How are textbooks used in the middle schools?

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Abstract

This study reported on the extent and nature of usage of mathematics textbooks by eleven middle schools in the United States. The data were collected in a variety of ways. These middle schools located in six states and differed in size. Results indicated that most teachers relied heavily on textbooks to decide what content to teach and when to teach. Among the set of teachers, the percentage of lessons in Number & Operation strand selected to be taught was significantly higher than it reported for each of the other content strands. Furthermore, the differences of content composition between NSF and non-NSF funded textbooks were explored.

Key words: (non)NSF-funded, Standards-Based, Textbook.

1. Introduction

In this era in which there were quite different mathematics curricula; high-stakes testing and public accountability, school staff were scrambling for ways to improve mathematics opportunities for all students. Many people might be interested in the differences and the relationship between the textbooks in use and performance.

Recent research indicated that most mathematics classes had a textbook that they followed rather closely. Based on a recent report (Weiss, Pasley, Smith, Banilower & Heck, 2003), researchers concluded that the textbook is a major factor in the teacher's selection of content for a lesson. In the meantime, Whitman (2004) reported that "80 to 90 percent of classroom and homework assignments are textbook-driven or textbook-centered."

Despite these evidences, some people possibly argue that some teachers might use textbooks differently. Sometimes they used more than one textbook, sometimes they did not use any textbook at all. Indeed, how to use textbooks was viewed as one factor that influenced what students learned.

2. Research Questions

Because of space limitation here, this study only examines the extent and nature of use of district-adopted textbooks by teachers. Originally, three primary research questions are included, namely:

1. To what extent and in what ways do middle school mathematics teachers use the textbooks and other curricular resources for planning and conducting mathematics lessons?
2. What is the relationship between the type of textbook used and achievement differences between districts using an NSF-funded curricula and districts using commercially-generated (non-NSF funded)curricula?
3. To what extent do middle school teachers employ standards-based instructional practices? Are these practices associated with particular textbooks and are they associated with higher student achievement?

3. Methodology

These research questions required a project design that captured the complexity of mathematics teaching and was sensitive to the reality of school settings. Hence, this research employed qualitative and quantitative methods. The qualitative methods, including teacher interviews and classroom observations, were used to describe the nature and focus of instruction. Particularly, the extent to which instructional strategies were influenced by the textbook was noted by observers. Meanwhile, observations also documented teachers' use of strategies generally associated with NSF curriculum development efforts. The quantitative methods employed aggregating data from mathematics achievement tests and teacher-reporting textbook use.

3.1 Sample Selection

In this research, some general criteria were established to select schools as samples. These criteria included the length of implementation of the mathematics curricula, the organizational structure of the school, and the size of the community where the school was located, etc.

Basically, schools in their second or third year of implementation of NSF-funded curricula were considered and preferred for this study, since this might increase the likelihood of a full implementation. Also, in order to facilitate the monitoring of students (longitudinal study), decision was made to select middle schools with 6-8 organizational structure. In addition, a decision was made to insure that rural, suburban and urban schools were included. Once sample schools were selected, all students in grades 6-8 and all of their mathematics teachers were invited to participate in this study. The scope of this study listed as follows:

- 11 middle schools located in 6 states.
- About 50 mathematics teachers each year involved.
- About 4500 students (All students were in grades 6,7 &8).
- Demographic diversity: urban, suburban, small and rural districts, and a range of percentages of minority across sample.
- Geographic diversity: 6 states (Iowa, Minnesota, Washington, South Dakota, Colorado, Missouri).
- Diversity of textbooks: some NSF-funded curricula (CMP, MiC, MT) and some commercially-generated curricula (Addison-Wesley, Glencoe, H-M, Saxon, Prentice Hall).

3.2 Research Instruments

In order to gauge the fidelity of implementation of the textbook, a number of instruments were developed or adapted. These instruments include:

Teacher Survey: At the first meeting project staff held at each school, each teacher took about 30 minutes to complete a written survey/questionnaire designed to document his educational background, experience, attitudes and beliefs, instructional practices, professional development opportunities, and self-reported use of the textbook.

Textbook-Use Logs: During three different 10-day intervals during the school year, teachers were asked to document the curriculum materials they utilized to plan and enact mathematics instruction. The main purpose was to gather information regarding how often the textbook was used during a continuous interval. They listed the unit and page numbers of materials, unit and pages for homework, other print materials used by teacher and students, etc.

Table-of -Contents Implementation Record: Teachers were asked to indicate the lessons from the textbook that were presented to students. We collected these data three times a year and utilized this information to document the amount of the textbook that was covered as well as the parts of the textbook that were not presented to students in class.

Classroom Observation Protocol: A research member observed three lessons over the course of a school year in each teacher' classroom. Based on the designed rubrics as follows, observers collected information about the use of the textbook by the teacher and students. Also, observers recorded the extent to which the teacher utilized instructional strategies.

(1) Rubric for classroom observations:

- The teacher did not generally encourage students to offer different perspectives

and/or strategies to solving problems. Generally, if a correct solution was offered by a student, the teacher accepted it and moved on.

- Different perspectives or strategies were occasionally elicited from students or mentioned by teacher. However, this did not appear to be a regular occurrence.
- The teacher encouraged students to view problems or mathematical situation from multiple perspectives and to learn from each other's viewpoints. When appropriate, alternative strategies were solicited and discussed as an important element of classroom instruction.

(2) Use of Standards-Based Instructional Practices:

- The lesson provided opportunities for students to make conjectures about mathematical idea.
- The lesson fostered the development of conceptual understanding.
- Students explained their responses or solution strategies.
- Multiple perspectives/strategies were encouraged and valued.
- The teacher valued students' statements about mathematics and used them to build discussion or work toward shared understanding for the class.

Teacher Interview Protocol: The main purpose was to learn the teachers' perceptions of the textbook and about how it was used to teach mathematics in their classrooms. For example, teachers were asked:

- How often do you use the textbook? How often do your students use the textbook?
- What parts or features of the textbook do you use most often? What parts or features of the textbook do your students use most often?
- How important is the textbook for planning or teaching mathematics in your classroom?

Student Assessments: In order to monitor mathematics learning, students were expected to take two types of assessments, developed by CTB McGraw-Hill.

- Balanced Assessment in Mathematics (Form A): Items represent a variety of formats including short-answer, constructed response and non-routine items. All items are scored using a rubric.
- TerraNova Survey: Multiple choice examination that includes items from a wide range of content domains. Focusing on a variety of mathematical skills, procedures and concepts.

4. Findings

The textbook-use logs were used to determine the frequency of use. The frequency of

use was calculated as the percent of the total instructional days when the textbook was used by the teacher, students, or to assign homework during three 10-day periods. The following Figure 1 illustrates the frequency of textbook use by the teacher for both years. Noted that, in both years, all teachers but one reported using their mathematics textbooks for at least half of the 30 instructional days. In fact, in the second year more than 70% of the teachers reported their frequencies at least 75% of instructional days.

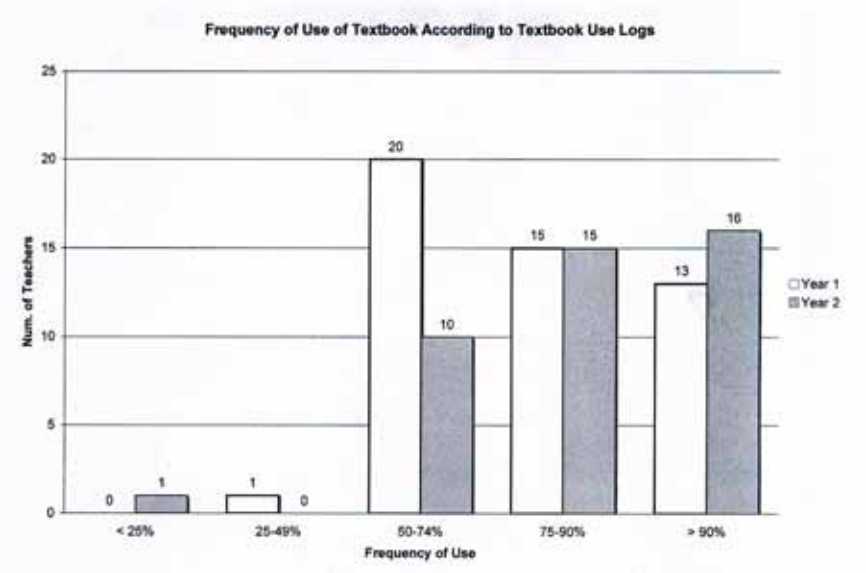

Figure 1: Frequency of textbook use by the teacher.

From Figure 2 below, we found the differences between NSF and non-NSF funded mathematics textbook with respect to the distribution and placement of mathematics content. It was clear that approximately 20% of lessons in textbooks used by NSF teachers focused on Number & Operation in contrast to about 34% of lessons in non-NSF textbooks. Likewise, about 30% of lessons focused on Geometry & Measurement in NSF-funded textbooks exceeded the set of non-NSF textbooks containing approximately 23% of lessons focused on this strand.

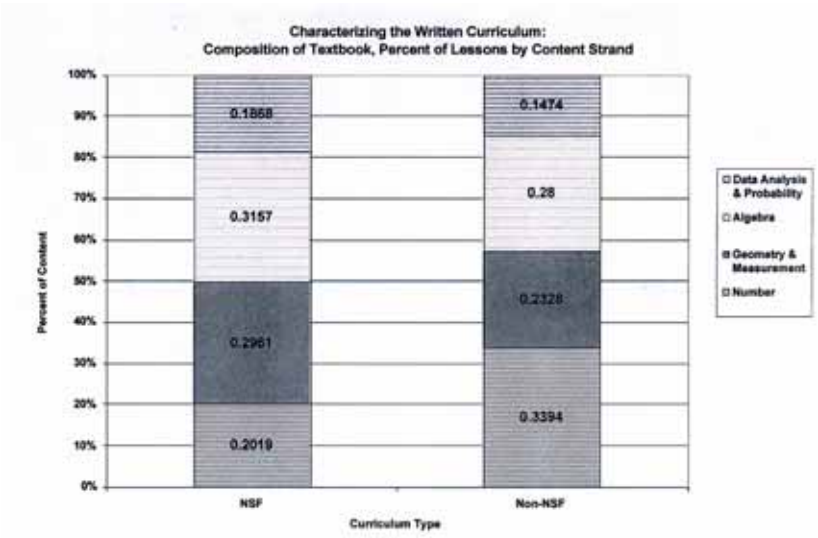

Figure 2: Composition of textbooks used by NSF and non-NSF teachers.

Furthermore, both sets of teachers were most likely to select lessons on Number & Operation with teachers indicating about 83% of such lessons taught. Algebra lessons were second-most likely to be selected with about 77% and 70% of such lessons reportedly taught by NSF and non-NSF teachers, respectively. See Figure 3.

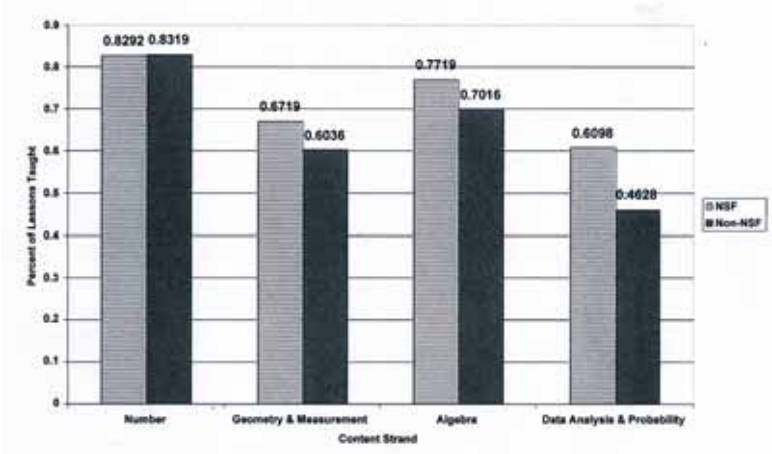

Figure 3: Percent of textbook lessons taught.

5. Limitations

We realized that Textbook-Use Logs were gathered from teachers self-reporting their use of textbooks (Porter, 2002). Although classroom observations were made for several intervals or periodically interviewing teachers through the year, some limitations still existed. Also, some textbooks were used by only one or two schools.

6. Concluding Remarks

To conclude, textbooks helped most teachers organize and deliver instruction; serve as a resource of problems for students to engage in and apply their knowledge; provide assessments to monitor student learning; serve as homework assignments, etc.

Also, results indicated that NSF-funded textbooks (standards-based) were designed and used in different ways from the non-NSF-funded textbooks (traditional textbooks). Actually, NSF-funded textbooks were developed with support from the National Science Foundation to incorporate recommendations of the NCTM (Reys, Robinson, Sconiers, & Mark, 1999). These textbooks often emphasized the real problem contexts and active involvement, so students were expected to gather data; organize information; search for patterns; make test conjectures; and discuss their ideas and strategies. Hopefully, this study provided some valuable insights on the use of mathematics textbooks in the middle schools.

Acknowledgement

This project was funded by a grant from the Office of Educational Research and Improvement (OERI), and U.S. Department of Education. Project Team members: Robert Reys, Barbara Reys, James Tarr, Oscar Chavez, Brain Townsend, & Jung-Chih Chen.

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