**College of Science and Mathematics**

**Strategic Plan 2019 - 2024**

**Overview, Process, Mission and Vision Statements.**

**Overview.** The seven departments in the College of Science and Mathematics (CSM) – Biology, Chemistry and Biochemistry, Computer Science, Earth and Environmental Sciences, Mathematics, Physics, and Psychology - serve our diverse and talented students seeking careers in science, technology, education, and the health professions with an emphasis on discovery and innovation. Fresno State is both a Hispanic-Serving Institution (HSI) and an Asian-American, Native American Pacific Islander Serving-Institution which is reflected in our CSM student population and the surrounding vibrant and diverse community of the Central Valley. We provide access to a high quality and affordable education for our students, over 66% of whom are first-generation college students, with over 60% being Pell Grant eligible. Many of these student have limited knowledge about STEM careers beyond health professions and aspire to stay and work in the Central Valley. The potential for these students to contribute to the workforce and economy is enormous and would be transformative for the Central Valley.

The CSM faculty bring in millions of dollars per year in grants and contracts, including very competitive awards from the National Science Foundation and National Institutes of Health. These funds allow for hundreds of our students a year – both undergraduates and graduate students - to engage in the high impact practice of “learning by doing” in collaborative research with faculty. This is in accord with national calls to improve STEM education by widespread engagement of students in research. Student researchers report gain in their ability to think and work like scientists and are more likely to pursue further education and careers in science and research, which drives the nation’s progress and economic prosperity. More STEM graduates are needed to find solutions to the major societal challenges in food, energy, water, health, and the environment: all of these challenges are significant to the Central Valley and beyond.

We are very proud of the accomplishments of our alumni who have gone on to important industry positions in the workforce as well as prestigious graduate programs and highly ranked medical, dental, and pharmacy schools. It is our goal to continue graduating the next generation of scientists, mathematicians, teachers, and highly skilled technicians and doctors for our region and state. Our rigorous and engaging curriculum and programs are designed to best prepare students for a number of exciting and diverse careers. All of our departments provide current and innovative disciplinary training to enhance student technical, critical thinking, and communication skills. At the college level, our first-year experience program and Course-based Undergraduate Research Experiences (CUREs) program are two example of how we prepare students for 21st Century STEM careers. We get our students off to a great start with our first year experience BOND program (Building Opportunities with Networks of Discovery) where they are exposed to research, enhanced general education coursework (covering the scientific method and evidence based decision making), and impactful professional development activities using a cohort model. The high impact practices that are part of the BOND experience have resulted in higher STEM major retention and reduced achievement gaps for first generation and minority students. The College of Science and Mathematics have begun to transform their laboratory courses into the scalable research experiences called CUREs. Students who participate in CUREs achieve many of the same gains as students who participate in independent research and internships. The integration of teaching and authentic research that occurs in CUREs addresses student demand for courses that are more inquiry based, allowing them to work with real data, engage in troubleshooting of experiments, and providing more opportunities for creative input in experimental design. Investment in a CURE Program (beginning in the freshman year) provides access to authentic research for large numbers of students, many of whom are most vulnerable to dropping out of STEM pathways, particularly underserved first generation college students. *A CUREs Program will democratize the exposure of all students to research with students investing time primarily in classes that count toward their degree requirements.*

We recognize the challenges we face in recruiting and retaining students in STEM disciplines, training large numbers of underserved students, and exposure of students to interdisciplinary and team science necessary to solve complex societal problems – this is particularly difficult given state and federal budget limitations. Our Strategic Plan is guided by the following principles, which are in accord with Fresno State strategic priorities:

* Commitment to excellence in pursuit of our goals
* Promise to a collaborative approach in working together for the greater good of the college
* Dedication to building the required modern infrastructure to support sustainable solutions for our goals
* Obligation to investing in human capital and providing the necessary resources for our dedicated faculty and staff in order to make needed changes in response to the rapidly evolving STEM landscape
* Dedication to student success

**Process.** Our approach to crafting the Strategic Plan began with data gathering, problem framing, and ideas generation that emerged from the analyses of a college wide survey and follow up presentations and brain storming discussion at college assemblies. Development of the themes and goals was provided by the Strategic Planning Committee, which consisted of representative faculty and staff from all departments as well as the Dean and Associate Dean. The committee went through several iterative rounds using divergent and convergent thinking in establishing the framework for the plan. This was followed by detailed feedback on outcomes, strategies, metrics, and inputs from three Focus Groups (one for each of the three overarching goals). The Focus Groups were comprised of representative faculty and staff from the college with the sessions facilitated by Strategic Planning Committee members as well as the Dean and Associate Dean. Further input, solution generation, and action planning was provided by the Department Chairs (from feedback at department meetings), and the CSM Advisory Board. This dynamic plan will help guide our activities for the next five years.

**Mission** **Statement**. The College of Science and Mathematics is dedicated to the holistic preparation of the next generation of scientists and mathematicians for vital and diverse careers in STEM using innovative High Impact Practices. We provide an environment in which faculty can develop and sustain high quality research programs and meaningfully contribute to new knowledge in collaboration with students. We serve our community and regional industry as an objective source for science education, literacy and solution generation to challenges.

**Vision Statement.** We aspire to serve as a national model for comprehensive universities in the integration of teaching and research and STEM education for diverse students and as a regional and state leader in educational outreach and community service. We will become a destination campus for postdoctoral scholars to lead research projects with multiple labs and teach innovative CUREs. In addition to disciplinary knowledge, the marks of a Fresno State College of Science and Mathematics student will include expertise in communication at multiple levels, interdisciplinary team science and deliberate creative problem-solving. We will develop an interdisciplinary center to serve the community and industry in solution generation for complex challenges. We will engage in collaborative research across colleges to address unique problems in our region. We will contribute to economic growth of the Central Valley by unique partnerships with industry to establish productive technology incubators. We will participate as a vital part of the national and global conversation about STEM research, education, and sustainability as we have much to offer and share. We will build national and international networks to sustain and advance a vibrant ecosystem of discovery, diversity, and distinction.

**Strategic Goals and Themes:**

1. **Preparing the Next Generation of STEM professionals through Innovation and Discovery.** Providing the best preparation and highest quality experiences for success of all of our diverse students to excel in graduate and professional programs and meaningfully contribute to the STEM workforce. This includes developing a diverse, inclusive and integrated transdisciplinary STEM campus community focused on excellence in basic and applied research that engages both undergraduate and graduate students.

* 1. **Outcomes**

*What would our main ‘points of pride’ be 5 years from now if we were successful in this area?*

CSM will be an exemplar within the CSU and California for:

* + 1. Integrating CSM students from underserved, under-represented and rural backgrounds into the university and STEM communities.
    2. Providing all students with the tools and training needed to make early, dynamic, informed careers decisions and to develop the skills and knowledge to successfully transition into the regional and national STEM workforce, graduate school, or professional school.
    3. Preparing students for success in solving regionally-relevant complex and interdisciplinary problems related to food, water, energy, health, and the environment.
    4. Creating a comprehensive, accessible, and searchable database of alumni and employers of our alumni for effective networking
    5. Producing highly skilled and well-rounded MS graduates who will stand out in the workforce and Ph.D. programs.
    6. Making meaningful contributions to disciplinary and interdisciplinary basic and applied research that is regionally and nationally important.

**B. Strategies**

*What are some good approaches that CSM could implement in the next five years that would support these goals?*

* + 1. Expand BOND to a) include all First-time Freshmen and Transfer students, b) extend activities into the sophomore year, c) include relevant boot camps for hard and soft skills, and interdisciplinary team science.
    2. Expand HIPs in the curriculum, including deliberate creative problem-solving, in relevant courses in all majors and at all levels.
    3. Expand CUREs program to expose all students to research in the classroom at both lower and upper division levels as well as graduate courses (Course-based Graduate Research Experiences (CGREs).
    4. In collaboration with ARC and Student Affairs, create and implement an Individual Development Plan (IDP) and portfolio for each student.
    5. Strengthen and integrate CSM student programs (ARC, LSAMP, HCOP, clubs, etc.) to provide students with wraparound support in accessing advising, career development, research and internship opportunities, campus support services etc.
    6. Strengthen and integrate our MS programs to provide students with more support, professional development, and training in interdisciplinary team science.
    7. Strengthen our MS programs by development of interdisciplinary (cross listed) coursework at the interface of disciplines.
    8. Create co-curricular roadmaps to support undergraduate and graduate student development beyond the classroom.
    9. Establish a postdoctoral scholar program that will host at least 3 postdocs/year to support CUREs and disciplinary and transdisciplinary research involving graduate and undergraduate students.
    10. Establish a searchable database for all of our alumni and employers of our alumni across the valley, state, and nation.

**C. Metrics**

*How would we gauge progress towards these goals during this period?*

* + 1. CSM retention, graduation rates; reduction/elimination of achievement gaps.
    2. Number of HIP/BOND sections, students served.
    3. Number of postdoctoral scholars; co-authored publications/presentations; sections/students taught.
    4. Sense of Belonging, Science Identity survey responses.
    5. Performance of students on embedded problems to assess quantitative and critical thinking skills.
    6. Number of students entering STEM workforce, graduate school, or professional school within 1 year of graduation.
    7. MS retention and graduation rates
    8. Number of papers with MS student co-authors
    9. Career outcomes of MS students

**D. Inputs**

*What resources are needed (time, money [state, grants, donors…], personnel, facilities…) to effectively implement these strategies?*

1. Increased grant support: regional, state, federal (NSF, NIH, USDA, DOE, etc.)
2. Grow endowments to support HIPs and CUREs (including BOND), graduate student travel and professional development.
3. Increased partnerships with neighboring Ph.D. institutions and industry to enhance our MS programs and leverage additional resources
4. Additional staff and infrastructure support for student support program coordination (internships, professional development etc.), and student assessment
5. Additional support for student tracking to network with alumni, identifying all relevant employers of our alumni, and convening meetings with stakeholders to engage in mutual reinforcing activities.

**2. Promoting the transfer and communication of science and mathematics to educators and society. Creating an outreach center and network for engagement of K-16 educators and the community focused on sharing best teaching practices and promoting science and mathematics literacy in the Central Valley.**

**A. Outcomes**

*What would our main ‘points of pride’ be 5 years from now if we were successful in this area?*

CSM will be a key partner with local school districts in the development and professional growth of K-12 STEM educators in rural, underserved and under-represented communities.

CSM will partner with the Kremen School of Education & Human Development (KSOEHD) as well as the Central Valley Community Foundation (CVCF) in outreach efforts and joint ventures

CSM will attract and train new K-12 educators that meets the growing need for STEM teachers in diverse communities.

CSM will be known as the ‘go-to’ resource for formal and informal STEM education in the Central Valley and serve as a national model.

CSM will be known as the “go to” source for talented MS graduates that are well prepared for teaching careers.

Regionally-renowned training and development programs for graduate student TAs, lecturers and TT/Tenured faculty.

**B. Strategies**

*What are some good approaches that CSM could implement in the next five years that would support these goals?*

* + 1. Develop a TA training program to promote evidence-based pedagogies and provide the foundation for life-long excellence for educators in rural, underserved and minority-majority communities.
    2. Develop curricular (e.g., combined STEM degree/credential programs) and co-curricular (e.g., Master teacher seminar series) components to attract and retain outstanding students planning to pursue teaching careers.
    3. Centralize the coordination and support of outreach activities across CSM (including departmental and student club activities).
    4. Initiate the Dean’s Student Advisory Circle (DSAC) with under graduate and graduate student ambassadors as liaisons to other students for outreach activities, near peer mentoring of high school and college students, and assistance to K-12.
    5. Develop a strong online/virtual presence providing support/information for outreach in formal and informal settings.
    6. Develop curricular components that promote outreach, service learning, citizen science, and science communication.

**C. Metrics**

*How would we gauge progress towards these goals during this period?*

* + 1. Number of TAs completing pedagogy training.
    2. Improved TA performance as measured by assessment, student performance, and relevant student evaluations.
    3. Numbers of students pursuing pre-service teaching pathways.
    4. Numbers of formal and informal outreach activities; numbers of participants; pre- and post- measures of outreach effectiveness.
    5. Assessment from K-12 teachers of educational outreach efforts.
    6. Numbers of users accessing, using online resources.
    7. Community feedback and assessment.

**D. Inputs**

*What resources are needed (time, money [state, grants, donors…], personnel, facilities…) to effectively implement these strategies?*

* + 1. Staff admin support to coordinate/support outreach efforts.
    2. Grant/donor funds to support outreach efforts.
    3. Staff support to develop and maintain online resources.
    4. Leveraging of resources with partners (school districts, CVCF, City of Fresno, etc).

**3. Creating Partnerships and Networks. Development of a STEM Hub addressing community and industry challenges, contributing to economic development, the workforce, and strengthening the Central Valley and California.**

**A. Outcomes**

*What would our main ‘points of pride’ be 5 years from now if we were successful in this area?*

* + 1. CSM will be viewed as a key partner in regional development by industry, government and non-profit agencies.
    2. CSM will be viewed as engaged with professional societies in being part of the national conversation on education and research.
    3. CSM is viewed as integral to improving the quality of life of our communities (e.g., mental health of workforce, environmental safety, contributions to intellectual life of residents).
    4. CSM is known as the ‘go-to’ resource to facilitate solutions to complex regional STEM problems related to food, water, energy, health, and the environment.
    5. CSM is known as the ‘go-to’ source for highly skilled and creative MS graduates that are adaptable and workforce ready.
    6. CSM is recognized as an archive/resource for data and data analysis to address regional challenges.
    7. Growth of CSM partnership with LCOE, the Craig School of Business, and JCAST for data science.

**B. Strategies**

*What are some good approaches that CSM could implement in the next five years that would support these goals?*

* + 1. Creation of a comprehensive, accessible, and searchable data base of regional and statewide employers and stakeholders
    2. Convene and run Ideas labs with key stakeholders (including other colleges (e.g., LCOE, JCAST), community, industry, other academic partners [CSU, UC system, other universities], etc.) to develop novel strategies that address regional and state challenges. The inclusion of our graduate students in Ideas Labs is essential to give them cutting-edge skills in problem-solving.
    3. Host meetings for relevant professional societies on campus to enhance network connections.
    4. Convene workshops for academic, community, industry, and professional society stakeholders on campus in partnership with other institutions.
    5. Develop activities and approaches to break down the stereotype of scientists/academics as elitists in an “Ivory Tower”, and build trust with the community.
    6. Develop partnerships with local/regional agencies/industry that leverage Fresno State’s human capital and disciplinary expertise to solve regional challenges. We envision our graduate students playing a key role in this endeavor, acting as near peer mentors to undergraduates in developing their leadership skills.
    7. Develop strategic partnerships with key industries (biotechnology [ such as Genomatica, Amgen], high tech [such as Bitwise, FocusVision]) for joint ventures and pilot incubators engaging students and preparation of the workforce.
    8. Develop a Data Science Center to host and analyze data sets as a resource for regional users. We envision our graduate students playing a key role in the center, including as mentors of undergraduates in developing their leadership skills.
    9. Develop online resources that disseminate CSM expertise, facilities and solutions to facilitate novel approaches to regional problems.

**C. Metrics**

*How would we gauge progress towards these goals during this period?*

* + 1. Number of engaged community partners and joint projects
    2. Number and quality of related classes, student participants.
    3. Number of industry partners, pilot projects/incubators, and number and quality of network connections.
    4. Number of graduate and undergraduate student participation.
    5. Number and impact of meetings and events held on campus.

**D. Inputs**

*What resources are needed (time, money [state, grants, donors…], personnel, facilities…) to effectively implement these strategies?*

* + 1. Donor/grant funds to facilitate projects.
    2. Staff support to coordinate community partnerships, projects.
    3. Time for development of projects
    4. Leveraging of resources with strategic partners (city, state, national government and regional, state, and national/international industry stakeholders.

**Integration and Coordination of Strategic Priorities.**

This Strategic Plan is meant to be a “living” and dynamic document with progress reviewed biannually at the Fall and Spring College Assemblies and the CSM Advisory Board meetings. During the year a Strategic Plan taskforce will meet regularly and report to the Dean and Associate Dean along with the Chairs’ of the departments. Evaluation and assessment of progress toward our goals and the collaborative roles of departments will take place at the assemblies as well as brainstorming sessions to generate new ideas and approaches.