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EVOLVING QUANTITATIVE REASONING EXPECTATIONS IN THE CALIFORNIA STATE UNIVERSITY

FORD, RICHARD L.
DEPARTMENT OF MATHEMATICS
CALIFORNIA STATE UNIVERSITY, CHICO
CALIFORNIA

BOYD, ELIZABETH A.
COLLEGE OF AGRICULTURE
CALIFORNIA STATE UNIVERSITY, CHICO
CALIFORNIA

Evolving Quantitative Reasoning Expectations in the California State University¹

Richard L. Ford, PhD and Elizabeth A. Boyd, PhD^a
California State University, Chico

Abstract:

In this paper we present the efforts of the California State University (CSU) to improve college readiness in mathematics and quantitative reasoning while maintaining and improving social equity. In the AY 2015-2016 the CSU Academic Senate authorized the formation of the Quantitative Reasoning Task Force (QRTF) to examine the current state of preparation of incoming freshmen to the CSU and to make recommendations on how to improve that preparation. The QRTF released their final report in September, 2016. Since that time the report has been endorsed by several academic organizations. This paper will highlight key issues addressed in the report and present responses by various organizations including summaries of the general positions of campuses. The CSU Chancellor's Office subsequent plans for implementation will be summarized and discussed. Specific attention is paid to the competing issues of access and opportunity, as defined in the report. We will discuss the relation between access and opportunity to the most controversial recommendation: requiring four full years of high school quantitative reasoning as a CSU admissions requirement.

Background, Introduction, and Methodology:

CSU Organization and Governance: The California State University (CSU) is a 23 campus system that is centrally managed by the CSU Chancellor's Office (CO) and CSU Board of Trustees. Each campus President is responsible for implementation of Executive Orders from the CO. To uphold the precepts of the California [Higher Education Employer-Employee Relations Act](#)², there are faculty organizations of shared governance at both the CO and individual campus levels. The CO level of faculty governance is the Academic Senate of the California State University (ASCSU) and is comprised of members from each of the 23 campus Academic Senates.

Quantitative Reasoning: Basic admissions and general education standards are uniform throughout the California system. Regarding quantitative reasoning, all students must successfully complete high school mathematics content including Algebra I, Geometry, and Algebra II per the California Common Core State Standards (CCCSS)³. In addition, to verify base competency, first time freshmen in the CSU must pass a standardized statewide exam known as the Entry-Level Mathematics (ELM) exam. To earn a bachelor's degree at the CSU all

^a Authors: Richard L. Ford, Ph.D. Vice Chair, CSU, Chico Academic Senate, Professor and Chair, Department of Mathematics and Statistics, and Elizabeth A. Boyd, Ph.D., Chair, CSU, Chico Academic Senate, Associate Professor, College of Agriculture

students also must complete at least one general education mathematics/quantitative reasoning course that builds upon and extends the entry level proficiencies required. Current CSU general education policy requires that all mathematics/quantitative reasoning courses carry an “intermediate algebra” prerequisite. In practice, transferable community college general education mathematics/quantitative reasoning courses meet this course requirement, but many of the general education mathematics/quantitative reasoning courses at the CSU are out of compliance, and instead carry explicit requirements that students meet the ELM proficiency standard.

In the 2015-16 academic year the ASCSU formed and charged a Quantitative Reasoning Task Force (QRTF) to review the CSU's mathematics proficiency expectations and to recommend changes to existing policies and practices to improve academic preparation. On September 1, 2016, the QRTF issued their final report to the Chancellor and the ASCSU. On November 17, 2016, Dr. Loren Blanchard, the Executive Vice Chancellor sent a letter to the CSU Presidents⁴ asking for each to provide campus feedback on the recommendations of QRTF Final Report. The feedback should include “an analysis of the equity implications and how to prevent any adverse impact to underserved populations.” The deadline for the campus responses was set as February 6, 2017.

Twenty-one of the 23 campuses responded to the request. Other CSU stakeholders responded as well. At most campuses, due to the short deadline, this response was crafted by various members of the campus. For example, at CSU, Chico the response was created by faculty members of Academic Senate Executive Committee and was shared by email with a request for feedback from Executive Committee, Provost’s Advisory Council, Department Chairs, and Academic Senators.

In March, after compiling the campus and other stakeholder responses (see Appendix 1), the CO Division of Academic and Student Affairs issued a series of memoranda that set the stage for changes to CSU’s educational programs with respect to Quantitative Reasoning. The first memorandum on March 7, 2017 was addressed to the Chair of the ASCSU and provided an overview of campus responses as well as an initial implementation plan⁵. Two subsequent memoranda in March included 1) a request for review of the CO Executive Order governing General Education Breadth Requirements⁶ and 2) inclusion of QR recommendations in Academic Preparation⁷ as it pertains to the CSU Initiative for Student Success.

In this paper we provide synopses of the QRTF recommendations, summaries of campus and stakeholder responses, and the current state of the CO implementation plans. The paper concludes with analyses and discussion of the recommendations, responses, and plans.

QRTF Recommendations, Responses and CO Plans for Implementation:

QRTF Recommendation I Synopsis: Definition of Quantitative Reasoning. Quantitative reasoning depends on the methods of computation, logic, mathematics, and statistics. The following definition of quantitative reasoning was created for the CSU in order to guide planning and practice.

“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.”

Campus & Stakeholder Responses to I: The mainstream campus response was to endorse this definition provided in the QRTF final report, although one campus wanted to delete the last line.

CO Implementation of I: The CO has adopted the QR definition found in the report. Revisions will be made to the CSU General Education Breadth Requirements in order to accommodate equity issues and to provide quantitative reasoning education appropriate to the majors. The revision process commenced with a request (memo sent March 10, 2017) for campuses to review the current requirements and to respond with recommended changes by June 2017.

QRTF Recommendation IIA Synopsis: Separate foundational and baccalaureate quantitative reasoning requirements. This recommendation carries with it the proposal to end the current prerequisite language that defines a de facto foundational requirement (essentially “intermediate algebra”) and instead clearly articulates separate and equitable foundational and baccalaureate expectations. The QRTF identified equity issues relative to different standards between community colleges and CSU practice that will be addressed by this recommendation and the subsequent Recommendation IIB that defines foundational level quantitative reasoning standards.

Campus & Stakeholder Responses to IIA: Campus responses generally indicated support for ending the current prerequisite language and believe it will provide each campus with consistent tools for assessing and improving the quantitative reasoning aspects of our curriculum in ways that will mirror the integration of writing proficiency. Some expressed concern that removing the Intermediate Algebra language could result in a lowering of standards. No campus expressed strong opposition to Recommendation IIA and many supported it and expressed optimism that it would resolve equity issues.

QRTF Recommendation IIB Synopsis: Define baccalaureate quantitative reasoning. The definition illuminates the reality that quantitative reasoning is not just mathematics and that the college curriculum should be consciously designed to improve these intellectual attributes throughout the curriculum. QR is one aspect of critical thinking that is important in all academic fields and is embedded in the responsibilities of our graduates in their personal, civic, and professional lives.

Campus & Stakeholder Responses to IIB: It was observed that this definition is quite flexible but necessarily requires building upon and expanding the knowledge and thinking skills expected at the foundational level as defined in Recommendation IIC. Some campuses expressed concern that such flexibility meant the definition was too vague. With respect to impacts on equity, some expressed that a more mindful integration of QR into the full spectrum of the college curriculum

would be a positive contribution because improved QR skills are perceived to enhance the opportunities and economic benefits of the CSU degree equitably for all students. Several campuses noted that this mindful integration is also consistent with updated accreditation standards.

QRTF Recommendation IIC Synopsis: Define foundational quantitative reasoning.

Foundational QR is defined in the QRTF Final Report relative to the California Common Core State Standards (CCCSS)⁸. Those standards, in turn, have been widely accepted in educational, government, and private enterprise circles as appropriate and necessary for college and career readiness. The QRTF Final Report defines foundational QR as “proficiency and fluency” in the CCCSS up through Algebra I and Integrated Math I. This is essentially fluency with QR at the grade 9 level. The definition also calls for “practiced skills” in higher levels and that the eight Common Core mathematical practices are “developed”.

Fluency and proficiency in the full K-12 set of CCCSS is not required. The QRTF Final Report states that fluency and proficiency with K-8 and Algebra I/Integrated Math I was “close to the ELM threshold supported by the CSU Council of Math Chairs.” Thus, in the short term, the existing ELM structure could be used for implementation.¹ The QRTF Final Report also provides significant argument and evidence that this definition of foundational QR is appropriate for proper QR preparation for the broad range of college level pursuits available at the CSU and would be consistent with standards in other states including Georgia, Indiana, Maryland, and Texas.

Campus & Stakeholder Responses to IIC: The general response was to applaud and support the definition of foundational QR found in Recommendation IIC, but as noted earlier the removal of the intermediate algebra language was seen by some as opening the door to reducing standards. Concern was also expressed that the new foundational QR description would differentiate STEM and non-STEM tracks too early in the students’ careers. Several campuses expressed opposition to a 2-track approach to remediating deficiencies, but others expressed support for practices that recognized different QR requirements in STEM vs non-STEM majors. With the foundational QR definition being so proximate to current CSU QR requirements, no significant concerns outside of premature tracking, were expressed relative to equity.

The idea that the mathematical practices and exposure to standards beyond the grade 9 level should be verified through the completion of the high school coursework received no opposition by the campuses. The recommendation in the report that “proficiency and fluency” should continue to be verified by standardized testing instruments also received little note. Although the report observed standardized tests such as the SAT, ACT, and ELM will require recalibration and possible modifications, some campuses wondered what the continuing role of some of those instruments would be.

CO Implementation of II: As part of the revision to the CSU General Education Breadth Requirements policy, the CO will incorporate the QRTF recommended mathematics/quantitative reasoning definition that does not include an intermediate algebra prerequisite. In addition, the CSU GE policy also will specify one common general education mathematics/quantitative reasoning requirement for all students to mitigate against possible tracking of students into

majors with differential earning potential careers. The CO position sides with campuses concerned about tracking and seems to refute the notion of different developmental tracks for students in STEM and non-STEM fields.

In an effort to improve college readiness among CSU students the CO is establishing workgroups focused on elements of academic preparation with the intent of subsequent academic preparation policy revision. The CO also announced that methods for assessing foundational proficiency will change. They propose that the current system assessment instrument known as the ELM exam may be retired and replaced with an artificially intelligent assessment and learning system known as Assessment and LEarning in Knowledge Spaces ([ALEKS](#))⁹ in combination with other “multiple measures”. These measures will take into consideration SAT, ACT, EAP, ALEKS, high school course grades, and other data.

QRTF Recommendation IIIA Synopsis: Promote equity, access, and opportunity. The QRTF Final Report calls for aligning CSU GE mathematics/quantitative reasoning course requirements between the community colleges and the CSU. It further encourages that each CSU provide at least one mathematics/quantitative reasoning course that has no prerequisite beyond the foundational QR threshold. This means that the “intermediate algebra” prerequisite language will be appropriately replaced. This will require revisions to *CSU General Education Breadth Requirements policy* where the “intermediate algebra” language is codified. The recommendation also includes requiring additional QR preparation and standards for students in QR-intensive majors such as engineering or science. This requirement is consistent with existing CSU practice where additional placement assessment is required for students wishing to take advanced mathematics/quantitative reasoning courses such as calculus.

Campus & Stakeholder Responses to IIIA: The campus responses generally indicated support for Recommendation IIIA. Implementation of the recommendation was seen by some as furthering the interests of equity for all students, particularly bringing consistency to the treatment of native and transfer students. We have mentioned previously that some campuses are concerned about premature tracking of their students, while others already have in place different remediation tracks for STEM and non-STEM majors. All campuses have additional requirements to establish readiness for mathematics coursework beyond the lowest baccalaureate level GE courses.

QRTF Recommendation IIIB Synopsis: Require four years of high school QR for admission to the CSU. The final QR course would be required to be taken in the senior year. There are a variety of ways a student could meet this requirement besides taking an additional mathematics course. Notably, the QRTF Final Report suggests that an additional algebra-based Area D (per CCCSS) science course such as chemistry or physics, if taken in the senior year, would be acceptable to meet the new requirement. We understand this to mean that any Area D science course would be acceptable because to receive UC-CSU Area D approval, these courses¹⁰ “...will specify, at a minimum, elementary algebra as a prerequisite or co-requisite, and will employ quantitative reasoning and methods wherever appropriate.” More than 60 percent of students advancing to the CSU from high school already complete four years of math. Over 20 states in the U.S. already require a fourth year of mathematics for admission to their state

university systems.¹ Currently the UC and CSU require three years of high school mathematics (Area C) including Algebra II or Integrated Math III.⁴

Campus & Stakeholder Responses to IIIB: A strong majority of the campus responses indicated support for the 4th year QR requirement and saw it as necessary to ensuring preparation for college level work. It was widely agreed that the added requirement would reduce the need of the CSU to remediate. Conversely, there were also concerns expressed by most campuses about the negative impact to access that a 4th year requirement might cause. For example the SFSU Academic Senate passed a resolution¹¹ opposing the fourth year requirement due to potential impacts to access. The mainstream view was that a cautious approach should be taken and that implementation should try to minimize such negative impacts.

Some campuses observed that the opportunities in terms of value of the degree would be increased and noted that since underserved populations are currently over-represented in developmental courses,¹² the reductions in remediation placements would likely be differentially beneficial to those populations. Multiple organizations including the CSU Council of Mathematics Chairs, the ASCSU,^{13,14} the ELM Test Development Committee,¹⁵ and others have endorsed this recommendation. In the endorsement provided by the ELM Test Development Committee, it was noted that any negative impacts to access would likely be shorter term and disappear over time, while the benefits to opportunity and the reduced needs for remediation by underserved populations would be permanent.

Several campuses observed that under-resourced schools may have insufficient levels of capacity to adjust to the requirement of offering an additional QR course (see specific concerns in Appendix I). This could differentially impact access to the CSU by underserved populations. The impact on the workforce and the needs for professional development of mathematics teachers was also a common concern. Campuses were asked to provide suggestions for mitigations but few were offered. One campus suggested using algebra-based science courses that are already required for admission to meet the requirement during an extended “grace period”.

QRTF Recommendation IIIC Synopsis: Ensure early and appropriate QR courses for CSU first-time freshmen. Foundationally proficient students should take a mathematics/quantitative reasoning course appropriate to their major within their first two terms. Those who are not foundationally proficient should demonstrate proficiency within two terms and complete a baccalaureate QR course within two semesters of the demonstrated proficiency. As part of this recommendation the QRTF supports accommodating co-requisite remediation. This is intended to shorten time to degree by allowing the remediation of foundational QR deficiencies simultaneously with the completion of a mathematics/quantitative reasoning general education course.

Campus & Stakeholder Responses to IIIC: These recommendations regarding early QR coursework for both foundationally proficient and non-proficient students were widely accepted as non-controversial and basically common sense. One campus questioned whether taking GE mathematics/quantitative reasoning early was at odds with the goal of improvement of QR abilities throughout the college experience. Some believe the recommendation will encourage

the creation of developmental tracks appropriate to different programs. The differing tracks have raised concerns about tracking students too soon in their academic careers. Differing tracks raise equity issues in terms of opportunity because QR intensive degrees such as business and STEM tend to provide more employment options. The equity issue of opportunity is negatively impacted when underserved populations are disproportionately tracked away from algebra-rich curriculum.

QRTF Recommendation IIID Synopsis: Establish equitable articulation of mathematics/quantitative reasoning credit for transfer students. This includes the call for community college students to be assessed in foundational QR in alignment with the standards called for in the Final Report. The recommendation reaffirms the expectation that transfer students meet both the foundational level QR proficiency and earn the appropriate grade in a transferrable general education mathematics/quantitative reasoning course. The recommendation explicitly includes the expectation that community colleges could provide co-requisite coursework meeting foundational QR and mathematics/quantitative reasoning requirements for transfer. Developmental coursework should not simply develop proficiency and fluency in the CCCSS for Algebra I and Integrated Math I, but should also address the other expectations in the definition of foundational QR such as promoting the CCCSS mathematical practices expectations. Developmental coursework should “provide opportunities to deepen and broaden quantitative reasoning skill in a wide variety of contexts from the K-12 curriculum, as well as frequent opportunities to engage in learning experiences that promote the Common Core’s mathematical practices.”

Campus & Stakeholder Responses to IIID: There was no articulated opposition to Recommendation IIID by the campuses and some noted that implementation would enhance equity issues for transfer students.

CO Implementation of III: As previously indicated, the CSU will explore additions to the currently employed multiple measures of college readiness. Revision of CSU General Education Breadth Requirements policy will ensure that same standards (coursework and minimum grades) are in place for CSU campuses and the California Community Colleges for mathematics/quantitative reasoning requirements. College freshmen will be advised to complete the mathematics/quantitative reasoning general education requirement in their first year. When multiple measures of readiness indicate the student requires remediation, campuses will offer access to co-requisite model courses, tutoring, and other resources. Early Start, a summer requirement for incoming freshmen lacking full proficiency, will be reconsidered in order to provide more comprehensive and effective experience for incoming freshmen. Summer-entry programs will be modified with outreach, academic support, and recruitment components. Changes to college curriculum are expected by Fall of 2018 (necessitating catalog alterations to be submitted by Fall 2017 for most campuses).

The CO will develop a recruitment and advising campaign that will encourage all students to explore algebra-intensive majors and careers as well as provide advising on pathways to STEM majors and careers.

Implementation of a fourth-year of high school QR for admission to the CSU is supported by the CO, but it will be phased in gradually to ensure negative equity impacts to access are addressed. Initially, the CSU will “strongly recommend” the fourth year of QR. Conversations with K-12 partners have been initiated to develop a plan towards this new requirement. Superintendents from the eight largest K-12 school districts in California have already been engaged in providing perspectives on the fourth year QR requirement and estimation of resources needed to ensure equal access for all students.

QRTF Recommendation IV Synopsis: Create a CSU “Center for the Advancement of Instruction in Quantitative Reasoning”.

Campus & Stakeholder Responses to IV: Explicit endorsements of Recommendation IV were found in most campus responses. The ASCSU passed a resolution¹⁶ in support of the creation of this center. Some campuses provided suggestions as to what the duties of the center should be. Others encouraged that the charge of the center be clearly and comprehensively articulated. At least one campus expressed the concern that the center should be properly funded to achieve its mission.

CO Implementation of IV: In the November letter to the presidents requesting campus responses it was noted that implementation of this recommendation was already underway and external grant funding had been acquired for this purpose. Recruitment for the Center co-director began in March and closed in April, with the expectation that the co-director would assume the position in May 2017. Center personnel will continue discussion with K-12 partners.

Analysis and Discussion:

We find that the QRTF Final Report provides a rich articulation and discussion of the national and local educational issues surrounding the improvement of quantitative reasoning skills for all students. The QRTF Final Report has provided clear distinctions between the competing equity issues related to access versus opportunity. Access was identified as the entrance standards to the university and general education mathematics/quantitative reasoning courses. Opportunity was defined relative to the economic benefit of the resulting university degree. The CO call for feedback included a specific request for “an analysis of the equity implications and how to prevent any adverse impact to underserved populations.” Each of the recommendations received significant, but qualified support from the campuses and stakeholders. The qualifications nearly always related to concerns about access and opportunity, but the analysis and mitigations requested were lacking.

In general, the CO implementation plans mirrored the campus and stakeholder input. The concerns expressed by the CO also were consistent with the responses and nearly exclusively related to equity. One example of the sensitivity to access was the uniform standard for the first college level general education mathematics/quantitative reasoning course. Course requirements that have been different for community college transfers and native university students will be brought into alignment. The existing misalignment was perceived as a differential disadvantage to underserved populations. The alignment will resolve this important access issue.

A second example of the sensitivity to equity interests was the endorsement of co-requisite model courses for students lacking foundational proficiency. Currently students from underserved populations are disproportionately represented in remedial coursework that carries no academic credit toward the degree. Co-requisite models will allow these populations to begin earning college credit sooner with the expectation that persistence, time to degree, and other student success measures will improve. The co-requisite models were promoted by the report, the responses, and found in the CO implementation plans.

A third example of the attention to equity related to opportunity was the CO call for every campus to specify one common general education mathematics/quantitative reasoning requirement for all students. This decision was made to mitigate against possible tracking of students into majors with differential earning-potential careers and to encourage all students to consider algebra-intensive majors.

The QRTF Recommendations are informed by data and grounded in educational research. In particular, Recommendation IIIB and the corresponding pledge by the CO to promote a fourth year of quantitative reasoning is widely supported by educational research. A major federal study concluded¹⁷, “Of all the components of curriculum intensity and quality, none has such an obvious and powerful relationship to ultimate completion of degrees as the highest level of mathematics one studies in high school...Finishing a course beyond the level of Algebra II more than doubles the odds that a student who enters postsecondary education will complete a bachelor’s degree.” This 15-year longitudinal study was conducted for the US Department of Education and included over 1.9 *million* college students. Educational research conclusions, including this federal study, clearly indicates significant increases in opportunity to all students,

including underserved populations when a fourth year of mathematics beyond Algebra II is required. The QRTF, campus and stakeholder respondents, and the CO all weighed this information against the potential negative impacts to access for underserved populations in California. The CO plan calls for the eventual adoption of a fourth year of required QR in high school, but the adoption will be phased in over time to allow districts and teachers to adjust and build capacity so that underserved populations are not negatively denied access. At the same time this action addresses opportunity or the value of the degree by promoting stronger QR skills for all college students. The cautious but steady approach to implementing a fourth year QR course requirement appears to be accepted as a balanced compromise and first step to addressing the competing interests of access and opportunity.

The benefits of implementing all of the recommendations, including the fourth year QR requirement, will be substantial and long term and we are confident that any negative impacts to access can be properly mitigated and will be short term. For all these reasons the QRTF Final Report and all of its recommendations were widely endorsed by campuses and stakeholders and the indications to date are that these recommendations have also largely been embraced by the CO and implementing actions are already beginning.

With the single exception of Recommendation IIIB, the equity implications in the QRTF Final Report were generally positively received regarding access and opportunity for historically underserved populations. Regarding Recommendation IIIB most stakeholders saw a potential for negative impacts to access, but few suggestions were provided that will minimize or eliminate those negative impacts.

References:

- ¹ Academic Senate of the CSU: Quantitative Reasoning Task Force. Final Report, September 1, 2016. (<http://www.calstate.edu/acadsen/records/reports/documents/qrtf.finalreport.kssf.pdf>)
- ² Higher Education Employer-Employee Relations Act (<https://www.perb.ca.gov/laws/heera.aspx>)
- ³ California Common Core State Standards, Mathematics. (<http://www.cde.ca.gov/be/st/ss/documents/ccssmathstandarداug2013.PDF>)
- ⁴ Memorandum from Loren Blanchard to Campus Presidents, November 17, 2016 (Appendix 2)
- ⁵ Memorandum from Loren Blanchard to ASCSU Chair Outlining Initial Implementation Plan, March 7, 2017 (Appendix 3)
- ⁶ The California State University, Office of the Chancellor, General Education Breadth Requirements – Executive Order 1100, February 16, 2015. (<http://www.calstate.edu/EO/EO-1100.pdf>)
- ⁷ The California State University Graduation Initiative: Academic Preparation Frequently Asked Questions, Updated: April 24, 2017. (<https://www2.calstate.edu/csu-system/why-the-csu-matters/graduation-initiative-2025/documents/academic-preparation-faq.pdf>)
- ⁸ California Common Core State Standards, Mathematics. (<http://www.cde.ca.gov/be/st/ss/documents/ccssmathstandarداug2013.PDF>)
- ⁹ Assessment and LEarning in Knowledge Spaces (ALEKS) (<https://www.aleks.com/>)
- ¹⁰ University of California A-G Guide. (<http://www.ucop.edu/agguide/a-g-requirements/d-lab-science/index.html>)
- ¹¹ SFSU Academic Senate Plenary Resolution opposing ASCSU resolution 3244-16/APEP. (<https://senate.sfsu.edu/resolution/opposing-ascsu-resolution-3244-16apep>)
- ¹² Attewell, P., Lavin, D., Domina, T., & Levey, T. (2006). New evidence on college remediation. *Journal of Higher Education*, 77, 886–924. DOI: 10.1353/jhe.2006.0037 (<http://muse.jhu.edu/article/200923>), and Mejia, M.C., Rodriguez, O., & Johnson, H., (2016). Preparing Students for Success in California’s Community Colleges. Public Policy Institute of California. San Francisco, CA. 36p. (http://www.ppic.org/content/pubs/report/R_1116MMR.pdf)

¹³ ASCSU Resolution: Support for Requiring a Fourth Year of Mathematics/Quantitative Reasoning for Admission to the California State University January 21-22, 2016. (http://icas-ca.org/Websites/icasca/images/8_ASCSU_Resolution_3244.pdf)

¹⁴ ASCSU Resolution Implementation of the Quantitative Reasoning Task Force (QRTF) Recommendations, September 15-16, 2016. (https://www.calstate.edu/acadsen/Records/Resolutions/2016-2017/documents/3270_000.pdf)

¹⁵ ELM Test Development Committee QRTF Final Report Endorsement. (Appendix 4)

¹⁶ ASCSU Resolution: Call for a Center for Advancement of Instruction in Mathematics, May 19-20, 2016. (<https://www.calstate.edu/acadsen/Records/Resolutions/2015-2016/documents/3253.shtml>)

¹⁷ Adelman, C. (1999). Answers in the tool box: Academic intensity, attendance patterns, and bachelor's degree attainment. Washington, DC: U.S. Government Printing Office. *Chronicle of Higher Education*. (2001, August). Almanac Issue. (<http://www.ed.gov/pubs/Toolbox/toolbox.html>)

Appendix 1 – Themed Campus and Stakeholder Responses.

Themed Campus and Stakeholder Responses to November Request from Chancellors Office

Lowering standards

- We support the proposed reduction of student prerequisites for Area B4 to mastery of Algebra I for those students not pursuing majors with higher level mathematical requirements.
- The intermediate algebra “bar” is not too high
- Proficiency and fluency should continue to be verified by standardized testing instruments updated and aligned
- High schools must ensure that intermediate algebra continues to be part of the curriculum for students considering STEM, Business or Economics.
- Students may choose non-algebra paths, making decisions at 17 that have negative long-term impact, and may delay graduation.
- Does a recommendation to remove Algebra 2 reflect a lowering of standards in the CSU at the time that there is a national push to increase high school math standards?
- Significant concern if Algebra 2 is no longer required in high schools and the effect on URM entry and graduation gap in STEM majors for both FTF and transfer students
- There is opposition to the replacement of intermediate algebra requirements with a foundational QR requirement.
- Certifying courses that do not meet “UC Area C” is a significant logistical hurdle; however, without that this is a fourth year math requirement.

Fourth year concerns

- High school faculty, CSU faculty and legislators will need to work together, however, to make sure that all California high school students will have access to fourth year courses
- high schools ability to implement the additional responsibilities, particularly inner-city schools possibly resulting in their students being more disadvantaged
- Is there a common system-wide requirement or threshold out of the course?
- A fourth year in high school that deepened the understanding of the previous three years would enhance performance on the ELM and demonstrate the seriousness with which the CSU views QR. The fourth year of high school math is the linchpin and essential to the rest.
- Why might the mandatory fourth year of high school math course be anchored in a g-level college-preparatory elective rather than a c-category mathematics course. Would a student who takes an area G (vs. C) course be disadvantaged in college preparation?
- Fourth year in high school is supported but it could track students very early into decisions of the type of career they can enter.
- The impact of the recommendations on educational and opportunity gaps should be investigated before implementing increases in CSU eligibility.
- Though there clearly are many options on the table, K-12 teachers are already overburdened with state demands, so requiring a fourth year course could be a major resource issue.

Appendix 1 – Themed Campus and Stakeholder Responses.

- The Task Force report places the burden of the fourth year of high school math on the high school students while ignoring the critical roles of teachers and schools.
- SJSU supports the expanded list of candidates for a fourth year course in algebra-based science, statistics, computer science, quantitative reasoning, as well as advanced-level math.
- Those critical of the fourth year believe that it is an unfunded mandate that will negatively affect underserved populations, poorly serve students whose talents lie outside of STEM, and could not be adequately supported by the proposed Center.
- Significant equity concern about the proposed 4-year high school QR requirement. The CSU must engage with the high schools and community colleges to design and implement high quality courses in ALL high schools.

Tracking and equity

- We want to make sure that changing the QR standard within the CSU doesn't result in de facto tracking of students that could have detrimental impacts on equity
- ensure that students have equitable pathways that lead to STEM majors and other high-paying math-related careers;
- This creates two tracks of students and may create second-class students who are not algebraically competent. What will be the effect on nationally normed exams such as the GRE and GMAT?
- Should this be tied so closely to the Common Core since there is no guarantee of its longevity and since the Common Core appears to establish a two-tier system of instruction in QR.
- Will developmental math be redesigned to align with the different pathways to meet the GE B4 requirement?

Baccalaureate QR implementation/assessment

- The QR requirement should be redefined so that there is a clear statement of what it is within the context of GE and what purpose it serves.
- embed QR into appropriate UD GE and into program review.
- Make math relevant by building QR into every discipline, and connecting math curriculum to real world applications.
- Align assessment of QR close to graduate to meet WASC standards
- The definition of baccalaureate QR contemplates the deepening and expanding of the student's QR beyond the boundaries of B4 as WASC has made clear it expects.
- The requirement to take a baccalaureate QR course within two semesters of demonstrating foundational QR appears to be at odds with the acknowledgement that students improve their QR abilities throughout their education.
- Differentiating the level at which students should demonstrate quantitative reasoning for foundational and baccalaureate levels will motivate a more coherent curriculum and educational experience.
- The CSU baccalaureate QR outcomes should be based on the B4 course with no prerequisites beyond the foundational QR requirement
- A wider discussion of quantitative reasoning competency at or near graduation with input from a broad range of disciplines within and outside of STEM would be valuable.

Appendix 1 – Themed Campus and Stakeholder Responses.

- A stronger effort should be made to develop course sequences that integrate remediation with B4 courses (similar to Statway and Stretch English) so that students can more rapidly clear their remedial status.
- There was strong concern of a vagueness in the definitions of terms and core competencies, that could lead to a drastic softening of standards.
- The campus does not support a GVAR like exam for baccalaureate QR assessment.

Center concerns

- We look to the Center to guide CSU faculty development as well as secondary faculty development and to construct and deploy ERWC-like curriculum for mathematics.
- The Center should be a resource to support campuses in the development of curricula, assessment instruments, rubrics, etc., with a two way dialog between the Center and the campuses.
- We seek additional details about the Center's composition, overall structure, and goals. The K-12 and community college communities need to be continuously engaged.
- The SJSU QR Task Force favors the creation of a CSU Task Force, but is concerned that the task(s) for such a Center were not well defined in the CSU Report. This Center would be ideally positioned to work toward ensuring consistency in expectations from the high school curriculum, the ELM (or other appropriate substitute measure), the GE Area B4, and QR as a Core Competency to be demonstrated by university graduates.
- We would like to reiterate the importance of making it easy for K-12 instructors in areas geographically distant from significant population centers in California to benefit from the Center's resources and materials.

Appendix 2 – Memo from LJB to Campus Presidents



Academic and Student Affairs
401 Golden Shore, 6th Floor
Long Beach, CA 90802-4210

www.calstate.edu

Loren J. Blanchard, Ph.D.
Executive Vice Chancellor

Tel: 562-951-4710
Email lblanchard@calstate.edu

November 17, 2016

MEMORANDUM

TO: CSU Presidents

FROM: Loren J. Blanchard, Ph.D. 
Executive Vice Chancellor

SUBJECT: ASCSU Quantitative Reasoning Task Force Report

The Academic Senate of the California State University (ASCSU) on November 4, 2016 issued Resolution AS-3270-16, which endorsed the *ASCSU Quantitative Reasoning Task Force (QRTF) Final Report* and called for implementation of the report recommendations. The Office of the Chancellor is pleased to share that enclosed report and to initiate the process of systemwide consultation.

We appreciate the work of the ASCSU examining issues related to quantitative reasoning definitions, standards and policies; and we applaud the consistent concern expressed for how policies affect student access, achievement, equity, and lifelong success and opportunities. As we engage in systemwide consultation and consider implementation of these recommendations, we will pay particular attention to how both the existing and proposed policy changes may affect our most underserved students.

Senate-Endorsed ASCSU QRTF Task Force Recommendations

- I. Define quantitative reasoning
- II. Revise CSU quantitative reasoning requirements.
 - IIA. Separate foundational and baccalaureate quantitative reasoning requirements.
 - IIB. Define baccalaureate quantitative reasoning.
 - IIC. Define foundational quantitative reasoning.

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Appendix 2 – Memo from LJB to Campus Presidents

CSU Presidents
November 17, 2016
Page 2

- III. Ensure equitable access and opportunity to all students.
 - IIIA. Promote equity, access, and opportunity.
 - IIIB. Require four years of high school quantitative reasoning.
 - IIIC. Ensure early and appropriate quantitative reasoning courses for first-time freshmen.
 - IIID. Establish equitable articulation of quantitative reasoning credit for transfer students.

- IV. Create a CSU “Center for Advancement of Instruction in Quantitative Reasoning.”

We have begun work to establish the recommended math center and have received initial grant funding to support this effort. The center will bring together CSU education and mathematics faculty with high school faculty to create a new state-level fourth-year high school course. Students in the course would practice the Algebra/Math I skills that are introduced in the full California State Standards K-12 curriculum and are necessary for success in baccalaureate-level quantitative reasoning courses. Our intention is for the new fourth-year course modules to foster excellence in math preparation for California’s high school students.

As we implement this effort and consider other recommendations, we will pay close attention to any potential impact on our underserved students. Through collaboration with partners in K-12 and the other public California higher education segments, we will adopt only those approaches with high promise for improving educational access to the CSU and improving equity in student achievement across all CSU student groups.

By February 6, 2017, we ask for campus feedback on each of the recommendations, including an analysis of equity implications and how to prevent any adverse impact to underserved populations. Campus responses may be submitted separately by the faculty senate and administration, or one unified and signed report may be submitted. Please send Word versions of your reports to feedback@calstate.edu.

Thank you for your assistance in this matter. If you have any questions, please contact Dr. Christine Mallon, assistant vice chancellor, academic programs and faculty development. Chris may be reached at cmallon@calstate.edu or (562) 951-4672.

LJB/ktg

Enclosure

c: CSU Trustees
Academic Senate CSU
ASCSU Quantitative Reasoning Task Force
CSU Associated Students, Campus Presidents

Appendix 2 – Memo from LJB to Campus Presidents

CSU Presidents
November 17, 2016
Page 3

California State Student Association
CSU Chancellor's Office Executive Staff
CSU Provosts and Vice Presidents for Academic Affairs
CSU Vice Presidents for Student Affairs
CSU Deans
CSU Faculty

Appendix 3 – Memo from LJB to ASCSU Chair



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401 Golden Shore, 6th Floor
Long Beach, CA 90802-4210

www.calstate.edu

Loren J. Blanchard, Ph.D.
Executive Vice Chancellor

Telephone: 562-951-4710
Email: lblanchard@calstate.edu

March 7, 2017

Dr. Christine Miller
Chair, Academic Senate, California State University
California State University, Office of the Chancellor
401 Golden Shore
Long Beach, California 90802

Dear Dr. Miller:

On behalf of the California State University (CSU), Office of the Chancellor, I wish to convey our sincere appreciation of the *Academic Senate CSU (ASCSU) Quantitative Reasoning Task Force Report*, as well as our gratitude for Resolution AS 32-70-16/ APEP *Implementation of the Quantitative Reasoning Task Force Recommendations*. We regard the task force report and related senate resolution the inspiration and impetus for a turning point in how the CSU serves students and works through policy and practice to achieve educational equity. Presidents and provosts have signaled their support for applying these principles to expanded efforts focused on access to the university, equitable success in university-level courses, and timely completion of high-quality, career-relevant degree programs. Campus feedback urges us to consider carefully how not to exacerbate inequities by requiring a fourth year of high school math without first allowing time for K12 districts to build sufficient resources to be able to offer face-to-face courses statewide, including in under-resourced communities. We also received feedback cautioning us not to track students, even unintentionally, into math-to-majors pathways that lead to higher- or lower-paying careers. We will need to work together as a system to provide the outreach, advising, and supplemental instructional support to ensure that all students have equal opportunities to pursue and excel in majors that prepare our graduates for long-term success in the workplace.

As we initiate implementation of the changes described below, please understand that we will involve the ACSU in consultation regarding draft policies. I want to extend, again, our offer to support meetings among our faculty and their colleagues from the University of California (UC) and California Community College (CCC) systems. As campuses so strongly emphasized in their consultation feedback, ongoing communication is required in order to be successful in changing policies and practices regarding mathematics and quantitative reasoning education.

Recommendation I: Formulate an updated quantitative reasoning definition based on CSU best practices and reflecting national standards.

In response to equity issues raised in the report, and to provide quantitative reasoning education appropriate to the majors, Executive Order (EO) 1100 *General Education Breadth Requirements* will be

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Appendix 3 – Memo from LJB to ASCSU Chair

Dr. Christine Miller

March 7, 2017

Page 2

revised. Included in the revision will be an updated mathematics/quantitative reasoning definition that does not include the current intermediate algebra prerequisite. To mitigate against the possible tracking of students into paths leading to lower- and higher-earning careers, policy will specify one common general education Area B4 requirement for all students. The requirement would be met by satisfactory completion of any course meeting or exceeding the EO 1100 definition for Area B4. Satisfaction of CSU General Education (GE) Area B4 Mathematics/Quantitative Reasoning will fulfill the CSU graduation requirements for quantitative reasoning, and students satisfactorily completing Area B4 will be deemed proficient in quantitative reasoning at the GE baccalaureate level. Additional mathematics or quantitative reasoning courses may be pursued in fulfillment of major requirements, and campuses will be responsible for carrying out WASC requirements for assessing core competencies, including in quantitative reasoning.

The Chancellor's Office accepts the task force's definition for quantitative reasoning, appearing on page 9 of the report, and we will incorporate that definition into a revision of EO 1100, Area B4. The Academic Programs and Faculty Development Department will manage this effort.

Recommendation II: Revise CSU quantitative reasoning requirements and adopt equitable, feasible requirements that articulate with the other segments.

As established in the task force report and echoed in the senate resolution, the four report recommendations are interdependent. Reflecting that interrelatedness, implementation plans for Recommendation II are addressed in the section above and in Recommendation III below.

Recommendation III: Ensure equitable access and opportunity to all CSU students.

To establish that students are proficient at the foundational level, the CSU will explore additions to the currently employed multiple measures of college readiness, shifting away from the Entry-Level Mathematics examination and toward reliance on SAT, ACT, EAP, ALEKS, four years of high school mathematics or quantitative reasoning courses, and successful completion of California's Common Core State Standards. Revision of EO 1100 will ensure that the same standards are in place for CSU Area B4 courses and for articulated California Community College Area B4 courses. Similarly, minimum grades for Area B4 courses will be the same for transfer students and students who enter the CSU as freshmen.

The Chancellor's Office will develop a recruitment and advising campaign, similar to the "[How to Get to College](#)" website and print materials, that: (1) encourages all students to explore algebra-intensive majors and careers; and (2) provides advising on mathematics/quantitative reasoning pathways to STEM majors and careers.

To improve access, equity, quality, and achievement, freshmen will be advised to complete college-level, credit-bearing Area B4 courses by the end of the first year of attendance. Students who do not demonstrate measures of readiness at admission will be given appropriate support, including access to co-requisite model courses, tutoring, and other resources. Campuses will be required to schedule sufficient numbers of sections for students to be able to complete Area B4 courses within the first year of attendance. Early Start will be reconsidered to provide a more comprehensive and effective experience for incoming freshmen who will benefit from that initial immersion in university life and college-level quantitative reasoning instruction. Summer-entry programs will include outreach, academic support, and recruitment into algebra-intensive majors.

In response to concerns about adding a fourth-year of high school mathematics or quantitative reasoning to university admission requirements, there will be a longer-term plan put in place. Initially, the CSU will

Appendix 3 – Memo from LJB to ASCSU Chair

Dr. Christine Miller

March 7, 2017

Page 3

strongly recommend that high school students enroll in four years of mathematics or quantitative reasoning course. We have begun discussing with K12 partners a plan for working toward the fourth year being an admission requirement rather than a recommendation. The Student Academic Support and Teacher Education and Public School Programs Departments are managing these integrated issues.

Recommendation IV: Create a CSU ‘Center for Advancement of Instruction in Quantitative Reasoning’

The Center for Advancement of Instruction in Quantitative Reasoning has been established and has received \$89,000 in funding from the College Futures Foundation. The external funding is being used for initial planning and development, and to support regional meetings this spring. The center will operate within the Chancellor’s Office budgetary framework and Academic and Student Affairs Division resources, priorities, and strategic planning. Housed at the Chancellor’s Office, at least initially, the center will address instruction at K12 levels, and will contribute to the preparation of CSU students preparing to be K12 teachers. The center will facilitate ongoing communication among the higher education segments and K12 districts, to provide current information and to support collaboration on common aims. In collaboration with the CSU Institute for Teaching and Learning, the center—housed in the Teacher Education and Public School Programs Department—will provide university faculty development that enhances CSU student learning. Together, the institute, the center and Academic and Student Affairs Division offices will ensure that these related faculty development objectives are met in a way that improves student access to CSU campuses and majors and that improves equitable student success in courses and in completing degrees.

Recruitment for the center co-director position will begin on March 10, 2017, when provosts have been asked to distribute an announcement of this opportunity for CSU faculty, a call for applications and the co-director position description. The faculty co-director will work in collaboration with the director of the California Academic Partnership Program (CAPP) and will report to Dr. Marquita Grenot-Scheyer, Assistant Vice Chancellor, Teacher Education and Public School Programs. In keeping with the center’s development-and-consultation plan, discussions with key groups have begun. Initial communication has involved, for example, project directors of the California Mathematics Readiness Challenge Initiative, for which four of our campuses received award funding. Center personnel will continue these discussions in order to learn from those projects’ implementation and evaluation of grade-12 experiences designed to prepare pupils for placement into college-level mathematics courses. Additionally, Dr. Grenot-Scheyer has engaged superintendents from the eight largest school districts in the state, seeking their perspectives on a fourth year of high school mathematics/ quantitative reasoning and their estimation of the resources that would be required to ensure equal access for all students.

We look forward to working with you on these efforts, and we thank the senate for identifying opportunities for ensuring academic rigor and quality while providing more equitable treatment of students, greater access to the CSU, more responsive curricula, and greater support for student academic success.

Sincerely,



Loren J. Blanchard, Ph.D.
Executive Vice Chancellor
LJB/clm

Appendix 3 – Memo from LJB to ASCSU Chair

Dr. Christine Miller

March 7, 2017

Page 4

c: Rebecca D. Eisen, Chair, CSU Board of Trustees
Adam Day, Vice Chair, CSU Board of Trustees
Lillian Kimbell, Chair, Educational Policy Committee
Jane Carney, Vice Chair, Educational Policy Committee
Timothy P. White, Chancellor
CSU Presidents
CSU Provosts/Vice Presidents for Academic Affairs
CSU Vice Presidents for Student Affairs

Appendix 4 – ELM Test Devel. Comm. QRTF Final Rpt Endorsement.

From: Tyler J Evans <tyler.evans@humboldt.edu>

Date: Friday, December 23, 2016 at 2:05 PM

To: "Cardenas, Carolina" <ccardenas@calstate.edu>

Cc: Rick Ford <rford@csuchico.edu>, Laura Wallace <wallace@csusb.edu>, "tsnell@sum.edu" <tsnell@sum.edu>, "erichsu@sfsu.edu" <erichsu@sfsu.edu>, "hdsadaghiani@cpp.edu" <hdsadaghiani@cpp.edu>

Subject: CSU ELM Test Development Committee Response for feedback on the CSU QRTF report

Dear Carolina,

I am attaching the CSU ELM Test Development Committee's response to the CSU QRTF report as per your request at our December 2016 meeting in San Diego. Can you make sure that this response is included with the campus responses to the CO requested by February 2017?

Thank you!

Tyler

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Tyler J. Evans, Ph.D.
Professor of Mathematics
Humboldt State University
Arcata, CA USA

Office: BSS 458
707-826-3217

Appendix 4 – ELM Test Devel. Comm. QRTF Final Rpt Endorsement.

ELM TEST DEVELOPMENT COMMITTEE ENDORSEMENT OF THE FINAL REPORT OF THE QUANTITATIVE REASONING TASK FORCE (QRTF)

The ELM Test Development Committee has reviewed and discussed the report and its recommendations at length. The committee commends the QRTF for the high quality of their work. We are particularly impressed with the mindful articulation and balancing of the competing issues of access and opportunity in the pursuit of authentic equity. We feel the report and recommendations are appropriately sensitive to these issues. The ELM Test Development Committee endorses the report and all of its recommendations. The committee was in unanimous agreement regarding the endorsement of all of the recommendations with the sole exception of recommendation IIIB.

With regards to recommendation IIIB, requiring four years of high school quantitative reasoning, the committee formally endorses this recommendation, but unlike the endorsements of the other recommendations, the support was not unanimous. The recommendation has two elements. First, four year-long college-prep QR courses would be required for admission. Second, one of those courses must be taken in the senior year.

Concerns were expressed by some on the committee regarding implementation and access. We currently do not have a process to ensure a QR course is taken in the senior year as an admissions requirement. A process does exist at each campus to ensure math is taken in the senior year by conditionally exempt students, but when a student fails to complete the course, admission is not jeopardized. Creating this admissions requirement could prove difficult and have unintended consequences.

The larger concern was regarding access. Some on the committee fear the requirement will disproportionately affect women and underrepresented minorities (URMs) and restrict access further. The report contains thoughtful discussion regarding the increased opportunity to URM students when more high school QR is required. We have seen that those reviewing the report often overlook the opportunity aspects of the fourth year of QR. The whole committee supports implementation that monitors and steadily reduces any negative impacts to access. The committee would only unanimously support the call for a 4th year of QR if these negative impacts to access were temporary and disappeared over time. The point the majority on the committee would like to emphasize is that they believe these negative impacts to access will be temporary and disappear over time, while they also believe the positive contribution to opportunity to URM students will be permanent. The majority therefore endorse the QRTF recommendation of a fourth year of quantitative reasoning, taken in the senior year, and sees this change as a critical step in the march forward to permanently improve opportunity and equity.

In addition to the recommendations and endorsements above, the committee also recommends the thoughtful development of a comprehensive plan to communicate the recommendations of the QRTF final report to all of the stakeholders. This plan should be vetted through experts including the QRTF, GEAC, and the ELM Test Development Committee. The communication plan should emphasize the

Appendix 4 – ELM Test Devel. Comm. QRTF Final Rpt Endorsement.

notion that any negative effect to access will be temporary whereas the positive impacts of opportunity, as defined in the report, will be substantial and permanent.