How Do K-8 Teachers Change Their Practices After Learning More Mathematics?

Yasemin Copur-Gencturk
The category most likely to distinguish the understanding of the content specialist from that of the pedagogue (Shulman, 1987, p.7)
## Introduction

### Program Description

### Data Collection

### Results

### Discussion

<table>
<thead>
<tr>
<th>Student A</th>
<th>Student B</th>
<th>Student C</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>x 25</td>
<td>x 25</td>
<td>x 25</td>
</tr>
<tr>
<td>125</td>
<td>175</td>
<td>25</td>
</tr>
<tr>
<td>+ 75</td>
<td>+ 700</td>
<td>150</td>
</tr>
<tr>
<td>875</td>
<td>875</td>
<td>875</td>
</tr>
</tbody>
</table>

- Calculate: 35 x 25 = 875
- Calculate: 35 x 25 = 875
- Calculate: 35 x 25 = 875

**Total: 875**
Research Questions

How does teachers’ MKT affect their instruction?

What is the relationship between teacher beliefs and mathematics instruction?
Description of the Program

- 2.5-year master’s program for K-8 teachers
- Funded by the Illinois State Board of Education (ISBE)
- Partnership between UIUC and a particular public school district
- Designed to deepen the content knowledge and PCK of in-service teachers in math and science
<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall 2008</strong></td>
<td><strong>Fall 2009</strong></td>
<td><strong>Fall 2010</strong></td>
</tr>
<tr>
<td><strong>Spring 2009</strong></td>
<td><strong>Spring 2010</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Summer 2009</strong></td>
<td><strong>Summer 2010</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Math Hybrid Course</strong></td>
<td><strong>Science &amp; Educational Psychology Courses</strong></td>
<td><strong>Math Content Course</strong></td>
</tr>
<tr>
<td><strong>Science Education Course</strong></td>
<td><strong>Educational Psychology</strong></td>
<td><strong>Science Education Course &amp; Seminar</strong></td>
</tr>
<tr>
<td><strong>Science &amp; Educational Psychology Courses</strong></td>
<td><strong>Math Content Course</strong></td>
<td><strong>Action Research Course</strong></td>
</tr>
</tbody>
</table>
Math Courses

Hybrid Course
- Combination of typical “math methods” and “math for elementary teachers” courses
- Taught by a professor from Education Department
- Focused on number, geometry, measurement, algebra, and statistics/probability

Content Course
- Centered around the theme, “mathematics in the world around you”
- Taught by a professor from Math Department
- Focused on algebra, probability and statistics, number theory

Introduction | Program Description | Data Collection | Results | Discussion
Participants

21 in-service teachers

- 3 middle school, one special education, the rest elementary teachers (K-6)
- Teaching experience ranging from 1 to 12 years (mean=5.4; median=4)
- All certified teachers
- Majority had elementary education major (n=19)
**Instruments**

- MKT assessment
- Classroom Observation Protocol
- Beliefs Survey
### Multiple choice items
Captures teachers’ common & specialized content knowledge
Two parallel forms (.75 and .76 reliabilities)

<table>
<thead>
<tr>
<th># of Items</th>
<th>Number &amp; Operations</th>
<th>Geometry</th>
<th>Patterns, Functions, &amp; Algebra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form A</td>
<td>26</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>Form B</td>
<td>25</td>
<td>23</td>
<td>18</td>
</tr>
</tbody>
</table>
## Classroom Observation Protocol

<table>
<thead>
<tr>
<th>Scale</th>
<th>Reliability Estimates (Cronbach’s Alpha)</th>
<th># of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inquiry-Oriented Lesson</td>
<td>.95</td>
<td>14</td>
</tr>
<tr>
<td>Student Engagement</td>
<td>.89</td>
<td>7</td>
</tr>
<tr>
<td>Worthwhile Mathematical Task</td>
<td>.87</td>
<td>5</td>
</tr>
<tr>
<td>Mathematical Sense-Making Agenda</td>
<td>.84</td>
<td>7</td>
</tr>
<tr>
<td>Classroom Climate</td>
<td>.71</td>
<td>3</td>
</tr>
</tbody>
</table>

Adapted from Local Systemic Change Classroom (LSC) Observation Protocol & the Oregon Mathematics Leadership Institute (OMLI) Classroom Observation Protocol

39-items on 5-point scale, ranging from “Never” to “Consistently”
Beliefs Survey

Modified by Beswick (2005)

26 items (alpha=.78)

Designed to capture to what extent teachers hold a traditional view or problem-solving view of mathematics

Five-point Likert scale, ranging from “Strongly Disagree” to “Strongly Agree”

Sample Items

• Discovery methods of teaching have limited value because students often get answers without knowing where they came from.
• There are often many different ways to solve a mathematics problem.
## Timetable for Data Collection

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Fall 2008</td>
<td>Spring 2009</td>
<td>Summer 2009</td>
<td>Fall 2009</td>
</tr>
<tr>
<td>MKT</td>
<td>August</td>
<td>December</td>
<td>January</td>
<td>June</td>
</tr>
<tr>
<td>Classroom Observations</td>
<td>May</td>
<td>March-May</td>
<td>March-May</td>
<td>October-November</td>
</tr>
<tr>
<td>Beliefs Survey</td>
<td></td>
<td></td>
<td></td>
<td>August</td>
</tr>
</tbody>
</table>
Quantitative Analysis

- Multi-level growth modeling w/time varying covariates
- 2-level MLM for the relationship between MKT & instruction
- Linear regression for beliefs
MKT & Instructional Practices

Level 1:

\[ \text{Instruction}_{ij} = \beta_{0j} + \beta_{1j} \times \text{year}_{ij} + \beta_{2j} \times \text{MKT}_{ij} + r_{ij} \]

Level 2:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} \times \text{grade}_j + \gamma_{02} \times \text{experience}_j + u_j \]

Level 2: Teachers

Level 1: Time-Varying Covariates
- Year in the Program
- MKT score
- Instructional Practices

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Results

Inquiry-based lesson

Student Engagement

Classroom Climate

Inquiry-based lesson

Sense-Making Agenda

Worthwhile Task

**p < .01**

* p < .05

~ p < .10

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This 2.5-year program changed teachers’ MKT and those changes corresponded with inquiry-oriented teaching, mathematical agenda, and classroom climate.

Teachers’ beliefs corresponded with teachers’ lesson designs, task choices, and mathematical agenda.

Teachers’ beliefs and current level of MKT mediated the effect of the gain on changes in teachers’ practices.

**Limitations**
- Convenience sample
- Sample size
- Measures
Thanks!
Questions?