

MOTIVATION AND CONTEXT

The mission of the Association of Mathematics Teacher Educators (AMTE) is to promote the improvement of mathematics teacher education Pre-K–12. Two of the organization's stated goals focus on effective mathematics teacher education programs and advocacy for effective policies and practices related to mathematics teacher education at all levels. As the lead organization for mathematics teacher education in the United States, AMTE puts forth the Standards for Preparing Teachers of Mathematics (SPTM) as an aspirational vision that will support candidates in becoming effective teachers of mathematics who have the knowledge and skills to support each and every student in their future classrooms.

AMTE, in the *Standards for Preparing Teachers of Mathematics*, puts forward a national vision of initial preparation for all Pre-K–12 teachers who teach mathematics. *SPTM* pertains not only to middle and high school mathematics teachers who may teach mathematics exclusively but also to elementary school teachers teaching all disciplines, special education teachers, teachers of emergent multilingual students, and all other teaching professionals and administrators who have responsibility for students' mathematical learning. *SPTM* has broad implications for teacher preparation programs, in which stakeholders include faculty and administrators in both education and mathematics at the university level; teachers, principals, and district leaders in the schools with which preparation programs partner; and the communities in which preparation programs and their school partners are situated.

SPTM is intended as a national guide that articulates a vision for mathematics teacher preparation and supports the continuous improvement of teacher preparation programs. Such continuous improvement includes changes to preparation program courses and structures, partnerships involving schools and universities and their leaders, the ongoing accreditation of such programs regionally and nationally, and the shaping of state and national mathematics teacher preparation policy. *SPTM* is also designed to inform accreditation processes for mathematics teacher preparation programs, to influence policies related to preparation of teachers of mathematics, and to promote national dialogue around preparing teachers of mathematics. The vision articulated in *SPTM* is aspirational in that it describes a set of high expectations for developing a well-prepared beginning mathematics teacher who can support meaningful student learning. The vision is research-based and establishes a set of goals for the continued development and refinement of a mathematics teacher preparation program and a research agenda for the study of the effects of such a program.

SPTM contains detailed depictions of what a well-prepared beginning teacher knows and is able to do related to content, pedagogy, and disposition, and what a strong preparation program entails with respect to learning experiences, assessments, and partnerships. Stakeholders in mathematics teacher preparation will find messages related to their roles.

STAKEHOLDER ROLE

MESSAGES RELATED TO THE ROLE



For **education faculty members or administrators** in a university setting

The standards guide discussions related to teacher preparation program design, policy, and practice.



For **mathematics faculty members or administrators** in a university setting

The standards provide targeted guidance for the content preparation of all prospective teachers.



For **Pre-K–12 teachers, principals, or district leaders**

The standards illustrate the aspects of productive school-university partnership and the specific pedagogical practices and dispositions that mentor teachers foster in student teachers.



For **state and national education policymakers**

The standards serve as a guide for the design of standards for state teacher licensure and national program accreditation, as well as informing national discussion and action related to education policy.



For **families, community members, and business leaders** concerned with mathematics education

The standards describe productive ways in which the larger community can collaborate with schools and universities to foster a productive vision of mathematics teaching.

Standards for Preparing Teachers of Mathematics includes standards and indicators for teacher candidates and for the design of teacher preparation programs. *SPTM* outlines assessment practices related to overall quality, program effectiveness, and candidate performance. *SPTM* describes specific focal practices by grade band and provides guidance to stakeholders regarding processes for productive change. These standards rest on five key assumptions that frame the vision that *SPTM* promotes.

UNDERLYING ASSUMPTIONS

- ASSUMPTION 1** Ensuring the success of every learner demands a deep, integrated focus on equity in every program that prepares teachers of mathematics.
- ASSUMPTION 2** Teaching mathematics effectively requires career-long learning about teaching mathematics.
- ASSUMPTION 3** Learning to teach mathematics requires a central focus on mathematics.
- ASSUMPTION 4** Multiple stakeholders should be responsible for and invested in preparing teachers of mathematics.
- ASSUMPTION 5** Those involved in mathematics teacher preparation must be committed to improving their effectiveness in preparing future mathematics teachers.

These five assumptions serve as a foundation for the specific standards and indicators in *SPTM*, the guidance on assessment of programs and candidates, and the recommendations for action. The view that a focus on equity should be pervasive across program experiences underlies the assumptions. The collaborative nature of mathematics teacher preparation is represented in the description of multiple stakeholders; this idea in conjunction with Assumptions 1 and 3 implicates all these stakeholders in considering how to prepare teachers with strong content knowledge and in ways that attend to equity of candidates and the students they will teach. According to Assumption 5, across the areas of content, pedagogy, partnerships, and dispositions, programs must continuously assess their effectiveness. The elaborated standards and indicators describe goals for candidates and programs—goals that embody these five assumptions. The work of building, implementing, assessing, and revising mathematics teacher preparation programs at all levels must include explicit attention to these five assumptions.

THE STANDARDS

SPTM articulates a set of high expectations for what well-prepared beginning teachers of mathematics should know and be able to do as well as characteristics for effective programs that prepare teachers. As such, the standards address **candidate knowledge, skills, and dispositions** and the **program characteristics** that will support the development of candidate knowledge, skills, and dispositions. Each standard is associated with a set of **indicators** that elaborate the standard in more detail and provide a guide for stakeholders to interpret and apply the standard.

CANDIDATE KNOWLEDGE, SKILLS, AND DISPOSITIONS

In Chapter 2, *SPTM* includes four equally important and interrelated standards that are focused on and describe the knowledge, skills, and dispositions that well-prepared beginners should attain. The focus on the importance of mathematical understanding throughout all four candidate standards and across all grade bands is intentional. Well-prepared beginning teachers of mathematics need not only to have deep mathematical knowledge relevant to teaching but also to situate their mathematical knowledge for teaching in their learning of effective strategies for teaching mathematics and in understanding their students' mathematical knowledge, skills, and dispositions. Initial preparation that is focused on candidates' knowledge of the subject, of curriculum, and of how students learn mathematics is more effective than general methods coursework focused on generic teacher behaviors that might be unrelated to the content itself. Well-prepared beginning teachers should have knowledge of the social, historical, and institutional contexts that affect teaching and learning; thus, the reader will see the themes of equity and access interwoven throughout the standards.

STANDARDS FOR WELL-PREPARED BEGINNING TEACHERS OF MATHEMATICS

C.1 MATHEMATICS CONCEPTS, PRACTICES, AND CURRICULUM

Well-prepared beginning teachers of mathematics possess robust knowledge of mathematical and statistical concepts that underlie what they encounter in teaching. They engage in appropriate mathematical and statistical practices and support their students in doing the same. They can read, analyze, and discuss curriculum, assessment, and standards documents as well as students' mathematical productions.

C.2 PEDAGOGICAL KNOWLEDGE AND PRACTICES FOR TEACHING MATHEMATICS

Well-prepared beginning teachers of mathematics have foundations of pedagogical knowledge, effective and equitable mathematics teaching practices, and positive and productive dispositions toward teaching mathematics to support students' sense making, understanding, and reasoning.

C.3 STUDENTS AS LEARNERS OF MATHEMATICS

Well-prepared beginning teachers of mathematics have foundational understandings of students' mathematical knowledge, skills, and dispositions. They know how these understandings can contribute to effective teaching and are committed to expanding and deepening their knowledge of students as learners of mathematics.

C.4 SOCIAL CONTEXTS OF MATHEMATICS TEACHING AND LEARNING

Well-prepared beginning teachers of mathematics realize that the social, historical, and institutional contexts of mathematics affect teaching and learning and know about and are committed to their critical roles as advocates for each and every student.

PROGRAM CHARACTERISTICS TO DEVELOP CANDIDATE KNOWLEDGE, SKILLS, AND DISPOSITIONS

Although teacher preparation programs take various forms across states and in different institutions within states, some qualities are important for all effective mathematics teacher preparation programs to support their candidates' development of the knowledge, skills, and dispositions needed to be well-prepared beginners. The five standards in Chapter 3 describe those characteristics and qualities of effective mathematics teacher preparation programs. These standards address the capacity of the program to provide opportunities to learn mathematics for teaching, to learn to teach mathematics effectively, and to learn in clinical settings. These standards also describe the role of partnerships among stakeholders at all levels and practices for both recruiting and retaining candidates into mathematics teacher preparation programs.

Throughout the program standards, attention to equity, diversity, and social justice is evident. To meet the vision of effective mathematics teaching and learning for each and every student, equity must be a lens through which stakeholders view all aspects of mathematics teacher preparation programs. Effective programs address equity issues within mathematics methods courses or in program experiences focused specifically on mathematics; the program standards address the prevalence of deficit-thinking models and the need to help teacher candidates build a new framework that is supportive of each and every learner.

STANDARDS FOR EFFECTIVE PROGRAMS FOR PREPARING BEGINNING TEACHERS

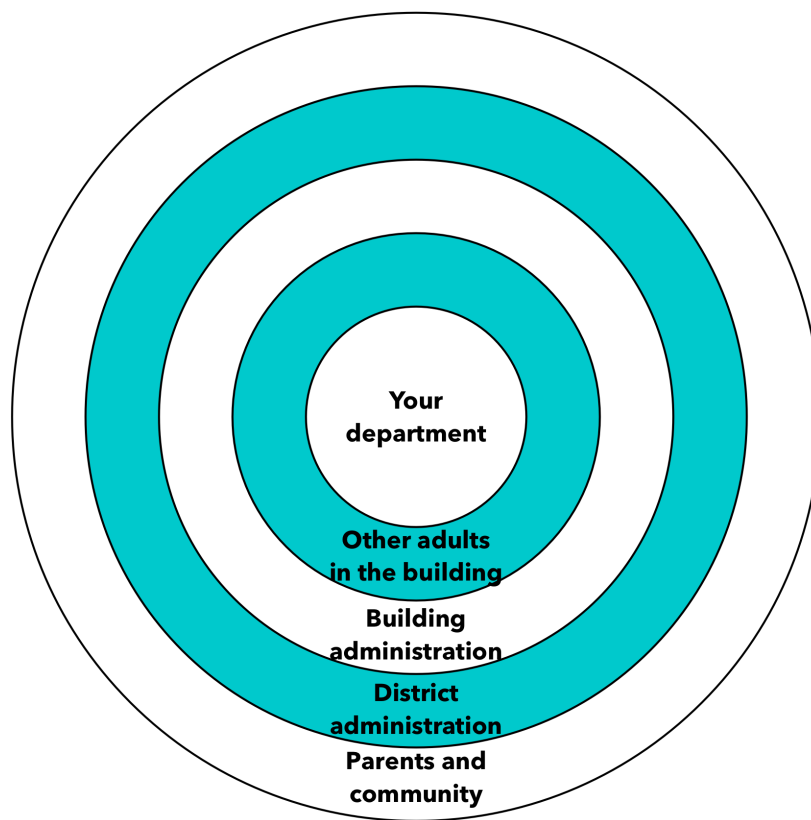
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| P.1 | ESTABLISH PARTNERSHIPS | An effective mathematics teacher preparation program has significant input and participation from all appropriate stakeholders. |
| P.2 | OPPORTUNITIES TO LEARN MATHEMATICS | An effective mathematics teacher preparation program provides candidates with opportunities to learn mathematics and statistics that are purposefully focused on essential big ideas across content and processes that foster a coherent understanding of mathematics for teaching. |
| P.3 | OPPORTUNITIES TO LEARN TO TEACH MATHEMATICS | An effective mathematics teacher preparation program provides candidates with multiple opportunities to learn how to teach through mathematics-specific methods courses (or equivalent professional learning experiences) in which mathematics, practices for teaching mathematics, knowledge of students as learners, and the social contexts of mathematics teaching and learning are integrated. |
| P.4 | OPPORTUNITIES TO LEARN IN CLINICAL SETTINGS | An effective mathematics teacher preparation program includes clinical experiences that are guided on the basis of a shared vision of high-quality mathematics instruction and have sufficient support structures and personnel to provide coherent, developmentally appropriate opportunities for candidates to teach and to learn from their own teaching and the teaching of others. |
| P.5 | RECRUITMENT AND RETENTION OF TEACHER CANDIDATES | An effective mathematics teacher preparation program attracts, nurtures, and graduates high-quality teachers of mathematics who are representative of diverse communities. |

Excerpts from A Quiet Revolution: One District's Story of Radical Curricular Change in High School Mathematics

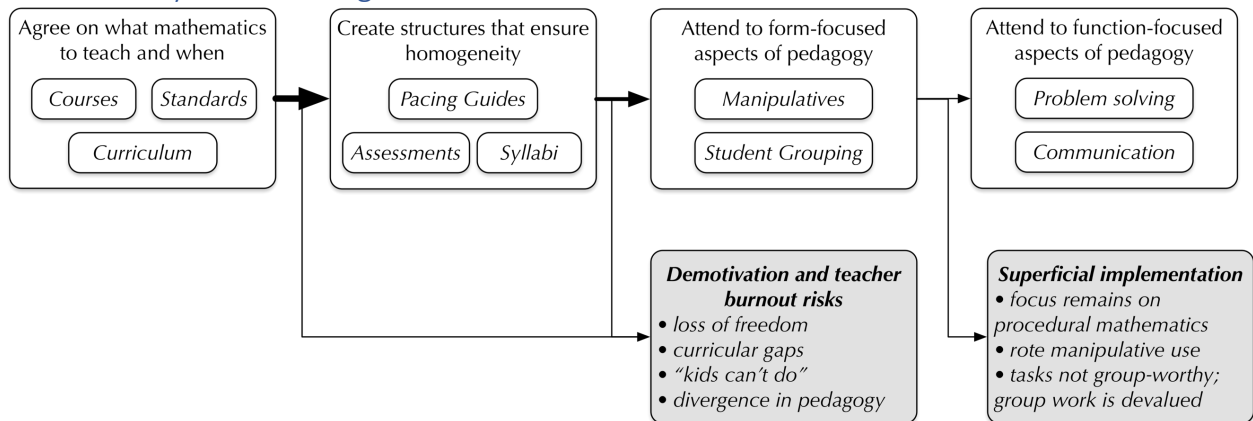
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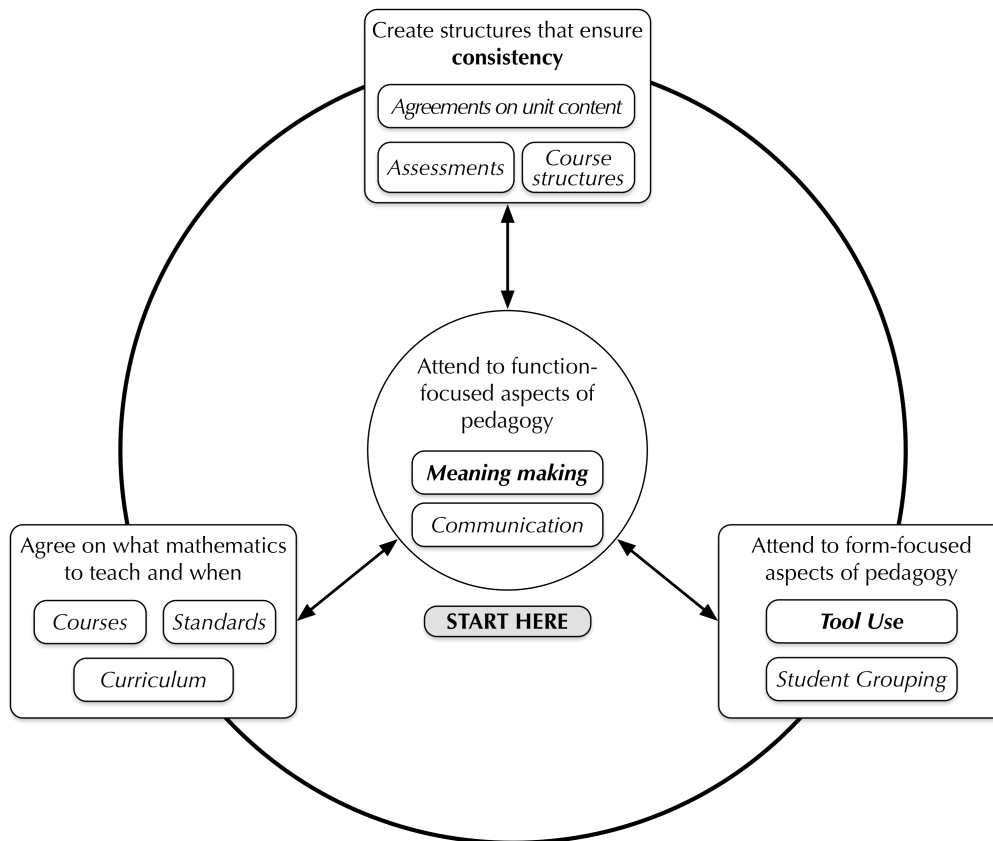
Circles of Encumbrance



Models of Systemic Change: Traditional



Models of Systemic Change: Holt's Way





STANDARD P.1. PARTNERSHIPS

An effective mathematics teacher preparation program has significant input and participation from all appropriate stakeholders.

The Council for the Accreditation of Educator Preparation (CAEP) (2013) has described the need for and characteristics of effective partnerships. The Association of Public Land-Grant Universities' (APLU) Mathematics Teacher Education Partnership has developed Guiding Principles for Secondary Mathematics Teacher Preparation Programs (Mathematics Teacher Education Partnership, 2014) to provide guidance to educators in partner institutions to educate secondary mathematics teachers. These and other documents can help guide the establishment of the partnership.

Strong partnerships engage all partners in developing a common vision and identifiable goals. As argued by the National Association for Professional Development Schools (2008), a common vision must be focused on “the advancement of the education profession and the improvement of P-12 learning” (p. 3). More specifically, this vision should lead to identifiable goals that promote “professional growth across the continuum of preservice teacher candidates, in-service educators, and college/university faculty and administrators” (p. 4).

While members of the partnership may include a broad range of stakeholders, the partnership *must* include mathematics teacher educators and researchers, their teacher preparation colleagues, Pre-K–12 educators and administrators, mathematicians, statisticians and statistics educators, community-based organizations and community members, and representatives from business and industry. Leadership for creating and sustaining the partnership will typically fall to the mathematics teacher educator.

We envision this group working within a professional council of stakeholders. This council is responsible for reviewing the partnership and verifying that the partnership is inclusive of all stakeholders. Partners recognize that for a collaboration to be successful, it must have systematic ways of verifying that the partnership is mutually beneficial.

Indicator P.1.1. Engage All Partners Productively

An effective teacher preparation program benefits from an interdisciplinary collaborative partnership that is a shared endeavor focused on the preparation of mathematics teachers who are well prepared to improve Pre-K–12 student learning in mathematics from multiple perspectives.

These types of partnerships inform different facets of mathematics teacher preparation based on the wisdom of practice and solid theoretical and research-based knowledge and do so in concert with practitioners to prepare effective mathematics teachers for work in diverse schools.

Mathematics teacher educators (MTEs) provide leadership to ensure that the partners recognize the complex nature of mathematics teaching and learning and respect the contributions needed from each partner. MTEs play a central role in ensuring that the program supports the preparation of well-prepared beginners. The partnership is enhanced by the contributions of research scholars who ensure that the program is designed using the best available knowledge.

The partnership includes active participation by **faculty who teach mathematics and statistics** courses. According to *The Mathematical Education of Teachers II (MET II, CBMS, 2012)*, “Teacher education should be recognized as an important part of a mathematics department’s mission and should be undertaken in collaboration with mathematics education faculty” (p. 19). In addition, “Prospective teachers need mathematics courses that develop a solid understanding of mathematics they will teach;” further, mathematics departments

should offer a minimum of “three courses with a primary focus on high school mathematics from an advanced viewpoint” (p. 62). When these criteria are met, an institution’s mathematics teacher educators are positioned to partner with mathematics and statistics faculty to ensure that both mathematics courses and mathematics education courses are designed to educate well-prepared beginning teachers. Some students in undergraduate teacher preparation programs begin their higher education at a community college, where they may be taking required mathematics courses for the program. Thus, it is important that partnerships also be formed with mathematics and statistics faculty at community colleges, to ensure that the content courses they offer meet the needs of prospective teachers of mathematics.

An effective partnership requires **collaboration with faculty** in social foundations, special education, educational psychology, educational leadership, and learning technologies as well as faculty in other disciplines who teach courses in teacher preparation, such as statistics educators and engineering educators.

The engagement of **Pre-K–12 school-based personnel** is essential to the partnership. Through shared responsibility, mathematics teacher preparation programs can integrate coursework, theory, and pedagogy. The partnership must ensure that future teachers have high-quality school-based experiences that are needed to educate well-prepared beginners and support the development of candidates’ skills as related to the needs of schools and school districts. Similarly, close cooperation with preparation programs helps districts hire teachers who are prepared to be effective in their schools. Building these partnerships not only supports candidates’ learning but also deepens classroom teachers’ knowledge of mathematics content and pedagogy to support their students’ learning.

Families and community leaders are important but often overlooked participants in teacher preparation partnerships. When mathematics teacher educators collaborate with families and leaders in the community, they can design learning experiences that help prepare teachers to better understand family and community cultural perspectives, the various activities and responsibilities students have in their homes and communities, the kinds of mathematics that are performed by community members in their jobs, and the values that are highly regarded. In this way, mathematics teacher educators can help the beginning teacher to reflect on and build lessons and classroom cultures that support students to be themselves and be experts in ways that others in the classroom (including the teacher) may not be.

Members of an effective partnership collaborate with families and community leaders to create activities that are immediately and mutually beneficial for the beginning teacher and students. Such activities could include students’ learning mathematics with and from beginning teachers and others in community spaces (e.g., public libraries, Boys & Girls clubs, community centers, or places of worship).

Partnering with **business and industry representatives** helps candidates see the uses of mathematics, technology, and statistics in real-world contexts and ways these partners can assist in supporting students and teachers in learning more about these uses.

Indicator P.1.2. Provide Institutional Support

Institutional commitment for a strong mathematics teacher education program includes institutional support for mathematics teacher educators’ career trajectories and appropriate rewards for both their institution and school-based partners.

To have a high-quality teacher preparation program, an institution must provide the resources and the support needed to achieve this vision. In particular, the preparation program’s reward structures, including awards, commendations, salaries, and promotion and tenure criteria, must clearly support this work. Mathematics teacher preparation cannot be viewed as a duty or chore delegated to graduate assistants or instructors but rather a core activity of all involved departments.

Institutions must support program-improvement activities, including supporting mathematics teacher educators' attendance at relevant professional conferences so they may learn about other high-quality programs. For example, attending any or all of the following could expand faculty members' awareness of effective program components: the annual meetings of the Association of Mathematics Teacher Educators (AMTE), the Council of Exceptional Children (CEC) Teacher Education Division (TED), and the Professional Development Schools (PDS) conference.

Institutions must provide resources necessary to support teaching and learning. Mathematics teacher educators need access to the materials vital to teaching mathematics in Pre-K–12 schools to prepare beginning teachers for the classrooms in which they will teach. For example, faculty teaching a mathematics methods course should have access to textbooks, online resources, and other instructional materials used by Pre-K–12 teachers in their area to help beginning teachers learn to use curriculum materials effectively.

Education Preparation Providers (EPPs) must value the work involved in developing and improving mathematics teacher education programs. Such work includes communication and collaboration with stakeholders, program-assessment work, and work related to program reviews and meeting program standards. This important work must be valued in the promotion and tenure process.



STANDARD P.2. OPPORTUNITIES TO LEARN MATHEMATICS

An effective mathematics teacher preparation program provides candidates with opportunities to learn mathematics and statistics that are purposefully focused on essential big ideas across content and processes that foster a coherent understanding of mathematics for teaching.

Developing candidates' knowledge of mathematics concepts and practices relevant to teaching must be a priority in an effective teacher preparation program, and developing such knowledge is a career-long endeavor. As addressed in the preface, we use the term *mathematics* to encompass mathematics and statistics because school mathematics teachers are responsible for instruction in both content areas of mathematics and statistics. In instances in which the distinction between mathematics and statistics is important, statistics is identified separately. Within a mathematics teacher preparation program, a variety of individuals provide opportunities for candidates to learn mathematics content. Regardless of their departmental affiliations or academic backgrounds, whether they are employed by a university or a school district, each of these individuals must be considered part of the community of mathematics teacher educators. The responsibility for ensuring appropriate opportunities for candidates to learn mathematics is the joint responsibility of all such mathematics teacher educators.

The NCTM/CAEP Standards (NCTM & CAEP, 2012a, 2012b) describe specific content requirements for secondary mathematics candidates, and *The Mathematical Education of Teachers II (MET II)* (CBMS, 2012) and *Statistical Education of Teachers (SET)* (Franklin et al., 2015) provide specific guidance on the mathematics courses required for teaching at the elementary, middle, and high school levels; these requirements and guidelines are summarized in Table 3.2. **We take these recommendations as the minima for effective mathematics teacher preparation.** More detailed discussion of the mathematics-content expectations is provided in Chapters 4 through 7 of this document.