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Information

Professional Services Committee

Discussion of the Subject Matter Program Review Process

Executive Summary: This agenda item describes the current review process for prospective subject matter programs and provides suggestions for potentially streamlining this process.

Recommended Action: For information only

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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

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Discussion of the Subject Matter Program Review Process

Introduction

This agenda item describes the current review process for subject matter programs and proposes some suggestions for potentially streamlining this review. The last time the Commission considered the review process for subject matter programs was at the July-August 2006 meeting (<http://www.ctc.ca.gov/commission/agendas/2006-08/2006-08-6F.pdf>.) Based on the Commission's discussion at the present meeting, staff could potentially bring an action item to a future meeting to revise the review procedures for subject matter programs.

Background

Since the Ryan Act of 1970 (Chap. 557, Stats. 1970), the Education Code has provided two routes for individuals to satisfy the subject matter requirement (§ 44310). The Ryan Act instituted a requirement that all candidates for a Multiple or Single Subject Teaching Credential pass a subject matter examination. However, the legislation also provided for an alternative to the subject matter examination requirement. This option authorized colleges and universities to design and implement subject matter programs approved by the Commission that would "waive" the examination by providing a coursework route to establishing subject matter competence. (In addition, each candidate was/is required to complete an approved professional teacher preparation [pedagogy] program.)

Over the years, Commission policies have directed that the two routes ensure equivalent content knowledge of individuals preparing to become teachers and that the content is closely related to the curriculum of the public schools. When the Commission developed subject matter program standards and its own subject matter examinations in the early 1990s, the two routes were brought into even closer alignment by using one set of subject matter requirements (SMRs) for the development of both the examination and the program standards. Also, as a part of the program standards, the Commission included some standards that addressed program qualities beyond the subject matter content that were recommended by the subject matter advisory panels. Later, SB 2042 (Chap. 548, Stats. 1998) required that both the examination and the program routes be aligned to the K-12 student academic content standards.

Typically subject matter preparation occurs during a candidate's undergraduate coursework. To satisfy the subject matter requirement, an individual may elect to complete a course of study as part of the bachelor's degree that meets the Commission's subject matter requirements or an individual may complete a bachelor's degree in any subject, take and pass the appropriate subject matter examination. Some argue that completing an approved subject matter program as compared to passing the subject matter examination ensures a greater level of knowledge and understanding in that subject matter for an individual who wishes to become a teacher. A rationale for this point of view stems from concerns that it might be possible that an individual who is good at taking tests could pass the appropriate subject matter examination but not have a rich and deep understanding of the particular subject matter.

Colleges and universities that intend to offer subject matter preparation to undergraduate students through Commission-approved programs must meet the adopted subject matter standards in order to be approved by the Commission for this purpose. Because of NCLB requirements, since 2004, candidates for a multiple subject credential do not have the program option to meet the subject matter requirement but must take and pass the subject matter examination (currently the California Subject Examinations for Teachers - CSET: Multiple Subjects). An approved single subject matter program is viewed as equivalent to a college major by NCLB. Therefore, at this time, the completion of an approved subject matter program in lieu of a subject matter exam is only available for the single subject credential.

To meet the adopted subject matter standards, colleges and universities submit a subject matter program document for review by expert subject matter panels. These panels review all program documentation and make an informed determination as to whether the program meets the standards common to all subject matter programs and the subject-specific subject matter standards. Once the review panel has determined that a single subject matter program proposal meets the adopted standards, the Commission receives the recommendation to approve the single subject matter program.

Overview of the Subject Matter Program Review Procedures

Following are the current general procedures for the review of subject matter programs:

1. Technical Assistance – After the Commission adopts a set of new program standards, Commission staff members provide technical assistance to prospective program sponsors wishing to submit responses to the new standards. Technical assistance materials are provided on the Commission’s website. Staff members train, assign, and coordinate review team work.
2. Preconditions Review – After the program proposal is received, Commission staff review the sponsor’s response to the preconditions. The preconditions are based on both state laws and Commission policies, and address minimum unit and content area requirements. If the preconditions response is incomplete, the sponsor is requested to provide specific information necessary for compliance with the preconditions.
3. Program Review – The program sponsor’s responses to the Commission’s subject matter program standards are reviewed by a team of two or more subject matter educators to determine if the program meets the program standards, including the subject matter requirements (SMRs). The SMRs are the content knowledge required to be covered in the program and are aligned to the K-12 content standards that the candidate will be expected to know. The reviewers are trained in the alignment of the standards and subject matter requirements and in the review process before they are assigned proposals to review. Reviewers are instructed to find explicit evidence that programs not only align with K-12 content standards but also introduce their candidates to those standards within the context of their subject matter studies. The team must reach consensus that each standard and required element is met based upon evidence provided in the

document. If the program does not meet the standards, the sponsor is given an explanation of the findings. The sponsor may then submit the additional information requested. Once reviewers determine that the program proposal provides a convincing and adequate body of evidence to meet the Commission's adopted subject matter program standards, the program is recommended to the Commission for approval. At this time the agenda items for approval of subject matter programs are contained in the Commission's Consent Agenda.

4. After subject matter program approval is granted by the Commission, the institution may accept candidates in the approved subject matter program. Graduates of a Commission approved single subject matter preparation program meet the Commission's subject matter requirement and are not required to take the subject matter examination (CSET).

The process of 1) program development, 2) submission, 3) review, and 4) approval can be quite lengthy. The length of time an institution takes to develop a program will vary. Subject matter programs are typically housed in Colleges of Arts and Sciences, not the School or College of Education. The internal institutional program development and review process itself prior to submission of the program to the Commission for review can be lengthy and complex. Apart from establishing the curriculum for the program, institutions face additional challenges in developing proposed subject matter programs because of the need to coordinate faculty outside of the School or College of Education in an activity that is voluntary. Yet, institutions submit the prospective subject matter programs in large measure because of the belief that subject matter programs aligned to the K-12 content standards prepare prospective teachers effectively in their content knowledge.

While the internal institutional challenges with the program development process are beyond the Commission's ability to affect, improvements to the submission and review process conducted by the Commission could be considered. The submission and review process has been viewed as overly arduous by many. The current review process described in the overview above and more specifically below uses educators as peer reviewers. For a time, the Commission did not have sufficient funds to provide "protected" reading time for the review process. For a number of years, it was expected that the expert review panels would do the voluntary job of reviewing prospective program proposals on their own time and communicate with their partner(s) through the use of technology, but this approach was changed in 2006 when the Commission confirmed that protected reading time would be provided to subject matter review panels. With protected time for the review process, the panel members can travel to a common location and work together to read and review the program proposals.

In 2006 the Commission amended the review process for subject matter programs slightly to require that programs in the core content areas submitted after January 1, 2007, submit information showing how the courses, texts and key assessments proposed by the program are aligned to the Commission's SMRs. For example, the English content area matrix (<http://www.ctc.ca.gov/educatorprep/standards/SSMP-Matrix-English.doc>) requires the institution to provide information that shows which courses, textbooks and key assignments will address each of the SMRs in the Commission's adopted program standards. This requirement

currently only pertains to programs in the four core areas of English, mathematics, science and social science. Matrix templates are provided on the Commission's web site for these four core content areas: <http://www.ctc.ca.gov/educator-prep/STDS-subject-matter.html>

Detailed Description of the Current Review Process

Prospective sponsors of subject matter preparation programs must submit a number of types of documentation that address a variety of requirements:

1. Preconditions—requirements that must be met based on state law or Commission policy
2. Standards Common to All—Category I
3. Content-specific Standards—Category II
4. Alignment Matrix-if the program is in English, mathematics, science or social science

Preconditions: The Preconditions for subject matter programs address the required number of units in the approved program and the breadth, depth and concentrations in the subject matter content areas for the program. The Preconditions related to the number of required units vary across the content area, but for most single subject programs the approved program must include a minimum of 45 semester units. A sample set of Preconditions—from the Mathematics subject matter standards—is presented in Appendix A. For comparison purposes, the unit requirement for a major as defined by the No Child Left Behind law is 32 semester units.

Standards Common to All: The *Standards Common to All* are the first ten standards for subject matter programs and are applicable across all content areas. (Please note that these are different standards than the Commission's Common Standards which apply to all educator preparation programs that lead directly to a credential.) The *Standards Common to All* address issues of program design and capacity. They were originally developed and recommended to the Commission by the subject matter advisory panels to highlight desirable qualities of subject matter preparation programs beyond the subject matter content. Two of the *Standards Common to All* are presented in Appendix B and the full text of the *Standards Common to All* can be found in each of the subject matter program handbooks: <http://www.ctc.ca.gov/educator-prep/STDS-subject-matter.html>

- Standard 1: Program Philosophy and Purpose
- Standard 2: Diversity and Equity
- Standard 3: Technology
- Standard 4: Literacy
- Standard 5: Varied Teaching Strategies
- Standard 6: Early Field Experiences
- Standard 7: Assessment of Subject Matter Competence
- Standard 8: Advisement and Support
- Standard 9: Program Review and Evaluation
- Standard 10: Coordination

The *Standards Common to All* were designed to ensure that approved programs provide prospective teachers with a variety of experiences and content that are/will be useful to a teacher. For example, the Early Field Experiences standard requires approved programs to provide opportunities for the prospective teacher to observe in a K-12 classroom and work with small

groups of students. The Varied Teaching Strategies standard requires the approved program to ensure that the prospective teacher is exposed to a variety of teaching strategies through the subject matter program. None of the program qualities defined in the *Standards Common to All* are included in the examination content specifications or assessed by the adopted content examinations, although the advisory panel considered these experiences to be important qualities of a subject matter preparation program.

Content-specific Standards-Category II: For each content area, the Category II standards define the breadth and depth of content that the approved subject matter program must address. Each content area has a different number of content-specific standards depending on the topics that must be addressed in the program. The Category II standards are closely aligned with the adopted K-12 academic content standards. Presented in Appendix C are three of the content-specific mathematics standards. Within each content area, subject matter requirements (SMRs) were developed by a Commission-appointed content expert advisory panel and adopted by the Commission. Appendix D provides the SMRs for the Algebra domain of the mathematics single subject content standards. The SMRs are directly aligned with the adopted K-12 academic content standards and the alignment is provided in the SMR document. See pages 15-16 of this agenda item for an example of how the alignment of the academic content standards with the SMRs is documented.

Alignment Matrix: For the content areas of mathematics, English, science and social science prospective program sponsors must also complete the alignment matrix as described above.

The intent of the Commission’s review of subject matter programs is to ensure that approved programs are designed in such a manner that the program completers have all the necessary content knowledge and skills to become successful teachers. At this time, subject matter programs are only reviewed initially and once approved may continue to operate until revised program standards are adopted. It is intended that subject matter programs will be integrated into the Commission’s accreditation system beginning in the 2010-2011 year, once the Committee on Accreditation develops appropriate procedures to include the subject matter programs.

Transition from Prior Subject Matter Standards to SB 2042 Standards

It seems possible that the very detailed nature of the current review process for subject matter programs may be precluding some institutions from submitting a subject matter program. Approval for the pre-SB 2042 subject matter programs has expired for four content areas and within the next three years for the remainder of the content areas. In fact at this time, no new candidates may begin a subject matter program unless it has been approved under the SB 2042 program standards as is shown in the table below.

Phase	Content Areas	Last date to for a candidate to	
		begin a non-SB 2042 program	complete a non-SB 2042 program
I	English, mathematics, science, and social science	July 1, 2005	July 1, 2009
II	Art, music, languages other than English, and physical education	July 1, 2006	July 1, 2010

Phase	Content Areas	Last date to for a candidate to	
		begin a non-SB 2042 program	complete a non-SB 2042 program
III	Agriculture, business, health science, home economics, and industrial and technology education	July 1, 2008	July 1, 2012

The total number of approved subject matter programs that were in operation under the prior standards as well as the number of programs approved under the SB 2042 standards is shown below. A table that provides information for each of the single subject content areas is available in Appendix E of this agenda item. Clearly, at this time there are fewer approved programs than there were under the prior standards. For the multiple subject programs, there are 39 programs instead of the 64 that were previously approved. This decrease is most likely due to the fact that since July 2004 the No Child Left Behind (NCLB) law has required all individuals seeking to earn a multiple subject teaching credential to pass an examination.

Number of Approved Subject Matter Programs								
	Prior Standards				SB 2042 Standards			
	CSU	Private	UC	Total	CSU	Private	UC	Total
Multiple Subject Subject Matter Programs	21	40	3	64	12	24	3	39
Single Subject Subject Matter Programs	194	118	43	355	81	31	9	121

As previously stated, single subject candidates who complete an approved subject matter program meet the subject matter competency requirement and do not need to pass a subject matter examination. However, there are only 121 single subject matter programs approved under the SB 2042 standards. There were 355 approved subject matter programs under the prior standards. This is almost a 66% decrease in the number of approved single subject matter programs since the SB 2042 standards were adopted. According to many individuals, the arduous nature of the review process under the SB 2042 standards has been one of the reasons why there are so many fewer approved programs.

If the subject matter review process were to be streamlined without losing the assurance of program quality and the depth and breadth of subject matter coverage, then it is possible that additional subject matter programs would be submitted, reviewed in a timely manner, and available for prospective teachers to complete.

Possibilities for Streamlining the Review Process for Subject Matter Programs

The Commission could consider several possible ways to streamline the review process for subject matter programs. The subject matter preparation programs are part of the SB 2042 reform (Chap. 548, Stats. 1998) and as such the program standards were developed with “required elements.” This is true for both the *Standards Common to All* (Standards 1-10) and the content-specific standards. In January 2009, the Commission adopted edited standards for the multiple and single subject preliminary preparation programs which no longer have “required elements.” Therefore, one logical streamlining option would be to require programs to respond

only to the standard statement and not the “required elements.” The subject matter program standards are due to be reviewed and revised within the next five years so it does not make sense to do a full review of all required elements at this time. Therefore staff suggests holding the programs to the content of the standard statement instead of the standard and its required elements.

In addition to requiring prospective programs to respond only to the standard statement, the review process could restrict the response from prospective program sponsors to approximately one to two pages per standard. Currently, prospective program sponsors provide extremely detailed responses to each standard. It is not unusual for a response to one standard to be 10 pages in length.

An alternate streamlining option could be for the Commission to remove the ten *Standards Common to All* from its adopted subject matter program standards. This would bring the approved subject matter programs into closer parity with the adopted examinations. This action would be a significant shift in Commission policy. The advisory panels that developed the subject matter *Standards Common to All* believed that in addition to subject matter content, early field experience, varied teaching strategies, literacy, diversity, equity and technology are essential concepts for a prospective teacher to consider and be exposed to when completing subject matter coursework. Therefore, staff is not recommending this option.

For one of the standards, ***Program Standard 5: Varied Teaching Strategies***, programs often provide extensive narrative in response to the standard and its required elements. Instead staff proposes to provide a table, “Teaching Strategies Matrix”, that prospective program sponsors would complete (See Appendix F for a draft of this table). This table would allow an institution to provide information that addresses the program standard in a brief table format.

Staff suggests that a SMR Alignment Matrix could be posted on the Commission’s webpage for each content area (See Appendix G for a draft of such a table). Currently, only the four core content areas (English, mathematics, science, and social science) must complete an alignment matrix. The current alignment matrix provides the SMRs and the K-12 academic content standards and the institution must provide information on each course including the text(s) and key assignments. This proposed SMR Alignment Matrix would provide a clear yet concise way for the prospective program sponsor to demonstrate that all adopted SMRs will be addressed in the subject matter program. If the Commission were to decide that an alignment matrix is appropriate for all content areas, staff could identify which of the subject specific standards are addressed by the matrix and therefore would not need to be responded to by a prospective program sponsor or the Commission could decide that an alignment matrix addresses the content specific requirements for the Category II standards. If this were to be the case, then prospective programs would submit the alignment matrix and not respond to the Category II standards.

In addition, staff suggests that the Commission’s secure website could be used for sponsors to upload program proposals. This would save institutions the expense of copying the program proposal, putting all parts of the proposal into binders, and shipping the proposal to Sacramento. In addition reviewers could access the program proposals through the secure website. Therefore,

significant time and resources could be saved by the institution and the Commission. The savings in shipping time alone would be at least one week.

In summary, staff suggests that one or more of the following changes could be considered to streamline the subject matter program review process:

1. All prospective subject matter program proposals would respond to the adopted standard statement but not the required elements. This would be the case for both the *Standards Common to All* and the content-specific program standards.
2. Responses to the standard statement would be limited. Responses would be approximately one or two pages in length per standard and describe how the program will meet the standard in narrative form.
3. Prospective programs would be provided a sample Teaching Strategies Matrix. This matrix would be a way for the program to submit information for Program Standard 5 which requires information on the variety of teaching strategies that are utilized across the proposed courses. To satisfy Program Standard 5, the program would complete the table or provide the information in another format (Appendix F).
4. Prospective programs would be provided a sample SMR Alignment Matrix. The program would complete the table or provide the information in another format. (Appendix G). This information would provide sufficient detail to address the content-specific program standards.
5. Program proposals would be uploaded to a secure website, including appendices and course syllabi. Prospective programs would submit course syllabi for all courses that would be required in the approved program.
6. Peer reviewers would access all program documentation through the secure website.

Next Steps

Based on the Commission's discussion of the subject matter program review process and the staff's suggestions for potentially streamlining the process, staff could prepare an agenda item for the Commission's consideration and possible action.

If the Commission would like additional stakeholder input before finalizing the suggested streamlining of the subject matter review process, staff could seek feedback from stakeholders. Staff could conduct a field review of the proposed streamlined review system or work with the three higher education segments, or with a wider stakeholder group, to review the potential streamlined review process for subject matter programs.

Appendix A Preconditions

Preconditions for the Approval of Subject Matter Programs in Mathematics

To be approved by the Commission, a Subject Matter Program in Mathematics must comply with the following preconditions.

- (1) Each program of subject matter preparation for the Single Subject Teaching Credential in Mathematics shall include (a) a minimum of 30 semester units (or 45 quarter units) of core mathematics coursework that is directly related to subjects that are commonly taught in departmentalized mathematics classes in California public schools, and (b) a minimum of 15 semester units (or 22 quarter units) of coursework that provides extended study of the subject. These two requirements are elaborated in Preconditions 2 and 3.
- (2) The core of the program shall include coursework in subjects commonly taught in departmentalized classes of mathematics and related subjects in the California public schools such as algebra (or demonstrated proficiency), geometry, number theory, calculus, history of mathematics, and statistics and probability.
- (3) Extended studies (breadth, depth, perspective, concentrations) in the program shall be designed to supplement the core of the program.

In addition to describing how a program meets each standard of program quality in this handbook, the program document by an institution shall include the course titles, unit designations, catalog descriptions and syllabi of all courses in the program that are used to meet the standards. Program documents must include a matrix chart that identifies which courses meet which standards.

Institutions may determine whether the standards and required elements are addressed through one or more courses for each commonly taught subject or courses offering integrated study of these subjects. Institutions may also define the program in terms of required or elective coursework. However, elective options must be equivalent in meeting the standards. Coursework offered by any appropriate department(s) of a regionally accredited institution may satisfy the preconditions and standards in this handbook. Programs may use general education courses in meeting the standards.

Preconditions for the Approval of Subject Matter Programs in Foundational Mathematics

To be approved by the Commission, a Subject Matter Program in Foundational Mathematics must comply with the following preconditions.

- (1) Each program of subject matter preparation for the Single Subject Teaching Credential in Foundational Mathematics shall include (a) a minimum of 30 semester units (or 45 quarter units) of core mathematics coursework that is directly related to subjects that are commonly taught in departmentalized mathematics classes in California public schools, and (b) a minimum of 15 semester units (or 22 quarter units) of coursework that provides extended study of the subject. These two requirements are elaborated in Preconditions 2 and 3.
- (2) The core of the program shall include coursework in subjects commonly taught in departmentalized classes of mathematics and related subjects in the California public schools such as algebra (or demonstrated proficiency), geometry, number theory, and statistics and probability.
- (3) Extended studies (breadth, depth, perspective, concentrations) in the program shall be designed to supplement the core of the program.

In addition to describing how a program meets each standard of program quality in this handbook, the program document by an institution shall include the course titles, unit designations, catalog descriptions and syllabi of all courses in the program that are used to meet the standards. Program documents must include a matrix chart that identifies which courses meet which standards.

Institutions may determine whether the standards and required elements are addressed through one or more courses for each commonly taught subject or courses offering integrated study of these subjects. Institutions may also define the program in terms of required or elective coursework. However, elective options must be equal in meeting the standards. Coursework offered by any appropriate department(s) of a regionally accredited institution may satisfy the preconditions and standards in this handbook. Programs may use general education courses in meeting the standards.

Appendix B

Two Example of Standards Common to All

Standard 6: Early Field Experiences

The program provides prospective Single Subject teachers with planned, structured field experiences in departmentalized classrooms beginning as early as possible in the subject matter program. These classroom experiences are linked to program coursework and give a breadth of experiences across grade levels and with diverse populations. The early field experience program is planned collaboratively by subject matter faculty, teacher education faculty and representatives from school districts. The institution cooperates with school districts in selecting schools and classrooms for introductory classroom experiences. The program includes a clear process for documenting each prospective teacher's observations and experiences.

Required Elements:

- 6.1 Introductory experiences shall include one or more of the following activities: planned observations, instruction or tutoring experiences, and other school based observations or activities that are appropriate for undergraduate students in a subject matter preparation program.
- 6.2 Prospective teachers' early field experiences are substantively linked to the content of coursework in the program.
- 6.3 Fieldwork experiences for all prospective teachers include significant interactions with K-12 students from diverse populations represented in California public schools and cooperation with at least one carefully selected teacher certificated in the discipline of study.
- 6.4 Prospective teachers will have opportunities to reflect on and analyze their early field experiences in relation to course content. These opportunities may include field experience journals, portfolios, and discussions in the subject matter courses, among others.
- 6.5 Each prospective teacher is primarily responsible for documenting early field experiences. Documentation is reviewed as part of the program requirements.

Standard 10: Coordination

One or more faculty responsible for program planning, implementation and review coordinate the Single Subject Matter Preparation Program. The program sponsor allocates resources to support effective coordination and implementation of all aspects of the program. The coordinator(s) fosters and facilitates ongoing collaboration among academic program faculty, local school personnel, local community colleges and the professional education faculty.

Required Elements:

- 10.1 A program coordinator will be designated from among the academic program faculty.
- 10.2 The program coordinator provides opportunities for collaboration by faculty, students, and appropriate public school personnel in the design and development of and revisions to the program, and communicates program goals to the campus community, other academic partners, school districts and the public.
- 10.3 The institution allocates sufficient time and resources for faculty coordination and staff support for development, implementation and revision of all aspects of the program.
- 10.4 The program provides opportunities for collaboration on curriculum development among program faculty.
- 10.5 University and program faculty cooperate with community colleges to coordinate courses and articulate course requirements for prospective teachers to facilitate transfer to a baccalaureate degree-granting institution.

Appendix C

Category II: Mathematics Subject Matter Program Standards

Standard 11: Required Subjects of Study

In the program, each prospective teacher studies and learns advanced mathematics that incorporates the Mathematics Content Standards for California Public Schools: Kindergarten Through Grade Twelve (1997) and the Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve (1999). The curriculum of the program addresses the *Subject Matter Requirements* and standards of program quality as set forth in this document.

Required Elements:

- 11.1* Required coursework includes the following major subject areas of study: algebra, geometry, number theory, calculus, history of mathematics, and statistics and probability. This coursework also incorporates the content of the student academic content standards from an advanced viewpoint (see *Attachment to Standard 11: Required Subjects of Study* page 18). Furthermore, infused in required coursework are connections to the middle school and high school curriculum.
- 11.2 Required coursework exposes underlying mathematical reasoning, explores connections among the branches of mathematics, and provides opportunities for problem solving and mathematical communication.
- 11.3 Required courses are applicable to the requirements for a major in mathematics. Remedial classes and other studies normally completed in K-12 schools are not counted in satisfaction of the required subjects of study.
- 11.4 The institution that sponsors the program determines, establishes and implements a standard of minimum scholarship for coursework in the program.
- 11.5 Required coursework includes work in computer science and/or related mathematics such as: 1) discrete structures (sets, logic, relations and functions) and their application in the design of data structures and programming; 2) design and analysis of algorithms including the use of recursion and combinations; and, 3) use of the computer applications and other technologies to solve problems.

*Calculus and history of mathematics are not required subjects of study for the foundational-level credential.

Standard 12: Problem Solving

In the program, prospective teachers of mathematics develop effective strategies for solving problems both within the discipline of mathematics and in applied settings that include non-routine situations. Problem-solving challenges occur throughout the program of subject matter preparation in mathematics. Through coursework in the program, prospective teachers develop a sense of inquiry and perseverance in solving problems.

Required Elements:

In the program, each prospective teacher learns and demonstrates the ability to:

- 12.1 Place mathematical problems in context and explore their relationship with other problems.
- 12.2 Solve mathematical problems in more than one way when possible.
- 12.3 Generalize mathematical problems in more than one way when possible.
- 12.4 Use appropriate technologies to conduct investigations and solve problems.

Standard 13: Mathematics as Communication

In the program, prospective teachers learn to communicate their thinking clearly and coherently to others using appropriate language, symbols and technologies. Prospective teachers develop communication skills in conjunction with mathematical literacy in each major component of a subject matter program.

Required Elements:

In the program, each prospective teacher learns and demonstrates the ability to:

- 13.1 Articulate mathematical ideas verbally and in writing, using appropriate terminology.
- 13.2 Where appropriate present mathematical explanations suitable to a variety of grade levels.
- 13.3 Present mathematical information in various forms, including but not limited to models, charts, graphs, tables, figures, and equations.
- 13.4 Analyze and evaluate the mathematical thinking and strategies of others.
- 13.5 Use clarifying and extending questions to learn and to communicate mathematical ideas.
- 13.6 Use appropriate technologies to present mathematical ideas and concepts.

Appendix D

Subject Matter Requirements

Domain 1. Algebra

Candidates demonstrate an understanding of the foundations of the algebra contained in the Mathematics Content Standards for California Public Schools (1997) as outlined in the Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve (1999) from an advanced standpoint. To ensure a rigorous view of algebra and its underlying structures, candidates have a deep conceptual knowledge. They are skilled at symbolic reasoning and use algebraic skills and concepts to model a variety of problem-solving situations. They understand the power of mathematical abstraction and symbolism.

1.1 Algebraic Structures

- a. Know why the real and complex numbers are each a field, and that particular rings are not fields (e.g., integers, polynomial rings, matrix rings)
- b. Apply basic properties of real and complex numbers in constructing mathematical arguments (e.g., if $a < b$ and $c < 0$, then $ac > bc$)
- c. Know that the rational numbers and real numbers can be ordered and that the complex numbers cannot be ordered, but that any polynomial equation with real coefficients can be solved in the complex field

(Mathematics Content Standards for California Public Schools, Grade 6, Number Sense: 1.0, 2.0; Grade 7, Algebra and Functions: 1.0; Algebra I: 1.0, 3.0-7.0, 9.0-15.0, 24.0, 25.0; Geometry: 1.0, 17.0; Algebra II: 1.0-8.0, 11.0, 24.0, 25.0; Trigonometry: 17.0; Mathematical Analysis: 2.0; Linear Algebra: 9.0, 11.0)

1.2 Polynomial Equations and Inequalities

- a. Know why graphs of linear inequalities are half planes and be able to apply this fact (e.g., linear programming)
- b. Prove and use the following:
 - ♦ The Rational Root Theorem for polynomials with integer coefficients
 - ♦ The Factor Theorem
 - ♦ The Conjugate Roots Theorem for polynomial equations with real coefficients
 - ♦ The Quadratic Formula for real and complex quadratic polynomials
 - ♦ The Binomial Theorem
- c. Analyze and solve polynomial equations with real coefficients using the Fundamental Theorem of Algebra

(Mathematics Content Standards for California Public Schools, Grade 7, Algebra and Functions: 2.0-4.0; Algebra I: 1.0, 2.0, 4.0-10.0, 12.0-15.0, 17.0-23.0; Algebra II: 2.0-11.0, 16.0, 17.0; Trigonometry: 17.0, 18.0; Mathematical Analysis: 4.0, 6.0)

1.3 Functions

- a. Analyze and prove general properties of functions (i.e., domain and range, one-to-one, onto, inverses, composition, and differences between relations and functions)
- b. Analyze properties of polynomial, rational, radical, and absolute value functions in a variety of ways (e.g., graphing, solving problems)
- c. Analyze properties of exponential and logarithmic functions in a variety of ways (e.g., graphing, solving problems)

(Mathematics Content Standards for California Public Schools, Grade 6, Algebra and Functions: 1.0; Grade 7, Number Sense: 1.0, 2.0; Algebra and Functions: 3.0; Algebra I: 3.0-6.0, 10.0, 13.0, 15.0-18.0, 21.0-23.0; Algebra II: 1.0-4.0, 6.0-17.0, 24.0, 25.0; Trigonometry: 2.0, 4.0-8.0, 19.0; Mathematical Analysis: 6.0, 7.0; Calculus: 9.0)

1.4 Linear Algebra

- a. Understand and apply the geometric interpretation and basic operations of vectors in two and three dimensions, including their scalar multiples and scalar (dot) and cross products
- b. Prove the basic properties of vectors (e.g., perpendicular vectors have zero dot product)
- c. Understand and apply the basic properties and operations of matrices and determinants (e.g., to determine the solvability of linear systems of equations)

(Mathematics Content Standards for California Public Schools, Algebra I: 9.0; Algebra II: 2.0; Mathematical Analysis: 1.0; Linear Algebra: 1.0-12.0)

Appendix E

Approved Single Subject Subject Matter Programs by Segment and Content Area

Single Subject Subject Matter Programs by Content Area										
Content Area		Prior Standards				SB 2042 Standards				% Change
		CSU	UC	Private	Total	CSU	UC	Private	Total	
Phase I	English	11	4	26	41	12	2	7	21	-48%
	Mathematics	12	19	4	35	19	10	2	31	-17%
	Science: Biology	16	13	0	29	2	2	0	4	-86%
	Science: Chemistry	14	8	0	22	3	3	0	5	-77%
	Science: Geoscience	15	5	0	20	3	1	0	4	-80%
	Science: Physics	14	9	0	23	3	1	0	4	-83%
	General Science	-	-	-	-	2	2	0	4	-
	Social Science	17	20	8	45	10	3	0	13	-71%
Phase II	Art	5	0	0	5	4	4	0	8	+60%
	Languages other than English	36	13	1	40	10	1	0	11	-73%
	Music	17	13	1	21	4	1	0	5	-76%
	Physical Education	18	12	3	33	8	1	0	9	-73%
Phase III	Agriculture	4	0	0	4	0	0	0	0	-100%
	Business	3	0	0	3	0	0	0	0	-100%
	Home Economics	5	3	0	8	0	0	0	0	-100%
	Health Science	3	0	0	3	0	0	0	0	-100%
	Industrial & Technology Education	2	0	0	2	1	0	0	1	-50%

Appendix F

DRAFT Teaching Strategies Matrix

(Complete this matrix or provide the information in another manner)

Standard 5: Varied Teaching Strategies

In the program, prospective Single Subject teachers participate in a variety of learning experiences that model effective curriculum practices, instructional strategies and assessments that prospective teachers will be expected to use in their own classrooms.

Proposed Course		Curriculum Practices	Instructional Strategies	Assessments
#	Summary of Content			

Appendix G

Sample SMR Alignment Matrix

(Complete this matrix or provide the information in another manner)

Subject Matter Requirements (SMRs)	Course #s (Include key assignments or assessments, title of texts, or other evidence that the course will address the SMR)	Met/ Not Met
<p>Domain 3. Number Theory Candidates demonstrate an understanding of the number theory and a command of the number sense contained in the <u>Mathematics Content Standards for California Public Schools (1997)</u> as outlined in the <u>Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve (1999)</u> from an advanced standpoint. To ensure a rigorous view of number theory and its underlying structures, candidates have a deep conceptual knowledge. They prove and use properties of natural numbers. They formulate conjectures about the natural numbers using inductive reasoning, and verify conjectures with proofs.</p>		
<p>3.1 Natural Numbers</p> <p>a. Prove and use basic properties of natural numbers (e.g., properties of divisibility)</p>		
<p>b. Use the Principle of Mathematical Induction to prove results in number theory</p>		
<p>c. Know and apply the Euclidean Algorithm</p>		
<p>d. Apply the Fundamental Theorem of Arithmetic (e.g., find the greatest common factor and the least common multiple, show that every fraction is equivalent to a unique fraction where the numerator and denominator are relatively prime, prove that the square root of any number, not a perfect square number, is irrational)</p>		