

Examination of Mathematics Content Courses for Teachers: An On-ramp for Addressing the AMTE *Standards for Preparing Teachers of Mathematics*

Sarah Quebec Fuentes
Texas Christian University

Theresa Jorgensen
University of Texas at
Arlington

Gwendolyn Johnson
University of North Texas at
Dallas

Christina Gawlik
CLG Consulting, LLC

Christopher Kribs
University of Texas at Arlington

Developing preservice teachers' mathematics content knowledge should be a key aspect of teacher education programs (CBMS 2012). Supporting this notion, the Association of Mathematics Teacher Educators' *Standards for Preparing Teachers of Mathematics (SPTM)* are based on five grounding assumptions (AMTE, 2017). In particular, Assumption 3 states "learning to teach mathematics requires a central focus on mathematics," Assumption 4 stipulates "multiple stakeholders must be responsible for and invested in preparing teachers of mathematics," and Assumption 5 says "those involved in mathematics teacher preparation must be committed to improving their effectiveness in preparing future teachers of mathematics" (AMTE, 2017, p. 2).

By what means can institutions evaluate how their teacher education program is addressing these three assumptions? One avenue for preservice teachers to acquire mathematics content knowledge is through mathematics content courses. The purpose of the present paper is to describe an approach that mathematics teacher educators can use to investigate mathematics course offerings specifically designed for preservice teachers, the content focus of these courses, and the characteristics of the instructors who teach them.

Methods

The Texas Higher Education Coordinating Board provides a list of all of the Texas baccalaureate-degree granting institutions. For each institution, from the courses offered during the 2012-13 academic year, researchers identified all undergraduate mathematics courses designed explicitly for students in teacher education programs. Independently, two researchers substantiated the inclusion of a course in the data set using at least two sources, such as course title, course description, and degree plans.

For every section of the identified courses, the two researchers independently collected the following data: course number, name, and description; degree program; instructor name, gender, and position; instructor's highest degree and corresponding field. Data was collected via internet search of publicly available sources (e.g., institution website). Any discrepancies identified across the two researchers were systematically resolved.

Findings

All of the Texas four-year institutions with teacher education programs ($n=72$) were classified by three variables: Public or Private; Small, Medium or Large; Doctoral-, Master's-, or Baccalaureate-granting (Carnegie 2001). The findings reported herein are for the four most prevalent combinations of these three variables: Small, Private, Baccalaureate-granting (SPrB); Small, Private, Master's-granting (SPrMa); Medium, Public, Master's-granting (MPuM); and Large, Public, Doctoral-granting (LPuD). Three sets of findings are presented: number of course offerings, course content, and instructor characteristics. For each of the four institution types, relative frequencies are reported.

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Course Offerings

In Table 1, the n values refer to the number of institutions within each categorization. Most SPrB and SPrM institutions offer between zero and three courses, with a notable percentage that offer no courses. In contrast, the majority of MPuM institutions offer between three and five courses. LPuD institutions represent a greater range of number of course offerings, with the majority falling between five and seven.

Table 1
Relative Frequency Distributions of the Number of Course Offerings

Number of Courses	SPrB $n=13$	SPrM $n=11$	MPuM $n=10$	LPuD $n=10$
0	31%	55%	0%	10%
1	8%	9%	0%	0%
2	38%	9%	0%	0%
3	15%	9%	30%	20%
4	0%	0%	30%	0%
5	8%	18%	20%	10%
6	0%	0%	10%	20%
7	0%	0%	10%	30%
8+	0%	0%	0%	10%

Course Content

In Table 2, n represents the number of distinct course offerings within each institution type. The course content was examined in two ways: (1) mathematical strand(s) addressed in the course and (2) whether the course incorporated only mathematics content or mathematics content together with pedagogy. The first four mathematical content strands represent the NCTM (2000) Content Standards, with Geometry and Measurement merged. Advanced Mathematics was used as the strand for courses such as Introduction to Proof or Calculus. A course was coded Combination of Strands only if more than one strand was addressed. In all institution types, courses addressing a combination of mathematical strands were a plurality of the course offerings, representing a majority for SPrB, SPrM, and MPuM institutions. Similarly, across all institution types, more course offerings addressed mathematics content only versus a melding of mathematics content and pedagogy. Notably, nearly 90% of the course offerings at LPuD institutions focused solely on mathematics content.

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Table 2
Relative Frequency Distributions for Course Content

Course Content	SPrB n=22	SPrM n=14	MPuM n=43	LPuD n=54
Number & Operations	14%	0%	9%	9%
Geometry & Measurement	5%	14%	16%	13%
Algebraic Thinking	5%	0%	5%	11%
Data Analysis & Probability	9%	14%	5%	6%
Advanced Mathematics	5%	7%	7%	15%
Combination of Strands	64%	64%	58%	46%
Math Content only	68%	57%	74%	89%
Content & Pedagogy	32%	43%	26%	11%

Instructor Characteristics

For the analysis of instructor characteristics, within each institution type n represents the number of course sections of mathematics courses for teachers (Table 3). Instructor characteristics include highest degree, field of highest degree, position, and gender. Across all institution types, the majority of instructors have a doctorate. SPrM institutions had the highest percentage (96%) of instructors with a doctoral degree. For SPrB, SPrM, and MPuM institutions, the highest degree of the majority of instructors is in mathematics whereas the majority of instructors at LPuD institutions hold their highest degree in mathematics education. Of interest, the highest degree of 22% of instructors at SPrM institutions is in a field other than mathematics or mathematics education.

With respect to instructor position, the difference between the percent of tenure stream and full-time instructors is at least 60% for SPrB and SPrM institutions (favoring tenure stream), whereas there is nearly no difference between percentages for MPuM institutions. In contrast, LPuD institutions have more full-time than tenure stream instructors in mathematics courses for teachers, with a difference of about 20%. Additionally, MPuM and LPuD institutions have a higher percentage of adjuncts teaching these courses. A greater difference exists between the percentage of female and male instructors at SPrB and SPrM institutions in comparison to MPuM and LPuD institutions.

Table 3
Relative Frequency Distributions of Instructor Characteristics

Instructor Characteristics	SPrB n=25	SPrM n=23	MPuM n=103	LPuD n=168
Highest Degree				
Doctorate	72%	96%	52%	64%
Master's	28%	4%	48%	36%
Bachelors	0%	0%	0%	1%
Field of Degree				
Mathematics	56%	61%	65%	45%
Math Education	44%	17%	34%	55%
Other	0%	22%	1%	0%
Position				
Tenure Stream	80%	83%	44%	34%
Full-time Instructor	20%	13%	40%	55%
Adjunct	0%	4%	16%	11%
Gender				
Female	76%	35%	46%	46%
Male	24%	65%	54%	54%

Conclusion

Although the aforementioned findings are reported in aggregate for institution types, you can conduct a similar analysis for the teacher education program at your institution. To start, identify the mathematics courses solely included in the programs of studies for preservice teachers. For these course offerings, classify the content (mathematical strand(s), incorporation of pedagogy) and gather instructor characteristics. To extend your analysis, organize the data according to certification level and examine whether your institution meets the *Mathematical Education of Teachers II (MET II)* (CBMS, 2012) recommendations for number and focus of mathematics content courses. For instance, MET II recommends that for the middle grades certification level, prospective teachers should complete at least five mathematics courses specifically designed for middle grades teachers,

with course content aligning to the first four mathematical strands in Table 2. The AMTE *SPTM* highlight connections to *MET II* related to mathematics content for each of the grade band elaborations.

The AMTE *SPTM* recommend that all stakeholders must be invested in and responsible for the preparation of teachers of mathematics, which involves mathematics content courses, methods and pedagogy courses, and clinical experiences. The present paper focuses on one of these aspects, mathematics content courses. The assessment of instructor characteristics identifies some key stakeholders involved in the mathematics preparation of teachers. This is a first step toward collaborative critical conversations reflecting upon and enhancing mathematics teacher preparation program characteristics and effectiveness.

References

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