# 5D

## Information

*Professional Services Committee*

## Update on the Work of the Teaching Mathematics Advisory Panel and Introduction of Draft Standards

**Executive Summary:** At its December 2008 meeting, the Commission directed that an advisory panel be convened to study the mathematics specialist authorization. This agenda item provides an update on the work to date of the Teaching Mathematics Advisory Panel. In addition, this item presents proposed revisions to Standard 8-A: Pedagogical Preparation for Mathematics Content Instruction for Multiple Subject (MS) candidates and introduces a proposed revised Mathematics Specialist authorization structure with associated draft preparation program standards.

**Recommended Action:** For information only

**Presenters:** Rebecca Parker, Consultant and Terry Janicki, Administrator, Professional Services Division

**Strategic Plan Goal: 1**

**Promote educational excellence through the preparation and certification of professional educators**

- Sustain high quality standards for the preparation and performance of professional educators and for the accreditation of credential programs

# Update on the Work of the Teaching Mathematics Advisory Panel and Introduction of Draft Standards

**Introduction**

At the December 2008 Commission meeting, the Commission directed staff to convene an advisory panel to consider the need for, and, if necessary, to propose revised authorizations and program standards for the Mathematics Specialist Credential (http://www.ctc.ca.gov/commission/agendas/2008-12/2008-12-3G.pdf). During the January 2009 Commission meeting, the Commission expanded the charge to the advisory panel to include a review of all authorizations that allow the teaching of mathematics. This agenda item (a) provides an update on the work of the Teaching Mathematics Advisory Panel; (b) proposes changes to the structure of the mathematics specialist authorization; and (c) presents proposed draft program standards for the revised authorizations as well as for the mathematics pedagogy preparation of multiple subject credential candidates.

**Background**

Currently a variety of authorizations permit a certificated individual to teach mathematics in California's public schools. An agenda item describing all authorizations that allow an individual to teach mathematics was presented to the Commission in January 2009 (http://www.ctc.ca.gov/commission/agendas/2009-01/2009-01-3E.pdf). An individual who will teach mathematics must demonstrate a specified level of content knowledge in the area of mathematics and must complete coursework and fieldwork related to the teaching of mathematics.

The subject matter program standards and examination content specifications for mathematics were last updated between 2001 and 2003 as part of the SB 2042 revision process. These content specifications describe the mathematics content knowledge a teacher must have to satisfy the subject matter requirement. An individual with a multiple subject teaching credential must meet the content specifications applicable to the mathematics subject matter taught in the self-contained classroom at the elementary school, and an individual with a single subject teaching credential in mathematics must meet the content specifications applicable to the subject matter taught in departmentalized mathematics classes in K-12.

The teacher preparation standards focusing on pedagogy, including the teaching of mathematics for multiple and single subject credentials, were last revised in 2001. Although the Commission adopted modifications to the SB 2042 standards in January 2009, none of the modifications addressed the pedagogy of teaching mathematics. The program standard that addresses the teaching of mathematics for a multiple subject teacher is program standard 8A (a), while the program standard that addresses the pedagogy of teaching mathematics in a single subject classroom is program standard 8B (a).

The authorizations that allow an individual to teach mathematics include a Mathematics Specialist Credential. However, this authorization does not permit the holder to perform any service above and beyond that of the authorization for a single subject teaching credential in

mathematics. The standards for the mathematics specialist preparation program were last reviewed in 1992 and the authorization was formalized in regulations in 1999.

In order to look more closely at the issues raised by the January 2009 agenda item, the Commission directed staff to convene a Teaching Mathematics Advisory Panel which would include representatives from key stakeholder groups. Staff developed an application that was publicized widely through the Commission's website, mathematics professional associations, the California Subject Matter Projects, and the Professional Services Division weekly e-news. The application process closed on February 20, 2009.

The twenty member panel (see Appendix A) was appointed by Executive Director Dale Janssen following a review of a large number of applications for the panel. The members were selected based on their expertise in mathematics and mathematics instruction. The panel membership represents diversity with respect to organizational affiliation, geographic region, and credentials held. In addition, a consultant from the California Department of Education (CDE) serves as a liaison to the panel.

**Charge to the Advisory Panel**

The panel was charged to review the need for and, if necessary, propose revisions to the authorization and program standards for the Mathematics Specialist Credential. Further, the panel was charged to review the requirements of all authorizations for the teaching of mathematics, keeping in mind the need for flexibility in assignments at the local level. In discharging this task, the panel considered:

- the *Mathematics Specialist Credential Program Standards*
- the *2005 K-12 Mathematics Framework* (2005)
- the Commission-adopted *Multiple and Single Subject Teacher Preparation Program Standards* (2009)
- other resources as appropriate such as current credential requirements and standards used by other states or professional organizations for similar credentials
- current research about effective instructional strategies in the teaching of mathematics

An update on the work of the advisory panel was presented to the Commission at its December 2009 meeting. During that meeting, a member of the advisory panel introduced results from current and ongoing research about how children understand and learn mathematics and the mathematics teaching skills required to support learning. Since that time, the advisory panel has met formally two more times and has continued its work between meetings as well.

**Deliberations of the Teaching Mathematics Advisory Panel**

During the first meeting, panel members identified concerns about the adequacy of students' preparation for Algebra I that begins in the primary grades, and continuing through Algebra I classes, and listened to presentations by Commission staff about the mathematics content and pedagogy requirements for teachers of mathematics. Panelists observed that in their opinion there is a mismatch in what multiple subject teachers have been prepared to do with respect to teaching algebra and what they are authorized to do. There were no concerns about the adequacy of the preparation for single subject mathematics authorizations.

During the second panel meeting, panelists participated in a video link presentation with Deborah Lowenberg-Ball, Dean of the School of Education at the University of Michigan and a respected researcher in the preparation of teachers for teaching mathematics. Her research has focused on identifying the mathematical knowledge teachers need. Dr. Ball's research led to the development of a model of mathematical knowledge for teaching comprised of Subject Matter Knowledge and Pedagogical Content Knowledge. Dr. Ball's research was presented to the Commission at the December 2009 Commission meeting (http://www.ctc.ca.gov/commission/agendas/2009-12/2009-12-3F.pdf).

**Issues Identified in the Preparation of Individuals to Teach Mathematics**

Based on the study and discussion of research articles, national panel recommendations, Commission agenda reports, and the California mathematics curriculum framework, the panel decided to focus its work in two areas: 1) expanding the mathematical pedagogy preparation for multiple subject credential candidates, and 2) restructuring and updating the authorizations and standards for the Mathematics Specialist Credential. These foci were chosen because they provided a mechanism for responding relatively quickly to the critical need for mathematics teaching expertise at the K-8 grade levels and for a longer-term solution to the needs of K-8 students for mathematically-competent multiple subject teachers.

**Improved Preparation to Teach Mathematics for Multiple Subject Teachers**

The current standards for multiple subject preparation programs contain one standard that is devoted specifically to the teaching of reading – Program Standard 7A. One result of this emphasis is that teacher preparation programs typically have at least one course that focuses exclusively on developing candidates' knowledge and skills for teaching reading. In contrast, program standards for preparing candidates' pedagogical skills in mathematics are found in a standard that also defines the content for subject-specific pedagogical preparation for science, history-social science, the visual and performing arts, physical education, and health.

The panel determined that the current single standard that includes mathematics along with other content areas does not provide enough specificity to ensure that multiple subject candidates develop the mathematical knowledge for teaching identified by Ball as essential for ensuring that children in K-8 classrooms receive effective instruction in mathematics. To address the need for placing more focus on developing the mathematics knowledge of multiple subject teachers, the panel developed draft language for a mathematics-specific teacher preparation program standard that addresses candidates' mathematics content knowledge, specialized content knowledge for teaching mathematics, and mathematics pedagogical skills.

The following excerpt from the proposed draft program standard illustrates this focus:

> "The program coursework and fieldwork consider three domains of professional knowledge to be central to the work of teaching mathematics: mathematics content knowledge, specialized content knowledge for teaching mathematics, and general pedagogical knowledge (Ball, Thames, & Phelps, 2008). The specifications for the Multiple Subject CSET provide a basis for documenting candidates' foundational mathematical content knowledge prior to field experiences. The program develops candidates' specialized mathematical knowledge for teaching and integrates mathematical content knowledge and pedagogical knowledge. The program teaches

candidates' to use and integrate these three domains of knowledge in their developing practice."

The draft standard is included in Appendix B and is proposed to replace the current language in Standard 8-A(a) which is provided in Appendix C.

**Overview of Proposed Revised Mathematics Specialist Credentials**

The panel agreed that the most expeditious and effective mechanism for increasing the mathematics teaching expertise available to support teachers at the elementary and middle grades level was by updating the mathematics specialist credential program standards. The panel discussed how an individual with a Mathematics Specialist authorization could work with both K-12 students and teachers to support improved teaching and learning of mathematics in California's public schools.

The panel agreed that an individual with a Mathematics Specialist authorization must complete advanced preparation and fieldwork in both mathematics content and the pedagogy of mathematics above and beyond what is required for the multiple subject teaching credential. The panel further identified a potential reorganized authorization structure that would parallel the current reading certificate and reading specialist concepts.

Within this revised authorization structure, there would be both a Mathematics Instruction Certificate (formerly the Mathematics Specialist credential) and a Mathematics Instruction Leadership credential which would be a new authorization. This structure would offer two distinct ways that individuals with specialized mathematics knowledge could support mathematics instruction in the schools, depending on which authorization the individual sought. In addition, the panel recognized that within the Mathematics Instruction Certificate option, some teachers might be interested in a certificate that would go through but not beyond the level of mathematics typically taught in PreK through Pre-Alegbra, whereas other teachers might be interested in a certificate that would include mathematics PreK through Algebra I and require expertise in Geometry and Algebra II as well The current regulations that define the authorization for a Mathematics Specialist do not distinguish between the levels of knowledge and skills that the proposed draft standards would now address..

Provided below is a further description of a possible two route system incorporating the Mathematics Instruction Certificate and the Mathematics Instructional Leadership Credential.

**Mathematics Instruction Certificate (MIC): PreK-Pre-Algebra and PreK-Algebra I**

A Mathematics Instructional Certificate (MIC) holder would be an individual with expertise in integrating PreK through Pre-Algebra or Algebra I (depending on the mathematical content knowledge of the individual) mathematical knowledge, mathematical knowledge for teaching, and pedagogical knowledge. The MIC authorization would be an "add-on" to a preliminary or a clear multiple subject teaching credential. An individual with a single subject mathematics teaching credential could complete the MIC program, but there would be no additional teaching authorization earned. It is anticipated that the MIC holder would play a major role in bridging the existing achievement gap due to his or her expertise in curriculum design, coaching teachers, designing and implementing intensive interventions, and teaching teachers to effectively intervene, accommodate, and differentiate their mathematics instruction to increase student engagement and proficiency in mathematics from Kindergarten through Pre-Algebra/Algebra I.

The panel proposes that the Mathematics Instruction Certificate have two authorization options that would be distinguished by the level of mathematical content knowledge required of the certificate holder. Holders of the PreK-Pre-Algebra MIC would need to have mastered the PreK-7 through Algebra I California mathematics content standards and would be authorized to teach the California mathematics content standards for Pre-Kindergarten through Pre-Algebra in any setting. Holders of the PreK through Algebra I MIC would need to have mastered the PreK-7, Algebra I, Geometry, and Algebra II California content standards and would be authorized to teach the California mathematics content standards for grades PreK through Algebra I in any departmentalized setting. MIC PreK-Pre-Algebra candidates who were not able to initially demonstrate mastery of Geometry and Algebra II standards may be able to do so through subsequent assessments, and thereby move into the MIC PreK-Algebra program. The proposed structure of the MIC preparation program for both routes to a MIC Certificate is shown in Figure 1 on page 6. The draft standards are provided in Appendix D.

**Structure of Proposed Mathematics Instruction Certificate**

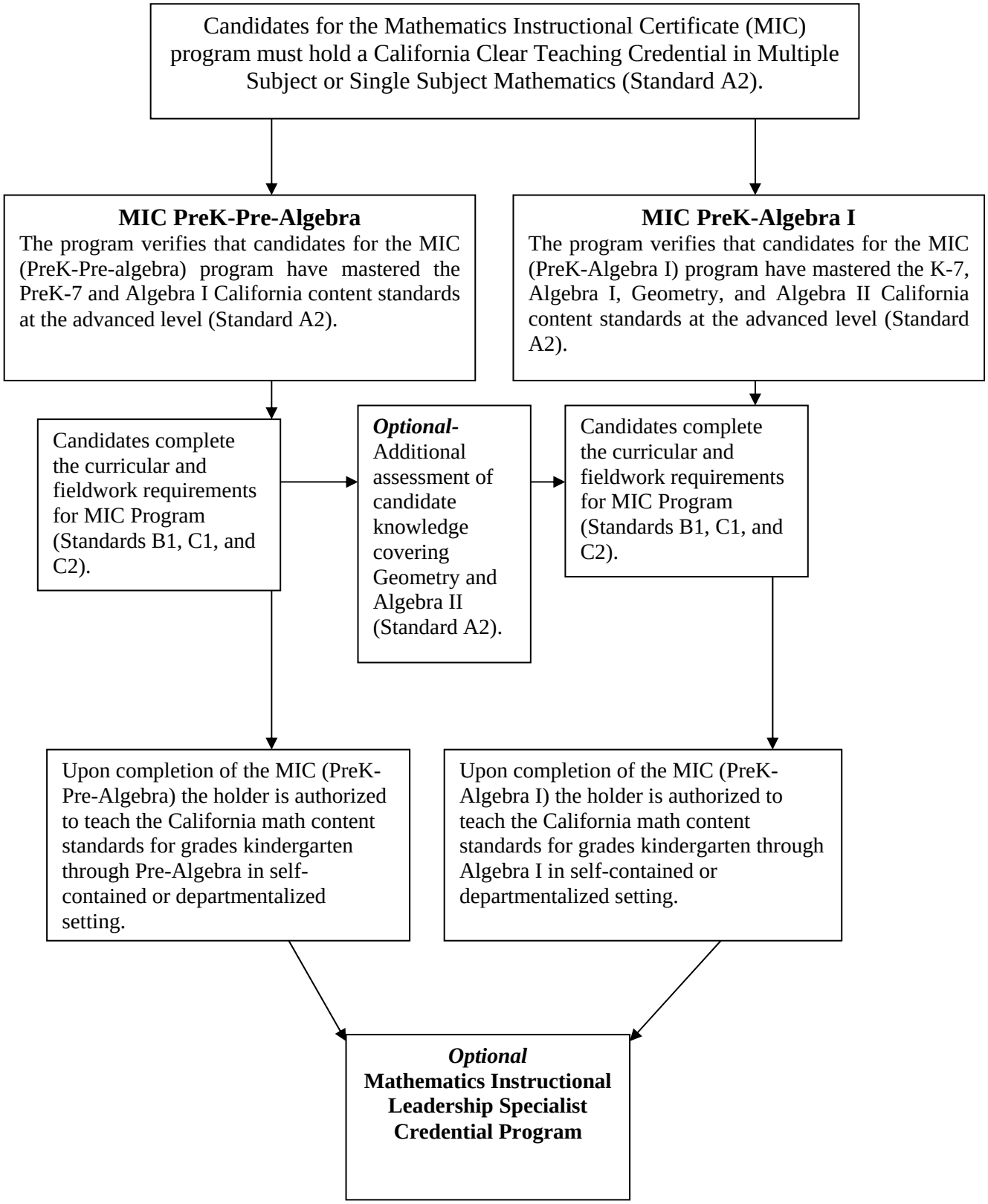
| MIC Route | Precursor Credential | Mathematic Content Knowledge of the Teacher | Authorizes Teaching |
|---|---|---|---|
| PreK-Pre-Algebra | Multiple Subject or Single Subject teaching credential | PreK-7 through Algebra I | PreK-Pre-Algebra |
| PreK-Algebra I | | PreK-7, Algebra I, Geometry, and Algebra II | PreK-Algebra I |

The MIC holder would need to have the knowledge and skills needed to provide leadership and vision for a comprehensive Kindergarten through Pre-Algebra/Algebra I math program that addresses the instructional needs of English Learners, students with disabilities, gifted and talented students, and students at risk. Additionally, the MIC holder could potentially teach mathematics from Kindergarten through Pre-Algebra/Algebra I in a departmentalized setting. The impacts of the MIC holder might include, but are not limited to, increasing:

- student proficiency in PreK-Pre-Algebra/Algebra I and closing the achievement gap by providing math instructional leadership to schools, districts, and counties in areas such as curriculum design, coaching, intensive interventions, accommodation, and differentiation
- expertise in teaching PreK-Pre-Algebra/Algebra I subject matter in either a departmentalized or self-contained setting to all students, including English Learners, students with disabilities, gifted and talented students and students at risk
- the number of highly qualified PreK-Pre-Algebra/Algebra I teachers in departmentalized settings

Specifically, Mathematics Instruction Certificate holders will have advanced expertise in the three domains that are central to the work of teaching mathematics: mathematics content knowledge, content knowledge for teaching mathematics, and pedagogical knowledge (Ball, Thames, & Phelps, 2008). The MIC program would be responsible for teaching candidates for the authorization to expertly use and integrate these three domains of knowledge in their practice as well as to coach and lead teachers and administrators in designing targeted intervention programs for PreK-Pre-Algebra/Algebra I students.

**Figure 1: Proposed Structure for the Mathematics Instruction Certificate (MIC)**



**Proposed Mathematics Instructional Leadership Specialist Credential**

The proposed new Mathematics Instructional Leadership (MIL) Specialist Credential option would prepare experienced teachers with skills required to promote more effective teaching and learning of mathematics PreK-12, provide leadership in mathematics instruction for schools, districts, and county offices, and fulfill a need in the field for a cadre of mathematics teacher leaders who have the ability to connect content level and coaching expertise with school, district, and/or county leadership. Individuals must hold a prerequisite Mathematics Instruction Certificate before they would be eligible for the Mathematics Instructional Leadership Specialist credential.

Programs preparing Mathematics Instructional Leadership Specialist Credential candidates would include advanced preparation and fieldwork in: a) effectively connecting action research and mentoring/coaching skills with theoretical research to bridge the theory and practice divide in mathematics teaching and learning, b) designing and implementing a school and/or district professional development system that involves teachers and administrators in working collaboratively to increase student engagement and learning in mathematics, c) analyzing and using student, school, district, county, state, and college/university data to inform school and district program design to increase the number of students who are college-ready and reverse the pervasive achievement gap, and d) leading a professional community of practice. The draft program standards for the proposed Mathematics Instructional Specialist Leadership credential are shown in Appendix E.

**Field Review and Further Panel Work**

A survey to collect comments about the draft standards from the field is currently being distributed widely through professional mathematics teacher associations and through the PSD e-news. The panel will meet in June to review comments from the field and to edit the draft standards documents [Multiple Subject 8-A(a), Mathematics Instructional Certificate (MIC), and Mathematics Instructional Leadership Specialist (MIL)] as appropriate.

**Next Steps**

Based upon Commission discussion and direction, staff will continue to work with the Teaching Mathematics Advisory Panel in refining the conceptual framework for the revised Mathematics authorization structure as well as the proposed draft program standards. The proposed standards would be brought to the Commission in August for further discussion and possible adoption.

# Appendix A
## CTC Teaching Mathematics Advisory Panel (2009)

| Name | Employer | Representing |
|---|---|---|
| CK Green | Newport-Mesa Unified School District | California Federation of Teachers (CFT) |
| Zulmara Cline | California State University, Office of the Chancellor | California State University, Office of the Chancellor |
| Jody Priselac | University of California, Los Angeles | University of California, Office of the President |
| Katharine Clemmer | Loyola Marymount University | The Association of Independent California Colleges and Universities (AICCU) |
| Pam Tyson | Contra Costa County Office of Education | California County Superintendents Educational Services Association (CCSESA) |
| Phil Quon | Cupertino Unified School District | Association of California School Administrators (ACSA) |
| Jan Bridge | Chino Valley Unified School District | California Teachers Association (CTA) |
| | None appointed | California School Boards Association |
| Brenda Hensley | Vacaville Unified School District | |
| Carole Vargas | Folsom Cordova Unified School District | |
| Katherine Morris | Sonoma State University | |
| Kyndall Brown | University of California, Los Angeles | |
| Lisa Hoegerman | Apple Valley Unified School District | |
| Dennis Parker | University of the Pacific | |
| Nadine Bezuk | San Diego State University | |
| Sunny Chin-Look | Alhambra Unified School District | |
| Vriana Kempster | San Francisco Unified School District | |
| Zeev Wurman | Independent Consultant | |
| Megan Holstrom | High Tech High, San Diego | |
| David Simmons | Ventura County Office of Education | |
| Michael Fickel | California State University, San Marcos | |
| Jim Greco | California Department of Education | |
| **Staff Working with the Math Advisory Panel** | | |
| Terry Janicki | Commission on Teacher Credentialing | |
| Rebecca Parker | Commission on Teacher Credentialing | |
| Teri Clark | Commission on Teacher Credentialing | |

# Appendix B

## Draft Standard 8-A: Pedagogical Preparation for Mathematics Content Instruction by Multiple Subject (MS) Candidates

Program coursework and fieldwork provide candidates with an environment conducive to intellectual risk-taking and multiple ways of approaching mathematical and pedagogical problems, thereby providing a model for candidates to enact in their own practice. The program teaches candidates to apply the *Teaching Performance Expectations* (TPEs) to the teaching of mathematics by implementing curriculum frameworks, state-adopted academic content standards for students, and adopted curriculum materials.

Overall, the program design needs to ensure that candidates are able to create a mathematical instructional program that meets the diverse needs of California's student population. The program prepares candidates to teach mathematics using the balanced approach, including computational and procedural skills, conceptual understanding, and problem solving, outlined in the *California Mathematics Framework*. The program provides opportunities for candidates to develop and implement teaching and learning strategies designed to enable all students to become mathematically proficient in the intertwined strands of adaptive reasoning, strategic competence, conceptual understanding, productive disposition, and procedural fluency.

Specifically, the program coursework and fieldwork considers three domains of professional knowledge to be central to the work of teaching mathematics: mathematics content knowledge, specialized content knowledge for teaching mathematics, and general pedagogical knowledge. The specifications for the Multiple Subject CSET provide a basis for documenting candidates' foundational mathematical content knowledge prior to field experiences. The program develops candidates' specialized mathematical knowledge for teaching and integrates mathematical content knowledge and pedagogical knowledge. The program teaches candidates to use and integrate these three domains of knowledge in their developing practice.

The three domains, when applied to preparing candidates to teach mathematics, are integrated, mutually supportive, interdependent, and interactive. Each domain is defined by the following elements that provide structure for the program design:

| **Mathematical Content Knowledge** | **Specialized Mathematical Knowledge for Teaching** | **Pedagogical Knowledge** |
|---|---|---|
| Multiple subject CSET topics provide foundation | Children's mathematical thinking | Mathematics Curriculum |
| | Modes of mathematical representation | Planning instruction |
| | Mathematical language | Classroom discourse |
| | | Assessment |

The program should provide documentary evidence of how it deeply and coherently integrates the elements across domains to develop and strengthen candidate competencies in mathematics teaching.

Below are examples of topics representative of each of element within the three domains to illustrate depth and coherence (these examples are not intended to be used as a checklist). Candidates must demonstrate competence in:

1. Children's mathematical thinking:
    a. Use and analyze student misconceptions and conduct error analysis.
    b. Use developmental trajectories and challenges-to-understanding mathematics concepts.
    c. Explain algorithms and alternative algorithms and solution strategies.
2. Modes of mathematical representation:
    a. Use a variety of modes of representation (oral language, written symbols, pictures, concrete materials/models, real-world situations) for mathematics concepts.
    b. Recognize limitations related to representing mathematical concepts.
    c. Link representations to underlying mathematical theories and to other representations.
3. Mathematical language:
    a. Connect mathematical vocabulary to the mathematical concepts when listening and responding to students' mathematical questions.
    b. Effectively use mathematical definitions and academic language, while not over-emphasizing form over function.
4. Mathematics curriculum:
    a. Review, analyze, and sequence state-adopted curriculum materials.
    b. Identify, implement, and connect high-leverage math topics, such as place value, fractions, and real numbers.
5. Planning instruction for learning mathematics:
    a. Select and develop tasks to enable students to make conjectures and generalizations.
    b. Align instructional goals, assessments, instructional strategies, and practice (assignments, homework).
    c. Use flexible grouping strategies (homogeneous, semi-homogeneous, heterogeneous, large group, small group, and individual learning) according to students' needs and achievement.
    d. Sequence curriculum or instruction, focusing on the mathematics content standards and the key concepts within the standards.
6. Classroom discourse:
    a. Use questioning strategies to lead discussions.
    b. Select generative examples and reframe problems for deeper understanding.
    c. Foster positive attitudes toward mathematics and encourage student curiosity, flexibility, and persistence in solving mathematical problems.
7. Assessment:
    a. Use formative, summative, standardized, and authentic assessments.
    b. Use assessment results to adapt instruction.

# Appendix C

## Adopted Multiple Subject Standard Language

### 8-A(a): Pedagogical Preparation for Subject-Specific Content Instruction by Multiple Subject (MS) Candidates

8-A(a) **Mathematics.** During interrelated activities in program coursework and fieldwork, MS candidates learn specific teaching strategies that are effective in supporting them to teach the state-adopted academic content standards for students in mathematics (K-8). They enable students to understand basic mathematical computations, concepts, and symbols; to use these tools and processes to solve common problems; and to apply them to novel problems. They help students understand different mathematical topics and make connections among them. Candidates help students solve real-world problems using mathematical reasoning and concrete, verbal, symbolic, and graphic representations. They provide a secure environment for taking intellectual risks and approaching problems in multiple ways. Candidates model and encourage students to use multiple ways of approaching mathematical problems, and encourage discussion of different solution strategies. They foster positive attitudes toward mathematics, and encourage student curiosity, flexibility, and persistence in solving mathematical problems.

# Appendix D

## Mathematics Instructional Certificate (MIC)
## Draft Program Standards 2010

### Category A: Program Design for the Mathematics Instructional Certificate (MIC)

### Standard A1: Program Design

The preparation programs and their prerequisites include a purposeful, interrelated, developmentally-designed, and culturally sensitive sequence of coursework, leadership, and field experiences. By design, these programs are based on a sound rationale informed by theory, research, and practice. The program provides extensive opportunities for candidates to demonstrate mathematical and pedagogical content knowledge and skills to support effective mathematics instruction and student learning. The program accomplishes these goals by helping teachers develop into scholar practitioners and leaders whose work is informed by the complex interplay of math content and pedagogy in effective teaching.

The design of the MIC program follows an explicit statement of program philosophy and purpose. It effectively coordinates and articulates expertise in integrating PreK-Algebra I content knowledge, PreK-Algebra I knowledge for teaching, and pedagogical knowledge in a culturally sensitive manner. It is anticipated the MIC holder will play a major role in bridging the existing achievement gap based on his/her expertise in curriculum design, interventions, differentiations, and accommodations. Additionally, the MIC holder will be an effective coach for PreK-Algebra I teachers to help increase student proficiency and reverse the achievement gap in PreK-Algebra I.

The sponsoring institution demonstrates a commitment to the preparation of an MIC holder by providing appropriate support for the program. The program has a qualified leadership team with expertise in mathematics content, mathematics education, teacher education, and teacher leadership. The program includes a comprehensive assessment system that effectively prepares candidates to teach K-Pre-Algebra or PreK-Algebra I and to understand the challenges of developing mathematical literacy among California's diverse student and teaching population. Successful candidates will be able to maximize mathematical development for all students including English Learners, students with disabilities, students who are gifted and talented, and students at risk.

### Standard A2: Admission

In each program, applicants are admitted on the basis of well-defined admission criteria and procedures, including all Commission-adopted requirements. Qualified personnel are assigned to determine whether admission criteria have been met. The key admission criterion for an MIC program is the possession of the appropriate English Learner authorization, as well as a California Professional Clear Teaching Credential. Additionally, candidates for the MIC K-PreAlgebra program must have mastered the K-7 and Algebra I standards at an advanced level. Candidates for the MIC K-Algebra I program must have mastered the K-7, Algebra I, Geometry, and Algebra II standards.

The program sponsor has a process for determining how recency of work will be considered when determining a candidate's placement. The program has an appeals process in place. The appeals policy addresses granting equivalencies and is provided in writing within admission forms and in the program catalog.

## Category B: Curriculum

### Curricular Requirements for the MIC

The curriculum for the MIC program is based on candidates entering the programs with strong mathematics content knowledge and integrates three domains of knowledge: Advanced Mathematics Content Knowledge, Specialized Mathematics Knowledge, and Mathematical Knowledge for Teaching.

The three domains of knowledge, when applied to preparing MIC K-Pre-Algebra and K-Algebra, are integrated, mutually supportive, interdependent, and interactive. Each domain is defined further by the elements in the table below. Together they provide the structure for the MIC curriculum program design:

| **Mathematics Content Knowledge** | **Specialized Mathematics Knowledge and Mathematical Knowledge for Teaching** | |
|---|---|---|
| Satisfied by Admission to the MIC Program | Children's mathematical thinking<br>• Intervention<br>• Accommodations<br>• Differentiation | Mathematics Curriculum<br>• Intensive targeted intervention |
| Route I-Mastery of PreK-Algebra I | Modes of mathematical representation<br>• Technology,<br>• Resources | Planning instruction<br>• Coaching & Leadership |
| Route II-Mastery of PreK-7, Algebra I, Geometry, Algebra II | Mathematical language<br>• Increased student proficiency | Classroom discourse<br>• Culturally sensitive |
| | | Assessment<br>• Closing the achievement gap |

The program will provide documentary evidence of how it comprehensively and coherently integrates the elements across the domains to develop and strengthen candidates' advanced competencies in mathematics teaching and coaching. Mastery of the specific content and pedagogical knowledge for teaching mathematics, defined as the seven sub-domains in SB 2042 Multiple Subject Standards 8-A (2010), is essential for program success. In particular, candidates will design, select, and adapt standards-aligned mathematics tasks and sequences of examples that support a particular learning goal for all students, including English Learners, students with disabilities, students who are gifted and talented, and students at risk. Finally, candidates will be

able to effectively design targeted curriculum that addresses the achievement gap. Candidates also will be able to coach teachers and administrators in effectively implementing the curriculum.

**Standard B1: Specialized Mathematics Thinking**

*Specialized Mathematics Knowledge* is the way teachers need to know and understand mathematics in order to effectively teach mathematics (Ball, Thames, Phelps, p. 4). Specifically, this knowledge consists of developing a flexible understanding of mathematical content that is central to instruction and that creates opportunities for students to access the school curriculum. Candidates must build connections among mathematical ideas, multiple representations, and solution methods in order to effectively address student needs.

*Mathematical Knowledge for Teaching* is the intersection of knowledge of mathematics *with* knowledge of teaching and learning. It is the product of transforming subject matter into a form that will facilitate student learning. It includes understanding what makes the learning of specific topics easy or difficult; i.e., "the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons." It includes the most useful way of representing and formulating a particular subject matter to increase its comprehensibility (such as knowledge of how to use the most powerful analogies, illustrations, examples, explanations, and demonstrations to teach given topics).

Based on Shulman's notion of pedagogical content knowledge, mathematics knowledge for teaching is an amalgam of what Ball and her colleagues term *Mathematics Knowledge for Teachin*g and *Specialized Content Knowledge* which is the "mathematical knowledge and skill unique to teaching."

The MIC program will incorporate mathematical knowledge to successfully design and implement intervention, accommodation, and differentiation to increase student proficiency and close the achievement gap. Specifically, MIC candidates should have specialized knowledge in the use of technology, resources, and materials to enhance student learning.

Below are the elements that represent *Mathematical Knowledge for Teaching*. These examples illustrate the depth and coherence needed for advanced study. These examples are not intended to be used as a checklist, but as a guide to program sponsors for the rigor and relevance they must achieve. Candidates must demonstrate advanced competency in the following:

1. Design interventions, accommodations, and differentiation that take into account children's mathematical thinking:
    a. Analyzing and explaining student misconceptions and error analysis.
    b. Analyzing and explaining cultural and developmental trajectories and challenges to understanding mathematics concepts.
    c. Explaining algorithms and alternative algorithms and solution strategies to overcome obstacles to student learning.
2. Use technology, resources, and other materials to enhance various modes of mathematical representation:
    a. Recommending a variety of modes of representation (oral language, written symbols, pictures, concrete materials/models, real-world situations) for further understanding of mathematics concepts.

   b. Indentifying and helping others understand the limitations related to representing mathematical concepts.
   c. Explaining representations to underlying mathematical theories and to other representations.
3. Increase student proficiency in the correct usage and understanding of mathematical language:
   a. Analyzing mathematical vocabulary in the context of mathematical concepts when listening and responding to students'/teachers' mathematical questions.
   b. Effectively evaluating mathematical definitions and academic language to sequence curriculum for targeted interventions.

**Standard B2: Pedagogical Knowledge**

The effective MIC holder will develop the type of pedagogical expertise needed to modify curriculum to address the specific needs of struggling students. The MIC holder will also have advanced skills in coaching teachers, collaboratively working with others, and designing appropriate interventions to increase student achievement.

Below are examples of topics representative of the elements within the domain of pedagogical knowledge that illustrate the depth and coherence for advanced study (these examples are not intended to be used as a checklist). Candidates must demonstrate advanced competency in:

1. Design and implement mathematics curriculum that includes intensive targeted interventions, developmentally appropriate sequencing, and cultural sensitivity:
   a. Analyzing and adapting state-adopted curriculum materials for targeted audiences.
   b. Accommodating and differentiating high-leverage math topics, such as place value, fractions, and real numbers to reverse the achievement gap.
2. Develop and plan coaching sessions to enable teachers to strengthen their instructional strategies for learning mathematics:
   c. Selecting and developing tasks to enable teachers to understand the conjectures and generalizations that students make.
   d. Supporting teachers in aligning instructional goals, assessments, instructional strategies, and practice (assignments, homework).
   e. Collaborating with teachers to design and implement flexible grouping strategies (homogeneous, semi-homogeneous, heterogeneous, large group, small group, and individual learning) according to students' needs and level of achievement.
   f. Facilitating the collaboration of sequencing curriculum and instruction, focusing on the mathematics content standards and the key concepts within the standards.
3. Develop strategies for culturally sensitive classroom discourse:
   g. Analyzing questioning strategies to lead discussions that actively involve all students.
   h. Selecting culturally appropriate generative examples and reframing problems for deeper understanding within a cultural and mathematical context.
   i. Advancing and cultivating positive attitudes toward mathematics, and encouraging student and teacher curiosity, flexibility, and persistence in solving mathematical problems.

4. Effectively use assessments to reverse the achievement gap:
    j. Analyzing formative, summative, standardized, and authentic assessments to determine the gaps in students' knowledge and design instruction to bridge the gaps.
    k. Collaboratively engaging in the process of using assessment results to guide instruction and develop curriculum that is targeted, accommodated, and differentiated for intensive intervention.

**Standard B3: Coaching, Intensive Interventions, Accommodations and Differentiations**

As candidates advance through the program, particular attention to the following outcomes is paramount to ensure proficiency in working with students and teachers in the various grade spans. This is not meant to be a checklist, but an integrated guide for the MIC candidate and the program sponsor to ensure a comprehensive and coherent program. The effective MIC program and candidate will demonstrate advanced competencies in the following:

- Using mentoring skills to improve mathematics programs in the following ways:
    - Develop appropriate classroom- and school-level learning environments.
    - Build relationships with teachers, administrators, and the community.
    - Develop evidence-based interventions for English Learners, students with disabilities (Tier 1 for RTI), students who are gifted and talented and students at risk.
    - Collaborate to create a shared vision and develop an action plan for school improvement.
    - Partner with school-based professionals to improve each student's achievement and mentor new and experienced teachers to better serve students.
- Collaborating with individual teachers (pre-service, novice, and experienced) through co-planning, co-teaching, and coaching to reverse the achievement gap in mathematics.
- Working with teachers and schools to promote the use of formative, summative, and standardized assessments to refine curriculum and design intensive interventions, accommodations, and differentiations.
- Supporting and facilitating teachers' use of successful, research-supported mathematics instruction.
- Using demographic, process, and outcome data at the student, school, and district levels to support informed decisions in designing targeted instructional offerings that promote students equitable access to learn high-level mathematics.
- Effectively sequencing and developing mathematical ideas, concepts, and skills in the K-Algebra I.

**Category C: Supervised Fieldwork in the Program for the MIC**

**Standard C1: Design of Fieldwork Experiences**

Programs facilitate individualized and balanced field experiences that enable each candidate to demonstrate the identified proficiency in practice. Programs provide candidates with timely and ongoing feedback to guide improvement in practice in both instruction and leadership. These field experiences are integrated into coursework and are aligned with the program assessment

standards.
By design, the supervised field experiences extend candidates' understandings of the three domains and their elements. The MIC candidate is provided extensive opportunities to observe, acquire, practice, and implement appropriate MIC holder knowledge, skills, and abilities. Qualified members of the sponsoring MIC program develop and document the professional qualifications and leadership skills of each candidate. The program collaborates with local educational agencies in guidance, site-based support, and supervision of field experiences.

**Standard C2: Fieldwork Component**

For successful completion of the fieldwork component, candidates must collect field-based evidence to demonstrate advanced competencies in the service of improving mathematics teaching and learning to close the achievement gap in the following grade spans: Kindergarten through Grade 3, Grade 4 through Grade 7, and Algebra 1 (for **MIC K-Algebra**). At each grade span, each of the following areas is to be given particular attention:

- Demonstrating multiple strategies for coaching and curriculum design to address intensive intervention, accommodation, and differentiation.
- Effectively engaging students and increasing proficiency.
- Designing and implementing targeted instruction for students in individual, small group and whole class settings.
- Designing and implementing intensive intervention for English Learners, students with disabilities, students who are gifted and talented and students at risk.
- Designing and implementing instructional sequences that demonstrate competence in teaching topics in mathematics that have been documented to be challenging in students' mathematical development.
- Assessing student outcomes, using student outcomes to inform subsequent practice, and relating student outcomes to candidates' teaching effectiveness.

**Category D: Assessment of Candidate Professional Competence for the MIC**

**Standard D1: Determination of Candidate Competence**

Candidates will be assessed against the *California Standards for the Teaching Profession (2010)* with particular emphasis on CSTP 3: Making Subject Matter Comprehensible to All Students. "Teachers exhibit in-depth working knowledge of subject matter, academic content standards, and curriculum frameworks. They apply knowledge of student development and proficiencies to ensure student understanding of content. They organize curriculum to facilitate students' understanding of the subject matter. Teachers utilize instructional strategies that are appropriate to the subject matter. They use and adapt standards-aligned materials, resources, and technologies to make subject matter accessible to all students. They address the needs of English learners and students with special needs to provide equitable access to the content." Program sponsors can use any combination of advanced level culminating projects to demonstrate professional competency. These can include, but are not limited to, professional presentations, published action research, curriculum design shared through web-based platforms, and/or school, district, or county collaborative projects.

## Appendix E

## Mathematics Instructional Leadership Specialist
## Draft Program Standards 2010

### Category A: Program Design for the Mathematics Instructional Leadership Specialist

### Standard A1: Program Design

The program develops candidates as scholar practitioners who work with teachers, administrators, parents, community members, and policymakers in programmatic leadership in the service of improving student mathematical engagement and learning and reversing the achievement gap.

An MIL program is unique in that it blends the skills of effective leadership in education with comprehensive content expertise and knowledge. In preparing these candidates as an MIL, the program sponsor is preparing a true scholar practitioner who blends the best of scholarly work with best practices to achieve bold and lasting changes in the field. With an emphasis on integrating theory, research, and practice, the scholar practitioner is able to design and implement research-based best practices to achieve results, reverse the achievement gap, and inform the research field.

The preparation programs and their prerequisites include a purposeful, interrelated, developmentally designed sequence of coursework and field experiences. The program includes a planned process for the comprehensive assessment of candidates in the following areas: (1) influence the field of math education through action research in teaching mathematics, (2) design and implement professional development that engages teachers, administrators, and parents while increasing student engagement and achievement in mathematics, (3) analyze and use data to design solutions to the challenges of developing mathematical literacy among California's diverse population, and (4) lead and expand a professional community of expert practitioners committed to increasing student engagement and achievement in mathematics and reversing the achievement gap. Successful candidates will be able to maximize mathematical development for all students including English Learners, students with disabilities, students who are gifted and talented, and students at risk.

The design of the mathematics leadership program follows an explicit statement of program philosophy and purpose. It is coordinated effectively with a cohesive design that has a cogent rationale. The program philosophy articulates a clear theory of action of the instructional needs of K-12 mathematics learners and the professional learning needs of K-12 mathematics teachers, administrators, parents, and policymakers. The sponsoring institution demonstrates a commitment to the preparation of mathematics leaders by providing appropriate support for the program. The program has a qualified leadership team with expertise in mathematics content, mathematics education, and leadership in mathematics education.

**Standard A2: Admission**

In each program, applicants are admitted on the basis of well-defined admission criteria and procedures, including all Commission-adopted requirements. Qualified personnel are assigned to determine whether admission criteria have been met. The basic admission requirement for the MIL program is one of the following:

1. Multiple Subject Clear Credential with a Mathematics Instructional Certificate PreK-PreAlgebra or PreK-Algebra I;
2. Single Subject Professional Clear in mathematics with demonstrated advanced content knowledge in K-12 and specialized mathematics pedagogy; or
3. Administrative Services Credential Tier I or II with demonstrated advanced content knowledge in K-12 and specialized mathematics pedagogy.

Please note that the advanced content knowledge in K-12 and specialized mathematics pedagogy are to be ascertained and determined by the program sponsor prior to admission.

The program sponsor has a process for determining how recency of work will be considered when determining a candidate's placement. The program has an appeals process in place that addresses granting equivalencies and is provided in writing within admission forms and in the program catalog.

**Category B: Curriculum**

**Curricular Requirements for Mathematics Instructional Leader or Mathematics Leadership Specialist:**

The program develops candidates' leadership skills and knowledge at the advanced level in relation to K-12 mathematics education. The program helps candidates to refine their leadership skills in the areas of a) conducting and publishing action research in mathematics teaching and learning, b) designing and implementing professional development and learning that engages teachers and administrators in pursuing a measurable increase in student achievement, c) analyzing, using, and connecting assessments to inform programmatic and instructional design within a comprehensive system that results in increasing student proficiency in mathematics, and d) leading and expanding professional communities of practice to reverse the achievement gap and move beyond college-ready to college success in science, technology, engineering, and mathematics fields (STEM).

**Standard B1: Leadership Knowledge and Skills for the Mathematics Instructional Leader or Mathematics Leadership Specialist:**

The MIL will demonstrate the ability to share leadership with school and district administrators in the following areas by promoting equity, fairness, and respect among all members of the school community and shaping a culture in which high expectations are the norm for each student as evidenced by rigorous academic work. MILs should be able to facilitate the use of a variety of appropriate content-based learning materials and learning strategies that recognize students as active learners, value reflection and inquiry, emphasize the quality versus the amount of student application and performance, and utilize appropriate and effective technology.

Candidates should have the ability to guide and support the long-term professional development of all staff consistent with the ongoing effort to improve the learning of all students relative to the content standards and provide opportunities for all members of the school community to develop and use skills in collaboration, distributed leadership, and shared responsibility. The program will ensure that all candidates have an opportunity to create an accountability system grounded in standards-based teaching and learning and utilize multiple assessments to evaluate student learning in an ongoing process focused on improving the academic performance of each student.

Specifically, the program prepares candidates who can demonstrate expert competencies in the following four areas: research, professional development, data analysis, and professional learning communities. Following is a sample list of strategies, competencies, and program elements that define each of the four major areas of study. The list is by no means comprehensive nor meant to be a checklist; it is a guide to programs about how to effectively integrate and interweave these four areas of study into their program.

1. Research-supported mathematics teaching, learning, and coaching

Effectively connecting action research and mentoring/coaching skills with theoretical research to bridge the theory and practice divide in mathematics teaching and learning by

- Sequencing and strengthening the mathematical ideas, concepts, and skills in the *California Frameworks Standards* and adopted curricula to increase student retention of these ideas, concepts, and skills over time.
- Designing, selecting, and/or adapting standards-aligned worthwhile mathematics tasks and sequences of examples that support a particular learning goal for all students including those who are English Learners and those with special needs.
- Co-planning lessons and units with teachers, and courses and programs with administrators to address appropriate learning goals using the 3-phase instructional model (Framework p. 205, Chapter 4 Instructional Strategies), including those that address local, state, and national mathematics standards and legislative mandates.
- Modeling effective problem solving and mathematical practices, questioning, representing, communicating, conjecturing, making connections, reasoning and proving, self-monitoring, and cultivating the development of such practices in learners.
- Constructing and evaluating multiple representations of mathematical ideas or processes, establishing correspondences between representations, and understanding the purpose and value of doing so.
- Demonstrating knowledge of research results in the teaching and learning of mathematics, including knowledge of different types of instructional designs (i.e., cognitive apprenticeship models, constructivist models, engineering system models, etc.…) that support increasing teacher and administrator expertise in strengthening student learning of mathematics.
- Incorporating technology's potential for building understanding of mathematical concepts and developing important mathematical ideas in programmatic and instructional design.

2. Professional Development and Learning

Designing and implementing a school and district professional development system that engages teachers and administrators to working collaboratively to increase student engagement and learning in mathematics by:

- Evaluating educational structures and policies that affect high quality mathematics instruction and design interventions to ensure that all students have appropriate opportunities to learn important mathematics.
- Planning, designing, implementing, evaluating, and informing professional development programs at the school and district level to ensure a comprehensive approach that includes supporting teachers in systematically reflecting and learning from practice and supporting administrators in analyzing teacher needs in moving their professional practice forward to ensure an increase in student engagement and proficiency.

3. Assessment, Development, and Analysis

Analyzing and using student, school, district, county, state, and college/university data to inform school and district mathematics program design to increase the number of students who are college-ready and reverse the pervasive achievement gap by:

- Engaging in discussions and informed decision-making to establish appropriate benchmarks for analyzing the effectiveness of student learning goals.
- Selecting, using, adapting, and evaluating the alignment of local and state curriculum standards, district textbooks, and district and state assessments, and recommending appropriate adjustments to address gaps and ensure that the instructional design is culturally sensitive.
- Analyzing assessment results, both formal and informal, making appropriate interpretations and recommendations to administrative and policy leadership, communicating results to appropriate and varied audiences, and designing solutions to reverse the achievement gaps evident from the data.
- Analyzing and using demographic, process, and outcome data at the student, school, district, county, state, and college/university levels to design instructional offerings that give students equitable access to learn high-level mathematics.
- Designing and implementing programs that promote student understanding of the interrelatedness of math concepts and appropriate interdisciplinary bridges between math and other subjects.
- Designing and implementing programs that demonstrate knowledge of student learning including the ability to anticipate common misconceptions.
- Designing and implementing programs that support student learning-trajectories related to mathematical topics.
- Designing and implementing programs that use multiple strategies including listening to and understanding the ways students think about mathematics, to assess students' mathematical knowledge.
- Designing assessment systems that use the formative assessment cycle (administer a formative assessment task, analyze student responses to the task, and design and re-teach lessons based on this analysis) and be able to find or create appropriate resources for this purpose.

1. Professional Community of Practice

Leading and expanding professional communities of practice to reverse the achievement gap and move beyond college-ready to college success in science, technology, engineering, and mathematics fields (STEM) by:

- Selecting from a repertoire of methods to communicate professionally about students, curricula, instruction, and assessment to educational constituents, i.e., parents and other caregivers, school administrators, and school boards, and customize methods as needed.
- Using leadership skills to improve mathematics programs at the school and district levels, e.g., develop appropriate classroom- or school-level learning environments; build and strengthen relationships with teachers, administrators, and the community; develop evidence-based interventions for high and low-achieving students; collaborate to create a shared vision and develop an action plan for school improvement; partner with school-based professionals to improve each student's achievement; and mentor new and experienced teachers and administrators to better serve students.
- Developing a culture of shared leadership between teachers, parents, and administrators to strengthen student learning in mathematics and to reverse the achievement gap.

**Category C: Supervised Fieldwork in the Program**

Programs integrate coursework and fieldwork within an apprenticeship construct that enables each candidate to demonstrate proficiency as a MIL. Programs provide candidates with timely and on-going feedback to guide improvement in practice through action research connected to instruction, program design, assessment, and leadership. These field experiences are embedded in coursework and aligned with the program assessment standards.

By design, the supervised field experiences extend candidates' understandings of major ideas and emphases in the program and/or prerequisites to the programs. MILs are provided extensive opportunities to observe, acquire, and use appropriate pedagogical, leadership, knowledge, and skills to design and implement innovative processes that are research based. The program collaborates with local educational agencies in guidance, site-based support, and supervision of field experiences.

**Standard C1: Fieldwork Component for Mathematics Instructional Leader or Mathematics Leadership Specialist:**

The MIL will demonstrate the ability to share leadership with school and district administrators by promoting equity, fairness, and respect among all members of the school community. They will help to shape a culture in which high expectations are the norm for each student as evidenced in rigorous academic work. Additionally, they shall share leadership with school personnel in the following ways:

- Facilitate the use of a variety of appropriate content-based learning materials and learning strategies that recognize students as active learners, value reflection and inquiry, emphasize the quality versus the amount of student application and performance, and utilize appropriate and effective technology.
- Guide and support the long-term professional development of all staff consistent with the ongoing efforts to improve the learning of all students relative to the content standards.
- Create an accountability system grounded in standards-based teaching and learning and utilize multiple assessments to evaluate student learning according to an ongoing process focused on improving the academic performance of each student.
- Provide opportunities for all members of the school community to develop and use skills in collaboration, distributed leadership, and shared responsibility.

Candidates for the MIL must collect field-based evidence throughout the program to demonstrate competence in the four areas of leadership practice [in the service of improving mathematics teaching and learning at the various grade spans (Kindergarten-3, 4-7, Algebra I, Geometry, Algebra II, and Advanced Mathematical study). The following list of suggested activities is meant as a guide to programs, not a checklist for implementation. However, the evidence should be integrated and demonstrate a professional level of skill and success.

1. Research-supported mathematics teaching, learning, and coaching
   - Effectively connecting action research and mentoring/coaching skills with theoretical research to bridge the theory and practice divide in mathematics teaching and learning by
     - Leading Courses/Sequence of Workshops that provide professional development, follow-up support, teaching a course, or presenting at a conference.
     - Providing Collegial Support over time through lesson study, peer coaching, professional learning communities, or professional book clubs.

2. Professional Development and Learning
   - Designing and implementing a school, district, or county office professional development system that engages teachers and administrators in working collaboratively to increase student engagement and learning in mathematics.
   - Aligning curriculum materials to standards, evaluating/facilitating curriculum adoption, developing pacing guides, supporting implementation, or articulation of transitions between levels of schooling.

3. Assessment, Development, and Analysis
   - Analyzing and using student, school, district, county, state, and college/university data to inform school and district mathematics program design to increase the number of students who are college-ready and reverse the pervasive achievement gap, such as standardized testing data analysis, development/implementation/analysis of local formative or summative assessments, or facilitating instructional design and improvement based on assessment results.

4. Professional Community of Practice
   - Leading a Professional Community of Practice that reinforces the collegiality and relationships among inter-institutional groups, reinforces the role of P/16 articulation and involves parents/families, community, and businesses and non-profit service learning
     a. Facilitating a parent night, engaging with business/school partnerships, working with a non-profit, or developing service learning tutorials for aspiring teachers.

MIL candidates must also demonstrate the capacity to analyze the effectiveness of their practices in terms of the direct impact on the people with whom they work (e.g., students, teachers, parents, administrators, and community members), as well as the real or potential impact on research around students and student learning of mathematics.

**Category D: Assessment of Candidate Competence**

**Standard D1: Determination of Candidate Professional Competence for the Mathematics Instructional Leader or Mathematics Leadership Specialist:**

Candidates will be assessed against two professional competencies:

a. *California Standards for the Teaching Profession (2009)* (CSTP) with particular emphasis on CSTP 6: *Developing as a Professional Educator*. Teachers reflect on their teaching practice to support student learning. They establish professional goals and engage in continuous and purposeful professional growth and development. They collaborate with colleagues and engage in the broader professional community to support teacher and student learning. Teachers learn about and work with families to support student learning. They engage local communities in support of the instructional program. They manage professional responsibilities to maintain motivation and commitment to all students. Teachers demonstrate professional responsibility, integrity, and ethical conduct.

b. *California Standards for Professional Leaders (2004)* Standard 2: A school administrator is an educational leader who promotes the success of all students by advocating, nurturing, and sustaining a school culture and instructional program conducive to student learning and staff professional growth.

Program sponsors can use any combination of advanced level culminating projects to demonstrate professional expertise and competency. These may include, but are not limited to, the following:

- Professional presentations at the district, county office, or conference level to inform decisions related to increasing student engagement and proficiency in mathematics and reversing the achievement gap for students in mathematics.
- Publications in practitioner journals or leadership within organizations dedicated to increasing student achievement in mathematics (i.e. CMC, NCTM, ACTE, University Math/Science Centers and projects).
- Curriculum design shared through web-based platforms and implemented within schools, districts, or communities.
- Program design shared with the community through School Board presentations and/or community publications and facilitated through shared leadership with school, district, or county administrations.
- Teaching within teacher education programs dedicated to strengthening the expertise of future teachers in mathematics that result in at least 80% satisfaction of participants.