

LESSONS LEARNED FROM THREE DECADES OF TEXTBOOK RESEARCH

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OUTLINE OF SESSION

- Share and expand on the conference paper
 - Background on the UCSMP
 - Lessons learned from UCSMP research
- Opportunity for discussion and questions

UCSMP BACKGROUND

- University of Chicago School Mathematics Project (UCSMP)
 - Founded 1983
 - K-12 curriculum development & research project
 - Elementary component
 - Secondary component
 - Evaluation component
 - Resource component
 - Funded with private and federal grants
 - Goal was to develop curriculum materials based on recommendations for mathematics reform at that time

Secondary Component

- Developed instructional materials for grades 7-12 (and since 2005 for grades 6-12)
 - *Pre-Transition Mathematics* (grade 6)
 - *Transition Mathematics* (grade 7)
 - *Algebra* (grade 8)
 - *Geometry* (grade 9)
 - *Advanced Algebra* (grade 10)
 - *Functions, Statistics, and Trigonometry* (grade 11)
 - *Precalculus and Discrete Mathematics* (grade 12)

Common Features of Textbooks

- Wide mathematical scope, incorporating data analysis and discrete mathematics to update curriculum
- Multi-dimensional approach to understanding
 - Skills, Properties, Uses, Representations (SPUR)
- Integration of technology as appropriate
 - Calculators (graphing, CAS)
 - Spreadsheets
 - Dynamic geometry
- Expectation for students to read and write mathematics
- Modified mastery learning

RESEARCH AND EVALUATION OF SECONDARY TEXTBOOKS

- School year long studies
- Formative aspect
 - Give feedback to authors prior to commercial publication
- Summative aspect
 - Investigate the effectiveness of textbooks in comparison to materials already in use at school
- Studies conducted since the beginning of the project in the 1980s



Multiple Cycles of Development & Research: An Example

- *Transition Mathematics*
 - First Edition
 - Initial development and small scale pilot testing: 1983-1984
 - Research and evaluation: 1984-1986
 - Commercial publication: 1990
 - Second Edition
 - Field Trial and Evaluation: 1992-1993
 - Commercial publication: 1995
 - Third Edition
 - Field Trial and Evaluation: 2005-2006
 - Commercial publication: 2008

Lessons Learned

Lesson 1: When studying the effectiveness of a textbook, the classroom is the appropriate unit of analysis.

- Instruction occurs in classrooms.
- We've used matched-pair, quasi-experimental design.
 - Match classes on basis of one or more pretests
 - Each pair is a mini-study
 - Ensures comparability of groups, even if random assignment is not possible
 - Avoids methodological difficulties from trying to match students or controlling for differences through ANCOVA

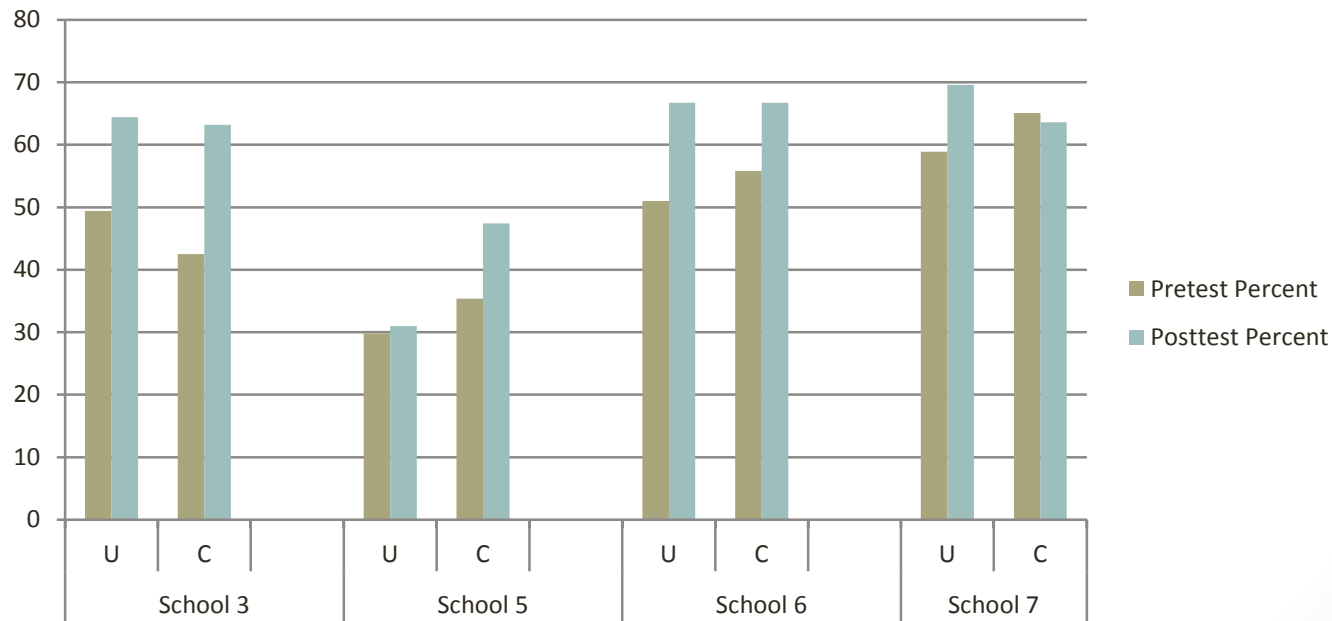
LESSON 2: Compare classes within the same school when possible.

- Schools have their own culture.
- Example: *Geometry* study (2006-2007)
 - 12 teachers from 12 schools using the same textbook
 - Instructional time: 215-300 minutes/week
 - Percent of 114 textbook lessons taught: 51-91%
 - Percent of 43 textbook lessons taught on congruence: 60-100%
 - Homework expected:
 - 16-30 min per night – 5 teachers
 - 31-45 min per night – 5 teachers
 - 46-60 min per night – 2 teachers

LESSON 2: Compare classes within the same school when possible.

- Posttest scores in some schools are lower than pretest scores in other schools. (U represents UCSMP classes and C represents Comparison classes.)

TM: Percent Correct on Common Pretest and Posttest Items



LESSON 3: Select more classes for study initially than you think you may need.

- Teachers
 - Fail to give all pretests.
 - Decide things are too difficult and quit using the textbook.
 - Leave the school.
- Classes in a pair don't match.
 - On pretests
 - On some other important characteristic
- Students switch classes during the school year.

LESSON 4: Collect data from teachers about the opportunities they have provided students to learn the mathematics in the textbook.

- Measure opportunity to learn mathematics in lessons and practice homework
 - *Algebra* study example (2005-2006):
 - 6 UCSMP teachers
 - Taught 47-100% of 103 lessons
 - Only 1 of 13 chapters had all lessons taught by all 6 teachers.
 - In this chapter, teachers assigned 25-97% of homework questions.

LESSON 4: Collect data from teachers about the opportunities they have provided students to learn the mathematics in the textbook.

- Measure opportunity to learn (OTL) on posttests
 - Teachers indicate whether they taught or reviewed the content for EACH posttest item.
 - In *Algebra* study, all 6 UCSMP teachers taught only 16 of 32 items on a standardized test.
 - In *Transition Mathematics* study, among 5 matched pairs of classes:
 - On standardized test, OTL 68-90%
 - On UCSMP designed multiple-choice test, OTL 50-100%
 - On UCSMP designed constructed-response test, OTL 38-100%

LESSON 4: Collect data from teachers about the opportunities they have provided students to learn the mathematics in the textbook.

- Posttest OTL used to report results three ways
 - No control for OTL – results given for entire test with OTL reported
 - Control for OTL at pair level (**Fair Test**) – results given for those items in each pair for which both UCSMP and comparison teachers reported “yes”
 - Control for OTL at study level (**Conservative Test**) – results given for those items for which ALL UCSMP and comparison teachers reported “yes”

OTL Examples: **Fair** and **Conservative**

	PTM	TM	Algebra	Geometry
Year	2006-2007	2005-2006	2005-2006	1993-1994
No. Teachers	14	10	9	8
No. Schools	9	4	5	4
Standardized Test	TerraNova CAT Survey 17	Iowa Algebra Aptitude	TerraNova Algebra	High School Subjects: Geometry
Number of Items	32	63	32	40
Items Common within Pair	50-97%	68-90%	62-100%	65-80%
Items Common Across Schools	34%	67%	50%	48%

LESSON 5: Collect multiple measures of implementation of the textbook, and when possible, collect implementation data from both teachers and students.

- Data collected from teachers
 - Chapter evaluation form for each chapter
 - Pre and post questionnaires about goals and instructional practices
 - Interviews
 - Classroom observations
 - Focus group meetings

LESSON 5: Collect multiple measures of implementation of the textbook, and when possible, collect implementation data from both teachers and students.

- Data collected from students
 - Pre and post tests
 - End of year Student Survey
 - Many questions similar to those on teacher end-of-year questionnaire
 - Amount of time spent on homework
 - Frequency and nature of use of technology
 - Frequency and nature of reading and writing mathematics
- Opportunity to compare teacher and student perspectives on instruction

LESSON 6: Pilot everything, including items, instruments, and procedures.

- Unanticipated issues arise even when tests are constructed by knowledgeable individuals
 - Incorrect graph
 - Items that provide clues to other items
 - Items with numbers that enable correct answers from wrong methods
 - Constructed response items that are not rich enough to be scored using the planned rubrics

Questions for DISCUSSION

- To what extent would these lessons be issues that you would face in conducting such research in your own country?
- What other lessons have you learned or what other issues have you encountered when conducting textbook research?

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