

## AGENDA

### COMMITTEE ON EDUCATIONAL POLICY

**Meeting:** 8:00 a.m., Wednesday, January 29, 2020  
Glenn S. Dumke Auditorium

Peter J. Taylor, Chair  
Jane W. Carney, Vice Chair  
Silas H. Abrego  
Rebecca D. Eisen  
Douglas Faigin  
Debra S. Farar  
Wenda Fong  
Juan F. Garcia  
Maryana Khames  
Lillian Kimbell  
Romey Sabalius  
Christopher Steinhauser

- Consent** 1. Approval of Minutes of the Meeting of November 20, 2019, *Action*
- Discussion** 2. Amendments to Title 5 Regarding Occupational Therapy Doctorate Degree Programs, *Information*
3. Research, Scholarship and Creative Activities, *Information*
4. Admission Requirements: Quantitative Reasoning, *Action*

**MINUTES OF MEETING OF  
COMMITTEE ON EDUCATIONAL POLICY**

**Trustees of The California State University  
Office of the Chancellor  
Glenn S. Dumke Conference Center  
401 Golden Shore  
Long Beach, California**

**November 20, 2019**

**Members Present**

Peter J. Taylor, Chair  
Jane W. Carney, Vice Chair  
Silas H. Abrego  
Rebecca D. Eisen  
Douglas Faigin  
Debra S. Farar  
Wenda Fong  
Juan F. Garcia  
Lillian Kimbell  
Thelma Meléndez de Santa Ana  
Romey Sabalius  
Christopher Steinhauser  
Adam Day, Chair of the Board  
Timothy P. White, Chancellor

Trustee Taylor called the meeting to order.

**Approval of Minutes**

The minutes from September 24, 2019 were approved as submitted.

**Amendment to Title 5 Regarding Student Organizations**

Loren J. Blanchard, executive vice chancellor for Academic and Student Affairs, introduced the action item, reminding trustees that the Title 5 amendments were presented as an information item during the July and September meetings.

The Title 5 amendment updates the policy prohibiting recognized student organizations from discriminating on the basis of any protected status. The amendment would align CSU policies as defined by federal and state law by adding as protected status: religious creed, medical condition, genetic information, sex, gender identity, gender expression and veteran and military status.

Following the presentation, trustees had no question. The committee recommended approval of the proposed resolution. **(REP 11-19-02)**

### **Amendment to Title 5 Regarding Admissions Requirements: Quantitative Reasoning**

Loren J. Blanchard, executive vice chancellor for Academic and Student Affairs, introduced the item, noting the improvements that have strengthened the CSU quantitative reasoning proposal and implementation, based upon consultation with stakeholders since the July 2019 board meeting.

James T. Minor, assistant vice chancellor and senior strategist for Academic and Student Affairs, presented and reviewed the results of CSU's recent data analysis based upon the provision of student data from the California Department of Education. The analysis showed that 93% of admitted CSU first-year applicants in fall 2018 had completed a course which would meet the proposed requirement. He reviewed elements of the proposal, highlighting that the change expands the a-g requirements that determine minimum eligibility for CSU admission beginning in 2027 to require the completion of one additional quantitative reasoning course. The course could be fulfilled with a high school science course, an elective with a quantitative reasoning foundation, such as personal finance or computer science, or a more traditional mathematics course beyond Algebra 2. It could also be met with a quantitatively-based course offered through Career and Technical Education or through dual enrollment in partnership with a local community college.

Marquita Grenot-Scheyer, assistant vice chancellor for Educator Preparation and Public School Programs, provided specific details about the breadth of and timeline for consultation on the quantitative reasoning proposal. She also reviewed the specific improvements to both the proposal and implementation plan which were as a result of consultation. These included the automatic exemption policy, the extended seven-year implementation timeline, the inclusion of a steering committee and CSU support and investments in curricular development, the teacher workforce and student outreach and enrichment.

Following the presentation, trustees had a number of questions and comments. These questions included, but were not limited to: outcomes for current students who currently complete a qualifying course versus those who do not, support for the proposal by CSU faculty, course sequences in high school that would satisfy the proposal, teaching and curricular capacity of schools to offer courses, measuring efficacy of educational policy changes, experiences when previous changes to admission standards were made and the experience of Long Beach Unified School District in implementing a similar course requirement.

The public was given notice 45 days prior to this meeting of the proposed Title 5 amendment and the opportunity to present statements orally or in writing relevant to the amendment. Approximately 24 members of the public addressed the committee regarding the proposed amendment. Following the public comment and the ensuing discussion among the trustees, a vote by trustees on the proposed Title 5 amendment was deferred until the January 2020 meeting.

### **Graduation Initiative 2025**

Loren J. Blanchard, executive vice chancellor for Academic and Student Affairs, introduced the information item. He noted that the 2019-20 academic year nears the mid-point of Graduation Initiative 2025, and that it is a critical time for the success of the initiative. He reviewed the five pillars serving as operational priorities for the initiative, academic preparation, enrollment management, student engagement and well-being, financial support, data-informed decisions making, and administrative barriers. He also highlighted the success of the Graduation Initiative 2025 Symposium, held in October, 2019.

Jeff Gold, assistant vice chancellor for Student Success, Research and Innovation presented an overview of the final 2019 graduation rate data. For the 2018-19 academic year, more than 107,000 students earned a bachelor's degree. This record number of degrees represents 20,000 more graduates compared to 2015, the year before the initiative was launched. Graduation rates improved for all students; however, equity gaps increased slightly from the prior year.

Maria Angelica Garcia, a fourth-year student at Humboldt State University (HSU), shared her personal experience at HSU as a first-generation Latina student. She discussed the impact of programs that have supported her interest in STEM and her role as a peer mentor on campus, both of which were funded through Graduation Initiative 2025.

Following the presentation, trustees inquired about the Graduation Initiative 2025, disaggregated outcomes data, specific strategies undertaken by campuses to address equity gaps and the allocation process for Graduation Initiative 2025 resources to campuses.

Trustee Taylor adjourned the Committee on Educational Policy.

## **COMMITTEE ON EDUCATIONAL POLICY**

### **Amendments to Title 5 Regarding Occupational Therapy Doctorate Degree Programs**

#### **Presentation By**

Loren J. Blanchard  
Executive Vice Chancellor  
Academic and Student Affairs

Alison M. Wrynn  
Associate Vice Chancellor  
Academic Programs, Innovations, and Faculty Development

#### **Summary**

Recent changes in legislation amended the California Education Code to add Education Code Sections 66043 and 66043.1, which grant the California State University (CSU) the authority to offer the doctoral degree in occupational therapy, called the Occupational Therapy Doctorate (OTD) degree. The purpose of this information item is to propose amendments to Title 5 which will implement and align with the provisions of Education Code Sections 66043 and 66043.1.

#### **Background**

Occupational therapists are skilled health care professionals who use research and scientific evidence to treat patients through the therapeutic use of everyday activities. Common occupational therapy interventions include helping children with disabilities to participate fully in school and social situations, helping people recovering from injury to regain skills and providing support for older adults experiencing physical and cognitive changes. Practitioners utilize a holistic perspective, in which the focus is on adapting the environment to fit the client.

According to the U.S. Bureau of Labor Statistics, employment of occupational therapists is projected to grow 18 percent from 2018 to 2028, much faster than the average for all occupations. Additionally, a 2015 study in Physical Medicine and Rehabilitation forecasts growing shortages of occupational therapists nationwide, with California projected to be one of the states with the largest shortages. As the population continues to age, the need for occupational therapists is expected to increase. Occupational therapists play a role in the treatment of conditions commonly associated with aging – such as arthritis and stroke – and can help senior citizens maintain their independence by recommending home modifications and strategies to support their daily life.

In California, only two public universities – San Jose State University and CSU Dominguez Hills – offer accredited master’s programs in occupational therapy. These programs have existed since 1960 and 2004, respectively. These programs educate approximately 30 percent of California’s occupational therapists and have developed community partnerships that provide students with service-learning models. Program graduates fare extremely well in the workforce. For example, CSU Dominguez Hills reports their occupational therapy graduates typically have more than four employment offers at graduation and are frequently offered sign-on bonuses.

The American Council for Occupational Therapy– the accrediting body for the profession of occupational therapy – determined that the doctorate will become the primary entry degree in order to become a certified occupational therapist. The CSU Board of Trustees sponsored legislation – Assembly Bill 829, *California State University: Doctor of Occupational Therapy Program* (Bloom) – to give the CSU OTD degree-granting authority. This legislation was signed into law by Governor Newsom on August 30, 2019.

Correspondingly, additions of the following Title 5 sections are recommended:

- **§ 40050.5 Function: Instruction Leading to the Occupational Therapy Doctorate Degree.**  
This addition will establish that CSU has been granted independent authority to offer OTD degrees.
- **§ 40519 The Occupational Therapy Doctorate Degree.**  
This addition will establish the OTD degree program scope and the minimum number of degree units, and reflect professional conventions regarding the doctoral capstone.
- **§ 40519.1 The Occupational Therapy Doctorate Degree: Requirements.**  
This addition will establish the minimum requirements for completion of the program.
- **§ 41024 Admission to Occupational Therapy Doctorate Programs.**  
This addition will establish admission requirements for the degree program.

An item will be presented at the March 2020 meeting for board action to adopt the following recommended additions to Title 5.

**Title 5, California Code of Regulations**  
**Division 5 – Board of Trustees of the California State Universities**  
**Chapter 1 – California State University**  
**Subchapter 2 – Educational Programs**  
**Article 1 – General Function**

**§ 40050.5. Function: Instruction Leading to the Occupational Therapy Doctorate Degree.**

Notwithstanding Section 40050, the Occupational Therapy Doctorate degree may be awarded independently of any other institution of higher education, provided that the program leading to the degree satisfies the criteria in section 40519.

Note: Authority cited: Sections 66043, 66043.1, 66600, 89030 and 89035, Education Code.  
Reference: Sections 66043, 66043.1, 66600 and 89030, Education Code.

**Title 5, California Code of Regulations**  
**Division 5 – Board of Trustees of the California State Universities**  
**Chapter 1 – California State University**  
**Subchapter 2 – Educational Programs**  
**Article 7 – Graduate Degrees**

**§ 40519. The Occupational Therapy Doctorate Degree.**

(a) A California State University program leading to an Occupational Therapy Doctorate degree may be offered independently of any other institution of higher education. California State University Occupational Therapy Doctorate programs shall:

(1) provide curriculum grounded in evidence-based practice;  
(2) prepare graduates to participate in the field of occupational therapy; and  
(3) be consistent with the requirements of a professional accrediting body and California state licensure laws.

(b) Each campus offering a program leading to an Occupational Therapy Doctorate degree shall establish requirements for admission to the program. The requirements for admission shall include, at a minimum, the requirements stated in Section 41024.

(c) The program leading to the Occupational Therapy Doctorate degree shall conform to the following specifications:

(1) The curriculum shall include learning experiences that balance research, theory, clinical education and practice. The core curriculum shall provide professional preparation focusing on critical thinking and decision making, including but not limited to: foundational sciences, clinical sciences and behavioral sciences; professional practice; patient/client management; and practice management.

(2) The postbaccalaureate pattern of study shall be composed of at least 110 semester units earned in graduate standing.

(3) At least 60 semester units shall be completed in residence at the campus awarding the degree. At the discretion of the appropriate campus authority, courses required for California State University Occupational Therapy Doctorate programs that are completed at another CSU campus may apply toward the residency requirement at the CSU campus that awards the degree.

(4) A qualifying assessment shall be required.

(5) The pattern of study shall include successful completion of a doctoral capstone in accordance with accreditation standards that is expected to contribute to knowledge in occupational therapy science or to an improvement in occupational therapy practice, policy or client outcomes.

(A) The doctoral capstone shall demonstrate the student's doctoral-level mastery of research skills, occupational science and/or current evidence-based practice. It shall demonstrate critical and independent thinking and a command of the research literature.

(B) The written component of the doctoral capstone shall demonstrate originality, evidencing critical and independent thinking. It shall be organized in an appropriate form and shall identify the research problem and question(s), state the major theoretical perspectives, explain the significance of the undertaking, relate it to the relevant scholarly and professional literature, identify the methods of gathering and analyzing the data, analyze and interpret data and offer a conclusion or recommendation.

(C) An oral defense or presentation of the doctoral capstone may be required.

(D) No more than fifteen semester units shall be allowed for the doctoral capstone.

Note: Authority cited: Sections 66043, 66043.1, 66600, 89030 and 89035, Education Code.  
Reference: Sections 66043, 66043.1, 66600, 89030 and 89035, Education Code.

**Title 5, California Code of Regulations**  
**Division 5 – Board of Trustees of the California State Universities**  
**Chapter 1 – California State University**  
**Subchapter 2 – Educational Programs**  
**Article 7 – Graduate Degrees**

**§ 40519.1 The Occupational Therapy Doctorate Degree: Requirements.**

(a) Advancement to Candidacy. For advancement to candidacy for the Occupational Therapy Doctorate degree, the student shall have achieved classified graduate standing and met such particular requirements as the chancellor and appropriate campus authority may prescribe. The requirements shall include a qualifying doctoral assessment.

(b) To be eligible for the Occupational Therapy Doctorate degree, the candidate shall have completed a program of study that includes: a qualifying examination or other qualifying doctoral assessment, and a doctoral capstone that is consistent with the specifications in section



40519 and is approved by the appropriate campus authority. A grade point average of 3.0 (grade of B) or better shall have been earned in aggregate in courses taken to satisfy the requirements for the degree, except that a course in which no letter grade is assigned shall not be used in computing the grade point average.

(c) The student shall have completed all requirements for the degree within five years of achieving classified standing in the doctoral program. The appropriate campus authority may extend the time for completion of the requirements if:

(1) the student is in good standing,

(2) the extension is warranted by compelling individual circumstances, and

(3) the student demonstrates current knowledge of research and practice in occupational therapy, as required by the campus.

Note: Authority cited: Sections 66043, 66043.1, 66600, 89030 and 89035, Education Code.

Reference: Sections 66043, 66043.1, 66600, 89030 and 89035, Education Code.

**Title 5, California Code of Regulations**  
**Division 5 – Board of Trustees of the California State Universities**  
**Chapter 1 – California State University**  
**Subchapter 3 – Admission Requirements**  
**Article 8 – Admission of Post-Baccalaureate and Graduate Students**

§ 41024. Admission to Occupational Therapy Doctorate Programs.

(a) An applicant may be admitted with classified graduate standing to a program leading to an Occupational Therapy Doctorate degree established pursuant to Section 40519 if the applicant satisfies the requirements of each of the following numbered subdivisions:

(1) The applicant holds an acceptable baccalaureate degree earned at an institution accredited by a regional accrediting association or the applicant has completed equivalent academic preparation as determined by the appropriate campus authority.

(2) The applicant has an overall cumulative grade point average of at least 3.00 in upper-division baccalaureate study, postbaccalaureate and master's study combined.

(3) The student has completed all campus-required prerequisite coursework.

(4) The applicant must have been in good academic standing at the last institution.

(5) The applicant has met any additional requirements established by the chancellor in consultation with the faculty and any additional requirements prescribed by the appropriate campus authority.

Note: Authority cited: Sections 66043, 66043.1, 66600, 89030 and 89035, Education Code.

Reference: Sections 66043, 66043.1, 66600, 89030 and 89035, Education Code.

## **COMMITTEE ON EDUCATIONAL POLICY**

### **Research, Scholarship and Creative Activities**

#### **Presentation By**

Ganesh Raman  
Assistant Vice Chancellor  
Research

Ariana Gonzalez  
Alumna  
California State University, Los Angeles

#### **Summary**

Research, scholarship and creative activity touch every part of the California State University (CSU) – enhancing learning and preparing students for the workplace of the future. The breadth and depth of this work spans 23 campuses and 10 multi-campus affinity groups through shared expertise, facilities and resources.

#### **Background**

As the CSU continues the fourth year of Graduation Initiative 2025, its ambitious effort to improve student success, increase graduation rates and eliminate equity gaps, “high-impact practices” – including research and creative activities – connect students to the university and increase the likelihood of a student earning a degree. The CSU offers a wide scope of high-quality, hands-on research opportunities to undergraduate students. With the mentorship of outstanding CSU faculty, students develop critical skills that support their learning and prepare them for future careers. This is particularly critical for students from historically underserved communities. CSU campuses pursue external funding grants specifically aimed at engaging and retaining underrepresented students in scientific and technical fields.

The myriad of research, scholarship and creative activity opportunities also help attract and retain outstanding faculty, sustain their engagement and provide opportunities for their continued growth in their field. Through peer-reviewed awards, journal publications, presentations and performances, faculty have the opportunity to demonstrate their leadership. As a result, CSU faculty create new knowledge and experiences across all academic disciplines.

Additionally, research, scholarship and creativity activities in the CSU advance California's most pressing needs. From agriculture, biotechnology and oceanography to palliative care and social science, faculty experts and students are conducting research that impacts communities, the state, the nation and the world.

### **External Funding Accomplishments**

Several of the most prestigious grants and contracts received by CSU faculty during the 2018-19 academic year are included below.

#### *National Institutes of Health: Building Infrastructure Leading to Diversity (BUILD)*

Many of the CSU's larger federal awards relate to community improvement and to student success, especially among historically underserved students, supporting the CSU goal of closing equity gaps.

The biotechnology and diversity foci of the National Institutes of Health (NIH)-funded Building Infrastructure Leading to Diversity (BUILD) grants are one example. The BUILD program supports the educational success of historically underserved students in educational programs that prepare graduates for biomedical research careers and graduate school.

Six years ago, three CSU campuses—Long Beach, Northridge and San Francisco—won three of the ten BUILD grants awarded nationally, for a combined total of more than \$61 million. In 2019, these three campuses competed for, and were successful in receiving, renewal grants for more than \$54 million dollars. These renewal grants will enable the campuses to continue to support the success of historically underserved students in biomedical sciences.

#### California State University, Northridge

Funding Amount: \$19.3 million

At CSU Northridge, the campus' BUILD effort, known as BUILD PODER, is rooted in critical race theory, uniting educational social justice and health equity to make biomedical research meaningful and relevant. The second phase funded through the renewal grant, BUILD PODER II, will sustain best practices through partnerships with community colleges and research institutions, faculty training and research infrastructure. It will also be supported through the Health Education Research and Education Center in CSU Northridge's first building dedicated to research, Lilac Hall.

California State University, Long Beach

Funding Amount: \$19.8 million

CSU Long Beach's BUILD II Program (the second phase of its work funded with the renewal grant) prioritizes enhancement, institutionalization and sharing of the evidence-based practices that were created during the first phase of the program. As part of BUILD II, the university has developed a plan to share these best practices in collaboration with CSU Northridge and San Francisco State, creating a CSU BUILD Alliance.

San Francisco State University

Funding Amount: \$14.8 million

With the NIH grant renewal, San Francisco State partnered with the University of California (UC), San Francisco, to continue to implement, investigate and share their transformative institutional efforts to enhance diversity of the biomedical research workforce. The partnership's BUILD efforts focus on students, faculty and institutional practices to create change that will transform teaching and research environments.

*National Science Foundation CAREER Award*

The National Science Foundation (NSF) Faculty Early Career Development Program award – or CAREER award – is the foundation's most prestigious award in support of early-career faculty who have the potential to serve as academic role models in research and education. Four CSU faculty members received this award in 2018-19:

- Alicia Kinoshita, associate professor, Department of Civil, Construction and Environmental Engineering, San Diego State: \$226,083 to understand and predict changes in vegetation, soil and stream processes that occur after fires;
- Susan Cohen, assistant professor, Department of Biological Sciences, CSU Los Angeles: \$330,239 to gain a near comprehensive understanding of the cyanobacterial circadian clock, and help set the foundation for leveraging these bacteria for broad ranging applications including bioremediation, biotechnology, and ecological/environmental issues;
- Kimberly Blisniuk, assistant professor, Geology Department, San José State: \$313,619 to re-evaluate the seismic hazard potential of individual faults that make up the southern San Andreas Fault system; and
- Chantal Stieber, assistant professor, Department of Chemistry and Biochemistry, Cal Poly Pomona: \$195,448 to study small molecule reactions at metal centers as mimics for existing biological processes involved in agricultural nitrogen fixation (such as in legumes) or for reducing the health effects of automobile pollutants.

*National Science Foundation's Centers of Research Excellence in Science and Technology II (CREST II)*

Funding Amount: \$5 million

CSU San Bernardino received a CREST II grant – one of only five CREST awards announced nationwide this year – to further extend the campus' Center for Advanced Functional Materials' capacity for discovery, innovation and student success in STEM fields. The funds also help broaden the campus' capacity to recruit and retain diverse students pursuing STEM degrees and careers as well as strengthen research collaborations with institutions and local community colleges to help students advance through the academic pipeline.

*California Education Learning Lab*

In 2018, California Assembly Bill 1809 established the California Education Learning Lab in order to increase learning outcomes and close equity and achievement gaps across California's public higher education segments, particularly in science, technology, engineering and mathematics (STEM) disciplines. The following CSU campuses partnered intersegmentally to receive these state-based research grants:

- CSU Fullerton, UC Berkeley, Santa Ana College: \$1,300,000 to improve outcomes for STEM learners in targeted courses by deploying and improving open, adaptive courseware;
- Humboldt State, UC Irvine, Foothill-De Anza Community College District, Modesto Junior College: \$1,300,000 to enact a three-year plan to initiate a systemic shift in the culture of online and hybrid STEM instruction across California public higher education institutions;
- CSU Los Angeles, UCLA, Los Angeles Pierce College: \$1,300,000 to develop, implement and continuously improve an online interactive textbook for introductory statistics;
- Cal Poly San Luis Obispo, UC Santa Barbara, Allan Hancock College: \$1,300,000 to eliminate equity and performance gaps in mechanics courses by developing a suite of adaptive web-based tools that incorporate videos while leveraging cognitive tools and interventions to establish a sense of belonging, a strong STEM identity and deep conceptual understanding;
- CSU San Marcos, MiraCosta College: \$1,038,000 to address the high rates of students not passing introductory computer science classes; and
- Sonoma State, UC Berkeley, College of Marin, Diablo Valley College: \$1,300,000 to disrupt pervasive narratives and misplaced assessments of what defines scientific brilliance through materials to help both instructors and students view science as an expansive and inclusive set of practices.

*National Science Foundation*

San Francisco State University

Funding Amount: \$1.3 million

San Francisco State received funding from the National Science Foundation (NSF) to develop and implement a computing applications minor that promotes an inclusive learning environment. The project seeks to increase the number of students who are proficient in data and computer science and to increase diversity in data and computational science to advance the diversification of the workforce.

California State University, Dominguez Hills

Funding Amount: \$1.3 million

CSU Dominguez Hills was awarded an NSF Improving Undergraduate STEM Education: Hispanic-Serving Institution (HSI) Award, which seeks to enhance the quality of undergraduate STEM education at HSIs and to increase retention and graduation rates of undergraduate students pursuing degrees in STEM at HSIs. The project seeks to broaden STEM faculty's use of inclusive pedagogy and welcoming environments in STEM courses, improve alignment between courses offered at the community colleges and the universities, and support the development of a diverse faculty.

California State University Channel Islands

Funding Amount: \$2.5 million (over five years)

CSU Channel Islands was also awarded an NSF Improving Undergraduate STEM Education: HSI Award for their project that aims to increase graduation rates and reduce the time to degree completion for all STEM majors and to reduce the gap existing between Latinx and non-Latinx white students as well as between female and male students. This program aims to create a self-propagating student community as Latinx and female students move through advising workshops and introductory courses and are looped back into the learning and research assistantship programs as they proceed toward graduation.

California State University, Fresno

Funding Amount: \$1.4 million

Fresno State was awarded an NSF Robert Noyce Teacher Scholarship Program Award, which seeks to encourage talented STEM majors and professionals to become K-12 mathematics and science teachers. With the award, the campus will provide scholarships to help majors in the integrated credential option pay tuition and other costs, so that the students can concentrate on earning a degree. The project is a collaboration between Fresno, Clovis and Sanger unified school districts and 14 community colleges to strengthen the teacher preparation pipeline.

*National Institutes of Health*

Dr. Marcelo E. Tolmasky, professor of biological science and director for the Center for Applied Biotechnology Studies at CSU Fullerton, was awarded \$1.3 million by the National Institutes of Health (NIH) to support the “LA Basin CSU Minority Health and Health Disparities Research Training Program.” Among a number of goals, this program works to increase the number of individuals from historically underserved communities who pursue advanced degrees and careers in the fields of biomedical, behavioral, clinical and social sciences research. The program is a consortium of seven CSU campuses – Fullerton, Dominguez Hills, Northridge, Long Beach, Los Angeles, Pomona and San Marcos – in addition to Charles R. Drew University of Medicine and Science.

*National Aeronautics and Space Administration (NASA)*

CSU Northridge received a \$3 million NASA award for an interdisciplinary team led by Dr. Nhut Ho. In partnership with the NASA Armstrong Flight Research Center and Jet Propulsion Lab, this award will establish the Autonomy Research Center for STEM, which will contribute to NASA’s research, further develop the STEM workforce and begin commercializing research results to address pressing societal needs.

*California Arts Council*

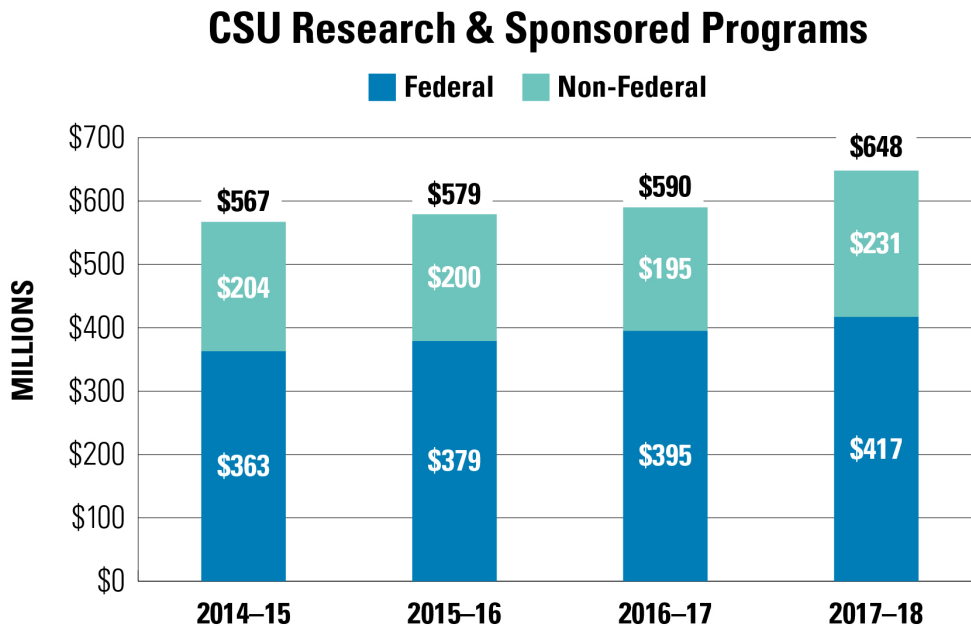
The PRAXIS City ArtS Parks program at CSU Dominguez Hills has received a \$135,000 award from the California Arts Council. The award will be used to provide art workshops taught by working artists at additional parks throughout the City of Carson and to create two public arts projects in the city. The PRAXIS City ArtS Parks program works to expand narratives of South Los Angeles with afterschool art and mentoring programs. The award was given to Devon Tsuno and Aandrea Stang, co-directors of PRAXIS.

*California Department of Education*

Dr. Carola Oliva Olson, an associate professor of early childhood studies at CSU Channel Islands, received a \$1.1 million grant from the California Department of Education for her project that provides continuous and comprehensive professional development focused on dual language learning to teachers, assistant teachers, administrators and coaches via online instruction.

**External Funding**

As demonstrated in the chart below, total external funding – grant and contract revenue – for CSU research and sponsored programs has increased steadily over the past several years. In 2017-18, the most recent year for which data are available, the total amount was \$648 million. This is an increase from the previous year’s \$590 million in external funding.



Unlike state funds that are used exclusively for basic university operations, faculty compete for these external funds, which are used for innovative projects that benefit local communities and prepare students for 21st century careers.

These external funds include approximately \$72 million to cover institutional overhead, also known as indirect costs. Programs in research, scholarship and creative activities have associated infrastructure expenses that are recovered with indirect costs budgeted into the application for external funding.



## **Research in the CSU**

Examples of faculty-led and student-led research can be found at all 23 CSU campuses. The following research focuses on addressing the needs facing local communities, California, the nation and the world. Some examples are included below.

### *California State University, Sacramento*

Dr. Kimberly Mulligan, an assistant professor of biological sciences at CSU Sacramento, is conducting research on whether three common environmental chemicals used in the synthesis of plastics exacerbate neurodevelopmental phenotypes in a *Drosophila* model of fragile X syndrome and autism spectrum disorder. The purpose of the research is to identify environmental factors that may confer risk or increase the severity of neurodevelopmental disorders (NDD), like autism and Fragile X syndrome, in individuals that have genetic risk factors for NDDs.

### *California State University Maritime Academy*

Dr. Alejandro Cifuentes-Lorenzen, an assistant professor of oceanography at Cal Maritime, is conducting research aimed at developing a better understanding of the complex process of energy transfer across the air-sea interface. The research project is a collaboration with the University of Connecticut, Woods Hole Oceanographic Institution, the University of Rhode Island and other research academics. Dr. Cifuentes-Lorenzen is overseeing all aspects of the technical research equipment deployment and retrieval in the North Atlantic Ocean. The study results will be shared in peer-reviewed journals and through presentations with students in California high schools and community colleges.

### *California State University, Fullerton*

Dr. JeeLoo Liu, a professor and department chair of the Department of Philosophy at CSU Fullerton, is pursuing research on “Confucian Robotic Ethics.” The research explores the possibility of implementing Confucian ethical codes in robots and considers what ethical precepts could be incorporated into robot morality. Dr. Liu was named a 2019 Andrew Carnegie Fellow for her work, and was the only one of the 32 fellows chosen for a project that focuses on philosophy.

### *California State University, East Bay*

Dr. Brian Perry, an associate professor and department chair of the Department of Biological Sciences at CSU East Bay, is conducting research on fungal biodiversity and molecular phylogenetic analyses with data from disciplines such as genetics, ecology and geography. The goal is to address broad questions about how biological and physical processes interact to drive evolution. His research has focused on regions with high levels of endemic, endangered plants and wildlife including Hawaii, Borneo and Micronesia. Most recently, his attention has been on Vanuatu where graduate student, Jonathan del Rosario and Dr. Perry have been on a survey of mushrooms and other fungi.

## **Scholarship and Creative Activities in the CSU**

Faculty scholarship benefits students, particularly as faculty weave their research into curricula and include students in the research and scholarship process. From 2014-19, CSU faculty authored 38,000 journal publications, the majority of which included student coauthors.

Creative activities are subject to discipline-specific standards for judging academic excellence. Faculty artistic contributions undergo peer evaluation, can qualify for funding from nationally competitive grants, may be included in scholarly conferences and journals and may be judged by specific criteria for tenure and promotion.

Below are some prime examples of those creative works at the CSU.

### *California State University, Fullerton*

Dr. Jamila Moore Pewu, an assistant professor of digital humanities and new media in history at CSU Fullerton, demonstrates to her students that books are not the only avenue for exploring history. An example of one of her compelling history projects is the study of Santa Ana's public murals. Funded by Cal Humanities, Dr. Moore Pewu collaborates with students, delves into local history and collects data that informs the community of the artist's vision. Her students interview artists, community members and archivists to map the location of the murals and provide information that was then adapted to a coloring book for youth and an app-based walking tour of 21 mural sites, provided in English and Spanish.

### *California State University, Sacramento*

Dr. Kathryn Kasic, assistant professor of communication studies at CSU Sacramento, is a collaborator on an NSF grant that is examining the physical and biological characteristics of Subglacial Lake Mercer, a lake that lies 1200 meters beneath the West Antarctic Ice Sheet. Dr. Kasic oversees the education and outreach components, including the production of a short film series and creation of accessible learning modules for K-12 students.

### *California State University, Fresno*

Dr. Vadim Keyser, assistant professor of philosophy at CSU Fresno, fuses art, philosophy and science to develop measurement puzzles that increase student engagement in science education. His transdisciplinary research brings together the humanities and STEM to develop empirical applications of measurement theory. His work involves models of reliable measurement in biology, ecology, biophysics and the social sciences and how to systemically make sense of producing new phenomena in science and technology.

*California State University Channel Islands*

Heather Castillo, an assistant professor of performing arts at CSU Channel Islands, founded Arts Under the Stars to bring awareness to the collaboration between the performing arts and research disciplines, including nursing, mathematics, environmental science and resource management, education and communication. With her students and in consultation with faculty researchers at CSU Channel Islands, Dr. Castillo choreographs pieces that interpret the significance of current research on campus with performances on an outdoor stage that are inclusive and express a commentary on subjects ranging from diversity to the environment to mental health.

**Systemwide Collaborations**

The CSU is uniquely positioned to have a statewide impact through collaborative research across disciplines and campuses. The CSU has a number of multi-campus partnerships, bringing together researchers from across the 23 campuses to share expertise, initiatives and facilities. Through these collaborations, faculty advance knowledge and expose their students to diverse perspectives, regional issues and innovative partnerships. These multi-campus partnerships share expertise, resources and facilities.

*Affinity Groups*

The CSU has ten multi-campus affinity groups that support research collaborations on a breadth of topics that are important to California.

Agricultural Research Institute

The Agricultural Research Institute (ARI) supports and funds applied agriculture and natural resource research within the CSU, which improves the economic efficiency and sustainability of California agriculture. Additionally, ARI is helping develop a highly-trained professional workforce for California agricultural and natural resource industries through student participation in research projects.

Six campuses comprise ARI: Chico, Fresno, Humboldt, Monterey Bay, Pomona and San Luis Obispo; however, faculty from all 23 campuses participate in ARI research programs. ARI faculty work on projects to develop and examine methods of maintaining or increasing California's contributions to the agriculture industry and the provision of healthy food resources in response to changes in weather, climate and political trends.

Students are the backbone of the research conducted by the ARI. In 2017-18, students were involved in 81 percent of ARI-funded projects. One hundred and seventy-nine CSU students benefited from 53,000 hours of career mentoring and scientific training that prepared them to enter the workforce with necessary experience and skills.

In one example, Dr. Nathaniel Jue (CSU Monterey Bay) and his students are studying genetic material to understand how microbial soil communities can be used to break down pesticides in soils. Another example, at Humboldt State, Dr. Matt Johnson and his students are conducting research with the goal of using barn owls to control rodents in vineyards in the Sonoma and Napa Valley vineyards.

#### Council on Ocean Affairs, Science and Technology

The CSU Council on Ocean Affairs, Science and Technology (COAST) is the umbrella organization for marine, coastal and coastal watershed-related activities within the CSU. COAST promotes research and education to advance knowledge of marine and coastal resources and the processes that affect them. COAST also shares scientific information with stakeholders for informed decision making and the development of responsible policy across California.

COAST is piloting a new program to connect CSU undergraduate students with graduate students for a mutually beneficial partnership in which the graduate students receive assistance with their research and the undergraduate students gain new skills and experience to prepare them for the workforce.

COAST projects are both rapid responses to urgent marine-related issues as well as longitudinal projects to study long-term impacts. In 2018-19, COAST provided more than \$290,000 to faculty to address a number of critical issues including ocean acidification, invasive species, water quality and microplastics.

#### CSU Program for Education and Research in Biotechnology

The CSU Program for Education and Research in Biotechnology (CSUPERB) mission is to develop a professional biotechnology workforce by catalyzing and supporting collaborative CSU student and faculty research, innovating educational practices and partnering with the life science industry. CSUPERB faculty are committed to ensuring that all CSU biotechnology students have access to an education that integrates experiential learning, especially team-based research or entrepreneurial projects.

As an example, Omar Apolinar, a first-generation college student at CSU San Marcos, was funded as a CSUPERB Presidents' Commission Scholar for summer research with chemistry professor Dr. Robert Iafe. Following the conclusion of his research, Mr. Apolinar published his discoveries, recently graduated, won a prestigious NSF Graduate Research fellowship and is pursuing a joint Ph.D./D.Phil degree through the Skaggs-Oxford program. Like Mr. Apolinar, more than 87 percent of the Presidents' Commission Scholars pursue life science-related graduate programs or careers.

Additionally, CSU I-Corps is a CSUPERB program in partnership with San Diego State that provides entrepreneurial training opportunities. Through this program, 12 start-up companies are active today, five teams have won \$50,000 NSF I-Corps Teams grants and CSU participants have won more than \$500,000 in commercialization grants and investment funding.

#### California Desert Studies Consortium

The CSU Desert Studies Consortium is a collection of seven campuses – Dominguez Hills, Fullerton, Los Angeles, Long Beach, Northridge, Pomona, and San Bernardino – that operate the CSU Desert Studies Center (DSC), located in the Mojave National Preserve. The DSC serves as a premier location and resource for research and education in the geology, hydrology and biology – among other areas – of California's desert and the American West.

In 2018-19, the Desert Studies Center hosted 22 research groups, typically externally-funded research projects. In addition, more than 30 CSU courses used the Desert Studies Center as a field laboratory.

Two CSU-led projects that exemplify this important resource are the 20-year investigation of the population dynamics of the Desert Holly (a shrub that is the most drought tolerant saltbush in North America) led by Cal Poly Pomona professors Drs. Christine Hartney and Sara Garver, and the continuation of the longest-known demographic record of a Mojave Desert reptile community led by CSU Fullerton professor Dr. William Presch and alumnus Jason Wallace. These projects have contributed to innumerable undergraduate research experiences.

#### CSU Shiley Institute for Palliative Care

As the population ages, the CSU Shiley Institute for Palliative Care works to train professionals with evidence-based, online and in-person programs for the variety of disciplines related to palliative care. The institute, located at CSU San Marcos, includes Fresno, Fullerton, Long Beach and Los Angeles as members, and collaborations are supported with other campuses throughout the CSU.

With funding from the California Health Care Foundation, the institute is collaborating with CSU San Marcos, Fresno State and CSU Monterey Bay on the development of a Faculty Toolkit for Palliative Care Curriculum Integration. The toolkit is a web-based repository of teaching and learning resources – slide sets, reading lists, case studies, discussion questions and role plays – that can be used in any classroom. Faculty directors on each of the campuses recruited 11 faculty across a variety of disciplines to pilot the toolkit for 684 students in kinesiology, gerontology, human development, health administration, nursing, social work, sociology and psychology.

#### Moss Landing Marine Laboratories

Moss Landing Marine Laboratories (MLML) is both a marine science field station with state-of-the-art research equipment and a satellite campus that administers the Master of Science in marine science program for CSU campuses in northern and central California. MLML is known for its hands-on, field-oriented approach that places students, faculty, researchers and staff at the forefront of marine science worldwide.

MLML received more than \$3 million in funding from the Ocean Protection Council/California Sea Grant to support monitoring of Marine Protected Areas (MPAs) off California. MLML-San José State graduate students and CSU Monterey Bay undergraduates are monitoring the surf zone and sandy beaches inside and outside of MPAs at eight sites. There, they are measuring beach profiles and physical characteristics, conducting beach seines to catch and measure fish sizes, and deploying surf zone remote video systems to characterize the fish living in the surf.

#### Ocean Studies Institute

The Ocean Studies Institute (OSI) is a consortium of CSU campuses that decided to pool resources to more effectively explore the ocean and coastal regions. It is based out of the Los Angeles Harbor and includes nine campuses – Channel Islands, Dominguez Hills, Fullerton, Long Beach, Los Angeles, Northridge, Pomona, San Bernardino, and San Marcos – addressing research and education on urban ocean and coast sciences.

A recent example of OSI research is an investigation on the spawning of giant sea bass and sound production conducted by Dr. Larry Allen, professor and chair of the Department of Biology at CSU Northridge. Alongside students, Dr Allen completed the acoustic monitoring of captive giant sea bass through two breeding seasons using handheld and underwater hydrophones. The sounds made by the male giant sea bass were found to be in the sound range of concert bass drums.

### Social Science Research and Instructional Center

The CSU Social Science Research and Instructional Center (SSRIC) supports the development and use of quantitative research skills among CSU students, faculty and staff. SSRIC provides a range of quantitative-skill teaching modules and exercises that faculty members can incorporate into classes, and which faculty, students, and staff can use to review specific topics.

Among other activities, SSRIC covers registration fees for faculty members to participate in training programs to improve their quantitative skills; awards faculty members funding that allows them to place questions on the CalSpeaks public opinion survey of Californians; and awards stipends to faculty for developing new instructional modules. SSRIC continues to provide CSU users with access to some of the most widely used subscription databases.

### Science, Technology, Engineering, and Mathematics Network (STEM-NET)

Today's students must have a strong foundation in STEM to meet tomorrow's workforce needs and the needs of California's innovation economy. The CSU is the state's largest supplier of engineers and is the leading supplier of top-tier talent to California's renowned high-tech companies. Additionally, the CSU produces more than 1,500 K-12 STEM teachers annually – the most of any institution in the country.

Recognizing the need for a systemwide affinity group to empower faculty to share campus best practices and produce scholarship and advancements that power California's future, in 2018-19, the CSU launched STEM-NET. This network will open up pathways for students to pursue STEM careers and to become STEM teachers through involvement in directed research and other scholarly activities. Through their engagement, students will learn teamwork and problem solving while also gaining the technical skills required to be successful in their future studies and careers.

### Water Resources and Policy Initiatives (WRPI)

Founded in 2008, this systemwide affinity group is developing and executing solutions for sustainable water resource management that changes the way California manages water. It is composed of more than 250 water experts from all 23 campuses across the CSU and is focused on developing water management solutions through research, partnerships, education and training, while providing students directed research opportunities. Through WRPI, the CSU has developed internship programs with the U.S. Department of Agriculture and the Environmental Protection Agency so that students can enter the workforce ready to develop solutions for business, government and the public.

In 2018-2019, WRPI provided more than 210 individuals from 20 CSU campuses with faculty research incentives, internship programs and an annual conference. Additionally, WRPI collaborated with other water agencies to co-host symposia on arsenic in water, homelessness and juvenile salmon Bioenergetics. WRPI also commercializes new ideas and services in water industries that are making irrigation more efficient than ever. Finally, WRPI and partners are working with communities to promote water education with a WaterTalks toolkit program in the Los Angeles and Ventura area.

### **Conclusion**

CSU research, scholarship and creative activities contribute to the intellectual and creative vibrancy of campus life while offering solutions to real-world problems. As a high-impact practice, these activities are critical to the success of Graduation Initiative 2025 and to fulfilling the CSU mission of student success, faculty excellence and service to California and beyond.



## **COMMITTEE ON EDUCATIONAL POLICY**

### **Admission Requirements: Quantitative Reasoning**

#### **Presentation By**

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#### **Summary**

As the largest and most diverse four-year public university system in the nation, the California State University (CSU) is committed to completely eliminating equity gaps – the gaps between degree attainment for students from historically underserved communities and their peers – at all levels of the university. One of the greatest hurdles to college degree attainment is a student’s level of academic preparation for college-level coursework upon entry.

Quantitative reasoning skills represent one of the greatest disparities among incoming college students. Too often, quantitative reasoning preparation disparities in PK-12 schools exacerbate equity gaps that follow students to college and influence their academic and career options. Students with additional quantitative reasoning preparation in high school – in every region of the country and across all ethnic groups – experience greater success in college. This preparation also readies students for the workforce, regardless of their field of interest.

The CSU’s ability to produce a greater number of diverse college graduates prepared for a range of professions is not only important for individual students but also for the future of California. This ability determines who participates in high-paying industries and influences the strength of our democracy.

Improving student success and closing equity gaps across a large university system require leadership and bold action that advance the mission of the institution. The CSU Quantitative Reasoning proposal will help achieve educational equity by ensuring that a greater number of

students from all backgrounds arrive at the CSU better prepared for a diverse range of majors and career paths. The goal is to expand access and equity for all students to achieve their personal and professional goals rather than limiting their opportunities at the point of college admission because of a lack of preparation for particular majors during high school.

The CSU proposes that graduating high school students, beginning with the entering first-year class of 2027, complete one additional course in quantitative reasoning to meet the minimum qualifications for CSU first-year admission. It will be possible for students to fulfill this requirement through high school coursework in mathematics, science or an elective course with a quantitative reasoning foundation. Students may also meet the requirement with a range of qualifying career and technical education courses or with appropriate dual enrollment courses at a local community college. Students who would otherwise be CSU eligible, but are unable to meet this requirement because of course limitations at their high school, will be automatically provided an exemption during the initial implementation of the requirement. This practice is consistent with prior phase-in processes of “a-g” course requirements for admission.

The proposed implementation term was extended to fall 2027 to ensure ample time for planning, communication and capacity building, particularly at high schools that currently have fewer course options. The CSU will continue to collaborate with PK-12 districts in every region of the state – building on decades-long partnerships – to expand curricular offerings in subjects that align with this requirement. Consistent with Governor Gavin Newsom’s 2020-21 proposed K-12 budget supporting approximately \$900 million for educator recruitment and training, the CSU has committed an additional \$10 million over the next four years to its Mathematics and Science Teacher Initiative to double (from 1,000 to 2,000) the number of mathematics, science and computer science teachers prepared at the CSU. Additionally, the university will continue to expand the co-development of transitional courses currently offered at more than 160 high schools across the state, and will tailor and expand existing student outreach and enrichment programs to support PK-12 student learning.

The proposal has benefited from significant consultation with stakeholders, the public and trustees. As a result of this consultation, a number of improvements have been made to the proposal. Each of these elements is detailed in greater detail throughout this agenda item, but they include:

- A seven-year phased implementation timeline to provide sufficient time to support school districts in developing course capacity and to educate counselors, students and their families about the changes.
- A shift from requiring the additional quantitative reasoning course in a student’s senior year to recommending it be completed in the senior year. This shift reflects a recognition that maximum flexibility will best serve students and high schools.
- An exemption that is automatic through a partnership with the California Department of Education (CDE) to remove the burden from students.

- Additional investments in teacher preparation to double the number of mathematics, science and computer science teachers prepared at the CSU. The Chancellor's Office and campuses will play a supportive role with CDE and local educational agencies to place these new math and science teachers in California's highest need public high schools.
- A plan to increase and expand student outreach and enrichment programs to support students' success in high school quantitative reasoning courses.
- An implementation steering committee, to meet biannually, that will be convened to provide implementation guidance and develop and monitor metrics to assess the impact and effectiveness of the requirement.
- An external review by a nonpartisan research organization, to inform the implementation by the CSU Board of Trustees.
- An annual report to trustees including implementation updates, progress toward the stated goals and a summary of first-time freshman applicants with attention to changes to student demographics. The draft of the report shall be reviewed by the steering committee.

The board discussed this matter as an information item during the March 2019 and July 2019 meetings, the August 29, 2019 special forum, and the September 2019 and November 2019 meetings. The board is now being asked to consider approving a phased implementation of a quantitative reasoning requirement and Title 5 change by spring 2022 to be effective fall 2027.

## **Background**

All 23 CSU campuses are recognized as being among the top universities in the nation for creating opportunities for students to improve their lives, according to multiple social mobility indices. The CSU's longstanding commitment to access remains unwavering today. However, it is earning a college degree – not simply being admitted – that positions students to transform their lives.

Since the 1950s, educators have examined the level of high school preparation required for admission to postsecondary institutions. In 1981, noting that many CSU students were taking fewer traditional college preparatory courses and that the courses failed to adequately equip students for university study, the Board of Trustees modified first-time, first-year student eligibility requirements to include preparatory study in English and mathematics. A 1984 CSU Taskforce on Entry-level Math Skills recognized the importance of progressive preparation, writing: "Today all students, not just those who major in technical fields, need to enter the CSU having mastered arithmetic as well as elementary algebra and geometry. More and more majors require mathematics courses."

During the same period, the board requested that a comprehensive pattern of college preparatory subjects be developed as a requirement for admission requirement. In 1988, amidst controversy and opposition, the board implemented a 15-unit high school college preparatory course pattern requirement for first-time, first-year students. Today, those courses are commonly known as the 'a-g' requirements that establish minimum eligibility for the CSU.

The current ‘a-g’ requirements for CSU admission have remained unchanged for more than 20 years. Yet, the preparation needed to be successful in a range of degree programs, the workforce and virtually every aspect of life *has* changed for this generation of students, and will continue to do so going forward.

Recognizing the incongruence in admission criteria and college readiness, the Academic Senate of the CSU created a task force in 2014, to examine academic preparation and quantitative reasoning. The task force included, among others, then-Lieutenant Governor Gavin Newsom and former California Department of Education Deputy Superintendent Keric Ashley. After two years of extensive consultation and investigation, one of the four recommendations was to revise quantitative reasoning requirements for CSU admission. The recommendation called for a “revised policy that evaluates the general quantitative reasoning ability of students entering and graduating from the CSU.”

At the same time, nearly one-third of regularly admitted CSU students were arriving underprepared for college-level mathematics and quantitative reasoning courses. These students were relegated to non-credit developmental education courses lengthening the time to earn a degree, costing them additional money and essentially excluding them from many science, technology, engineering and mathematics (STEM) degree programs. These students were disproportionately African American and Latinx.

One-in-four students who were assigned to developmental education courses did not return for their second year. Only 10 percent earned a degree in four years and fewer than half graduated within six years. In response to these findings, the CSU Office of the Chancellor issued Executive Order 1110 in August 2017. It addressed three main issues: a) it changed the way the CSU assessed students at entry and placed them in first-year courses; b) it strengthened the Early Start Program to allow students who need additional support to earn credit in the summer before their first term; and c) it discontinued stand-alone developmental education courses.

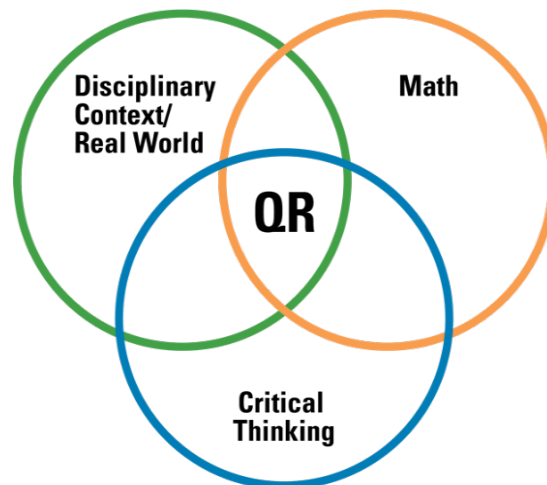
The CSU’s commitment is to “meet students where they are” and work to systematically increase the level of academic preparation and college-readiness for all incoming students. The first year of Executive Order 1110 implementation has shown positive outcomes for students; however, the policy was not intended to be the sole counterbalance for students arriving underprepared for various college-level quantitative reasoning courses.

The proposed quantitative reasoning admission requirement is a progressive step toward ensuring equity and authentic access for all CSU students. The proposal is not intended to curtail access or change the composition of the CSU student population. Instead, it is intended to ensure that all students who enter the CSU are prepared to be successful in their coursework so that they may participate in a range of majors and career fields.

## Defining Quantitative Reasoning

Quantitative reasoning is the ability to think and reason intelligently about measurement, dimensions, design, capacity or probability in the real world. The National Council of Teachers of Mathematics defines quantitative reasoning as:

...the developed ability to analyze quantitative information and to determine which skills and procedures can be applied to a particular problem to arrive at a solution. Quantitative reasoning, both generally and for assessment purposes, has an essential problem-solving focus. It includes the following six capabilities: reading and understanding information given in various formats; interpreting quantitative information and drawing inferences from it; solving problems using arithmetic, algebraic, geometric, or statistical methods; estimating answers and checking for reasonableness; communicating quantitative information; and recognizing the limitations of mathematical or statistical methods.



The ASCSU Quantitative Reasoning Task Force also proposed a general definition for quantitative reasoning:

“The ability to reason quantitatively is a stable combination of skills and practices involving: (i) the ability to read, comprehend, interpret, and communicate quantitative information in various contexts in a variety of formats; (ii) the ability to reason with and make inferences from quantitative information in order to solve problems arising in personal, civic, and professional contexts; (iii) the ability to use quantitative methods to assess the reasonableness of proposed solutions to quantitative problems; and (iv) the ability to recognize the limits of quantitative methods.”

One common misconception is that quantitative reasoning skills are exclusively taught in mathematics classes. While the ability to reason quantitatively utilizes mathematical skills for calculation, deriving real-world meaning and the application of findings are equally important. Quantitative reasoning extends beyond the ability to follow a mathematical procedure without error or memorize a formula. It invites students to think critically about problems in real-life contexts and intelligently develop and test solutions.

Quantitative reasoning is necessary to be a valued employee and an educated citizen in modern society. Planning for retirement, interpreting sports statistics, understanding economic forecasts, analyzing political arguments and making investment decisions all require strong quantitative reasoning skills. Critical thinking about quantitative data is increasingly necessary in many occupations, particularly for careers in STEM fields.

### **Proposal to Require an Additional Course in Quantitative Reasoning**

The CSU proposes that incoming high school students, beginning with the entering first-year class of 2027, complete one additional course in quantitative reasoning in high school to meet the minimum eligibility for CSU admission as a first-year student. The proposal strongly recommends that the additional quantitative reasoning course be completed during the senior year of high school. No changes are proposed for transfer admission eligibility.

The CSU is proposing to expand the ‘a-g’ requirements that determine minimal eligibility for CSU admission by including the completion of an additional course in quantitative reasoning, which could be fulfilled from area ‘c – mathematics,’ area ‘d – laboratory science’ or a quantitative reasoning course from area ‘g – college preparatory elective.’ Such college preparatory courses in area ‘g’ could include computer science, coding, personal finance and career and technical education courses with quantitative reasoning content. Students can satisfy this requirement with course-taking beginning in middle school.

As shown in the charts on the next page, under the CSU proposal, the area ‘c – mathematics’ requirement will not change. It is recommended that area ‘g – college preparatory elective’ be expanded from one to two courses to include an additional course in quantitative reasoning selected from area ‘c – mathematics’, area ‘d – laboratory science’, or a quantitative reasoning course from area ‘g – college preparatory elective.’ The objective of this change is that students take the next appropriate quantitative reasoning course to strengthen fluency and preparation for college-level coursework.

*Existing CSU College Preparatory Course Requirements for First-Year Admission*

Area	Subject	Courses
a.	<b>History and Social Science</b> (including 1 year of U.S. history or 1 semester of 2 U.S. history and 1 semester of civics or American government AND 1 year of social science)	2
b.	<b>English</b> (4 years of college preparatory English composition and literature)	4
c.	<b>Mathematics</b> (4 years recommended) including Algebra I, Geometry, Algebra II, or higher mathematics (take one each year)	3
d.	<b>Laboratory Science</b> (including 1 biological science and 1 physical science)	2
e.	<b>Language Other Than English</b> (2 years of the same language; American Sign Language is applicable - See below about a possible waiver of this requirement)	2
f.	<b>Visual and Performing Arts</b> (dance, drama or theater, music, or visual art)	1
g.	<b>College Preparatory Elective</b> (additional year chosen from the University of California ‘a-g’ list)	1
<b>Total Required Courses</b>		<b>15</b>

*Proposed CSU College Preparatory Course Requirements for First-Year Admission*  
 (The proposed change is indicated in red.)

Area	Subject	Courses
a.	<b>History and Social Science</b> (including 1 year of U.S. history or 1 semester of 2 U.S. history and 1 semester of civics or American government AND 1 year of social science)	2
b.	<b>English</b> (4 years of college preparatory English composition and literature)	4
c.	<b>Mathematics</b> (including Algebra I, Geometry, Algebra II, or higher mathematics or a comparable integrated pathway; take one each year)	3
d.	<b>Laboratory Science</b> (including 1 biological science and 1 physical science)	2
e.	<b>Language Other Than English</b> (2 years of the same language; American Sign Language is applicable - See below about a possible waiver of this requirement)	2
f.	<b>Visual and Performing Arts</b> (dance, drama or theater, music, or visual art)	1
g.	<b>College Preparatory Elective</b> (1 year selected from “c – mathematics”, “d – laboratory science”, or a quantitative reasoning course from the “g – college preparatory elective” areas AND 1 additional year chosen from the University of California ‘a-g’ list)	2
<b>Total Required Courses</b>		<b>16</b>

In fall 2018, new CSU first-year students enrolled having completed an average of 20.7 ‘a-g’ courses—20.2 and 20.6 for African American and Latinx students, respectively. This demonstrates students’ ability to exceed the minimum number of courses, 15, currently required for admission. Incoming students are also exceeding the minimum number of courses in each subject area—mathematics, laboratory science, language other than English, visual and performing arts, and college preparatory electives. This proposal is intended to ensure that the distribution of those courses includes additional quantitative reasoning preparation to support postsecondary success.

The University of California (UC) maintains the database of approved ‘a-g’ college preparatory courses submitted by public and private high schools. Similar to previous enhancements to support the review and identification of career and technical education courses for the CSU, modifications will be made to the database to more clearly identify qualifying high school courses that satisfy the requirement.

#### *Exemptions and Commitment to Do No Harm*

The proposal is designed to improve the level of preparation of incoming students, not create a barrier to the CSU. During the development of this proposal, the CSU has maintained a commitment to avoid placing an undue hardship on students who are unable to fulfill the new requirement because of limited course offerings in their high school.

Despite the multiple pathways available to meet the requirement and the CSU’s commitment to support capacity building over the next seven years, the university acknowledges that some students may experience unique circumstances requiring an exemption. The CSU will provide an automatic exemption for any student, who is otherwise eligible, who cannot fulfill the new requirement due to lack of resources and/or course availability at their high school.

To facilitate this process, the CSU will seek a working partnership with the UC and the California Department of Education (CDE) to classify schools with limited qualifying course offerings related to the implementation of this proposal in 2027. These schools would be internally identified in Cal State Apply, the CSU online application for admission, to ensure any student applying for the CSU from an identified high school receives the exemption. This will automate the exemption for students applying from these schools.

School course offerings and waiver information will be catalogued to more effectively target support with the expectation that, as with the initial implementation of the ‘a-g’ requirements, waivers will be phased out over time. The existing admission by exception policies already codified in Title 5 will remain.



## Preparation in Quantitative Reasoning Matters for College Success

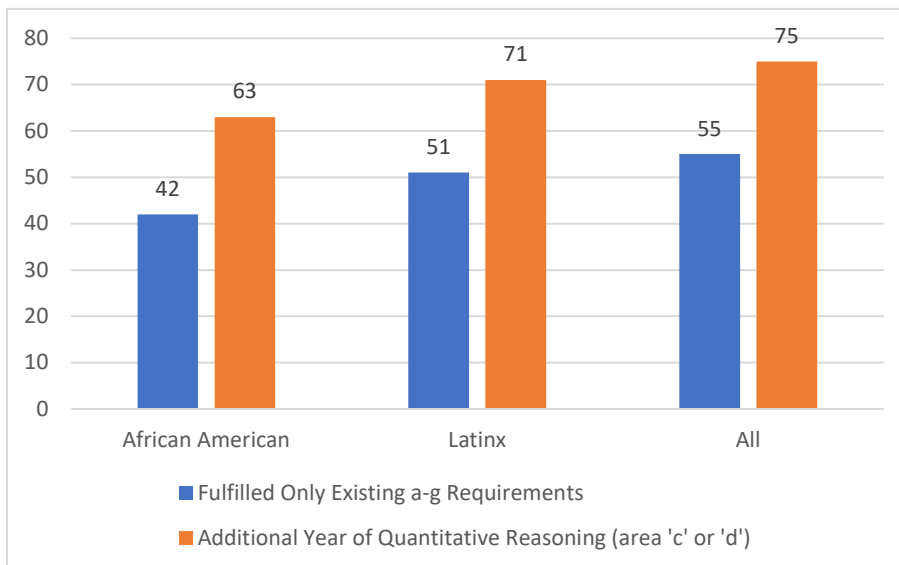
CSU-specific data and a growing body of national research suggest that additional quantitative reasoning preparation is associated with improved outcomes in college. While no single factor alone can be attributed to all student outcomes, the body of evidence clearly demonstrates the importance of academic preparation in improving retention and graduation outcomes.

### *CSU-Specific Data*

This section includes CSU student data – as previously shared with the board – and, where applicable, the CDE data that has been analyzed by the CSU.

### Successful Completion of the Quantitative Reasoning General Education Requirement

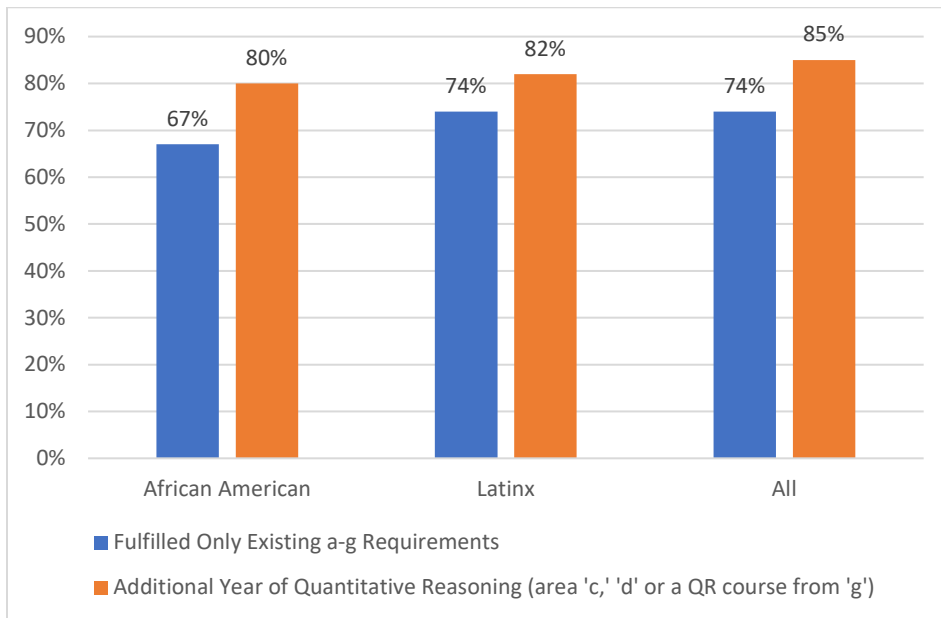
Additional quantitative reasoning preparation in high school dramatically increases the likelihood that a CSU student will complete the college-level quantitative reasoning (Subarea B4) general education requirement during their first year – a significant student success milestone associated with degree completion. A review of fall 2018 first-year CSU student data indicates that students with an additional course of quantitative reasoning (from areas ‘c’ or ‘d’) had a 20 percentage point higher pass rate in Subarea B4 as compared to peers with less preparation. This is consistent across all ethnic groups, including African American and Latinx students.



CSU Institutional Research & Analyses: Fall 2018 First-Year Students

First-Year Retention

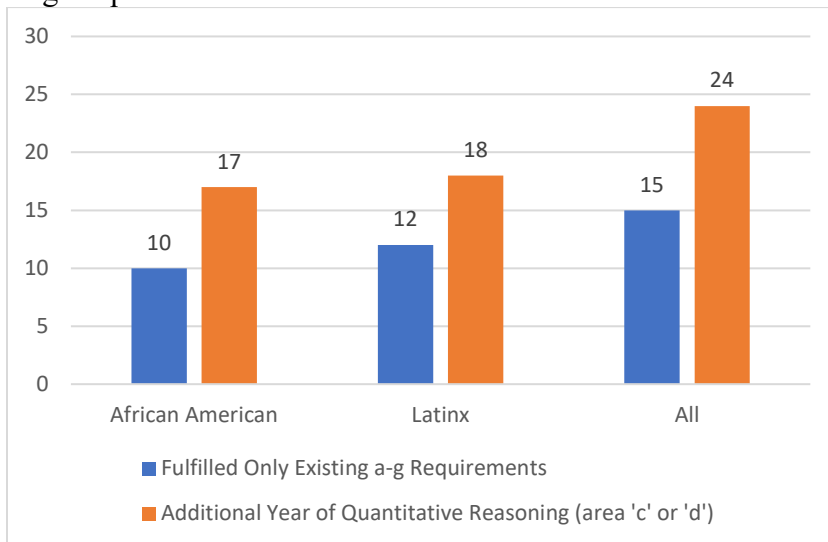
Students taking an additional quantitative reasoning course in high school are more likely to return for their second year of college. As shown below using CDE data, there is an 11-point gap in one-year retention rates for enrolled regularly admitted fall applicants between those meeting the proposed standard (85 percent retained after one year) and those not meeting the standard (74 percent retained after one year). These gaps hold across ethnic groups, as is shown in the chart below.



CSU Analysis of California Department of Education California Longitudinal Pupil Achievement Data System:  
Fall 2018 CSU First-Time Enrolled Regularly Admitted Students

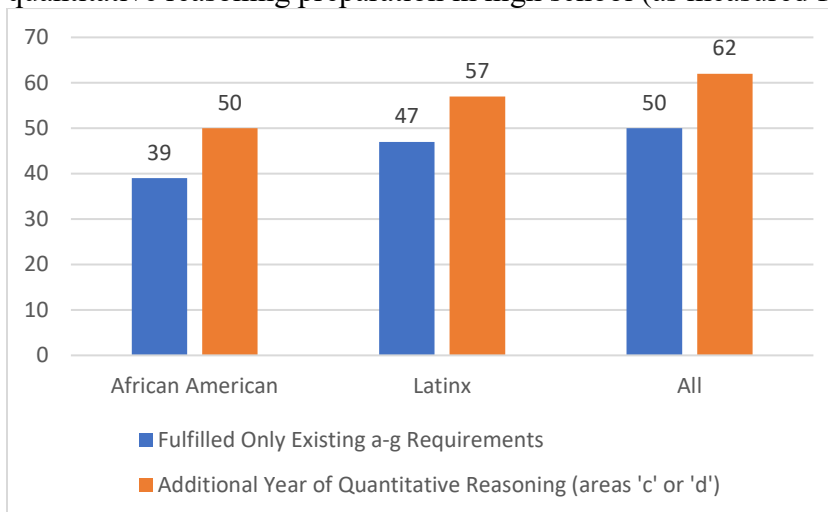
4- and 6-Year Graduation

Taking an additional quantitative reasoning course in high school is also linked to improved 4- and 6-year college graduation rates. As shown in the chart below (based on CSU data), there is a seven percentage point difference in the 4-year graduation rate for CSU African American students – and a six percentage point difference for Latinx students – who took an additional quantitative reasoning course in high school (from areas ‘c’ or ‘d’) versus those who fulfilled only the existing ‘a-g’ requirements.



CSU Institutional Research & Analyses: Fall 2014 Student Cohort

The chart below (based on CSU data) shows that 6-year graduation rates are also higher for all CSU students – including African American and Latinx students – who receive additional quantitative reasoning preparation in high school (as measured from areas ‘c’ or ‘d’).



CSU Institutional Research & Analyses: Fall 2012 First-Year Students

*National Data*

National data also support the relationship between increased quantitative reasoning preparation and college success. More than a decade ago, Cliff Adelman – a researcher and policy analyst at the U.S. Department of Education for more than 30 years – examined the association between high school mathematics course taking and college completion. He wrote:

“[The Toolbox Revisited](#) is a data essay that follows a nationally representative cohort of students from high school into postsecondary education and asks what aspects of their formal schooling contribute to completing a bachelor’s degree by their mid-20s. The universe of students is confined to those who attended a four-year college at any time, thus including students who started out in other types of institutions, particularly community colleges. The core question is not about basic ‘access’ to higher education. It is not about persistence to the second term or the second year following postsecondary entry. It is about completion of academic credentials – the culmination of opportunity, guidance, choice, effort, and commitment.”

Adelman’s findings on the association between high school mathematics course taking and college completion (not simply admission) are shown below:

<b>Highest Mathematics Course Completed in High School</b>	<b>Percentage of College Students Who Completed a Bachelor’s Degree</b>
Calculus	81.6
Pre-Calculus	73.7
Trigonometry	65.1
Algebra II	44.4
Geometry	28.5
Algebra I	11.9
Pre-Algebra	5.1

In 2014, a Policy Analysis for California Education (PACE) brief examined course-taking patterns of community college-bound students and verified Adelman’s 2005 research. The findings indicated that *not* taking a mathematics course in 12<sup>th</sup> grade was a significant predictor of not being college ready. The policy brief found that “all other factors being equal, students who took no mathematics in Grade 12 were 58 percent more likely to place 2 levels below [readiness] than into college-level mathematics.” The brief also corroborated Adelman’s 2006 findings that every class beyond high school Algebra II increased the probability of a student earning a bachelor’s degree.

The College Board, the organization that administers the SAT, found that high school seniors who take four or more years of mathematics have higher scores on college admission tests. Students who took four years of mathematics in high school averaged 518 in the mathematics section of the SAT. Those who took more than four years of mathematics averaged 572.

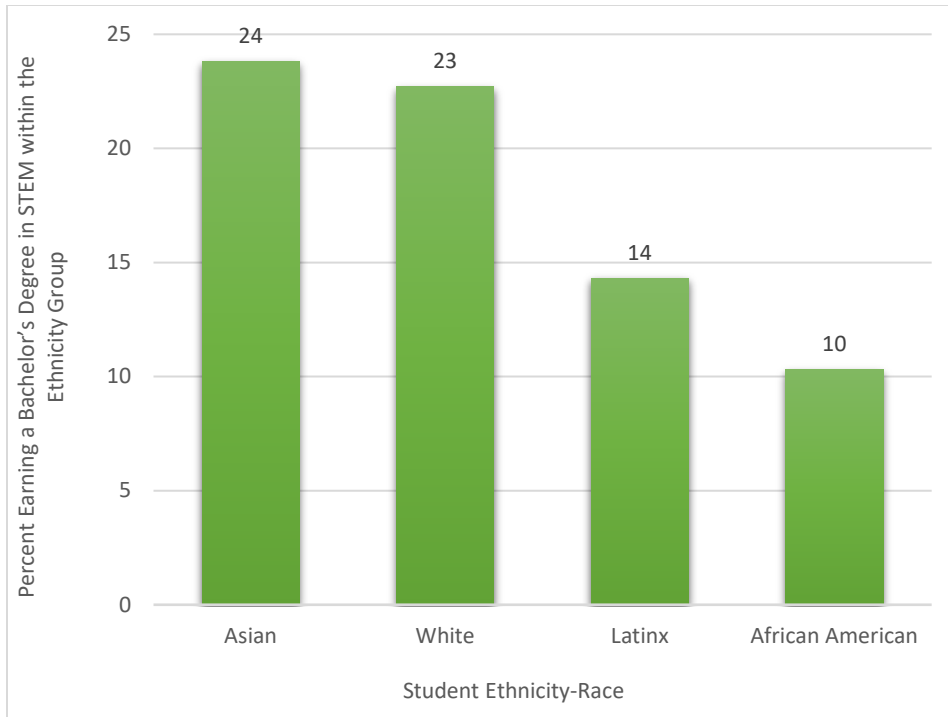
In addition, analysis from the ACT demonstrated a similar finding based on ACT student scores. Students who took four years of mathematics demonstrated higher percentages of proficiency levels in mathematics on the ACT exam (62 percent) than students who took fewer than four years of mathematics (16 percent).

Overall, the research on mathematics and quantitative reasoning course taking in high school and college success is clear. Additional mathematics and quantitative reasoning preparation in high school better prepares students to pursue a multitude of pathways once they begin their postsecondary studies. The national findings are consistent and present across all ethnic groups with sample sizes large enough to cancel selection biases or notions that the outcomes are simply correlational.

A list of other relevant studies can be found in attachment A.

#### *Data Related to Disparities in STEM*

Based on current trends in quantitative reasoning preparation, it is not surprising that persistent disparities exist at the CSU for students seeking degrees in STEM, despite progress in closing equity gaps. In 2017-18, 24 percent of students who self-identified as Asian and 23 percent who identified as white earned a baccalaureate degree in a STEM field. However, only 14 percent of Latinx students and 10 percent of African American students earned a similar degree. These data are reflected in the graph below.



CSU Institutional Research & Analyses: 2017-18 CSU Degrees Granted

This problem is not unique to the CSU. As noted in a 2017 Brookings Institute national report examining quantitative reasoning disparities beginning in middle school, “STEM college graduates are predominantly white or Asian, a pattern that has persisted for years despite historically high black and Hispanic college attendance and completion rates.”

The equity gap continues into the workplace despite the fact that careers in STEM have grown dramatically. According to a 2018 report by Pew Research Center, since 1990, STEM employment has grown 79 percent (from 9.7 million to 17.3 million). The report authors write “STEM jobs have relatively high earnings compared with many non-STEM jobs, and the earnings gap persists even after controlling for educational attainment. Among workers with similar education, STEM workers earn significantly more, on average, than non-STEM workers.”

In the Pew Research Center report, the authors find that “Black and Hispanic workers continue to be underrepresented in the STEM workforce. Blacks make up 11% of the U.S. workforce overall but represent 9% of STEM workers, while the Latinx community comprises 16% of the U.S. workforce but only 7% of STEM workers.”

CSU-specific data and a growing body of national research are clear that mathematics and quantitative reasoning preparation matter for college success and that the disparities in preparation can follow students across sectors, limiting their opportunities.

## **Many Public Comprehensive Universities Have Already Moved to Address Quantitative Reasoning Preparation**

Recognizing the need to improve preparation for postsecondary success, many universities now require additional mathematics and/or quantitative reasoning preparation. States with at least one public comprehensive university that have such a requirement include:

- Alaska
- Arizona
- Arkansas
- Colorado
- Florida
- Georgia
- Hawaii
- Idaho
- Indiana
- Kansas
- Louisiana
- Maryland
- Massachusetts
- Minnesota
- Mississippi
- New Mexico
- North Carolina
- Oklahoma
- Oregon
- South Carolina
- Tennessee
- Texas
- Utah
- Virginia
- Washington
- Wisconsin
- Wyoming

In 2006, North Carolina began requiring at least four years of mathematics for admission to any of its 15 public universities. Meanwhile, students seeking admission to the Twin Cities, Duluth, Morris and Rochester campuses of the University of Minnesota are required to have taken four years of mathematics in high school. The university system enacted this admission change in 2015 as a result of “university research [that] has shown that completing four years of math enhances student success in college. Grade point averages and graduation rates at the University of Minnesota are higher for students who have taken four years of math.”

Effective in 2015, students in Maryland were required to complete four years of mathematics in high school for entry to any of the state’s public universities, and those who complete Algebra II prior to their final year must complete the four-year mathematics requirement by taking a course or courses that utilize non-trivial algebra. Maryland is the home of Bowie State University, Morgan State University, Coppin State University and University of Maryland Eastern Shore – four historically black universities – dispelling the notion that such a requirement harms historically underserved student of color. The University of Maryland Baltimore County (UMBC) has become a national model for preparing African American STEM graduates. UMBC’s undergraduate admissions requirements are shown in the figure below:



## Undergraduate Admissions

### Application Requirements for Freshmen Students

The Admissions Committee weighs a number of factors in making its decision. In addition to grade point average and standardized test scores, the strength of your curriculum, class rank and other achievements as well as your essay will be considered. Reviewing the 2018 Freshman Class Profile in UMBC's **Fast Facts** may give you an idea of the students who are admitted to UMBC. UMBC expects applicants to have completed a strong college preparatory program of study from an accredited high school. The minimum program of study should include:

- **English:** four years
- **Mathematics:** four years including Algebra I, Geometry, and Algebra II. Additionally, applicants are expected to be enrolled in an eligible mathematics course in their senior year of high school study.
- **Social Science/History:** three years
- **Science:** three years
- **Language other than English:** two years

### How to Apply for Freshman Admission

1. **Complete the Common Application in its entirety.**  
[Apply Online](#)
2. **Complete the residency questions.** This information is located in the Member Questions section for applicants seeking in-state residency for tuition purposes.
3. **Submit the Common Application and \$75 non-refundable application fee.** You must submit all sections for UMBC to receive your Common Application. Prior to the deadline, make sure that there are green "complete"

Additionally, in 2016, both the Massachusetts State University and the University of Massachusetts systems began requiring entering students to complete four years of mathematics, including one course during the final year of high school.



### *California PK-12 School Districts*

Many California school districts have graduation requirements that align with the CSU proposal. Every student graduating from those districts has already fulfilled the quantitative reasoning requirement. While not an exhaustive list, examples include:

- San Diego Unified
- Long Beach Unified
- Elk Grove Unified
- Fresno Unified
- San Bernardino City Unified
- Oakland Unified
- Stockton Unified (beginning in 2023)
- La Cañada (beginning in 2021)
- Rocklin Unified
- Lake Elsinore Unified
- Murrieta Valley Unified
- Perris Union
- San Jacinto Unified

### *Long Beach Unified School District*

The Long Beach Unified School District (LBUSD) – where 70 percent of students are from households below the federal poverty level and 86 percent are non-white – increased the quantitative reasoning requirement six years ago to improve college readiness. Prior to changing the requirement, just 39 percent of students met the ‘a-g’ requirements for admission to the CSU. Today, 56 percent of students meet the ‘a-g’ requirements, and the district’s African American and Latinx students graduate at higher percentages compared to their peers in the county and across the state. Despite early opposition to the change and concern that underserved students would be disadvantaged, the outcomes have demonstrated the opposite. Students of color in LBUSD are graduating and attending college at higher rates due to increased quantitative reasoning preparation.

### *San Diego Unified School District*

In 2011, the San Diego Unified School District Board of Education adopted new, more rigorous graduation requirements that align with the district’s mission. The district is the second largest in California with more than 124,000 students, of which 23 percent are English Language Learners, 59 percent qualify for free or reduced lunch and 77 percent are non-white. The new requirements include specific high school courses that are aligned to the minimum subject-area course requirements for CSU and UC admission and are aligned to the California Next Generation Science Standards.

The high school graduating class of 2016 was the first class required to meet the new graduation requirements, which include three years of science (one year of life science, one year of physical science and one additional year of science coursework). Since adopting the new requirements, the percentage of graduates completing all ‘a-g’ requirements in the district has increased 10 percentage points over five years, from 46 percent in 2013 to 56 percent in 2018.

#### *PK-12 Institutions in Other States*

Recognizing the importance and power of quantitative reasoning preparation, a growing number of states now require four years of quantitative reasoning courses for a high school diploma:

- Alabama
- Arkansas
- Connecticut
- District of Columbia
- Florida
- Georgia
- Louisiana
- Maryland
- New Mexico

Five states go further, requiring four years of quantitative reasoning in high school and specifying that students take a course during the senior year to minimize skills gaps:

- Delaware
- Michigan
- Ohio
- Tennessee
- West Virginia

#### **Understanding California School District Capacity**

Given the CSU’s longstanding partnerships with school districts across the state, there is a working knowledge of existing capacity disparities and regional variations, which will be used to target implementation support to the districts and schools that are most in need.

#### *A Review of the University of California ‘a-g’ Database*

Data from the University of California’s ‘a-g’ database indicate that 99.7 percent (or 1,448 of 1,453) of California comprehensive high schools offer a course that would satisfy the proposed quantitative reasoning requirement. In addition, 88 percent of California comprehensive high schools offer a qualifying quantitative reasoning course in area ‘g-college preparatory elective,’ demonstrating the variety of curricular options which currently exist beyond traditional mathematics or science courses.

Still, CSU staff acknowledge the concerns about sufficient access to qualifying courses. A preliminary analysis of approved 2019-20 ‘a-g’ courses provides a clearer picture of course accessibility to meet the proposed requirement:

- Select charter schools with low enrollments presently have the least capacity. In many cases, these schools currently recommend students complete online courses or community college courses if they are seeking to satisfy the existing ‘a-g’ requirements. Several have since closed or have only recently begun enrolling students.
  - Five schools with 136 students combined earning their diplomas (2017-18) currently do not offer courses that would meet the proposed requirement.
  - Six schools, two with 56 students earning their diplomas (2017-18) and four charter schools with 112 students earning their diplomas (2017-18), had only area ‘c-mathematics’ courses that would meet the proposed requirement.
  - Seven schools, one with fewer than 10 students earning their diplomas (2017-18) and six charter schools with a combined 89 students earning their diplomas (2017-18), had only one area ‘d’ or ‘g’ course that would meet the proposed requirement.
- The remaining 1,435 schools offer multiple courses to satisfy the proposed requirement.

The table below summarizes these findings:

<b>Method to Meet Proposed Requirement</b>	<b>Charter School</b>		<b>Not a Charter School</b>		<b>Grand Total</b>	
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>
Can meet with area ‘c’ course or 2 or more courses from areas ‘d’ or ‘g’	380	89.8%	1,018	98.8%	1,398	96.2%
Can meet with area ‘c’ course or 1 area ‘g’ course	3	0.7%	2	0.2%	5	0.3%
Can meet with area ‘c’ course or 1 area ‘d’ course	11	2.6%	4	0.4%	15	1.0%
Can only meet with 2 or more courses from areas ‘d’ or ‘g’	14	3.3%	3	0.3%	17	1.2%
Can only meet with an area ‘c’ course	4	0.9%	2	0.2%	6	0.4%
Can only be met with 1 course in areas ‘d’ or ‘g’	6	1.4%	1	0.1%	7	0.5%
Does not meet proposed requirement	5	1.2%	--	--	5	0.3%
<b>Grand Total</b>	<b>423</b>	<b>100%</b>	<b>1,030</b>	<b>100%</b>	<b>1,453</b>	<b>100%</b>

*A Review of CSU Data*

In other school contexts, ample course offerings are available, but student course-taking behavior may need to be examined. Preliminary assessment of CSU fall 2018 first-time student data (through a review of high school course-taking behavior in areas ‘c-mathematics’ and ‘d-laboratory science’) identified the districts (shown below) that have 20 or more students who entered the CSU not having met the proposed standard and where the overall percentage of students meeting the requirement was well below the average (91 percent).

- Baldwin Park Unified
- Calexico Unified
- Central Unified
- Central Union High
- Chico Unified
- Coachella Valley Unified
- Delano Joint Union High
- Kern County Office of Education
- Kern High
- Lodi Unified
- Manteca Unified
- Merced Union High
- Oceanside Unified
- Salinas Union High
- San Gabriel Unified
- San Juan Unified
- Santa Rosa High
- Turlock Unified
- Visalia Unified
- Wasco Union High
- Washington Unified

These districts account for one in 14 of new fall 2018 enrollees from California public high schools while also accounting for one in six students who would not have met the proposed standard. The CSU recognizes it will need to work closely with these districts to build capacity and/or change course-taking behavior.

*A Review of CDE Data*

The CDE data analyzed by the CSU as part of the data-sharing agreement found that 360 of the 469 school districts (77 percent) with at least one CSU regular admit for fall 2018 would have 20 or fewer students who would not have met the proposed quantitative reasoning requirement. Only 13 of the 469 districts (3 percent) would have had 100 or more students who would not have met the standard.

Three districts (Los Angeles Unified, Long Beach Unified and Chaffey Joint Union High) had 150 or more students who would not have met the standard in 2018. A close examination of Los Angeles Unified indicates that 91 percent of the 15,167 regularly admitted students from the district met the proposed standard.

With the CDE data as a guide, the CSU has identified 42 California high schools that will be the immediate focus for partnership and implementation support, to support the schools in preparing for the quantitative reasoning admission requirement.

To be clear, considering the existing course completion and the intervening seven years to provide adequate curricular and advisement capacity for students, the proposed requirement will require limited changes in some high schools. The CSU is committed to working with all districts to meet this challenge.

### **Implementation**

With the data from the University of California ‘a-g’ database, the CSU and the CDE providing a clearer picture of how best to support PK-12 school districts, students and families, the CSU has identified four areas of focus for implementation partnership and investment: curriculum, teaching capacity, communication, and student outreach and enrichment.

#### *Curriculum*

The CSU will help expand curriculum in quantitative reasoning in California high schools by supporting and expanding existing partnerships and programs.

#### The California Mathematics Readiness Challenge Initiative (CMRCI)

The CSU will continue collaborating with school districts and PK-12 schools that need assistance developing qualifying courses. Since 2016, the staff at the CSU Center for the Advancement of Instruction in Quantitative Reasoning (CAIQR) have been working with the CDE and PK-12 and community college partners to develop a “bridge” or transitional course from high school to higher education through the California Mathematics Readiness Challenge Initiative (CMRCI). Transitional mathematics, defined as courses or curriculum needed to successfully transition to college-level mathematics, is crucial for student success. Analogous to the development of the Expository Reading and Writing Course (ERWC) for English language arts, five CMRCI sites (four at CSU campuses, one at a UC campus) are working with more than 150 high schools to offer such courses. In addition, CSU Northridge is currently offering a transitional mathematics course developed with the Los Angeles Unified School District.

The table below lists the current transitional courses developed at each CSU site, the number of school districts and schools at which the course is currently being taught, and the approximate number of students participating. Currently, more than 10,000 students are enrolled in a CSU transitional course annually.

<b>CSU Campus and Course Title</b>	<b>Districts</b>	<b>Schools</b>	<b>Students (approximate)</b>
CSU Monterey Bay: <i>Transition to College Level Mathematics</i>	5	8	197
CSU Northridge: <i>Transition to College Mathematics and Statistics</i>	1	48	2,131
CSU Sacramento: <i>Quantitative Reasoning with Advanced Math Topics</i>	20	52	4,293
CSU San Bernardino; Cal Poly Pomona; CSU Long Beach; San José State <i>Mathematical Reasoning with Connections</i>	20	48	2,963
San Diego State: <i>Discrete Mathematics for Pre-College Students</i>	1	12	1,204
<b>Totals</b>	<b>47</b>	<b>168</b>	<b>10,788</b>

These courses are approved in area ‘c’ of the ‘a-g’ requirements. The CSU will continue to partner with school districts to ensure that an ample supply of courses are available by 2027, the proposed implementation year, in the schools where they are most needed. Further, the CAIQR is assisting and supporting school districts in building their capacities of qualified teachers to teach these courses.

The ERWC Model for Capacity Building

The CSU will use a capacity-building framework for quantitative reasoning modeled on its work in reading and writing. The CSU’s Center for the Advancement of Reading and Writing, in partnership with California’s county offices of education, supports curricular development and integration, professional development for teachers and administrators, and evaluation frameworks. High school English language arts teachers have the opportunity to register for a four-day workshop to become an ERWC-certified instructor, at no cost for registration or materials. A council of CSU faculty representatives and an advisory board made up of faculty and public stakeholders provide direction for the center’s activities.

The CSU is utilizing a parallel approach in supporting quantitative reasoning course capacity development across California, centered in the CAIQR and leveraging the existing CMRCI bridge course pilot programs that currently operate in 168 high schools. The university will be expanding these efforts to include the schools and districts identified as most in need of capacity-building support.

#### Professional Development and In-Service Opportunities for PK-12 Teachers and Schools

The CSU will help expand curriculum in quantitative reasoning through professional development and in-service opportunities for new and veteran PK-12 teachers. Many of these opportunities will be conducted by the CSU CAIQR. Additionally, the CSU will continue to partner with the University of California, including the California Subject Matter Project in Computer Science, to provide support for high schools that are developing new courses and to clearly identify courses that meet the quantitative reasoning requirement.

#### *Teaching Capacity*

The CSU will address teaching capacity by leveraging the existing success of the CSU's colleges and schools of education in growing the teacher workforce. Consistent with Governor Gavin Newsom's 2020-21 proposed budget supporting approximately \$900 million for educator recruitment and training, the CSU has articulated several specific strategies to address teacher shortages in communities and disciplines of greatest need.

#### The CSU Mathematics and Science Teacher Initiative (MSTI)

The CSU is committed to increasing its annual production of credentialed teachers in STEM fields. Since 2005, the California legislature has provided ongoing support to the CSU's Mathematics and Science Teacher Initiative (MSTI), preparing mathematics and science teachers today and developing the next generation of California's STEM teacher-leaders. This work encompasses many components, including:

- Recruiting new students;
- Developing new credential pathways;
- Providing financial support to attract outstanding candidates and facilitate credential completion;
- Ensuring program alignment with California community colleges;
- Developing partnerships with federal agencies, laboratories and industry leaders; and
- Identifying the most successful approaches across the CSU system.

MSTI has enabled the CSU to increase its annual preparation of mathematics and science teachers from 700 to approximately 1,000. Through its recently announced commitment of an additional \$10 million investment over the next four years, the CSU is committed to doubling the number of mathematics, science and computer science teachers prepared at the university from 1,000 to 2,000 annually.

It is particularly noteworthy that the mathematics and science teachers prepared by CSU campuses often go on to teach in the state's high-need schools where 25 percent or more students come from families in poverty and mathematics achievement rates are significantly below statewide averages. As a result, these new mathematics and science teachers are contributing markedly to reducing the disparities in access to qualified teachers that have been found in the state for the past three decades and that have contributed to continued equity gaps in these fields. The Chancellor's Office and campuses will support CDE and local educational agencies' efforts to place new math and science teachers in California's highest need public high schools.

#### *Communication*

The CSU will engage in a significant communication campaign to ensure educators, families and prospective students are aware of – and prepared for – the admission change. This includes:

- **CSU Counselor Conferences** – The CSU will communicate directly about the admission change with more than 5,000 high school counselors and other educators across the state during these annual conferences.
- **Campus Outreach and Recruitment Offices** – All 23 CSU campuses operate outreach and recruitment offices designed to share information about the CSU and support students in applying to the university. Updated information about the quantitative reasoning admission requirement will be shared by these offices with students and families.
- **“How to Get to College” Campaign** – An educational campaign aimed at students, parents, teachers and counselors, “How to Get to College” provides critical information on preparing for – and pursuing – a CSU education. Information about the admission requirement will be included in these materials, which are available in English and Spanish.
- **California College Guidance Initiative (CCGI)** – A partnership between the California Community Colleges and the CSU, CCGI works to ensure that all 6-12 grade students in California have access to guidance and support as they plan, prepare and pay for postsecondary education and training. The CSU will ensure information about the new admission requirement is included in CCGI materials, and will increase its support for the expansion of CCGI, so that students in a greater number of geographical regions have access to these resources.



### *Student Outreach and Enrichment*

The CSU continues to work with PK-12 schools and community partners to address educational attainment disparities. Each year, the university spends more than \$70 million on these student outreach efforts, engaging with more than 1.1 million elementary, middle and high school students. Through additional investment and a focus on quantitative reasoning preparation, the CSU will leverage existing efforts to provide student support related to this new admission requirement.

#### CSU Summer Algebra Institute

The CSU Summer Algebra Institute (SAI) is a six-week mathematics enrichment program for rising 9-12 grade students. Currently, approved SAI sites receive \$30,000 in funding, program administration training for site coordinators and mathematics instructors, learning community check-ins to support successful program outcomes and support from the Office of the Chancellor to partner with local CSU campuses. The CSU will scale the SAI through the awarding of additional regional grants to build quantitative reasoning capacity across the state.

#### Early Assessment Program

The Early Assessment Program includes a dedicated employee on each CSU campus who engages directly with high schools in their respective region regarding English and mathematics preparation. This includes workshops and professional development for students and teachers. These efforts, which currently total an approximately \$4 million investment, would be tailored to specifically address quantitative reasoning in the coming years.

#### College Student Placements

The CSU will engage its existing VISTA grants to support the placement of volunteer college students in communities needing additional support in quantitative reasoning preparation. This includes the engagement of STEM VISTA, a program that place volunteers in CSU campus STEM departments and institutes to encourage STEM success in students from historically underserved communities. And, through the Center for Community Engagement and campus-based service-learning programs, additional college student placements are also possible.

#### **External Review**

The CSU will engage a nonpartisan research organization to conduct an independent study examining the potential impacts and informing implementation. The findings of the report, due by March 2021, will be provided to the Board of Trustees.

## **Safety Valves**

The proposal includes multiple reflection points and “safety valves” that would allow the implementation timeline to be extended – or halted – if the policy is resulting in unintended consequences. These safety valves include the seven-year implementation timeline and annual reports by staff from the Office of the Chancellor to the Board of Trustees. These reports, which would commence in 2021, with final report by January 2022 shall include: a. a third party independent analysis of the planned implementation and potential impact of the proposed requirement, b. the progress to-date on doubling the number of STEM qualified teachers from the CSU, c. the establishment of a Steering Committee, comprised of the Chair of the Board’s Committee on Educational Policy Committee, Superintendent of Public Instruction, Governor’s Office Higher Education advisor, President of the State Board of Education, chair of the Academic Senate, CSU, the California Community College chief academic officer, a CSU student, public school district superintendent, and senior leader of an community-based education group, d. Clarity on exemptions and subsequent accommodations for students whose public schools are unable to provide sufficient courses, and e. the progress on increased outreach and awareness of the proposed requirement with schools, counselors, and families.

## **Conclusion**

For decades, the CSU has served as a beacon of opportunity for students, families and the state of California, at the forefront of addressing the academic preparation of prospective and current students while maintaining a commitment to authentic access to a high-quality degree. To this end, groundbreaking programs like the CSU’s Early Assessment Program, established in 2003, provide prospective students, families and schools with early guidance on preparation for collegiate study and opportunities to enhance preparation in the senior year of high school. Similarly, the ERWC, now offered in more than 1,000 California high schools, provides high school seniors the opportunity to complete a fourth-year course in English language arts that was co-developed by the CSU and high school faculty to more closely align with college-level writing expectations.

Most recently, the CSU implemented new academic preparation policies associated with Executive Order 1110. These policy changes were also met with opposition, critical public comments and concern about the implications for historically underserved students. Yet, the CSU’s guiding question, “Is this the right thing to do for students?” remained central. One year later, the number of students passing credit-bearing courses, which count toward their degree, has increased eightfold. And historically underrepresented students experienced the greatest gains.

Similar opposition were associated with the CSU’s 1988 adoption of the ‘a-g’ courses. But today, a record number of students are meeting the ‘a-g’ requirements and are eligible for study at the CSU and UC. A recent report by the Public Policy Institute of California noted that “high school graduation rates increased from 75% in 2009–10 to 83% in 2015–16. Much of this increase has come from rising graduation rates among students of color: rates for both Latino students and African American students have increased 12 percentage points (to 80% and 73%, respectively).”

This proposal to modify the necessary academic preparation for first-year admission to the CSU continues the progress made to ensure equity and authentic access for all CSU students. The CSU has proposed a seven-year timeframe before implementation to allow for capacity-building and communication to students and families. The CSU also remains committed to access and takes seriously the responsibility to do no harm to students who may be attending schools with limited access to qualifying courses. And the university is committed to partnering with districts, schools and community organizations to build the necessary capacity for successful implementation.

There is widespread agreement that students continue to need – and deserve – access to better preparation for college. The workforce and world have changed significantly in the last 30 years and most certainly will continue to do so in the years ahead. The evidence is clear—additional quantitative reasoning preparation improves college success and access to a range of majors and career choices. Continued progress on behalf of students’ academic preparation requires the CSU to be the catalyst for change.

Because academic preparation matters for enhanced college student success and completion, and because analytical and quantitative skills are becoming increasingly important in all careers today and of the future, the following resolution for a phased implementation plan is presented for approval:

**RESOLVED**, by the Board of Trustees of the California State University, that:

1. The Board of Trustees seeks to have all incoming first year students complete, in addition to the current ‘a-g’ high school course requirements, a fourth year quantitative reasoning course, selecting from a wide range of courses as described in this agenda item, and will consider approving such a requirement and Title 5 change by spring 2022 to be effective fall 2027.
2. The Chancellor shall submit to the Board a progress report in March 2021 and a final report by January 2022 that includes:
  - a. a third-party independent analysis of the planned implementation and potential impact of the proposed requirement on high school students’ application to the CSU,
  - b. the progress on doubling the number of STEM qualified teachers annually prepared by the CSU,
  - c. clarity of the charge, role and composition of a steering committee that reports to the EVC of Academic and Student Affairs,
  - d. clarity on exemptions for students whose public schools do not provide sufficient courses, and
  - e. the progress on increasing outreach and awareness of the proposed requirement with schools, counselors, and families.

## Quantitative Reasoning Research Summary

**Adelman, C. (2005). Executive Summary: The Toolbox Revisited: Paths to Degree Completion from High School Through College. *The Journal for Vocational Special Needs Education*, 28 (1), 23-30.**

URL: [The Toolbox Revisited: Paths to Degree Completion From High School Through College](#)

“The academic intensity of the student’s high school curriculum still counts more than anything else in precollegiate history in providing momentum toward completing a bachelor’s degree. There is a quantitative theme to the curriculum story that illustrates how students cross the bridge onto and through the postsecondary landscape successfully. The highest level of mathematics reached in high school continues to be a key marker in precollegiate momentum, with the tipping point of momentum toward a bachelor’s degree now firmly above Algebra 2.”

**Long, M. C., Iatarola, P., & Conger, D. (2009). Explaining gaps in readiness for college level math: The role of high school courses. *Education Finance and Policy*, 4(1), 1-33.**

URL: [Explaining Gaps in Readiness for College-Level Math: The Role of High School Courses](#)

“Despite increased requirements for high school graduation, almost one-third of the nation's college freshmen are unprepared for college-level math. The need for remediation is particularly high among students who are low income, Hispanic, and black. Female students are also less likely than males to be ready for college-level math. This article estimates how much of these gaps are determined by the courses that students take while in high school. Using data on students in Florida public postsecondary institutions, we find that differences among college-going students in the highest math course taken explain 28–35 percent of black, Hispanic, and poverty gaps in readiness and over three-quarters of the Asian advantage. Courses fail to explain gender gaps in readiness. Low-income, black, and Asian students also receive lower returns to math courses, suggesting differential educational quality. This analysis is valuable to policy makers and educators seeking to reduce disparities in college readiness.”

**Long, M. C., Conger, D., & Iatarola, P. (2012). Effects of high school course-taking on secondary and postsecondary success. *American Educational Research Journal*, 49(2), 285–322.**

URL: <https://doi.org/10.3102/0002831211431952>

“Using panel data from a census of public school students in the state of Florida, the authors examine the associations between students’ high school course-taking in various subjects and their 10th-grade test scores, high school graduation, entry into postsecondary institutions, and postsecondary performance. The authors use propensity score matching (based on 8th-grade test scores, other student characteristics, and school effects) within groups of students matched on the composition of the students’ course-taking in other subjects to estimate the differences in outcomes for students who take rigorous courses in a variety of subjects. The authors find substantial significant differences in outcomes for those who take rigorous courses, and these estimated effects are often larger for disadvantaged youth and students attending disadvantaged schools.”

**Blair, R., & Getz, A. (2011). A Brief History of the Quantitative Literacy Movement.**

URL: [A Brief History of the Quantitative Literacy Movement](#)

“It has always been important for individuals to have the capacity to *do* arithmetic and algebra, however, in today’s global and technological society, doing calculations is not enough. An individual’s capacity to identify and understand quantitative situations, reason quantitatively, and communicate about the role mathematics plays in the world is essential. This quantitative literacy goes beyond basic computational skills. The quantitatively literate individual should be able engage in mathematics and solve quantitative problems from a wide array of authentic contexts and everyday life situations. These “habits of the mind” lead to making well-founded mathematical judgments that are useful in an individual’s current and future life as a constructive, concerned, and reflective citizen. Quantitative Literacy (QL) is more than just arithmetic skills and as fundamental as language literacy.”

**Bozick, R., Ingels, S., & Owings, J. (2008). Mathematics Coursetaking and Achievement at the End of High School: Evidence from the Education Longitudinal Study of 2002 (ELS:2002).**

URL: [Mathematics Coursetaking and Achievement at the End of High School: Evidence from the Education Longitudinal Study of 2002.](#)

“The findings show that the largest overall gains are made by students who take precalculus paired with another course during the last 2 years of high school. In terms of learning in specific content areas, the largest gains in intermediate skills such as simple operations and problem solving were made by those who followed the geometry–algebra II sequence. The largest gains in advanced skills such as derivations and making inferences from algebraic expressions were made by students who took precalculus paired with another course. The smallest gains were made by students who took one mathematics course or no mathematics courses during their last 2 years.”

**Elrod, S. (2014, December 19). Quantitative Reasoning: The Next "Across the Curriculum" Movement.**

URL: [Quantitative Reasoning: The Next "Across the Curriculum" Movement](#)

“By one definition, quantitative reasoning (QR) is the application of basic mathematics skills, such as algebra, to the analysis and interpretation of real-world quantitative information in the context of a discipline or an interdisciplinary problem to draw conclusions that are relevant to students in their daily lives. It is not just mathematics. Carleton College, for example, views QR as “the habit of mind to consider the power and limitations of quantitative evidence in the evaluation, construction, and communication of arguments in public, professional, and personal life.” The term numeracy is also used in conjunction with these skills.”

**Finkelstein, N., Fong, A., Tiffany-Morales, J., Shields, P., & Huang, M. (2012). College Bound in Middle School & High School? How Math Course Sequences Matter.**

URL: [College Bound in Middle School & High School? How Math Course Sequences Matter](#)

“Irrespective of students’ math performance, taking four years of high-school math strengthens their postsecondary opportunities. For students seeking entrance to one of California’s public university systems, a fourth year of math is strongly recommended. Yet our analysis shows that slightly more than 30 percent of students in the study sample did not take math during their senior year. For those who don’t study math their senior year (as well as for others who may not move directly from high school to college), having to take a college placement test after at least a year away from math can be a major deterrent to placing into a college-level math course; and students who do not do well on their placement test are likely to end up in a developmental, or remediation, math course, which yields no college credit.”

**Gao, N. (2016, July). College Readiness in California: A Look at Rigorous High School Course-Taking. Public Policy Institute of California.**

URL: [College Readiness in California: A Look at Rigorous High School Course-Taking](#)

“In this report we look at participation and performance in rigorous high school courses among California high school students, both overall and across demographic and racial/ethnic groups. While enrollment in rigorous courses has been increasing, particularly among students who are traditionally underrepresented in higher education, a large majority of California high school students are not taking the courses that can prepare them for college. Forty-three percent of high school graduates in 2015 completed the a–g requirement, and 27 percent of high school graduates in 2013 passed an advanced placement (AP) exam. Participation in advanced math, biology, chemistry, and physics courses is also low. In particular, only 30 percent of high school juniors and seniors enrolled in Algebra II and smaller shares enrolled in chemistry (28%) and physics (10%).”

**Lee, J. (2012). College for all: Gaps between desirable and actual P–12 math achievement trajectories for college readiness. *Educational Researcher*, 41(2), 43–55.**

URL: <https://doi.org/10.3102/0013189X11432746>

“This study addresses missing links in “college for all” debates by investigating gaps between actual and desirable math achievement trajectories for students’ college readiness. Linking multiple national data sets across P–16 education levels, the study estimates college readiness benchmarks separately for two-year and four-year college entrance and completion. The goals of the study are to compare performance standards, benchmarks, and norms for college readiness and to assess college readiness gaps among all students as well as gaps among racial and social subgroups. The results suggest that entrance into and completion of two-year versus four-year colleges require substantially different levels of math achievement in earlier education periods and that meeting national versus state proficiency standards leads to differences in postsecondary education outcomes and can mean the difference between bachelor’s and associate’s degree attainment. Persistent racial and social gaps in college readiness threaten the goal of getting all students academically ready for at least two-year college completion.”

**Daun-Barnett, N., & St. John, E. (2012). Constrained curriculum in high schools: The changing math standards and student achievement, high school graduation and college continuation. *Education Policy Analysis Archives*, 20, 5.**

URL: <http://dx.doi.org/10.14507/epaa.v20n5.2012>

“Mathematics education is a critical public policy issue in the U.S. and the pressures facing students and schools are compounded by increasing expectations for college attendance after high school. In this study, we examine whether policy efforts to constrain the high school curriculum in terms of course requirements and mandatory exit exams affects three educational outcomes – test scores on SAT math, high school completion, and college continuation rates. We employ two complementary analytic methods – fixed effects and difference in differences (DID) – on panel data for all 50 states from 1990 to 2008. Our findings suggest that within states both policies may prevent some students from completing high school, particularly in the near term, but both policies appear to increase the proportion of students who continue on to college if they do graduate from high school. The DID analyses provide more support for math course requirement policies than mandatory exit exams, but the effects are modest. Both the DID and fixed effects analyses confirm the importance of school funding in the improvement of high school graduation rates and test scores.”



**Trusty, J., & Niles, S. (2003). High-school math courses and completion of the bachelor's degree. *Professional School Counseling*, 7(2), 99-107.**

URL: <http://www.jstor.org/stable/42732549>

“Using a national longitudinal sample of 5,257 young people who were pursuing the bachelor's degree, we studied how credits in intensive high school mathematics courses affected their completion versus noncompletion of the degree. Finishing one unit in any of four intensive math courses more than doubled the likelihood that participants would later complete the bachelor's degree. Effects were present above and beyond the effects of background variables, including early math ability. Implications of findings are presented.”

**One Year Out: Findings From A National Survey Among Members Of The High School Graduating Class Of 2010 (Rep.). (2011). Washington, DC: Hart Research Associates.**

URL: [One Year Out: Findings From A National Survey Among Members Of The High School Graduating Class Of 2010](#)

“Four in nine members of the class of 2010 say that based on what they know now they wish they had taken different courses in high school, with the largest proportion of these graduates saying they wish they had taken more math courses or more difficult math courses. 44% say that they wish they had taken different courses in high school. Among this group, 40% would have taken more or higher-level math courses, 37% would have taken courses that would have trained them for a specific job, and 33% would have taken more or higher-level science courses. Regrets about course selection are higher than average among students who went on to college but felt less well prepared than others at their college, students who considered dropping out or did drop out of college, and students who were required to take non-credit remedial courses once they got to college.”

**Rigor at Risk: Reaffirming Quality in the High School Core Curriculum (Rep.). (2007). Iowa City, IA: ACT.**

URL: [Rigor At Risk: Reaffirming Quality in the High School Core Curriculum](#)

“Of those students who take a core mathematics curriculum, only 16 percent are ready for a credit bearing first-year College Algebra course (see Figure 4). It is not until students take one full year of additional mathematics courses beyond the core that we see more than half (62 percent) of ACT-tested students ready for college-level work in mathematics.”

**The Value of the Fourth Year of Mathematics (Rep.). (2013). Washington, DC: Achieve, Inc.**

URL: [The Value of the Fourth Year of Mathematics](#)

“Too many students and educators view the senior year and graduation from high school as an end point, rather than one vital step along the education pipeline. Students who engage in a fourth year of math tap into and build upon their advanced analytic skills and are more likely to have better success in postsecondary course work, as they have maintained their momentum and continued to practice mathematics throughout their high school experience.”