SECONDARY MATHEMATICS METHODS COURSES: WHAT DO WE VALUE?

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Mathematics teacher education has been criticized, both internally and externally, for failing to identify shared practices and goals within teacher preparation programs. Work has begun to address this criticism at the elementary level but less exists at the secondary level. This paper reports on a national survey with responses from 116 secondary mathematics methods course instructors from colleges and universities. The purpose of the survey was to identify those topics, or "touchstones," in secondary methods courses that are widely valued. The survey asked participants to rank 41 potential "touchstones" of secondary mathematics methods courses on a scale from one to five according to those touchstones they value most in their methods courses. The results were quantitatively and qualitatively analyzed looking for important characteristics that would spur discussion about shared goals in secondary teacher preparation.

Keywords: Teacher Education-Preservice; Mathematical Knowledge for Teaching

Teacher preparation is striving for continual improvement, motivated both internally and by critiques from external entities. Within the teacher preparation community, scholars and practitioners consistently press for self-improvement through adherence to guiding principles (Grossman, Hammerness, & McDonald, 2009), attention to the needs of schools and communities (Darling-Hammond, 2006), and emphasis on evidence-based practices as shared through venues such as the *Mathematics Teacher Educator* journal. External groups, such as some economists (e.g., Harris & Sass, 2011) or the National Council on Teacher Quality, have also called for reform, citing the difficult-to-detect effects of teacher preparation programs on beginning teacher performance. There are counterarguments, however, to the external critiques (e.g., Heller, Segall, & Drake, 2013). For example, it is unwise to condemn university-based teacher preparation programs in general when they vary widely in their specific features.

Some of these varied features are the quantity or quality of field components, course requirements, the content of required courses, and the alignment and integration of various aspects of a preparation program. In mathematics teacher preparation, specifically, some scholars (Ebby, 2000; Youngs & Qiang, 2013) have focused on the importance of prospective teachers' field experiences and the alignment between those experiences and the kinds of mathematics instruction advocated in methods courses. Others have called for more content courses for prospective mathematics teachers (Conference Board of the Mathematical Sciences, 2012) or for thoughtful integration of mathematics subject matter in pedagogical methods courses (Burton, Daane, & Giesen, 2008; Steele & Hillen, 2012). These subject-specific teaching methods courses—in which prospective teachers develop skills and pedagogical content knowledge essential to them developing effective, ambitious, and manageable classroom practices—are commonly a central component of teacher preparation programs (Sowder, 2007) but the number, format, and foci of these courses vary widely from institution to institution (Kidd, 2008).

This study focuses specifically on the topics addressed in mathematics teaching methods courses because these courses are largely under the control of mathematics teacher educators and so can be a focused area of improvement to complement larger-scale programmatic efforts. We address secondary methods courses because of our experiences at this level and because it is less studied than methods courses at the elementary level. This study involved a survey of 116 methods instructors from across the United States for the purpose of determining what topics they value for inclusion in

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secondary mathematics methods courses. We sought to determine the extent to which secondary mathematics methods instructors agree in their valuations and to identify topics that are broadly valued by instructors that may potentially serve as shared foci, or what we refer to as *touchstones*, for these courses. By analyzing and discussing responses from a large number of mathematics teacher educators, we can, as a field, work to clarify and bring needed coherence to the curricula of these methods courses.

Background

With regard to research on mathematics methods course, much of the past work focused on courses for prospective elementary teachers. Mewborn (1999) and Ebby (2000), for example, analyzed prospective elementary teachers' reflections on and connections between these courses and their concurrent field experiences. Swars and colleagues (2009) traced changes in prospective elementary teachers' beliefs and specialized content knowledge as they progressed through a two-course methods sequence that had associated field experiences, finding that shifts in the prospective teachers' beliefs about mathematics teaching and learning and their sense of efficacy with mathematical content could be traced to specific features of the methods courses. Ball and colleagues (2009) have also worked on features of elementary methods courses, developing and studying curricula for such courses that include high-leverage teaching practices and aim to develop mathematical knowledge for teaching.

At the secondary level, some scholars have developed textbooks for methods courses (e.g., Posamentier & Smith, 2009; Rock & Brumbaugh, 2013) and there is a wide range of studies that examine specific topics within the context of methods courses (e.g., Stump, 2001) but not a great deal of research focused on the overall content of secondary methods courses explicitly. Two exceptions to this lack of research on methods courses overall are the work of Markovits and Smith (2008) and Steele and Hillen (2012), both of which deal with content-focused methods courses that integrate pedagogical development with the development of mathematical knowledge for teaching through "discernible mathematical and pedagogical storylines that are tightly connected" (Steele & Hillen, 2012, p. 54). For the present study, it is important to note that one principle for designing content-focused methods courses is to choose a narrow focus on a specific mathematical topic or pedagogical process. This choice, then, becomes centrally important to the methods course and the advocates of content-focused methods courses do not explicitly specify what those focal topics or processes should be. Our study is complementary because it concerns the specific topics that one might choose to include in a secondary methods course but it does not specify how one might design a coherent course around the chosen topics.

Currently, there are many different topics addressed in secondary mathematics methods courses (Arbaugh & Taylor, 2008; Kidd, 2008). In an article about elementary programs that applies equally well to secondary programs, Ball and colleagues (2009) argued that the lack of a shared professional curriculum for teacher preparation means that "[s]tudent teachers' learning opportunities reflect the orientations and expertise of their instructors and cooperating teacher" rather than "common agreements about the preparation required for initial practice" (p. 459). Although the lack of common agreements is certainly a concern, the diversity that currently exists provides a rich set of resources to draw upon as we work to establish common agreement.

To guide the field in drawing upon those resources and achieving systematic improvement, Arbaugh and Taylor (2008) laid out a framework adapted from Borko (2004). Their framework identifies three phases of research phases. The first phase involves studying a single course or single teacher preparation program. The second phase involves studying a single course or a single program feature that is enacted in multiple teacher preparation programs. The final phase compares multiple programs with varying features across multiple sites. Arbaugh and Taylor (2008) pointed out that

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"the vast majority of work in mathematics teacher education fails to surpass Phase 1" (p. 5). The research in Phase 1 provides a valuable literature base for the field, but the present study moves into Phase 2 by focusing on a specific program feature—secondary mathematics methods courses—across the United States and Canada. This is not to say that our study is the first endeavor into Phase 2 with respect to methods courses. Indeed, Taylor and Ronau (2006) analyzed 58 methods course syllabi from members of the Association of Mathematics Teacher Educators (AMTE) and found considerable variation in the types of assignments included on the syllabus and the stated goals and objectives for the courses. The present study complements Taylor and Ronau (2006) by focusing on topics within secondary mathematics methods courses rather than assignments and broad learning goals and by relying on instructor survey responses which can capture more than what is encoded in a syllabus.

We use the term "touchstone" to refer to potentially agreed-upon topics for inclusion in secondary mathematics methods courses. This term has historical roots in the notion of a physical, public stone to which community members could bring their precious metal to verify its authenticity. In our usage, we imagine a set of touchstones as a community-developed, public resource to which instructors could refer as they design and develop their own courses. We chose to use "touchstone" rather than the term "standard" because "standard" conveys an official or authoritative quality that we do not intend. Rather, if this initial work of identifying potential touchstones for secondary mathematics methods courses leads to a well-defined set, we intend for the set to form a resource that instructors have the option but not the obligation to adopt.

Toward that end, this study addresses the following questions: Which potential touchstones do instructors of secondary mathematics methods courses value the most highly? Which potential touchstones are valued to significantly different extents by different instructors?

Method

Survey

Drawing on seminal research in the field related to mathematics teaching and teacher education (e.g., Arbaugh& Taylor, 2008; Schoenfeld & Kilpatrick, 2008; Swars et al., 2009) as well as our own experiences with secondary mathematics methods courses, we compiled a list of potential touchstones to be used in a survey for methods instructors. Examples of these touchstones are "Enacting mathematical tasks," "Formative assessment," and "Digital tools and technologies (e.g., calculators)." We piloted this list with approximately 20 instructors and asked whether items could be removed or whether items we had omitted should be added. Revision then yielded a list of 41 potential touchstones (see Appendix) that we used for this study. Our goal for the list was to balance comprehensiveness and specificity by covering a full spectrum of topics without overwhelming survey respondents with an inordinate number of options or with options that were too closely related to allow for meaningful distinctions.

We chose to supply a predetermined list of touchstones rather than ask open-ended questions because an open-ended approach would have likely led to a wide variety of phrasing and terminology in the responses and possible idiosyncrasies of meaning, as described by Kidd (2008), that we would then have to interpret and categorize with possible concerns for the internal validity of the analysis. We recognize that, with a predetermined list, respondents also have to engage in interpretation of what we mean with various phrasing of the touchstones, but we felt there would be less variability in the respondents' interpretations as readers of touchstones than there would be in their responses as writers of touchstones. Furthermore, it is possible that, when responding to an open-ended question, a respondent may inadvertently omit a topic that is actually quite valuable to them only because they did not happen to bring it to mind in the few minutes they were responding to the survey. With the

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predetermined list, we were able to go through a multi-step process to assure that there were no serious omissions and we also included an open-ended item at the end of the survey asking respondents to list any touchstones that they highly value but were not on the list. Finally, the predetermined list lessened the time demands on the respondents and thus likely increased the response rate.

The survey was administered electronically with the following prompt: "Please tell us how important you feel it is for each of the following content items to be valued and addressed by secondary mathematics methods courses for preservice teachers." The 41 touchstones were then listed with a five-point Likert scale ranging from "Not important" to "Very important." We chose to ask about the instructors' values rather than about their actual practice because the latter may elicit what instructors feel obligated to teach or what they are able to address in a limited timeframe rather than what they value in an ideal sense. In addition to the open-ended item about missing touchstones, there was also an open-ended item for general comments. The survey then gathered demographic information including professional title, secondary methods teaching experience, and academic home (e.g., college of education, department of mathematics).

Participants

The survey was sent to the approximately 940 members of AMTE, with the invitation email explicitly asking for responses from those involved in secondary mathematics methods courses. An item on the survey was used to verify that respondents were secondary methods instructors as opposed to other members of AMTE. Members of AMTE were chosen because the association is professional peers within the field who would most like participate and find value in the results of this study. It should be noted that AMTE's membership is not necessarily representative of all mathematics teacher educators in the United States but rather those who are active with regard to professional organizations of teacher educators. Thus our results should not be construed as the representative values of secondary mathematics methods instructors in general. The results, however, can be interpreted as representing the values of many of the leaders in mathematics teacher education and those likely to be involved in shaping future directions in the field.

We received 129 responses and included 116 responses in the analysis. Of these, 70 were from individuals in colleges of education and 36 were from individuals in mathematics departments. The remaining 10 individuals had either joint appointments or another situation.

Data and Analysis

The data were analyzed using quantitative and qualitative methods as the data included numerical and free responses. First, the data were compiled on the 41 touchstones to determine basic descriptive statistics (mean, standard deviation) to understand which touchstones participants valued the most and the least. Independent t-tests and analyses of variants (ANOVA) were used to determine if certain groups separated by department or professional title varied significantly in how they valued any of the 41 touchstones. Second, the free responses were qualitatively analyzed to determine what touchstones participants perceived as missing and to identify themes in any of the additional comments offered.

Results

Due to space limitations, only the overall valuations of the touchstones and comparisons according to academic home will be reported in this paper.

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Descriptive Statistics

Table 1 lists the 41 touchstones ordered by mean values. Note that every touchstone had a rating above 2.5 out of 5, which lends internal validity to the set of potential touchstones. Nineteen of the 41 touchstones had means within one standard deviation of the highest-rated touchstone and 0

Table 1: Touchstones Ordered by Mean Value

Touch stone	Description	Mean	St. Dev.
TS4	understanding of practice/process standards (e.g., CCSS, NCTM, NRC)	4.71	0.56
TS16	multiple representations of mathematical ideas	4.68	0.57
TS28	attending to student thinking and using student ideas to push understanding forward	4.68	0.58
TS35	mathematical knowledge for teaching	4.68	0.64
TS8	adapting, choosing, and generating mathematical tasks	4.61	0.59
TS20	productive classroom discourse	4.59	0.61
TS9	enacting mathematical tasks	4.55	0.68
TS6	lesson and unit planning	4.53	0.67
TS7	cognitive features of mathematical tasks	4.48	0.67
TS3	understanding of content standards (e.g., CCSS, state, district, school)	4.48	0.68
TS17	the relationship between conceptual and procedural knowledge	4.47	0.68
TS11	formative assessment (on-going assessment)	4.44	0.74
TS29	motivating students to persevere and take risks	4.36	0.76
TS36	reflection on practice and development as a professional educator	4.35	0.69
TS10	informal assessment (e.g., observation, conversations with students)	4.34	0.79
TS5	choosing and writing instructional goals	4.28	0.8
TS21	positive classroom culture	4.26	0.79
TS37	repertoires of effective mathematical teaching practices and pedagogical tools	4.22	0.74
TS18	pedagogies that address different types of knowledge and skills (e.g., procedural, conceptual, strategic, declarative)	4.17	0.83
TS25	digital tools and technologies (e.g., calculators)	4.14	0.72
TS34	mathematical content knowledge	4.13	0.91
TS30	nature of problem-solving	4.11	0.81
TS23	roles of the mathematics teacher (e.g., teacher as guide, teacher as lecturer)	4.11	0.84
TS26	analog tools and technologies (e.g., manipulatives)	4.05	0.78
TS14	issues of equity, status, fairness, and social justice	4.05	0.93
TS24	mathematical applications or mathematics in context	4.03	0.84
TS12	summative assessment to assess student understandings	3.98	0.78
TS15	needs of underrepresented populations	3.98	0.95
TS1	curriculum vision	3.91	0.86
TS2	knowledge of written curriculum materials	3.81	0.81
TS31	students' metacognitive skills	3.78	0.81
TS27	classroom management that supports cultural and learning goals	3.77	0.95
TS40	learning theories and applications to practice	3.73	0.89
TS22	sociomathematical norms	3.73	0.95
TS19	relationship between participation structures (e.g., pair work, complex instruction) and cultural and learning goals	3.72	0.97
TS33	personal and societal beliefs about teaching and learning mathematics	3.62	1.07

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TS13	expectations, purposes, and design of homework	3.61	0.88
TS39	teaching theories and applications to practice	3.54	0.88
TS38	read educational research	3.38	0.9
TS32	history and nature of mathematics	3.09	0.94
TS41	do educational research (e.g., Action Research)	2.78	1.07

touchstones had a mean near the "not important" or "less important" ratings, indicating that the respondents tended to value a large portion of the potential touchstones. Only 32 out of 116 respondents made any suggestion of additional touchstones and most were singular suggestions (e.g., working with parents). Seven additional touchstones were suggested by at least two respondents. One related to reflecting on practice was mentioned in some form 5 times and another related to learning trajectories was mentioned 4 times.

Comparison by Department

Focusing on respondents from colleges of education or mathematics departments, and using an alpha level of 5%, we found statistically significant differences between the valuations of five touchstones (see Table 2). As there were nearly twice as many participants in educational departments (70) to those in mathematics departments (36), assuming equal variance was not possible in every case. Thus we ran independent *t*-test comparisons with equal variance assumed or not assumed as appropriate according to Levene's statistic ($p<0.05$).

Table 2: Touchstones that varied significantly by respondents' department

Touchstone	TS3	TS9	TS10	TS14	TS15
Description	understanding of content standards (e.g, CCSS, state, district, school)	enacting mathematical tasks	informal assessment (e.g., observation, conversations with students)	issues of equity, status, fairness, and social justice	needs of underrepresented populations
Equal Variance	Not Assumed	Not Assumed	Assumed	Not Assumed	Not Assumed
***t*-score**	3.399	-2.288	-3.258	-3.205	-3.601
df	96.557	62.510	104	53.573	55.199
***p*-value**	0.001	0.026	0.002	0.002	0.001
Education Department Mean	4.429	4.686	4.529	4.271	4.271
St. Dev.	0.627	0.627	0.583	0.779	0.779
Mathematics Department Mean	4.778	4.361	4.028	3.611	3.556
St. Dev.	0.422	0.723	1.000	1.103	1.054

Table 2 shows that understanding content standards (TS3) varied significantly, with participants from mathematics departments valuing it more than participants from colleges of education. On the other hand, enacting mathematical tasks (TS9), informal assessment (TS10), issues of equity, status, fairness, and social justice (TS14), and needs of underrepresented populations (TS15) were valued more highly by those in colleges of education than in mathematics departments.

Bartell, T. G., Bieda, K. N., Putnam, R. T., Bradfield, K., & Dominguez, H. (Eds.). (2015). *Proceedings of the 37th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. East Lansing, MI: Michigan State University.

Discussion

The purpose of this study is to spur conversation amongst mathematics teacher educators about what we value with regard to topics in secondary mathematics methods courses. Based on our survey results, part of this conversation can be the idea of a set of touchstones for secondary methods courses, possibly consisting of those items valued most highly by our respondents. We found the notion of preservice secondary mathematics teachers coming to understand process standards (NCTM, 2000) or the Standards for Mathematical Practice (NGO & CCSSO, 2010) to be valued the most highly. Also valued very highly were the notions of using multiple mathematical representations, attending to student thinking and student ideas, and developing the preservice teachers' mathematical knowledge for teaching. These touchstones and others align with ongoing national efforts focused on mathematics education in general, such as the National Council of Teachers of Mathematics' (2014) *Principles to Actions*, which laid out eight effective teaching practices that are largely consonant with the highest rated touchstones.

Our results also confirm past work (e.g., Taylor & Ronau, 2006) showing that mathematics teacher education as a field places high value on a wide range of topics and activities. Although the set of touchstones covers a vast array of topics, each of which could easily warrant extended attention and development, results show nearly all of it being valued for inclusion in secondary methods courses. In other words, we may as a field be a bit too ambitious, especially considering the issue of limited time with which to address these touchstones in methods courses specifically. This concern was raised several times in the comment section of our survey and thus is worth discussing. One way to address the time constraints is to move certain touchstones to other facets of teacher preparation programs besides methods courses. Another way to address time constraints is to remove some of the lesser-valued touchstones from consideration, perhaps because they are unnecessary, such as having preservice teachers read or conduct empirical research, or because they are better suited for development for inservice teachers, such as the role of sociomathematical norms in classrooms or the applications of learning theories to practice. To be clear, we are not suggesting specific remedies for this dilemma, but the results presented here can form an empirical basis on which to make these decisions rather than relying solely on the idiosyncrasies of individual instructors as critiqued by Ball and colleagues (2009).

This study is a modest effort in Phase 2 of Arbaugh and Taylor's (2008) roadmap for research on mathematics teacher education. We have gathered input from methods instructors from across the country, representing many different teacher preparation programs. Yet, future research can go further to gather more detailed data to allow for the examination of the ways in which respondents interpreted the touchstones presented here. Moreover, future research could bridge the gap between what we value for methods courses in an ideal sense and what is actually occurring in the methods courses. Some of this work is already underway via the Mathematics Teacher Education Partnership (MTEP), which is a consortium of secondary mathematics teacher educators from 30 states and 69 universities formed to coordinate improvement of secondary mathematics teacher preparation. The results presented here can inform MTEP and other similar efforts to identify what we value in the field and what we want to emphasize with preservice teachers in the limited opportunities that we have to interact with them.

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References

Arbaugh, F., & Taylor, P. M. (2008). Inquiring into mathematics teacher education. In F. Arbaugh & P. M. Taylor (Eds.),*Inquiry into mathematics teacher education* (pp. 1–9). San Diego, CA: AMTE.

Ball, D. L., Sleep, L., Boerst, T. A., & Bass, H. (2009). Combining the development of practice and the practice of development in teacher education. *The Elementary School Journal, 109*, 458–474.

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher, 33*(8), 3–15.

Burton, M., Daane, C. J., & Giesen, J. (2008). Infusing mathematics into a methods course: Impacting content knowledge for teaching. *Issues in the Undergraduate Mathematics Preparation of School Teachers*, *1*, 1–12.

Conference Board of the Mathematical Sciences. (2012). *The mathematical education of teachers II*. Providence, RI, and Washington, DC: American Mathematical Society & Mathematical Association of America.

Darling-Hammond, L. (2006). Constructing 21st-Century teacher education. *Journal of Teacher Education, 57*, 300–314.

Ebby, C. B. (2000). Learning to teach mathematics differently: The interaction between coursework and fieldwork for preservice teachers. *Journal of Mathematics Teacher Education, 3*, 69–97.

Grossman, P., Hammerness, K., & McDonald, M. (2009). Redefining teaching, re-imagining teacher education. *Teachers and Teaching: Theory and Practice, 15*, 273–289.

Harris, D. N., & Sass, T. R. (2011). Teacher training, teacher quality and student achievement. *Journal of Public Economics*, *95*, 798–812.

Heller, D., Segall, A., & Drake, C. (2013, December 11).An open letter to NCTQ on teacher prep. *Education Week*. Retrieved from http://www.edweek.org/ew/articles/2013/12/11/14heller.h33.html on January 17, 2015.

Kidd, M. (2008). A comparison of secondary mathematics methods courses in California. In P. M. Lutz (Ed.), *Secondary mathematics methods courses in California*. California Association of Mathematics Teacher Educators.

Markovits, Z., & Smith, M. (2008). Cases as tools in mathematics teacher education. In D. Tirosh & T. Wood (Eds.), *International Handbook of Mathematics Teacher Education: Tools and Processes in Mathematics Teacher Education* (Vol. 2, pp. 39–64). Rotterdam: Sense Publishers.

Mewborn, D. S. (1999).Reflective thinking among preservice elementary mathematics teachers. *Journal for Research in Mathematics Education, 30*, 316–341.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. Reston, VA: Author.

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common Core State Standards for Mathematics*. Washington, DC: Author.

Schoenfeld, A. H., & Kilpatrick, J. (2008). Toward a theory of proficiency in teaching mathematics. In D. Tirosh & T. Wood (Eds), *The international handbook of mathematics teacher education* (Volume 2, pp. 321–354). Rotterdam: Sense Publishers.

Sowder, J. T. (2007). The mathematical education and development of teachers. In F. K. Lester, Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 157–223). Reston, VA: National Council of Teachers of Mathematics.

Steele, M. D., & Hillen, A. F. (2012). The content-focused methods course: A model for integrating pedagogy and mathematics content. *Mathematics Teacher Educator, 1*, 53–70.

Stump, S. L. (2001). Developing preservice teachers' pedagogical content knowledge of slope. *Journal of Mathematical Behavior, 20*, 207–227.

Swars, S. L., Smith, S. Z., Smith, M. E., & Hart, L. C. (2009).A longitudinal study of effects of a developmental teacher preparation program on elementary prospective teachers' mathematics beliefs. *Journal of Mathematics Teacher Education, 12*, 47–66.

Taylor, P. M., & Ronau, R. (2006). Syllabus study: A structured look at mathematics methods courses. *AMTE Connections*, *16*(1), 12–15.

Youngs, P., & Qian, H. (2013). The influence of university courses and field experiences on Chinese elementary candidates' mathematical knowledge for teaching. *Journal of Teacher Education*, *64,* 244–261.

Bartell, T. G., Bieda, K. N., Putnam, R. T., Bradfield, K., & Dominguez, H. (Eds.). (2015). *Proceedings of the 37th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. East Lansing, MI: Michigan State University.