

*California
Commission on Teacher Credentialing
Meeting of
January 9, 2003*

AGENDA ITEM NUMBER: PREP – 3

COMMITTEE: Preparation Standards Committee

TITLE: Recommended Single Subject, Subject Matter Standards of Quality and Effectiveness for Programs in English, Mathematics, Science, and Social Science

 X Action

Strategic Plan Goal(s):

Goal 1: Promote educational excellence through the preparation and certification of professional educators

- Sustain high quality standards for the preparation of professional educators
- Sustain high quality standards for the performance of credential candidates

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Recommended Single Subject, Subject Matter Standards of Quality and Effectiveness for Programs in English, Mathematics, Science, and Social Science

**Professional Services Division
January 9, 2003**

Executive Summary

This report presents recommended Single Subject, Subject Matter Program Standards for English, mathematics, science, and social science that if adopted by the Commission, will be utilized by Commission accredited colleges and universities in California for the development of subject matter programs in these four academic areas. The single subject, subject matter program standards were drafted by the four subject matter advisory panels during the past year. A sub-group of the four panels drafted ten program standards that are “Standards Common to All” that will eventually apply to all thirteen single subject areas. On a number of occasions the four academic panels reviewed and revised the draft language for the ten “Standards Common to All”. The panels completed final language for the program standards at their July 2002 meeting. During August and September 2002 the staff conducted a field review of the proposed standards. The proposed standards were mailed to all accredited four-year colleges and universities, county offices of education, school districts, the CSU Academic Senate, and selected education societies in California. Over 400 responses were received. In general, the responses were evenly distributed among the five program standard areas including the ten “Standards Common to All”. On October 15-16, the panels met in Sacramento to review and analyze all field review responses, and the standards were then revised based on this analysis. Finally, this report provides the Commissioners with further information on the field review and proposed plans for the implementation of the new subject matter standards when approved.

Policy Issue to be Considered

Should the Commission adopt the recommended single subject, subject matter program standards for programs in English, mathematics, science, and social science at California colleges and universities?

Fiscal Impact Statement

The development of these program standards in all four academic areas was funded from the Commission’s base budget. However, the costs for the October 2002, meetings of the panels and portions of three other meetings of the panels in late Spring and Summer were funded by the National Evaluation Systems, Inc. (NES). All future costs for the development of single subject, subject matter program standards will be covered by NES pursuant to a contract that has no cost to the Commission. Implementation activities are contingent on availability of funds in the Commission’s budget.

Recommendation

That the Commission approve the Single Subject, Subject Matter Program Standards for Standards Common to All, and for the single subject academic areas of English, mathematics, science, and social science.

**Recommended Single Subject, Subject Matter Standards of Quality
and Effectiveness for Programs in English, Mathematics, Science,
and Social Science**

Professional Services Division

January 9, 2003

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Recommended Single Subject, Subject Matter Standards of Quality and Effectiveness for Programs in English, Mathematics, Science, and Social Science

Professional Services Division

January 9, 2002

Background

The Single Subject, Subject Matter Program Standards for Approved Subject Matter Programs in English, Mathematics, Science, and Social Science

Teacher candidates in California are required to demonstrate competence in the subject matter they will be authorized to teach. Candidates have two options available for satisfying this requirement. They can either complete a Commission-approved subject matter preparation program, or they can pass the appropriate Commission-adopted subject matter examination(s). Because they satisfy the same requirement, these two options should be as aligned and congruent as possible.

In the early 1990s, the Commission developed and adopted (a) standards for subject matter preparation programs and, at the same time, (b) specifications for the subject matter examinations. This work was based on the advice of subject matter advisory panels and data from validity studies, and resulted in program standards and examination specifications (defining the subject matter competence requirement) that were valid and closely aligned with each other. Those standards and specifications are in use today.

The substance and relevance of the single subject, subject matter program standards and the validity of exam specifications (subject matter requirements) is not permanent, however. The periodic reconsideration of subject matter program standards and need for periodic validity studies are directly related to one of the fundamental missions of the Commission, to provide a strong assurance that teaching credentials issued by the Commission are awarded to individuals who have learned the most important knowledge, skills, and abilities that are actually needed in order to succeed in public school teaching positions in California. Best professional practice related to the standards and the legal defensibility of the exam specifications require that the validity of Commission policies be periodically reviewed and rewritten, as job requirements and expectations to change over time (Ed Code 44225i, j, 44257, 44288).

In the late 1990s, the State Board of Education adopted K-12 Student Academic Content Standards in English, mathematics, science, and social science. These new standards have obvious and direct implications for the subject matter competence requirement of prospective teachers. This was recognized in SB 2042 (Alpert, 1998), which requires the Commission to ensure that subject matter program standards and examinations are aligned with the K-12 student content standards adopted by the State Board. The single subject, subject matter panels spent

considerable time to ensure that the enclosed proposed standards were grounded in, and aligned with, the K-12 Student Academic Content Standards.

Subject Matter Advisory Panels

In January 2001 the Executive Director appointed subject matter panels in English, mathematics, science, and social science to advise Commission staff on the development of new subject matter program standards and examinations in these subject areas. Each panel consisted of:

- Classroom teachers of the subject area,
- Subject area specialists in school districts, county offices of education, and postsecondary institutions,
- Professors in the subject area teaching in subject matter preparation programs,
- Teacher educators,
- Members of relevant professional organizations,
- Members of other relevant committees and advisory panels, and
- A liaison from the California Department of Education.

There were eighteen members appointed to the English panel; seventeen members appointed to the mathematics panel; twenty appointed to the social science; and twenty-three appointed to the science panel.

The panels began their work in March 2001. At their initial meeting, staff provided and discussed (a) a written “charge” to the panels describing their responsibilities, (b) the existing single subject program standards, and (c) characteristics of the “subject matter requirements” (SMRs) that the panels were to help develop. The SMRs are the subject-specific knowledge, skills, and abilities needed by beginning teachers. The SMRs were approved by the Commission at its June 6, 2002 meeting. The SMRs will specify the content that is to be taught in Commission-approved subject matter preparation programs.

In April 2001 the Executive Director signed a contract with the American Institutes for Research (AIR) to work with Commission staff and the advisory panels to develop and validate, for each of the four subject areas, SMRs for prospective secondary teachers.

Development and Validation of the SMRs and Program Standards

With leadership from Commission staff and assistance from AIR staff, the advisory panels in English, mathematics, science, and social science have met almost monthly since their initial meeting in March 2001. The panels have focused their work primarily on their charge to develop new program standards including SMRs.

For each of their respective subject areas, the panels developed preliminary SMRs aligned with the student content standards. The following eight sets of SMRs have been developed and presented to the Commission and approved in June 2002:

- English
- mathematics
- social science

- science, which includes
 - general science
 - biology
 - chemistry
 - Earth and planetary science (geoscience)
 - physics

The SMRs are referenced in each of the proposed sets of program standards and were enclosed with the draft standards that were sent for field review in August 2002.

Essential Documents for Panel Use

Since their first meeting in March 2001, the subject matter panels used a number of documents as primary resources for their work. The documents listed below were essential for the panels' use in developing the draft program standards that are enclosed for adoption by the Commission.

- The K-12 Student Academic Content Standards and Frameworks that have been approved by the California State Board of Education (1998-2002).
- The Commission-approved (1992) Standards of Quality and Effectiveness for Subject Matter Programs in English, Mathematics, Science, and Social Science, and Handbooks for Teacher Educators and Program Reviewers in each of the four academic areas (1992).
- The Standards of Program Quality and Effectiveness for the Subject Matter Requirements for the Multiple Subject Teaching Credential (Sept., 2001).
- The Standards for Quality and Effectiveness for Professional Teacher Preparation Programs (Sept., 2001).
- The National Standards for the National Council for Teachers of Mathematics (NCTM), National Council for Teachers of English (NCTE), National Council for Social Science (NCSS), and National Science Teachers Association (NSTA).
- The panels also reviewed several other publications and research articles. Several panel members brought state and national studies and publications for each panels' use.

The State Board of Education-adopted K-12 Student Academic Content Standards were the seminal documents used by the panels. At the very first meeting of the single subject panels in March 2001, panel members reviewed the State Board of Education-adopted K-12 Student Academic Content Standards and began the development of a matrix in each academic area. They compared and contrasted the K-12 Standards with the existing 1992 set of Commission-adopted Single Subject, Subject Matter Program Standards and content allocation for each subject area. Further development of the matrix for each subject matter area continued through the entire process of identifying and drafting the proposed SMRs. In general, the panels identified important changes in the language of the 1992 Single Subject Standards, but found the

1992 standards to be a significant resource document. In the 1992 documents, the panels identified six standard areas that were common to each of the four sets of academic standards. This process was instrumental in assisting the panels in identifying the ten “Standards Common to All” enclosed for proposed adoption by the Commission.

The Subject Matter Requirements for the Multiple Subject Teaching Credential was also an important document used by the panel. The thirteen Multiple Subject, Subject Matter Program Standards became a model for the four single subject, subject matter panels. In many cases the multiple subject standards language and organization of the standards and standard elements were adopted by the panels. The standards of the national professional organizations also served as a guide and provided a comprehensive perspective for panel members.

The draft single subject, subject matter standards were formatted and aligned consistent with other standards adopted pursuant to SB 2042. The standard is presented, followed by the identification of the critical elements of the standard. No element was written that was not articulated in the language of the standard. This practice contrasts with the practice of the 1992 single subject standards, where a “rationale” was provided for each standard that, at times, went beyond the language of the standard itself. Also, the 1992 standards had “factors to consider” that, in a number of areas, also went beyond the language of the standard.

Proposed Single Subject, Subject Matter Program Standards

As stated earlier, there are two major categories of single subject, subject matter standards. The first category of program standards are those that are “Common to All”. These ten program standards apply to all 13 single subject, subject matter areas e.g., art, music, physical education, and languages other than English (LOTE). They address critical program elements that are to be developed by the sponsors of all single subject, subject matter programs.

Standards Common to All: Table 1 summarizes the content and purposes of the proposed standards. The full text of the new standards is included in Appendix A.

Table 1: Proposed Single Subject, Subject Matter Program Standards that are “Common to All”

Categories of Proposed Standards	Purpose of Each Proposed Category
<p>Category A: Program Design and Qualities Standard 1: Program Philosophy and Purpose Standard 2: Diversity and Equity Standard 3: Technology Standard 4: Literacy</p>	<p>Purpose: Category A describes essential program-wide elements that must be addressed by sponsors of single subject, subject matter programs in order to develop and deliver high quality subject matter programs.</p>
<p>Category B: Program Curriculum* Standard 5: Varied Teaching Strategies Standard 6: Early Field Experiences Standard 7: Assessment of Subject Matter Competence</p> <p>*Curriculum content is subject-specific and is found in subject-specific standards</p>	<p>Purpose: Category B addresses how perspective teachers experience the program curriculum. They experience a wide array of teaching in their courses and observe this same array in field work.</p>
<p>Category C: Program Governance Standard 8: Advisement and Support Standard 9: Program Review and Education Program 10: Program Coordination</p>	<p>Purpose: Category C describes aspects of subject matter programs that are essential to program operation, including a system of advising, effective coordination, and periodic review of practices.</p>

The second major category of standards that are enclosed in this item are the subject specific program standards for English, mathematics, science, and social science. The number and title for each specific program standard are summarized in Table 2.

Table 2: Specific Subject Standard Breakdown

Single Subject Area	Number of Standards	Standard Title
English	6	11: Required Subject of Study 12: Extended Studies 13: Literature and Textual Analysis 14: Language, Linguistics and Literacy 15: Composition and Rhetoric 16: Communications: Speech, Media and Creative Performance
Mathematics	6	11: Required Subjects of Study 12: Problem Solving 13: Mathematics as Communication 14: Reasoning 15: Mathematical Connections 16: Delivery of Instruction
Science	7	11: The Vision for Science 12: General Academic Quality 13: Integrated Study of Science 14: Breadth of Study in Science 15: Depth of Study in a Concentration Area 15A: Depth of Study in Biological Sciences 15B: Depth of Study in Chemistry 15C: Depth of Study in Geosciences (Earth and Planetary Sciences) 15D: Depth of Study in Physics 16: Laboratory and Field Experiences 17: Safety Procedures
Social Science	9	11: Overall Quality of Program Content 12: Emphasis and Depth of Study 13: Integration of Studies 14: World Perspective 15: National Perspective 16: State Perspective 17: Citizen Perspective 18: Ethical Perspective 19: Teaching and Learning History/Social Sciences

Field Review Survey

Early in August 2002, sets of the draft Single Subject, Subject Matter Standards and the ten “Standards Common to All” were mailed to all deans of education, directors of teacher education, and single subject coordinators at all Commission-accredited four-year institutions in California. Sets of the standards were also sent to learned societies and professional organizations, funded subject matter projects, teacher organizations, school districts, and county offices of education. There were also eighty selected K-12 public school teachers and college/university professors to whom the standards were sent. The standards were also placed on the Commission’s web-site with instructions on how to download the standards and complete the field review survey, and how to fax, email, or mail completed surveys to the Commission. Potential respondents were provided email addresses, fax numbers, and phone numbers of consultants who could provide further information.

Enclosed with the survey instrument was a cover page, a list of all standards for each academic area, directions for completion of the survey and a scoring rubric for each standard and each element of the standard. The format for the survey and scoring rubric is as follows:

Table 3: Sample Survey

Standard Title	Question – How important are these program characteristics for preparing effective teachers of English?			
	Essential	Important	Somewhat Important	Not Important
Standard Element				
Standard Element				

At the end of each standard statement the question was asked: Are there any critical characteristics of program quality missing from the above standard that are important in a program that will prepare effective English teachers? Answer “yes” or “no”. If yes, what would you add?

Consultant staff tallied all responses and listed all comments on a master survey form for each subject matter area. The single subject panels met in Sacramento on October 15-16, 2002 to consider all responses and comments for each standard and standard element. The specific instructions given to the panels are as follows:

- If 1/3 or more of the ratings were “somewhat important” or “not important”, the panel must give the standard special consideration for revision, and document the panel’s response to the feedback. Documentation must include the panel’s action and support (e.g., citation from student academic content standards) for that action.
- The panel must respond to all open-ended comments and document that panel’s response to the comment. Documentation must include the panel’s action and support (e.g., citation from student academic content standards) for that action.

Panel members were asked to respond to each comment and to provide a rationale for each change in the language of a standard or element of the standard. If one-third of the scores fell under “Somewhat Important” or “Not Important,” panel members were asked to provide a written rationale for making changes or not making changes.

There were 432 responses submitted to the Commission by the end of October. Over 80% of all responses fell in the “Essential” or “Important” categories. Fewer than 5% of all responses were scored as “Not Important,” and less than 15% were scored as “Somewhat Important.” The responses were evenly distributed among the five sets of standards.

Over 80% of all responses were from higher education faculty at colleges and universities in California. Over 70% of responses were received from academic departments or faculty in the CSU system. Responses were received from all twenty-three CSU campuses, five UC campuses, and fourteen private or independent institutions.

Staff worked with members of the CSU Academic Senate to distribute these surveys to the academic departments at all twenty-three campuses. The involvement of the Academic Senate was a major reason that more than 70% of responses came from faculty at CSU campuses.

Implementation Plan

It has been the policy of the Commission to establish a window of time for institutions that have single subject, subject matter programs to transition from current approved programs to new subject matter program standards that have recently been adopted by the Commission. Typically the transition timeline is two years from the date of Commission adoption of the new standards. During the transition period, Commission consultants, who have served as lead consultants to the subject matter advisory panels in the development of the subject matter standards, provide technical assistance in the development of new institutional documents prepared in response to the new standards.

In the proposed plan, consultant staff will work with administrators in the Professional Services Division in the identification of potential qualified professionals for each of the four academic areas who would serve as reviewers of newly submitted institutional documents. Once workgroups of reviewers are formed, consultant staff will provide training and calibration activities for new panel members who will review newly submitted documents in relation to the Commission approved standards and make recommendations to the Commission for program approval. Most recently, the Commission adopted Standards of Program Quality and Effectiveness in Elementary Subject Matter, and reviewed and approved a two-year transition and implementation plan. This process will be similar to that implementation plan.

If the Commission adopts the proposed Single Subject, Subject Matter Program Standards at its December 6, 2002 meeting, the implementation period, would begin in January 2003, and end in January 2005. Institutions with approved subject matter programs would have twenty-four

months to redesign the existing programs to meet the new standards, and institutions without approved programs would be encouraged to develop subject matter programs in the four single subject areas. The first six months will be a planning period. All institutions that have expressed an interest would be offered technical assistance. Informational meetings will be held in the Winter-Spring of 2003 for institutions with existing programs and for institutions who indicate an interest in developing new programs. Institutions will be asked to select from a set of submission windows so that the work flow is somewhat evenly paced across the transition period.

It may become apparent during the implementation process that institutions may need additional time in redesigning their subject matter programs or in developing new programs. The new standards are more complex and rigorous than the current standards, and staff may need to report to the Commission on factors that may call for some adjustments in the timeframe or the implementation plan.

Appendix A - Standards

Draft Standards Common to All and Standards for English, Mathematics, Science, and Social Science

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CATEGORY A

Standard 1: Program Philosophy and Purpose

The subject matter preparation program is based on an explicit statement of program philosophy that expresses its purpose, design, and desired outcomes in relation to the Standards of Quality and Effectiveness for Single Subject Teaching Credential Programs. The program provides the coursework and field experiences necessary to teach the specified subject to all of California's diverse public school population. Subject matter preparation in the program for prospective teachers is academically rigorous and intellectually stimulating. The program curriculum reflects and builds on the State-adopted *Academic Content Standards for K-12 Students* and *Curriculum Frameworks for California Public Schools*. The program is designed to establish a strong foundation in and understanding of subject matter knowledge for prospective teachers that provides a basis for continued development during each teacher's professional career. The sponsoring institution assigns high priority to and appropriately supports the program as an essential part of its mission.

Required Elements for Standard 1: Program Philosophy and Purpose

- 1.1 The program philosophy, design, and intended outcomes are consistent with the content of the State-adopted Academic Content Standards for K-12 students and Curriculum Frameworks for California public schools.
 - 1.1.1 The statement of program philosophy shows a clear understanding of the preparation that prospective teachers need in order to be effective in delivering academic content to all students in California schools.
- 1.2 The program provides prospective teachers with the opportunity to learn and apply significant ideas, structures, methods and core concepts in the specified subject discipline(s) that underlies the 6-12 curriculum.
- 1.3 The program prepares prospective single-subject teachers to analyze complex discipline-based issues; synthesize information from multiple sources and perspectives; communicate skillfully in oral and written forms; and use appropriate technologies.
- 1.4 Program outcomes are defined clearly and assessments of prospective teachers and program reviews are appropriately aligned.
- 1.5 The institution conducts periodic review of the program philosophy, goals, design, and outcomes consistent with the following: campus program assessment timelines, procedures, and policies; ongoing research and thinking in the discipline; nationally accepted content standards and recommendations; and the changing needs of public schools in California.

Standard 2: Diversity and Equity

The subject matter program provides equitable opportunities to learn for all prospective teachers by utilizing instructional, advisement and curricular practices that insure equal access to program academic content and knowledge of career options. Included in the program are the essential understandings, knowledge and appreciation of the perspectives and contributions by and about diverse groups in the discipline.

Required Elements:

- 2.1 In accordance with the Education Code Chapter 587, Statutes of 1999, (See Appendix B), human differences and similarities to examined in the program include, but are not limited to those of sex, race, ethnicity, socio-economic status, religion, sexual orientation, and exceptionality. The program may also include study of other human similarities and differences.
- 2.2 The institution recruits and provides information and advice to men and women prospective teachers from diverse backgrounds on requirements for admission to and completion of subject matter programs.
- 2.3 The curriculum in the Subject Matter Program reflects the perspectives and contributions of diverse groups from a variety of cultures to the disciplines of study.
- 3.4 In the subject matter program, classroom practices and instructional materials are designed to provide equitable access to the academic content of the program to prospective teachers from all backgrounds.
- 3.5 The subject matter program incorporates a wide variety of pedagogical and instructional approaches to academic learning suitable to a diverse population of prospective teachers. Instructional practices and materials used in the program support equitable access for all prospective teachers and take into account current knowledge of cognition and human learning theory.

Standard 3: Technology

The study and application of current and emerging technologies, with a focus on those used in K-12 schools, for gathering, analyzing, managing, processing, and presenting information is an integral component of each prospective teacher's program study. Prospective teachers are introduced to legal, ethical, and social issues related to technology. The program prepares prospective teachers to meet the current technology requirements for admission to an approved California professional teacher preparation program.

Required Elements:

- 3.1 The institution provides prospective teachers in the subject matter program access to a wide array of current technology resources. The program faculty selects these technologies on the basis of their effective and appropriate uses in the disciplines of the subject matter program.
- 3.2 Prospective teacher demonstrate information processing competency, including but not limited to the use of appropriate technologies and tools for research, problem solving, data acquisition and analysis, communications, and presentation.
- 3.3 In the program, prospective teachers use current and emerging technologies relevant to the disciplines of study to enhance their subject matter knowledge and understanding.

Standard 4: Literacy

The program of subject matter preparation for prospective Single Subject teachers develops skills in literacy and academic discourse in the academic disciplines of study. Coursework and field experiences in the program include reflective and analytic instructional activities that specifically address the use of language, content and discourse to extend meaning and knowledge about ideas and experiences in the fields or discipline of the subject matter.

Required Elements:

- 4.1 The program develops prospective teachers' abilities to use academic language, content, and disciplinary thinking in purposeful ways to analyze, synthesize and evaluate experiences and enhance understanding in the discipline.
- 4.2 The program prepares prospective teachers to understand and use appropriately academic and technical terminology and the research conventions of the disciplines of the subject matter.
- 4.3 The program provides prospective teachers with opportunities to learn and demonstrate competence in reading, writing, listening, speaking, communicating and reasoning in their fields or discipline of the subject matter.

CATEGORY B

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.

Required Elements:

- 5.1 Program faculty include in their instruction a variety of curriculum design, classroom organizational strategies, activities, materials, and field experiences incorporating observing, recording, analyzing and interpreting content as appropriate to the discipline.
- 5.2 Program faculty employ a variety of interactive engaging teaching styles that develop and reinforce skills and concepts through open-ended activities such as direct instruction, discourse, demonstrations, individual and cooperative learning explorations, peer instruction, and student-centered discussion.
- 5.3 Faculty development programs provide tangible support for subject matter faculty to explore and use exemplary and innovative curriculum practices.
- 5.4 Program faculty use varied and innovative teaching strategies, which provide opportunities for prospective teachers to learn how content is conceived and organized for instruction in a way that fosters conceptual understanding as well as procedural knowledge.
- 5.5 Program coursework and fieldwork include the examination and use of various kinds of technology that are appropriate to the subject matter discipline.

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 teachers' 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 7: Assessment of Subject Matter Competence

The program uses formative and summative multiple measures to assess the subject matter competence of each candidate. The scope and content of each candidate's assessment is consistent with the content of the subject matter requirements of the program, and with institutional standards for program completion.

Required Elements:

- 7.1 Assessment within the program includes multiple measures such as student performances, presentations, research projects, portfolios, field experience journals, observations, and interviews as well as oral and written examinations based on criteria established by the institution.
- 7.2 The scope and content of each assessment is congruent with the specifications for the subject matter knowledge and competence as indicated in the content domains of the Commission-adopted subject matter requirement.
- 7.3 End-of-program summative assessment of subject matter competence includes a defined process that incorporates multiple measures for evaluation of performance.
- 7.4 Assessment scope, process, and criteria are clearly delineated and made available to students when they begin the program.
- 7.5 Program faculty regularly evaluate the quality, fairness, and effectiveness of the assessment process, including its consistency with program requirements.
- 7.6 The institution that sponsors the program determines, establishes and implements a standard of minimum scholarship (such as overall GPA, minimum course grade or other assessments) of program completion for prospective single subject teachers.

CATEGORY C

Standard 8: Advisement and Support

The subject matter program includes a system for identifying, advising and retaining prospective Single Subject teachers. This system will comprehensively address the distinct needs and interests of a range of prospective teachers, including resident prospective students, early deciders entering blended programs, groups underrepresented among current teachers, prospective teachers who transfer to the institution, and prospective teachers in career transition.

Required Elements:

- 8.1 The institution will develop and implement processes for identifying prospective Single Subject teachers and advising them about all program requirements, and career options.
- 8.2 Advisement services will provide prospective teachers with information about their academic progress, including transfer agreements and alternative paths to a teaching credential, and describe the specific qualifications needed for each type of credential, including the teaching assignments it authorizes.
- 8.3 The subject matter program facilitates the transfer of prospective teachers between post-secondary institutions, including community colleges, through effective outreach and advising and the articulation of courses and requirements. The program sponsor works cooperatively with community colleges to ensure that subject matter coursework at feeder campuses is aligned with the relevant portions of the *State-adopted Academic Content Standards for K-12 Students in California Public Schools*.
- 8.4 The institution establishes clear and reasonable criteria and allocates sufficient time and personnel resources to enable qualified personnel to evaluate prospective teachers' previous coursework and/or fieldwork for meeting subject matter requirements.

Standard 9: Program Review and Evaluation

The institution implements a comprehensive, ongoing system for periodic review of and improvement to the subject matter program. The ongoing system of review and improvement involves university faculty, community college faculty, student candidates and appropriate public schools personnel involved in beginning teacher preparation and induction. Periodic reviews shall be conducted at intervals not exceeding 5 years.

Required Elements:

- 9.1 Each periodic review includes an examination of program goals, design, curriculum, requirements, student success, technology uses, advising services, assessment procedures and program outcomes for prospective teachers.
- 9.2 Each program review examines the quality and effectiveness of collaborative partnerships with secondary schools and community colleges.
- 9.3 The program uses appropriate methods to collect data to assess the subject matter program's strengths, weaknesses and areas that need improvement. Participants in the review include faculty members, current students, recent graduates, education faculty, employers, and appropriate community college and public school personnel.
- 9.4 Program improvements are based on the results of periodic reviews, the inclusion and implications of new knowledge about the subject(s) of study, the identified needs of program students and school districts in the region, and curriculum policies of the State of California.

Standard 10: Coordination

One or more faculty responsible for program planning, implementation and review coordinate the Single Subject Subject-Matter Preparation Program. The program sponsor allocates resources to support effective coordination and implementation of all aspects of the program. The coordinator 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 A

Draft Standards for English

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Standard 11: Required Subject of Study

The subject matter preparation program is based on an explicit statement of program philosophy that expresses its purpose, design, and desired outcomes reflective of the Standards for Single Subject Teaching Credential Programs. The program provides the course work and field experiences necessary to teach the specified subject to all students in California's diverse public school population. The subject matter preparation for prospective teachers is academically rigorous and intellectually stimulating. The institution assigns high priority to and appropriately supports the program as an essential part of its mission. The program curriculum reflects and builds on the State-adopted *Academic Content Standards for K-12 Students* and *Curriculum Frameworks for California Public Schools*. The program is designed to establish a strong foundation in subject matter knowledge and understanding that provides a basis for continued development during the teachers' professional career.

Required Elements

- 11.1 The core program provides broad foundational studies in the four English domains as detailed in Standards 13 through 16 (literature and textual analysis; language, linguistics and literacy; composition and rhetoric; and communications: speech, media and creative performance).
- 11.2 The core program includes focused, in-depth study in one or more domains to provide rigorous, scholarly work in the recognized disciplines of English Language Arts.
- 11.3 The core program introduces English candidates to current and emerging issues in literacy, language acquisition and multicultural studies.
- 11.4 The core program includes the study of canonical literature as well as the literature of diversity, world literature, non-literary readings, workplace communications, and visual technologically mediated texts.
- 11.5 The core program includes study of research conducted and presented in multiple genres and media reflective of current technology in usage.
- 11.6 Throughout the program, literary works and other forms of human communication are considered in their historical and political contexts.

Standard 12: Extended Studies

The program includes coursework to supplement the program core and further prepare prospective teachers in the range of subjects included in the state-adopted Reading/Language Arts Framework for California public schools (1999). Prospective teachers build upon foundational knowledge acquired in the program core by further work within or across content domains. The program's design for extended studies provides prospective teachers with options, including both specialized and comprehension preparation based on coherent patterns of coursework.

Required Elements

- 12.1 The program offers extended studies that ensure that prospective teachers deepen their knowledge within or across content domains.
- 12.2 Extended study may be offered in any or all of the following patterns:
 - a. A combination of related content areas across one or more of the four domains: literature and textual analysis; language and linguistics; composition and rhetoric; and communications: speech, media and creative performance
 - b. Concentration in one domain
 - c. Concentration in any content area within a domain (e.g., speech, multicultural literature, theater)
- 12.3 The program provides advising for prospective teachers to select or develop a coherent pattern of extended study based on a well-defined goal (i.e., to meet requirements of the major; to complement or supplement studies in the program core; to pursue special professional interests, e.g. drama, journalism, and media).

Standard 13: Literature and Textual Analysis

Prospective teachers of English learners are prepared to recognize the power and importance of literature as it reflects the most eloquent statements about the human condition. Prospective teachers of English develop an appreciation for our diverse literacy heritage as an expression of our poly-cultural society and understand the ways that language can be used to articulate moral and ethical values, delight the spirit, or express the creative impulses of human thought. The program curriculum includes traditional and emerging definitions of literature, types and periods of literature, and textual analysis.

Required Elements

- 13.1 Read, study and analyze works of literature from the canon, including the literature of diversity, from a variety of literary traditions, movements, and historical contexts.
- 13.2 Know and analyze a variety of literary elements, their forms and uses.
- 13.3 Analyze literary and non-literary texts and understand their structure, content and interpretations.
- 13.4 Consider and articulate the ways in which literature can engage readers and cause them to reflect on their own experiences and the human condition.
- 13.5 Reflect on the ways literature can inspire personal and social growth and change.

Standard 14: Language, Linguistics and Literacy

The program requires prospective teachers of English to develop an understanding of language structures, language acquisition, linguistic diversity, and the development of literacy. Prospective teachers know, understand and appreciate the varieties of spoken and written English, and how they are related to the diverse cultures and societies where English is a medium of communication. Recognizing the needs of both native and non-native speakers, the program effectively models English as a communicative tool.

Required Elements

- 14.1 Know the conventions, forms and functions of Standard English grammar and sentence structure.
- 14.2 Recognize the universality of linguistic structures while acknowledging variation arising from differences of time, place and community.
- 14.3 Learn basic principles of morphology, phonology, syntax, semantics and pragmatics.
- 14.4 Explain cognitive, affective and socio-cultural as well as first language influences on language acquisition and development, and the role of these influences in developing academic literacy.
- 14.5 Examine and explain strategies for constructing meaning within the processes of reading and writing.

Standard 15: Composition and Rhetoric

In the program prospective teachers learn and apply a variety of composing processes. Prospective teachers of English analyze and compose texts representing a variety of discourse types and demonstrate the ability to use research strategies, text production technologies, and presentation methods appropriately in a range of rhetorical contexts.

Required Elements

- 15.1 Read and study the rhetorical features of literary and non-literary texts, both fiction and non-fiction.
- 15.2 Analyze rhetorical and structural differences between oral written language to explain relations between speaking and writing. Study and apply aspects of oral and written composing processes.
- 15.3 Use and analyze grammatical elements of oral and written English for a variety of rhetorical effects.
- 15.4 Consistently and accurately apply the conventions of oral and written English.
- 15.5 Learn and apply advanced research strategies for academic work in English, including collection, integration and citation of data.

Standard 16: Communications: Speech, Media and Creative Performance

In the program prospective teachers of English acquire the breadth of knowledge needed to integrate journalism, technological media, speech, dramatic performance, and creative writing into the language arts curriculum. Prospective teachers gain experience with oral and visual communication as expressed through media and performance as well as creative writing forms in order to understand how to use language effectively to communicate ideas and express themselves creatively.

Required Elements

- 16.1 Demonstrate and evaluate oral performance in a variety of forms, using appropriate delivery criteria.
- 16.2 Demonstrate the ability to analyze and respond to components of communication discourse such as audience feedback, supportive listening and critical thinking.
- 16.3 Learn and apply strategies used by the media to impact society and evaluate their impact.
- 16.4 Specify the processes and techniques for making presentations in a variety of media forms.
- 16.5 Participate in dramatic performance, such as traditional playscripts, reader's theater and oral interpretation.
- 16.5 Engage in theatrical processes, which apply production techniques, such as rehearsal strategies, principles of theatrical design and textual interpretation.
- 16.6 Produce creative writing in a variety of genres using processes and techniques that enhance the text.

Appendix A

Draft Standards for Mathematics

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Standard 11: Required Subjects of Study

In the program, each prospective teacher studies and learns advanced mathematics that incorporates the California *Student Academic Content Standards and Mathematics Frameworks for California Public Schools*. 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, *Standard 11: Required Subjects of Study*). 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.

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

- 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.

Standard 14: Reasoning

In the program, prospective teachers of mathematics learn to understand that reasoning is fundamental to knowing and doing mathematics. Reasoning and proof accompany all mathematical activities in the program.

Required Elements

- 14.1 Formulate and test conjectures using inductive reasoning, construct counter-examples, make valid deductive arguments, and judge the validity of mathematical arguments in each content domain of the subject matter requirements.
- 14.2 Present informal and formal proofs in oral and written formats in each content domain of the subject matter requirements.

Standard 15: Mathematical Connections

In the program, prospective teachers of mathematics develop a view of mathematics as an integrated whole, seeing connections across different mathematical content areas. Relationships among mathematical subjects and applications are a consistent theme of the subject matter program's curriculum.

Required Elements

- 15.1 Illustrate, when possible, abstract mathematical concepts using applications.
- 15.2 Investigate ways mathematical topics are interrelated.
- 15.3 Apply mathematical thinking and modeling to solve problems that arise in other disciplines.
- 15.4 Recognize how a given mathematical model can represent a variety of situations.
- 15.6 Create a variety of models to represent a single situation.
- 15.7 Understand the interconnectedness of topics in mathematics from an historical perspective.

Standard 16: Delivery of Instruction

In the program, faculty use multiple instructional strategies, activities and materials that are appropriate for effective mathematics instruction.

Required Elements

- 16.1 Instruction is delivered in a way that fosters conceptual understanding as well as procedural knowledge.
- 16.2 Incorporates a variety of instructional formats, including but not limited to, direct instruction, collaborative groups, individual exploration, peer instruction, and whole class discussion led by students.
- 16.3 Provides for learning mathematics in different modalities, e.g., visual, auditory, and kinesthetic.
- 16.4 Develops and reinforces mathematical skills and concepts through open-ended activities.
- 16.5 Uses a variety of appropriate technologies.
- 16.6 Includes approaches that are appropriate for use at a variety of grade levels.

Attachment

Standard 11: Required Subjects of Study

The main purpose of the Subject Matter Requirements (SMRs) is to provide a guideline for the education of prospective mathematics teachers so that they will be well equipped to teach to the state-adopted Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve, and that they have a mathematical understanding and proficiency beyond those Standards. Taken at face value, the SMRs define a minimum core of skills, abilities, and understandings for all candidates of the Single Subject Teaching Credential in Mathematics. Ideally, teacher candidates develop an advanced viewpoint of the content areas represented in this core. The intent of this appendix is to give a sense of the mathematical context in which such advanced viewpoints can be developed. The appendix provides examples and ideas for this development, and is not intended to be prescriptive. While some of these examples may seem obvious to a professor of mathematics, many mathematics majors do not make the connections. Therefore, these ideas are important for prospective teachers.

It is important to note three principles that guided the development of the SMRs:

- a) mathematical reasoning is central to mathematical understanding;
- b) mathematics requires knowledge that is connected and integrated;
- c) college faculty are central to shaping the curriculum of subject matter programs.

First, the emphasis on mathematical reasoning amplifies what is already clearly enunciated in a critical passage of the Mathematics Framework for California Public Schools, Kindergarten Through Grade Twelve (Framework):

From kindergarten through grade 7, these [content] standards have impressed on the students the importance of logical reasoning in mathematics. Starting with grade 8, students should be ready for the basic message that logical reasoning is the underpinning of all of mathematics. In other words, every assertion can be justified by logical deduction from previously known facts. Students should begin to learn to prove every statement that they make. Every textbook or mathematics lesson should strive to convey this message, and to convey it well. (p. 154)

In order for such a vision of mathematics education to materialize, teachers themselves need to be well versed in writing proofs and explaining them. For this reason, the SMRs put a heavy emphasis on logical explanations, formal and informal proofs. Explanations and proofs also underscore the fact that logical arguments occur not only in Euclidean geometry but everywhere.

A proof is a logical explanation of why a statement holds. It need not have any particular form, and the emphasis should be on the student understanding why a result holds. Written proofs in textbooks may serve as a model for exposition, but never as a model for the discovery of a proof. Proofs are usually found by painstaking trials and errors, and almost never in the logical sequence of steps laid out in written proofs. It should be emphasized that it is the logical correctness of a proof that is important, not the literary polish of the presentation of the proof. The common complaint that geometry proofs in a real classroom have become a ritual divorced from mathematics would disappear if teachers are made more aware of the need to pay attention to mathematical substance rather than minute details of the write-up of a proof. A correct proof can be legitimately presented in many ways: two-column format, paragraph format, flow-chart format, etc. No one format is inherently superior to any other.

Second, the integration of subject matter is implied in more than a few of the standards. Although the SMRs are divided into separate content domains (e.g., algebra, geometry) such a division is more for the convenience of communication rather than an advocacy for a rigid separation of mathematical instruction. For example, prospective teachers should be able to analyze and solve polynomial equations using the roots of unity. This statement assumes that the prospective teacher understands De Moivre's Theorem (SMR 5.1e) and basic properties of regular polygons. In this case, algebra, trigonometry, and geometry are completely intermingled. As another example, prospective teachers need to be able to teach the graphing of polynomials, but simple facts about such graphs (e.g., that the graph of an n th degree polynomial has at most $n-1$ "peaks" and "valleys") are not accessible without the use of calculus.

Third, the SMRs are not prescriptive about curriculum or pedagogy. There is plenty of room for the creative and informed judgements of faculty to direct the education of teachers of mathematics. For example, although it is not included in the SMRs, faculty may choose to present the derivation of the cubic formula for the purpose of deepening teachers' understanding and appreciation of the quadratic formula. Similarly, some faculty may view SMR 1.3c, which deals with properties of the logarithm function, as an implicit invitation to go into the origin of the logarithm. Napier's invention of logarithms in the 1600s was the device which, in the word of the French mathematician-astronomer Laplace, "by shortening the labors, doubled the life of the astronomer." When teachers understand this utility, and the parallels of the discovery of logarithms with the discovery and development of computing technologies, they are much better equipped to motivate students' understanding of such mathematical topics.

The following sections provide some ideas and examples for developing an advanced viewpoint, particularly about the importance of mathematical reasoning and connections, through the main subject areas of the SMRs.

ALGEBRA

Mathematical reasoning

Prospective teachers' understanding of the three fields they use most often – rational, real, and complex numbers – should include what it means for rational and real numbers to be ordered fields, and why complex numbers cannot be ordered. Inequalities make sense in real numbers, because they are ordered. However, prospective teachers should understand that although inequalities do not make sense in complex numbers, equations have a fuller role with them, because every polynomial equation with real or complex coefficients can be completely solved in complex numbers by the Fundamental Theorem of Algebra (SMR 1.1c, 1.2c).

Implicit in SMR 1.2a, which calls for a proof of why the graph of a linear inequality is a half plane, is the need for a proof of the fact that the graph of a linear function is a straight line. The latter proof requires the use of basic properties of similar triangles.

The proof of the result that the roots of real polynomials come in complex conjugate pairs (SMR 1.2b) allows one to see how to make use of the Fundamental Theorem of Algebra in a nontrivial way. In the process, one gains a better understanding of both the Fundamental Theorem of Algebra and the Quadratic Formula.

The rational root theorem for polynomials with integer coefficients (SMR 1.2b) is one that students and textbooks often mistake as a recipe for locating all the roots of such a polynomial. By reviewing the proof carefully, a prospective teacher is likely to understand the full meaning of this theorem.

The Binomial Theorem (SMR 1.2b) occupies a place of honor in algebra and has important connections in other areas of mathematics. Prospective teachers should be able to understand one of its most accessible proofs, and thereby learn a substantive application of mathematical induction.

Connections

Although the SMRs are organized into discrete content domains (e.g., algebra or calculus), prospective teachers should learn that these domains cannot be rigidly separated. For example, the importance of the exponential function (SMR 1.3c) stems primarily from the fact that it is the unique solution of the differential equation $f'(x) = f(x)$ with the initial condition $f(0) = 1$ (SMR 5.3f). It should be emphasized that it is because of this differential equation that the exponential function e^x ($\exp x$) shows up in the growth and decay problems of algebra textbooks.

The fundamental difference between polynomial functions and both exponential and logarithmic functions should be emphasized (SMR 1.3b, c). The overriding concern with a polynomial is to locate its roots and the roots of its derivative (to get the x -intercepts as well as the "peaks" and "valleys" of its graph). For exponential and logarithmic functions, however, such a concern does not exist because $\log x$ has exactly one root whereas $\exp x$ has no root at all. Moreover, both are strictly increasing functions so that their graphs have no "peaks" or "valleys." Therefore our interests in the latter functions are different in kind. Our interests in the exponential and logarithmic functions are that $\log x$ converts multiplication into addition [i.e., $\log(ab) = \log a + \log b$] while $\exp x$ does the opposite [i.e., $\exp(a+b) = (\exp a)(\exp b)$], and the fact that they are inverses to each other [i.e., $\log(\exp x) = x$ for all x and $\exp(\log y) = y$ for all

positive y]. The algebraic properties of $\log x$ account for its historical importance as a computational aid (logarithm tables). Analytically, it is the fact that $\exp x$ is the solution of $f'(x) = f(x)$, as discussed above, and the fact that $\log x$ is the function that has derivative $1/x$ and satisfies $\log 1 = 0$. The trigonometric functions are important for yet a different reason: periodicity (SMR 5.1c). Many natural phenomena are periodic, and their modeling would require the trigonometric functions. Such a conceptual understanding of these three classes of functions is indispensable to helping teachers make sense of the functions they see almost daily in algebra classes.

Although the topic of rationalizing denominators is not one that is seen as essential, it is one for which a strong connection can be made with ideas from an advanced perspective. One example that shows how rationalizing denominators is related to more advanced ideas is the “rationalizing” of the denominator of

$\frac{1}{4^{\frac{1}{3}} - 2(2^{\frac{1}{3}}) + 2}$, which is to find a polynomial in $2^{\frac{1}{3}}$ with rational coefficients so that multiplying the

denominator $4^{\frac{1}{3}} - 2(2^{\frac{1}{3}}) + 2$ by this polynomial equals a rational number. Let $x = 2^{\frac{1}{3}}$, then the denominator becomes $x^2 - 2x + 2$. In the polynomial ring, $\mathbb{Q}[x]$ (where \mathbb{Q} is the field of rational numbers), the polynomials $x^3 - 2$ and $x^2 - 2x + 2$ are relatively prime and therefore, by the Euclidean algorithm, there are polynomials $p(x)$ and $q(x)$ in $\mathbb{Q}[x]$ so that $p(x)(x^2 - 2x + 2) + q(x)(x^3 - 2) = 1$.

Letting $x = 2^{\frac{1}{3}}$ gives $p(2^{\frac{1}{3}})(4^{\frac{1}{3}} - 2(2^{\frac{1}{3}}) + 2) = 1$. It turns out that $p(x) = \frac{1}{10}(x^2 + 3x + 4)$, so that

multiplying the numerator and denominator of $\frac{1}{4^{\frac{1}{3}} - 2(2^{\frac{1}{3}}) + 2}$ by $p(2^{\frac{1}{3}}) = \frac{1}{10}(4^{\frac{1}{3}} + 3(2^{\frac{1}{3}}) + 4)$ leads to

$$\frac{1}{4^{\frac{1}{3}} - 2(2^{\frac{1}{3}}) + 2} = \frac{1}{10} (4^{\frac{1}{3}} + 3(2^{\frac{1}{3}}) + 4).$$

Engaging in this example will help candidates to make a good connection between topics that they studied in their abstract algebra course and ideas related to the high school curriculum.

GEOMETRY

Mathematical Reasoning

The great challenge in a college geometry course for prospective teachers is teaching fluency with informal and formal proofs of geometric theorems in general and theorems in Euclidean geometry (SMR 2.2) in particular. There is a thorough discussion of this issue in Chapter 3 of the 1999 Framework (pp. 162-7; see also Appendix D on pp. 279-296). The following are key points:

(a) One cannot learn how to prove theorems in geometry without any geometric intuition. One way to acquire such an intuition is to perform constructions with ruler and compass, and to examine many models of standard solids (e.g., cubes, cones, cylinders).

(b) An introductory college geometry course should start from the beginning. One way to gain the confidence of prospective teachers is not to force them to write any proofs until they have been shown many nontrivial proofs of interesting theorems (see Appendix D of the 1999 Framework). Begin slowly, allowing them to imitate some standard proofs before they venture forth on their own. This is analogous to the method of teaching people how to speak a foreign language whereby you have them listen to the language for many hours before asking them to try to speak it.

(c) In middle and high school geometry as well as college-level geometry courses, one should de-emphasize the proofs of simple theorems that come near the beginning of the axiomatic development. The proofs of such theorems are harder to learn than those of theorems that follow, and this is true not only for beginners but also for professional mathematicians as well. These proofs also tend to be tedious and uninspiring. One way to acquaint prospective teachers with the proofs of more substantive theorems as soon as possible is to adopt the method of "local axiomatics," which is to list the facts one needs for a particular proof, and then proceed to construct the proof on the basis of these facts. This approach mirrors the axiomatic method because, in effect, these facts are the "axioms" in this particular setting (see the examples in Appendix D of the 1999 Framework).

Connections

The historical importance of the parallel postulate, not just in geometry but in all of mathematics up to the nineteenth century, should be thoroughly discussed (SMR 2.1a, b). In middle and high school geometry textbooks, this postulate is stated (if it is stated at all) as "through a point not on a given line, there is one and only one line parallel to the given line." The correct formulation replaces the phrase "there is one and only one" with "there is at most one." In other words, while the existence of the parallel line can be proved, the uniqueness must be assumed. This then gives a natural setting to introduce the concept of "uniqueness," which is a difficult concept for many students. In this context, an informal discussion of the counterparts of the parallel postulate in spherical and hyperbolic geometry (SMR 2.1b) will likely clarify the situation.

The deduction of the parallel postulate from the assumption that "every triangle has an angle sum of 180° " is somewhat more sophisticated than most of the theorems in plane Euclidean geometry, but when done carefully it can be immensely rewarding (SMR 2.1a).

Although the notion of area will be defined using the Riemann integral in the context of calculus (SMR 5.4d), it is essential for the teaching of middle and high school geometry that a basic definition of area be provided for plane geometric figures, and from this definition, a prospective teacher should be able to derive the area formulas for regular polygons, and many other plane geometric figures.

The theorem that every polygon can be triangulated into nonoverlapping triangles allows the areas of polygons to be calculated once the areas of the triangles is known (SMR 2.2c). There is, however, no analogous theorem for the volume of a general polyhedron (SMR 2.3b). This is because it can be proved (using advanced techniques) that there is no corresponding elementary algorithm to compute the volume of a general (non-regular) tetrahedron from the volume of a cube. Although the proof of this theorem is too difficult for an introductory course, prospective teachers need to know this fact to be able to explain to their students why all volume formulas (except that of a rectangular prism) require the use of calculus or equivalent limit arguments. However, from a basic definition of volume, with the use of informal arguments and Cavalieri's Principle, the volumes of prisms, pyramids, cones, cylinders, and spheres can be informally derived. Moreover, teachers should be aware that formally, the coefficient $1/3$ in the volume formulas of cones and pyramids comes from integrating x^2 (SMR 5.4d).

A key reason for introducing coordinates and discussing geometric transformations (SMR 2.4a, b) is to be able to clarify the concepts of congruence and similarity, not just for triangles or polygons, but for all plane and space figures. In other words, one defines two such figures to be *congruent* if one is the image of the other under an isometry, and defines them to be *similar* if one is the image of the other under an isometry followed by a dilation. Then it can be shown that when the figures are polygons, these concepts coincide with those of the equality of angles and proportionality of sides.

NUMBER THEORY

Mathematical Reasoning

The well-known divisibility rules for division by 3, 4, 5, 8, or 9 are usually stated and used in middle and high school textbooks but not often explained. It is imperative that prospective teachers understand the simple proofs of these rules (SMR 3.1a).

From the point of view of middle and high school mathematics, there are at least two aspects of the Fundamental Theorem of Arithmetic that are noteworthy. First, a completely correct proof of the existence of a prime decomposition for whole numbers requires the use of complete induction (and this gives an important example of a different application of mathematical induction). Second, whereas in middle and high school mathematics only the existence part of the theorem is used, one discovers that in fact it is the uniqueness of the prime decomposition that is important and difficult to prove. Experience shows that this particular uniqueness statement - more so than the uniqueness in the parallel postulate or the uniqueness of the remainder in the division algorithm - is elusive to beginners. The uniqueness is an essential aspect of the Fundamental Theorem of Arithmetic; otherwise, the proof of the irrationality of $\sqrt{5}$ (or any whole number not a perfect square) or why every fraction is equivalent to a unique fraction in lowest terms would be meaningless.

Connections

The Euclidean algorithm (SMR 3.1c) requires a strong understanding of the division algorithm, including a clear conceptualization of a remainder, and thus the uniqueness of the remainder in the division algorithm. This is another area in which the content domains merge; prospective teachers should understand both the division algorithm and the Euclidean algorithm for polynomials with real coefficients, and the relationship to the results in number theory.

CALCULUS

Mathematical Reasoning

One should emphasize that the sine and cosine addition theorems are the defining theorems of trigonometry (SMR 5.1b). Indeed, it can be proved that sine and cosine are the only differentiated functions satisfying the addition theorems and the condition that $\sin 0 = 0$ and $\cos 0 = 1$. Moreover, every trigonometric identity is a consequence of these addition theorems, and the identity that $\sin^2 x + \cos^2 x = 1$. Thus the latter identity and the addition theorems are the foundation of trigonometry. This fact gives structure to the subject, and should be clearly understood by each prospective teacher.

In the teaching of calculus, it would be inappropriate to insist on epsilon-delta proofs, but it would be equally inappropriate to eliminate such proofs altogether. Therefore, SMR 5.2 requires that at least the correct definition of limit be provided and applied in a restricted way. For example, proving the continuity of quadratic polynomials using epsilon-delta. One benefit of this insistence on a minimal amount of rigor is to expose prospective teachers to the fallacy of the common perception that the continuity of $f(x)$ means "a small change in x produces a small change in $f(x)$." For instance, if this were the case, should not a change in x to the order of $1/10000$ produce a "small" change in $f(x)$? The answer

is of course no, because if $f(x) = 10^9 x$, then a change in x of $1/10000$ produces a change of 100000 in $f(x)$. Thus in a small way, one can see why precision in mathematics (such as that found in the tortuous definition of continuity) is necessary. Not insisting on precise proofs on the most common differentiation formulas is likely to invite some abuse. For example, the usual proof that "from the product rule of differentiation, one can prove the quotient rule" is a common pitfall that should be avoided, especially in the context of middle and high school mathematics. The putative proof goes as follows: because $f(x)(1/f(x)) = 1$, differentiating both sides and applying the product rule on the right side of the formula gives: $f'(x)(1/f(x)) + f(x)(1/f(x))' = 0$, from which it follows that $(1/f(x))' = -f'(x)/[f(x)^2]$. Once this is known, another application of the product rule to $g(x)(1/f(x))$ gives the usual quotient rule for $g(x)/f(x)$. This is the "proof" of the quotient rule. The fallacy of the preceding argument lies in the fact that until one knows $1/f(x)$ is differentiated one cannot apply the product rule to $f(x)(1/f(x))$. Of course, when one tries to prove the differentiation of $1/f(x)$, the result is the usual messy proof of the quotient rule. What one can claim is that the above method gives a mnemonic device to remember the quotient rule. Such a statement, when so carefully phrased, has pedagogical value in a calculus classroom, but by no means should one convey the misconception that the product rule proves the quotient rule. Similar comments apply to the differentiation of the square root of a function or, in fact, of any rational power of a function.

The calculus SMRs require the proofs of few theorems, one of which is the proof of the Fundamental Theorem of Calculus (SMR 5.4c). Intended by this SMR is a proof that assumes the basic properties of continuous functions and the integral (e.g., that a continuous function attains a maximum and a minimum on a closed interval, that the integral is linear in the integrand, and that the integral of positive functions is positive). The reason prospective teachers should know this proof is not only that the Fundamental Theorem is truly fundamental (and why this is so should, of course, be carefully explained), but also that this proof is very instructive.

Connections

Both finite and infinite geometric series are important because they appear frequently (SMR 5.5a). In particular, one aspect of infinite geometric series deserves comment, namely the fact that the formal way of summing a geometric series gives rise to the expression of a repeating decimal as a fraction. This mechanism should be conducted carefully as it is often presented incorrectly in middle and high school textbooks. One reason for mentioning the convergence of infinite geometric series (SMR 5.5b) is to make sense of infinite decimals: an infinite decimal is merely a shorthand notation for a particular kind of infinite series. For Taylor series (SMR 5.5c), candidates should know at least the formalism of associating a power series to any one of the elementary functions. Candidates should be able to recognize the sine, cosine, and exponential series.

HISTORY OF MATHEMATICS

Many important developments in mathematics are too advanced to be discussed in an introductory course on the history of mathematics, yet four major developments that directly impact middle and high school mathematics deserve special attention (SMR 6.1b). The first development is the history of numeral systems through the early civilizations of Babylon, Rome, and China, and through the so-called Hindu-Arabic decimal system. A second development is the evolution of symbolic algebra, which includes contributions from Diophantus, the Hindus, Viete, and the finishing touches of Descartes. An understanding of this long and uneasy development enhances one's understanding of middle and high

school mathematics as a whole. The third development is of calculus, which is rooted in ideas from Eudoxus and Archimedes, continuing through the rich but informal development of Newton and Leibniz, and the rigorous formulation that culminated with Cauchy. The fourth and last development is the concept of a proof and, therewith, the concept of an axiomatic system. Proofs formally originated with Euclid's work, and until the twentieth century, were essentially the defining characteristic of European mathematics. For almost two centuries, the questionable foundation of calculus almost forced an abandonment of the classical ideal of proofs in mathematics. It was only toward the end of the nineteenth century when proofs would again occupy center stage and a clear definition of a proof was achieved.

Appendix A

Draft Standards for Science

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Standard 11: The Vision for Science

The institution articulates a philosophical vision of science and the education of prospective science teachers. Each program references the current California Science Framework as part of its vision statement.

Required Elements

- 11.1 The program includes a code of ethics that can be applied to the practice of science.
- 11.2 The program examines ethical, moral, social, and cultural implications of significant issues and ideas in science and technology.
- 11.3 The Program explores practical solutions to challenging important and relevant problems.

Standard 12: General Academic Quality

The program is academically rigorous and intellectually stimulating. It provides opportunities for students to experience and practice analyzing complex situations to make informed decisions and to participate in scientific problem solving. In the program, each prospective teacher develops effective written and oral communication skills with a focus on concepts and methodologies that comprise academic discourse in science.

Required Elements

- 12.1 The program requires sufficient practice in written and oral communication skills that enable prospective teachers to express scientific ideas, concepts, and methods accurately.
- 12.2 The program promotes the use of quantitative reasoning and encourages prospective teachers to analyze complex situations, make informed decisions, and participate in scientific problem solving.
- 12.3 The program regularly requires prospective teachers to participate in scientific investigations.
- 12.4 The program allows prospective teachers to gain experience in critically analyzing and reviewing scientific writings and research.
- 12.5 The program provides opportunities for prospective teachers to examine conceptual and physical models and their evolution over time.

Standard 13: Integrated Study of Science

The program reflects science as an integrated entity and emphasizes interrelationships among the disciplines are examined, and variations in the structures, content, and methods of inquiry in the disciplines are studied. Each prospective single subject teacher gains an understanding of how the conceptual foundations of the scientific disciplines are related to each other.

Required Elements

- 13.1 Each integrative study component develops the prospective single subject teacher's understanding of how the conceptual foundations of the scientific disciplines are related to each other.
- 13.2 Each integrative study component provides opportunities for prospective teachers to examine the interconnections between different fields of science.
- 13.3 The integrative study component(s) of the program require that prospective teacher use higher-level thinking skills while involved in coursework or research practice in each science discipline.
- 13.4 Faculty teaching in the program, and prospective teachers in various disciplines of science meet regularly to exchange ideas and perspectives.
- 13.5 The program includes courses and/or projects that integrate science as a whole.

Standard 14: Breadth of Study in Science

The science program is organized to provide prospective teachers a sufficiently broad understanding of science so that, as future literate science teachers, they have the necessary knowledge, skills, and abilities to develop scientific literacy among their students. A breadth of study provides familiarity with the nature of science and major ideas foundational to all the sciences, and provides a basis for prospective teacher to engage in further studies of a scientific discipline. The program is aligned with the *Science Content Standards for California Public Schools, Kindergarten through Grade Twelve*.

Required Elements

- 14.1 The program encompasses the general science specifications for subject matter knowledge and competence on pages 1 through 9, which includes the following general areas of study aligned with the K-12 Student Academic Content Standards.
- 14.2 The program addresses the subject matter skills and abilities applicable to the content domains in science listed below:
 - A- Astronomy
 - B- Dynamic Processes of the Earth (Geodynamics)
 - C- Earth Resources
 - D- Ecology
 - E- Genetics/Evolution
 - F- Molecular Biology and Biochemistry
 - G- Cell and Organismal Biology
 - H- Waves
 - I- Forces and Motion
 - J- Electricity and Magnetism
 - K- Heat Transfer and Thermodynamics
 - L- Structure and Properties of Matter

Standard 15: Depth of Study in a Concentration Area

Each candidate for the Single Subject Teaching Credential in Science must complete a subject matter program that includes Concentration 15A, 15B, 15C, or 15D. Concentration in the identified discipline prepares prospective teachers to teach a full range of courses authorized by the single subject credential authorization. Depth within a discipline is essential for teaching advanced and specialized courses.

Standard 15A: Depth of Study in Biological Sciences

The Concentration in Biological Sciences includes a depth of study of biology that is significantly greater than that required for a general understanding of science as described in Standard 14. The depth of study in Concentration 15A should provide conceptual foundations distributed across the discipline. Integral to the concentration are conceptual foundations that include cell biology and physiology, genetics, evolution, and ecology. Concentration 15A includes in-depth study and field/laboratory experiences in biology; achievement of an appropriate level of understanding in chemistry, mathematics and physics, use of methods employed by scientists in the generation knowledge; and application of biological sciences to technological and societal issues including ethical considerations. Candidates for the Science Credential with a Concentration in Biological Science will be able to teach a wide variety of biology courses in their teaching assignments. The program is aligned with the *Science Content Standards for California Public Schools, Kindergarten through Grade Twelve*. The Concentration in Biological Sciences will prepare prospective teachers to teach the full range of biology courses authorized by this credential.

Required Elements

- 15A.1 Encompass the biological science requirements for subject matter knowledge and competence on pages X through X, which are aligned with the K-12 Student Academic Content Standards.
- 15A.2 Encompass the subject matter skills and abilities applicable to the content domains in science as stated in the SMR Part II section on pages X and X.

Standard 15B: Depth of Study in Chemistry

The Concentration in Chemistry includes a depth of study within chemistry significantly greater than that required for a general understanding of science as described in Standard 5. The depth of study should provide conceptual foundations that include atomic and molecular structure, chemical reactions, kinetic molecular theory, solution chemistry, chemical thermodynamics, organic chemistry and biochemistry, and nuclear processes. Concentration 15B include in-depth study and field/laboratory experiences in chemistry, achievement of an appropriate level of understanding in mathematics and physics, use of methods employed by scientists in the generation of scientific knowledge, and application of chemistry to technological and societal issues including ethical considerations. Candidates for the Science Credential with a Concentration in Chemistry will be able to teach a wide variety of chemistry courses in their teaching assignments. The program is aligned with the *Science Content Standards for California Public Schools, Kindergarten through Grade Twelve*.

Required Elements

- 15B.1 Encompass the subject matter skills and abilities applicable to the content domains in science as stated in the SMR Part II section on pages X and X.
- 15B.2 Include demonstration of mathematical skills and other scientific knowledge needs to complete studies that are required by advanced courses in chemistry.
- 15B.3 Encompass the chemistry specifications for subject matter knowledge and competence on pages X through X that are aligned with the K-12 Student Academic Content Standards.

Standard 15C: Depth of Study in Geosciences (Earth and Planetary Sciences)

The Concentration in Geosciences (Earth and Planetary Sciences) includes a depth of study greater than that required for a general understanding of science as described in Standard 14. The depth of study in Concentration 15C should provide conceptual foundations in the earth and planetary sciences, and should provide conceptual foundations that include the Earth's place in the universe, planet Earth, energy in the Earth System, biochemical cycles, and California geology. Concentration 15C includes in-depth study and field/laboratory experiences in earth and planetary sciences, achievement of an appropriate level of understanding in mathematics, use of methods employed by scientists in the generation of scientific knowledge, and application of earth and planetary sciences to technological and societal issues including ethical consideration. Candidates for the Science Credential with a Concentration in Geosciences will be able to teach a wide variety of courses in their teaching assignments. The program is aligned with the *Science Content Standards for California Public Schools, Kindergarten through Grade Twelve*.

Required Elements

- 15C.1 Encompass the earth and planetary sciences specifications for subject matter knowledge and competence on pages X through X that are aligned with the K-12 Student Academic Content Standards.
- 15C.2 Encompass the subject matter skills and abilities applicable to the content domains in service as stated in the SMR Part II section on pages X and X.
- 15C.3 Include demonstration of mathematical skills needed to complete studies that are required by advanced courses in the earth and planetary sciences.

Standard 15D: Depth of Study in Physics

The Concentration in Physics includes a depth of study of physics significantly greater than that required for a general understanding of science as described in Standard 14. The depth of study in Concentration 15D should provide conceptual foundations in physics, and should provide conceptual foundations distributed across the discipline of physics. Integral to the concentration are conceptual foundations that include motion and forces, conservation of energy and momentum, heat and thermodynamics, waves, electromagnetism, and quantum mechanics and the standard model of particles. Concentration 15D include in-depth study and laboratory experiences in physics, achievement of an appropriate level of understanding in mathematics, use of methods employed by scientists in the generation of scientific knowledge. Candidates for the Science Credential with a Concentration in Physics will be able to teach a wide variety of physics courses in their teaching assignments. The program is aligned with the *Science Content Standards for California Public Schools, Kindergarten through Grade Twelve*.

Required Elements

- 15D.1 Encompass the physics specifications for subject matter knowledge and competence on pages X through X that are aligned with the K-12 Student Academic Content Standards.
- 15D.2 Encompass the subject matter skills and abilities applicable to the content domains in service in the SMR Part II section on pages X and X.
- 15D.3 Include demonstration of mathematical skills needed to complete studies that are required by advanced courses in physics.

Standard 16: Laboratory and Field Experiences

Laboratory and field experiences constitute a significant portion of coursework in a program that includes open-ended, problem solving experiences. Prospective teachers have the opportunity to design a variety of laboratory experiments. Data is collected, analyzed, and processed using statistical analysis and current technology (where appropriate).

Required Elements

- 16.1 The program includes required laboratory components in no less than one-third of its courses.
- 16.2 The program includes periodic open-ended, problem solving experiences in its coursework.
- 16.3 The program requires prospective teachers to organize, interpret, and communicate observation data collected during laboratory or field experiences using statistical analysis when appropriate.
- 16.4 The program requires prospective teachers to design and evaluate laboratory experiments and/or fieldwork.
- 16.5 The program involves prospective teachers in research and collection of data that requires utilization of current technology.

Standard 17: Safety Procedures

The program instructs prospective teachers in proper safety procedures prior to laboratory and field experiences. This includes instruction in emergency procedures and proper storage, handling and disposal of chemicals and equipment. The program provides facilities equipped with necessary safety devices and appropriate storage areas. When the program provides experiences with live organisms, they are observed, captured, and cared for both ethically and lawfully.

Required Elements

- 17.1 The program instructs prospective teachers in proper safety procedures (safe uses of chemicals, specimens, and specialty equipment) prior to laboratory and field experiences, and implements current safety guidelines and regulations.
- 17.2 The program provides facilities that are equipped with appropriate safety devices.
- 17.3 The program provides instruction in, and demonstrates emergency procedures and proper storage, handling, and disposal of chemicals, specimen, and equipment.

Appendix A

Draft Standards for Social Science

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Standard 11: Overall Quality of Program Content

In the program, each prospective history/social science single subject teacher studies and learns subjects required by Ed. Code Section 51210 and incorporated in the “History - Social Science Content Standards for California Public Schools” for grades 6-12 and the “History-Social Science Framework for California Public Schools”. The program includes coursework taught by appropriate faculty and field experiences that address the ideas, strategies and techniques essential to teaching the social sciences at the grade level of the authorization of the basic credential.

Required Elements

- 11.1 In the program, prospective teachers complete a series of required courses that include comprehensive coverage of the academic content/subjects of the state adopted K-12 student academic content standards and frameworks for California public schools.
- 11.2 The content of the program is based on contemporary research and published literature in history and the social sciences.
- 11.3 Prospective teachers examine the significance of eras, events, individuals, issues, paradigms, concepts and values in history and the social sciences.
- 11.4 In the program, prospective teachers select, integrate, and translate the content and methods of investigations of history and social sciences.
- 11.5 The faculty demonstrates teaching that models exemplary practices such as discussion, debate, role-playing, simulation and co-operative learning for their students.
- 11.6 The faculty meets academic requirements as determined by the university, and are actively involved in scholarly and professional activities in the social sciences. Programs also display coherence and continuity.
- 11.6 Required or elective courses in the program include appropriate lower division and upper division studies in each major subject area.

Standard 12: Emphasis and Depth of Study

Each program emphasizes knowledge aligned with the “History-Social Science Content Standards for California Public Schools,” the “History-Social Science Framework for California Public Schools” and the current Subject Matter Requirements. The prospective teacher must complete a broad range of course work in the required disciplines of history, economics, political science and geography.

Required elements

- 12.1 The program requires prospective teachers to successfully complete economics course work that includes scarcity and decision-making, incentives, voluntary exchange, U.S. product and labor markets in a global setting, economic data, and government’s economic role, with an emphasis on historical and contemporary international economic issues and problems.
- 12.2 The program requires prospective teachers to successfully complete coursework in United States history and geography, including comprehensive surveys and concentrated studies of selected historical periods after the founding of the nation.
- 12.3 The program requires prospective teachers to successfully complete coursework in world history (western and non-western), including comprehensive surveys and concentrated studies of selected historical periods.
- 12.4 The program requires prospective teachers to successfully complete coursework that develops knowledge of major geographic themes including location, place, human-environmental interaction, movement and regions.
- 12.5 The program requires prospective teachers to successfully complete coursework that includes study of the fundamental principles of American democratic institutions, with emphasis on the Constitution and the Bill of Rights, political theory and the comparative study of governments.
- 12.6 The program requires prospective teachers to successfully complete coursework that includes California history, geography, government, and economics.
- 12.7 The program provides prospective teachers with the opportunities in their coursework to have informed discussions of historical and contemporary issues.

Standard 13: Integration of Studies

The program includes the integrative study of world and United States history, economics, political science and geography. The program emphasizes relationships among the major themes and concepts of these disciplines. The program requires prospective teachers to learn and apply methods of inquiry, analysis and interpretation that are used in history and the social science disciplines as identified in the “History-Social Science Content Standards for California Public Schools” for grades 6 - 12 and the “History-Social Science Framework for California Public Schools.”

Required Elements

- 13.1 The program requires each prospective teacher to examine systematically the major concepts, themes and processes in history, the social sciences, and the humanities, and to examine similarities and differences among the different disciplines.
- 13.2 The program provides opportunities for prospective teachers to study issues selected from history and the social sciences through the humanities (including the arts).
- 13.3 Each prospective teacher in the program has multiple opportunities to learn and use appropriate methods of inquiry that characterize the study of history and the social sciences, and to compare methodologies across several disciplines.

Standard 14: World Perspective

The program develops each prospective teacher's knowledge and understanding of the historical and contemporary experiences and interrelationships of people of Africa, the Americas, Asia, and Europe. Prospective teachers acquire world perspectives in studies of history, human culture, geography, government, and economics as outlined in the "History-Social Science Content Standards for California Public Schools" for grades 6 - 12 and the "History-Social Science Framework for California Public Schools."

Required Elements

- 14.1 The program requires each prospective teacher to examine issues of world and regional interdependence and conflict in historical and contemporary studies of Africa, the Americas, Asia and Europe.
- 14.2 Studies address the influences of western civilization on the evolution of traditional and contemporary ideas in American political institutions, laws, and ideologies.
- 14.3 The subject matter program includes studies of non-western history, culture, geography, government, philosophy, religion, literature and art.
- 14.4 The program includes required study of world history, with emphasis on interrelationships between western and non-western cultures, intellectual and religious traditions, including the economic interdependence of world regions.

Standard 15: National Perspectives

The program develops prospective teacher’s knowledge and understanding of United States history, culture, geography, government, and economics, and of the evolving national experience as outlined in the “History-Social Science Content Standards for California Public Schools” for grades 6 - 12 and the “History-Social Science Framework for California Public Schools.”

Required Elements

The program requires each prospective teacher to examine the system of representative democracy in the United States and to examine the nature, structure and relationships of federal, state, local and tribal governments.

- 15.1 The program requires each prospective teacher to examine the major documents of American democracy including, but not limited to the Mayflower Compact, Declaration of Independence, Articles of Confederation, The Federalist Papers, The Constitution, the Bill of Rights and other amendments, Washington’s Farewell Address and the Gettysburg Address.
- 15.2 The program requires each prospective teacher to study the economic system in the United States, with particular emphasis on the historical development of economic institutions and thought.
- 15.3 The program requires each prospective teacher to examine the changing role of the United States in world affairs.
- 15.4 The program exposes the prospective teacher to a wide range of perspectives on United States history, including major historiographic and social science interpretations.
- 15.5 The program requires prospective teachers to study political, social, and cultural developments in the United States.

Standard 16: State Perspective

The program develops each prospective teacher's knowledge and understanding of significant issues in the history, geography, culture, economics and government of California as outlined in the "History-Social Science Content Standards for California Public Schools" for grades 6 - 12 and the "History-Social Science Framework for California Public Schools".

Required Elements

- 16.1 Each prospective teacher examines historical origins and critical issues in the context of the multi-cultural environment of California.
- 16.2 Each prospective teacher analyzes the historical background that led to the development of California's role in national, global, economic, technological, educational and cultural trends.
- 16.3 Each prospective teacher understands the critical role of water, transportation, energy, and environmental issues in California history and contemporary life.
- 16.4 Each prospective teacher discusses California's governmental systems, their structure, and the historical and contemporary use of direct democracy.
- 16.5 Each prospective teacher understands the historical origins and contemporary issues of migration and immigration and their impact on the state's development.

Standard 17: Citizen Perspective

The program develops each prospective teacher’s knowledge and understanding of the rights and responsibilities of citizens in a representative democracy, as outlined in the “History-Social Science Content Standards for California Public Schools” for grades 6 - 12 and the “History-Social Science Framework for California Public Schools.”

Required Elements

- 17.1 The program enables each prospective teacher to gain an appreciation for the dignity of individuals and the importance of human rights.
- 17.2 The program requires each prospective teacher to understand individual rights and responsibilities under the federal, state, local and tribal governments.
- 17.3 The program requires each prospective teacher to learn about the strengths and weaknesses of democratic institutions and the conditions that encourage democracy.
- 17.4 The program requires each prospective teacher to examine the economic, social and political factors that affect civic participation.
- 17.5 The program provides opportunities for each prospective teacher to confront controversial issues in ways that respect the right of individuals to differ.
- 17.6 The program provides opportunities for prospective teachers to take active citizenship roles in society and to develop social and political skills, such as those to be gained by service learning.
- 17.7 The program requires each prospective teacher to be familiar with theories and current research on democracy.

Standard 18: Ethical Perspective

The program develops each prospective teacher's knowledge and understanding of ethics, philosophy and the role of religion in human experiences as outlined in the "History-Social Science Content Standards for California Public Schools" for grades 6 - 12 and the "History-Social Science Framework for California Public Schools."

Required Elements

- 18.1 Each prospective teacher compares and contrasts the ethical, philosophical and religious ideas and beliefs in the major western and non-western cultures.
- 18.2 Each prospective teacher analyzes the role of religions in the formation and evolution of American society and culture, including issues specific to California.
- 18.3 Each prospective teacher demonstrates an understanding of scientific and religious perspectives on controversial issues.
- 18.4 Each prospective teacher understands the place of religion, philosophy, and ethical beliefs in American public education as defined by Constitutional principles and local, state and federal laws.

Standard 19: Teaching and Learning History/Social Sciences

The program exposes prospective teachers to a variety of teaching, learning, and assessment strategies that are appropriate to history/social science, including the appropriate use of instructional technology. Prospective teachers reflect on themselves as learners and explore ways in which historical and social science content and skills are conceived and organized for instruction as found in the “History-Social Science Content Standards for California Public Schools” for grades 6 - 12 and the “History-Social Science Framework for California Public Schools.”

Required Elements

- 19.1 The program provides opportunities for prospective teachers to learn how historical and social science content is conceived and organized for instruction.
- 19.2 The program provides opportunities for prospective teachers to reflect on different learning styles and their pedagogical implications for the teaching of history and the social sciences.
- 19.3 Each prospective teacher participates in discussions, debates, demonstrations, individual and group projects, cooperative learning activities, lectures, and other effective and appropriate approaches to learning history and the social sciences.
- 19.4 Each prospective teacher explores and uses various kinds of technology that are appropriate to the study of history and the social sciences.
- 19.5 Faculty development programs enable subject matter faculty to explore and use exemplary and innovative curriculum practices related to this standard.
- 19.6 The program exposes prospective teachers to a variety of assessment strategies to measure content, application and interpretation of that content.

Appendix B

Assembly Bill 537

Assembly Bill No. 537

CHAPTER 587

An act to amend Sections 200, 220, 66251, and 66270 of, to add Section 241 to, and to amend and renumber Sections 221 and 66271 of, the Education Code, relating to discrimination.

[Approved by Governor October 2, 1999. Filed with Secretary of State October 10, 1999.]

LEGISLATIVE COUNSEL'S DIGEST

AB 537, Kuehl. Discrimination.

(1) Existing law provides that it is the policy of the State of California to afford all persons in public schools and postsecondary institutions, regardless of their sex, ethnic group identification, race, national origin, religion, or mental or physical disability, equal rights and opportunities in the educational institutions of the state.

Existing law makes it a crime for a person, whether or not acting under color of law, to willfully injure, intimidate, interfere with, oppress, or threaten any other person, by force or threat of force, in the free exercise or enjoyment of any right or privilege secured to him or her by the Constitution or laws of this state or by the Constitution or laws of the United States because of the other person's race, color, religion, ancestry, national origin, disability, gender, or sexual orientation, or because he or she perceives that the other person has one or more of those characteristics.

This bill would also provide that it is the policy of the state to afford all persons in public school and postsecondary institutions equal rights and opportunities in the educational institutions of the state, regardless of any basis referred to in the aforementioned paragraph.

(2) Existing law prohibits a person from being subjected to discrimination on the basis of sex, ethnic group identification, race, national origin, religion, color, or mental or physical disability in any program or activity conducted by any educational institution or postsecondary educational institution that receives, or benefits from, state financial assistance or enrolls students who receive state student financial aid.

This bill would also prohibit a person from being subjected to discrimination on the basis of any basis referred to in paragraph (1) in any program or activity conducted by any educational institution or postsecondary educational institution that receives, or benefits from, state financial assistance or enrolls students who receive state student financial aid.

(3) This bill would state that it does not require the inclusion of any curriculum, textbook, presentation, or other material in any program or activity conducted by an educational institution or a postsecondary educational institution and would prohibit this bill from being deemed to be violated by the omission of any curriculum, textbook, presentation, or other material in any program or activity conducted by an educational institution or a postsecondary educational institution.

To the extent that this bill would impose new duties on school districts and community college districts, it would impose a state-mandated local program.

(4) The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for

making that reimbursement, including the creation of a State Mandates Claims Fund to pay the costs of mandates that do not exceed \$1,000,000 statewide and other procedures for claims whose statewide costs exceed \$1,000,000.

This bill would provide that, if the Commission on State Mandates determines that the bill contains costs mandated by the state, reimbursement for those costs shall be made pursuant to these statutory provisions.

The people of the State of California do enact as follows:

SECTION 1. This bill shall be known, and may be cited, as the California Student Safety and Violence Prevention Act of 2000.

SEC. 2. (a) The Legislature finds and declares all of the following:

(1) Under the California Constitution, all students of public schools have the inalienable right to attend campuses that are safe, secure, and peaceful. Violence is the number one cause of death for young people in California and has become a public health problem of epidemic proportion. One of the Legislature's highest priorities must be to prevent our children from the plague of violence.

(2) The fastest growing, violent crime in California is hate crime, and it is incumbent upon us to ensure that all students attending public school in California are protected from potentially violent discrimination. Educators see how violence affects youth every day; they know first hand that youth cannot learn if they are concerned about their safety. This legislation is designed to protect the institution of learning as well as our students.

(3) Not only do we need to address the issue of school violence but also we must strive to reverse the increase in teen suicide. The number of teens who attempt suicide, as well as the number who actually kill themselves, has risen substantially in recent years. Teen suicides in the United States have doubled in number since 1960 and every year over a quarter of a million adolescents in the United States attempt suicide. Sadly, approximately 4,000 of these attempts every year are completed. Suicide is the third leading cause of death for youths 15 through 24 years of age. To combat this problem we must seriously examine these grim statistics and take immediate action to ensure all students are offered equal protection from discrimination under California law.

SEC. 3. Section 200 of the Education Code is amended to read:

200. It is the policy of the State of California to afford all persons in public schools, regardless of their sex, ethnic group identification, race, national origin, religion, mental or physical disability, or regardless of any basis that is contained in the prohibition of hate crimes set forth in subdivision (a) of Section 422.6 of the Penal Code, equal rights and opportunities in the educational institutions of the state. The purpose of this chapter is to prohibit acts which are contrary to that policy and to provide remedies therefor.

SEC. 4. Section 220 of the Education Code is amended to read:

220. No person shall be subjected to discrimination on the basis of sex, ethnic group identification, race, national origin, religion, color, mental or physical disability, or any basis that is contained in the prohibition of hate crimes set forth in subdivision (a) of Section 422.6 of the Penal Code in any program or activity conducted by an educational institution that receives, or benefits from, state financial assistance or enrolls pupils who receive state student financial aid.

SEC. 5. Section 221 of the Education Code is renumbered to read:

220.5. This article shall not apply to an educational institution which is controlled by a religious organization if the application would not be consistent with the religious tenets of that organization.

SEC. 6. Section 241 is added to the Education Code, to read:

241. Nothing in the California Student Safety and Violence Prevention Act of 2000 requires the inclusion of any curriculum, textbook, presentation, or other material in any program or activity conducted by an educational institution or postsecondary educational institution; the California Student Safety and Violence Prevention Act of 2000 shall not be deemed to be violated by the omission of any curriculum, textbook, presentation, or other material in any program or activity conducted by an educational institution or postsecondary educational institution.

SEC. 7. Section 66251 of the Education Code is amended to read:

66251. It is the policy of the State of California to afford all persons, regardless of their sex, ethnic group identification, race, national origin, religion, mental or physical disability, or regardless of any basis that is contained in the prohibition of hate crimes set forth in subdivision (a) of Section 422.6 of the Penal Code, equal rights and opportunities in the postsecondary institutions of the state. The purpose of this chapter is to prohibit acts that are contrary to that policy and to provide remedies therefor.

SEC. 8. Section 66270 of the Education Code is amended to read:

66270. No person shall be subjected to discrimination on the basis of sex, ethnic group identification, race, national origin, religion, color, or mental or physical disability, or any basis that is contained in the prohibition of hate crimes set forth in subdivision (a) of Section 422.6 of the Penal Code in any program or activity conducted by any postsecondary educational institution that receives, or benefits from, state financial assistance or enrolls students who receive state student financial aid.

SEC. 9. Section 66271 of the Education Code is renumbered to read:

66270.5. This chapter shall not apply to an educational institution that is controlled by a religious organization if the application would not be consistent with the religious tenets of that organization.

SEC. 10. Notwithstanding Section 17610 of the Government Code, if the Commission on State Mandates determines that this act contains costs mandated by the state, reimbursement to local agencies and school districts for those costs shall be made pursuant to Part 7 (commencing with Section 17500) of Division 4 of Title 2 of the Government Code. If the statewide cost of the claim for reimbursement does not exceed one million dollars (\$1,000,000), reimbursement shall be made from the State Mandates Claims Fund.

Appendix C

Advisory Panel Membership Lists

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English Advisory Panel	100
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English Advisory Panel for the Development of Teacher Preparation Standards

NAME	POSITION	AFFILIATION
Helen E. Anderson-Cruz	Professor	National University
Peter D. Kittle	Assistant Professor	CSU Chico
Kiran Kuman	Teacher	Pomona Unified School District; UCLA Center X
Carol D. Lord	Assistant Professor	CSU Long Beach
Catherine M. Lucas	Professor	San Francisco State University
Kim V. Morin	Professor	CSU Fresno
Terri Munroe	Teacher	Newport-Mesa Unified School District
Jeannine D. Richison	Assistant Professor	Cal Poly San Luis Obispo
Carol L. Tyson	Teacher	Beverly Hills School District
John O. White	Professor	CSU Fullerton
Beth Brenneman	Consultant	California Department of Education
Darryl Eisele	Teacher	Paradise Unified School District

Math Advisory Panel for the Development of Teacher Preparation Standards

NAME	POSITION	AFFILIATION
Cheryl L. Avalos	Consultant	Los Angeles County Office of Education
Bill W. Chen	Retired Secondary Math Teacher	
Diane L. Herrington	Math Teacher	Clovis Unified School District
Maria T. Hirsch	Teacher	Montebello Unified School District
Jo Anne Hudson	High School Math Teacher	Poway Unified School District
Dorothy L. Keane	Math Professor	CSU Los Angeles
Dale R. Oliver	Associate Professor of Math	Humboldt State University
Dennis K. Parker	Associate Professor of Math	University of the Pacific
Jack Price	Director for the Center for Mathematics and Science Education	California Polytechnic University Pomona
Gary P. Shannon	Math Professor	CSU Sacramento
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