Project MENTOR: Assessing the Growth of Mathematical Content Knowledge

By
A. J. (Sandy) Dawson, PhD
Director, MENTOR Project, PREL

Kyaw Soe, PhD
Senior Specialist, PREL

Joseph Zilliox, PhD
Professor, University of Hawai'i

Alicia Aguon, PhD
Professor, University of Guam

BACKGROUND

In the Pacific region served by Pacific Resources for Education and Learning (PREL), lack of access to 4-year degree granting programs, coupled with a rapidly growing student population, results in the increased hiring of inexperienced and under-qualified teachers. The Mathematics Education for Novice Teachers: Opportunities for Reflection [MENTOR] project addresses this problem by establishing a mentoring program for novice teachers aimed at developing in them the knowledge, skills, and dispositions necessary to be effective teachers of mathematics, thereby decreasing the length and trauma of their induction into teaching and increasing their commitment to the profession. The project commenced in January 2003 and runs through August 2007.

DESCRIPTION OF THE PROJECT

Based on training led by PREL personnel, project mentors are providing summer institutes, as well as in-class mentoring, inquiry group sessions, and lesson study for novice teachers. The project is creating two cadres: (1) a group of well-trained and effective mentors of novice teachers and (2) a group of effective novice teachers who have an understanding of how to implement standards-based mathematics instruction and who exhibit a strong commitment to the profession.

The ability of the MENTOR project to achieve its stated purpose of nurturing effective mathematics instruction in novice teachers is dependent upon the achievement of a number of goals, including, but not limited to:

- Developing experienced mathematics educators' understandings of the roles and responsibilities of mentors, as well as of effective mentoring processes.
- Developing experienced mathematics educators' skills as mentors, as well as their abilities to design and implement professional development models that foster professional growth in novice teachers.
- Increasing mentors' and novice teachers' mathematical content knowledge, as well as their understanding of associated pedagogy.
- Increasing novice teachers' ability to plan, implement, and assess instructional sequences that reflect an understanding of the principles of standards-based mathematics learning and teaching.
- Developing novice teachers' and mentors' abilities to reflect critically on their practices and on their growth as educators.

This presentation focuses on the third goal: measuring the growth of mathematical content knowledge.

Originally presented at the 26th Annual Conference of the International Group for the Psychology of Mathematics Education, North America (PMENA), Toronto, Canada (October 2004).

Funded by the National Science Foundation (NSF), award number ESI0138916. The content does not necessarily reflect the views of the NSF or any other agency of the U.S. government.

RESEARCH QUESTIONS

- Is there any impact on the novice teachers in their content knowledge, teaching practices, and assessment skills?
- Is there any impact on the mentors in their content knowledge, teaching practices, and assessment skills?

This presentation will focus on an analysis of the scores obtained in 2003 and 2004, and will compare with scores of the University of Hawai‘i preservice education students.

DESIGN

Project staff developed an instrument to measure the mathematics content knowledge of the participants. This test instrument consisted of 32 items, including 24 multiple-choice items and 8 open-ended items that tried to find out the mathematics content knowledge of the mentors and novices. During the summer of 2003, the instrument was administered to both mentors and novices. Data collected will be used as baseline test data for the project. The novice teachers are to be retested during the summer of 2004, and the mentors in the summer of 2005. The instrument was also used to collect data from selected groups of preservice mathematics education students at the University of Hawai‘i in the fall 2003.

ANALYSIS AND FINDINGS

All 35 mentors and 76 novices of the project's first year participated in the administration of the test instrument. Forty-three preservice college students who were taking the education courses at the University of Hawai‘i were also asked to take the assessment during one of their class periods.

Cronbach's alpha was computed to check the internal consistency of the test instrument. It was found to be 0.9016.

Mean scores of novices, mentors, and college students were 17.7, 25.9, and 28.4, respectively. One-way ANOVA showed that these means were significantly different ($F2, 151 = 58.2$, $p = 000$). To find out which pairs of means were different from each other, t-tests were performed. For mentors and novices, means were significantly different from each other ($t = 6.36$, $df = 109$, $p = .000$), with mentors scoring higher than novices. For mentors and college students, means were also significantly different from each other ($t = 2.3$, $df = 76$, $p = .024$), with mentors scoring lower than the preservice college students. Thus, the mean score of college students were significantly higher than that of the novices ($t = 10.5$, $df = 117$, $p = .000$).

DISCUSSION

The results showing the novice teachers scoring significantly lower than the mentors and the UH college students are not surprising. The novice teachers across the Pacific, on average, have 2 years or less of college training. Many begin teaching directly from high school. One goal of the MENTOR Project is to raise the novice teachers' level of understanding of mathematics.

The fact that the UH college students scored significantly better than the mentors draws attention to the fact that mentors' mathematical education is not as strong as MENTOR Project staff had hoped for and believed. The result was somewhat surprising, though not totally unexpected. Analysis of the test results identified specific areas of weakness (e.g., operations on fractions) in the mentors' mathematical background, and these will be focused on during future MENTOR Project institutes.

Mathematics Education in the South and Western Pacific: Building Local Capacity to Support Teachers of Mathematics

By
A. J. (Sandy) Dawson, PhD
Director, MENTOR Project, PREL

Over the past 7 years, two National Science Foundation (NSF) funded projects—Developing Effective Leadership Training Activities [DELTA] and Mathematics Education for Novice Teachers: Opportunities for Reflection [MENTOR]—identified and trained mentor teams drawn from and working on remote Pacific islands. During the past 4 years, these mentor teams—composed of college mathematics instructors, district mathematics specialists, and expert classroom teachers—supported some 400 novice teachers of mathematics.

The ability of the projects to achieve their stated purpose of nurturing effective mathematics instruction in novice and experienced teachers was dependent upon the achievement of a number of goals, including but not limited to: (1) developing experienced mathematics educators' understandings of their roles and responsibilities of mentors, as well as of effective mentoring processes; (2) developing experienced mathematics educators' skills as mentors, as well as their abilities to design and implement professional development models that foster professional growth in teachers; (3) increasing mentors' and novice teachers' mathematical content knowledge, as well as their understanding of associated pedagogy; (4) increasing novice and experienced teachers' ability to plan, implement, and assess instructional sequences that reflect an understanding of the principles of standards-based mathematics learning and teaching; and (5) developing novice and experienced teachers' and mentors' abilities to reflect critically on their practices and on their growth as mathematics teachers and educators.

In addition to individual and focus group interviews, observations, and audio and video conferences, impact was measured using two instruments designed for the projects: (1) a mathematics content test administered yearly to the novice teachers and biennially to the mentors, and (2) a pre-post attitude questionnaire given to both mentors and novice teachers. These measures indicate modest growth in content knowledge, and a growing appreciation and understanding of standards-based instruction on the part of the novice teachers. The mathematical knowledge of the mentors has grown significantly. Questionnaire data for the mentors is not available until the conclusion of the projects in 2007. Anecdotal data from a few of the island communities indicates growth in student achievement taught by the novice teachers. Improved understanding and appreciation of the richness of their diverse island cultures is extensive among both mentors and novice teachers.

Originally presented at the 30th Annual Conference of the International Group for the Psychology of Mathematics Education (PME), Prague, the Czech Republic (July 2006).

Funded by the National Science Foundation (NSF), award number ESI0138916. The content does not necessarily reflect the views of the NSF or any other agency of the U.S. government.