Classroom Instructional Practices and Eighth Grade Math Achievement in the U.S.: A Preliminary Analysis of TIMSS 2015 Data

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Introduction
Student mathematics achievement is influenced by many factors. However, since what happens inside the classroom is the daily work of teachers and students, the role of instructional strategies in the classroom is especially important to consider. Although small-scale studies have shown a significant influence of classroom instructional practices on student math achievement, this information is not easily transferred on a national level and must be interpreted with the context of the particular study.

The purpose of this study is to examine the relationships between classroom instructional practices and student mathematics achievement among eighth grade students in the U.S. The study uses quantitative methods to engage in the secondary analysis of a large, national dataset and is intended to provide increased understanding of the relationships between classroom instructional practices and student achievement for educators and policymakers on the national level.

Research Problem
The mathematics achievement of students in the United States has been a topic generating major concern for decades. Published reports, such as A Nation at Risk, have raised concerns about the educational inadequacies of high school and college graduates and called for educational reform in order to improve the ability of the U.S. to compete internationally (Gardner, 1983). The term means “Nothing is a report (National Research Council, 2001) also stresses the need for reform and improve mathematics instruction in elementary and middle schools.

Reform efforts in mathematics education have been attempting to address these concerns for over 30 years. However, for example, beginning with Agenda for Action: Recommendations for School Mathematics of the 1980s (NCTM, 1980), the National Council of Teachers of Mathematics (NCTM), an organization founded in 1920 to promote educational excellence in mathematics, had a long history of developing standards to address the teaching and learning of mathematics. The most recent version of these standards, Principles and Standards for School Mathematics (NCTM, 2000), provided educators with Broad Content Standards, Process Standards, and Principles that were deemed characterizes of high quality mathematics program (NCTM, 2000). Most recently, the Common Core State Standards (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010) further attempted to define and promote reform-centered mathematics through its content standards and the Standards for Mathematical Practice, all of which were heavily influenced by publications such as Principles and Standards for School Mathematics. The current study represents the beginning steps to add a new dimension to the literature examining the relationships between mathematics instructional practices and student achievement in a national data set.

Methods
Research Questions:
1. What relationships exist between classroom instructional practices, as reported by mathematics teachers, and student background factors, as reported by students, during the 2015 U.S. eighth grade administration of the Trends in Mathematics and Science Study (TIMSS)?
2. What relationships exist between instructional practices, as reported by mathematics teachers, and student achievement as demonstrated on the 2015 U.S. eighth grade administration of the Trends in Mathematics and Science Study (TIMSS)?

Population:
15,491 U.S. Eighth Grade Students

Sample:
7,082 Students with Data on Each Variable

Data Source:
2015 TIMSS Eighth Grade Mathematics Assessment National Data Files
2015 TIMSS Eighth Grade Mathematics Teacher Questionnaires National Data Files

Data Analysis:
Programs: International Association for the Evaluation of Educational Achievement (IEA) International Database Analyzer (IDB) Version 4 IBM SPSS Statistics 23

Analysis: Chi Square Test of Independence, Partial Correlations

Results

Table 1: Chi Square Tests of Independence

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<th>Source</th>
<th>Gender</th>
<th>Race/Region</th>
<th>Income Level</th>
<th>subclass</th>
<th>Census</th>
<th>P-value</th>
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Table 2: Partial Correlations Coefficients

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<th>SOC</th>
<th>PRED</th>
<th>CIT</th>
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Table 3: Results, cont.

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Conclusions
This study responds preliminary investigations of the data set, with the results indicating relationships between classroom instructional practices, student background factors, and student achievement. For instance, the results of the Chi Square Tests of Independence reveal a significant relationship between the highest level of education of a student’s parent and all but one classroom instructional practice (a teacher asking students to work while the teacher was occupied with other tasks). Additionally, the correlation coefficients revealed positive, but weak, correlations between three classroom practices (having students work in homogeneous groups, allowing the use of a calculator during class, and having a computer or tablet available during class and student achievement at each plausible value when controlling for student background factors). Although no statistical findings can be drawn from these correlations, further research into these results will seek to describe the extent of each relationship by level of reported classroom practice and degree to which each level of reported classroom practice is related to student achievement.

Bibliography

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