18. The calculated African American student scores in Smith’s class was 72.89%, the calculated African American students score in Wesson’s class is 74% and the calculated African American students score in Ruger’s class is 68.94%. The MS within groups was calculated to be 9.38671. The calculated Q value comparing Smith and Wesson was 1.54, the calculated Q value comparing Smith and Ruger was 5.46 and the calculated Q value comparing Wesson and Ruger was 7.00. The Q value was determined to be 3.44 based on the number groups and degrees of freedom. The q value comparing Smith and Wesson is below 3.44 allowing
Math Scores and Methods of Instruction

for the researcher to accept the null hypothesis. The Q value comparing Smith and Ruger and Wesson and Ruger are both above 3.44 allowing for researchers to reject the null hypothesis.

The number of Asian students in Ruger’s class is 3, the number in Wesson’s class is 3 and the number in Smith’s class is 3. The calculated Asian students score in Smith’s class was 74.33%, the calculated Asian students score in Wesson’s class is 76% and the calculated Asian students score in Ruger’s class is 66.33%. The MS within groups was calculated to be 4.2222. The calculated Q value comparing Smith and Wesson was 1.40, the calculated Q value comparing Smith and Ruger was 6.74 and the calculated Q value comparing Wesson and Ruger was 8.15. The Q value was determined to be 3.95 based on the number groups and degrees of freedom. The q value comparing Smith and Wesson is below 3.95 allowing for the researcher to accept the null hypothesis. The Q value comparing Smith and Ruger and Wesson and Ruger are both above 3.95 allowing for researchers to reject the null hypothesis.

The number of Hispanic students in Ruger’s class is 22, the number in Wesson’s class is 22 and the number in Smith’s class is 22. The calculated Hispanic students score in Smith’s class was 74.91%, the calculated white students score in Wesson’s class is 74.23% and the calculated white students score in Ruger’s class is 67.27%. The MS within groups was calculated to be 5.683261. The calculated Q value comparing Smith and Wesson was 1.34, the calculated Q value comparing Smith and Ruger was 15.02 and the calculated Q value comparing Wesson and Ruger was 13.68. The Q value was determined to be 3.40 based on the number groups and degrees of freedom. The q value comparing Smith and Wesson is below 3.40 allowing for the researcher to accept the null
Math Scores and Methods of Instruction

The Q value comparing Smith and Ruger and Wesson and Ruger are both above 3.40 allowing for researchers to reject the null hypothesis.

**Discussion and Recommendations**

The data revealed that there is a significant difference in test scores among students at Harmony Creek Middle School that were enrolled in a standards based class compared to a direct instruction class. The data also revealed there is a significant difference in test scores based on gender, ethnicity and socioeconomic status of students enrolled in a standards based class compared to a direct instruction class. There was no variation in the result and all results came to the same conclusion. Based on the analysis of the data, standards based instruction in math is recommended to be used at the school site.

The data also revealed there is no significant difference in test scores among the different ethnicities in Smith’s and Wesson’s classes. The data does reveal that there is a significant difference in test scores among ethnicities when comparing Smith’s and Ruger’s classes and Wesson’s and Ruger’s classes. There is no variation in the data and the results for each ethnic group all came to the same conclusion. Based on the analysis of the data, it seems the ethnicity of the teacher and student and whether it is the same does not increase test scores but the type of instruction (standards based instruction) does. There was no data available concerning separating students based on academic abilities. However, the articles cited indicate that grouping students can be detrimental to those that would be classified as lower achieving and provide little benefit to the higher achieving students. It would be recommended that more research be done for the needs
of this site but research has already indicated that assigning students to teachers based on academic abilities does little to help the students.
Math Scores and Methods of Instruction

**Literature Cited**


