Program Planning Report
San Jose State University
Science Education Program
College of Science

http://www.sjsu.edu/scied/

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Submissions: Reports are to be submitted electronically via email. Please email the program plan, request for external reviewer (if applicable), and external reviewer’s report to programplanning@sjsu.edu. In addition, please cc the above email on all communications with the dean, external reviewer, Program Planning Committee, and UGS on matters pertaining to your program plan.
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1. PROGRAM DESCRIPTION

1a. Missions and Goals

The M.A. Science Education Program was composed to suit the learning goals of practicing and pre-service secondary science teachers, and others with careers in informal education and outreach. The curriculum is designed to assist its candidates in exploring science education literature, developing an area of interest for individual research or curriculum planning, and broadening the candidates’ backgrounds in basic science content and pedagogy.

The Master's program embraces the ideals of teaching science for all by emphasizing preparedness and competency of teaching in a diverse, multi-dimensional community. By providing local science teachers with a means for professional growth, this program helps to" build bridges" between the university and the South Bay Area region it serves, creating a local learning community of science educators. It is our hope that the professional development we provide our teachers will enhance college and career readiness in the students they teach and result in increasing the ranks of better-prepared future SJSU science students.

While promoting best practices in Science Education, our M.A. also delves into the philosophy of the nature of science, as emphasized by the National Research Council’s Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas\(^1\) (2012). The NRC’s contribution to science education is ground-breaking, providing the skeleton for the first new set of science standards adopted by California since 1998. The new standards, the Next Generation Science Standards\(^2\) (NGSS, 2013) have been adopted by California and 12 other states at the time of this report. NGSS focus on a greater depth of knowledge, and redefines the science disciplines in a revolutionary way (i.e., science disciplines are now defined as Life, Physical, Earth & Space, and Engineering Technology, as opposed to the traditional Biology, Chemistry, Physics progression, which has driven the U.S. science curriculum since 1893). It is one of the missions of the M.A. Science Education to better prepare South Bay secondary teachers to better implement these new inquiry-based student performance expectations in effective ways in their schools and districts, promoting them as leaders in the cause of redefining how science is taught.

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1. [http://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts](http://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts)
1b. Curricular Content of Degrees, Minors, Certificates, and Credentials

The M.A. in Science Education allows students to design an individual academic program that best suits their needs. In consultation with a faculty adviser, students may select from science content courses (offered by departments within the College of Science), pedagogy classes (offered by the College of Education), and Science Education’s own suite of courses.

A student may transfer as many as 12 units from four Secondary Science Credential requirements for which we prepare students, in alignment with the California Council of Teacher Credentialing (CTC) requirements. In addition to this flexibility, the Science Education M.A. Program mandates two classes of all students: SCI 220 (Theories and Practices in Science Education), and SCI 205 (Methods of Research). In SCI 220, students are provided with orientation for the philosophy and scope of the program. Emphasis is on the development of a theory of instruction and curriculum in science with implications for practice. SCI 205 introduces students to techniques and procedures of scientific research. Each student is required to prepare and defend a working outline/proposal of a master's thesis or project in his or her area of concentration.

The M.A. Science Education culminates in a thesis (Plan A), or a project (Plan B). All students work with an adviser from the time of their acceptance into the program, until their capstone manuscript is completed.

Most of the Science Education M.A. students are pre-service or practicing teachers. The need for highly qualified pre-college science teachers is clearly increasing. The U.S. Bureau of Labor Statistics’ Occupational Outlook Handbook claims that overall need for high school teachers will increase 6% from 2012-2022, but that the percentage increase will be far greater in the math and science education fields. Furthermore, training pre- and in-service teachers to serve as ambassadors for NGSS is one of the missions of our program. Our graduates will serve as teacher-trainers for the existing workforce of previously-trained science educators.

When students opt for our blended program, they earn both teaching credentials and an M.A., Science Education, which promotes them up the salary ranks. And although a B.A. or B.S. are the minimum required degrees for incoming educators, they must earn an M.A. or M.S. to continue teaching, long-term. Our M.A. provides in-service teachers with the qualifications they need to clear their credentials, and earn higher salaries.

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3 http://www.bls.gov/ooh/education-training-and-library/high-school-teachers.htm#tab-6
2. SUMMARY OF PROGRESS, CHANGES, AND PROPOSED ACTIONS

2a. Progress on action plan of previous program review

The action plan from our most recent self-study focused on two areas of need:

- Building a bridge from a secondary science credential to the M.A., and
- Offering more summer courses for our teacher-audience.

A great deal of progress has been accomplished for the first action item. We were approved to change our degree program from an M.A., Natural Science to an M.A., Science Education, and made this change in ????. We have developed this program in such a way as to allow students who obtain credentials from SJSU to transfer as many as 9 units from their College of science “foundational” courses plus 3 units from their SCED 173 course (Secondary Science Methods) toward the M.A., Science Education. This propels newly-credentialed student-educators to rapidly earn their M.A., which serves as both professional development and clearance toward higher salary steps.

We continue to struggle with summer course offerings, although we have had the opportunity to offer our SCED 173 course once during the summer in the last review cycle. One hundred percent of our faculty are “split appointees,” serving in both “home departments” (i.e., Biological Sciences, Chemistry, Geology, Meteorology, Physics and Climate Science), and in the Science Education Program. Only three of our six tenure track faculty serve at the rank of tenured professor, while the other three are still working toward tenure and/or promotion. Since summer is a period when all of us devote time to teacher training, research, and manuscript writing, we simply do not possess the bandwidth to offer summer courses.

2b. Significant changes to the program and context

We have lost three members of our program due to retirement, promotion, and change of appointment since the last review cycle. During the 2011-12 academic year, we recruited and hired two tenure track faculty: Cassandra Paul, Ph.D. (Department of Physics and Astronomy), and Elizabeth Walsh, Ph.D. (Department of Meteorology and Climate Science). Each new hire marks the first time that each of the two “home departments” have hosted split appointees. The new assistant professors have taught courses within the credential and M.A. Science Education.
Since the last review cycle, we have also struggled with issues of retention and time-to-degree in our master’s program. Our faculty have determined that graduation delays are usually due to a failure to complete the master’s culminating experience, which consists of a project, manuscript and oral presentation. To address these needs, we have are working towards three action items:

1) Assigning temporary masters advisers upon students enrollment in the masters program. (Practice started Fall 2014)

2) Integrating culminating experience preparation items into master’s level courses
   a) SCI 220: Semester culminates in completion of written literature review on topic of interest for culminating experience project (Practice started Fall 2014)
   b) SCI 205: Semester culminates in completion of written proposal for culminating experience project (Practice started Spring 2015)

3) Officially requiring SCI 205 as a part of our master’s program (Process initiated Spring 2015, waiting for approval) to make sure that:
   a) all students are exposed to the tools necessary to complete a master’s level culminating experience project
   b) all students complete a culminating experience proposal

3. ASSESSMENT OF STUDENT LEARNING

3a. Program Learning Objectives (PLO)

Program faculty discuss PLOs at several meetings per year; greensheets of courses are provided by faculty to verify the congruence of curricula with program learning outcomes.

List of Program Learning Outcomes (PLOs)
1 – To enhance student’s depth and breadth of understanding of selected topics in science education. (See Table 1)

PLO 1.1 Students will be able to synthesize primary literature from science education research and apply how it fits to their project.

PLO 1.2 Students will demonstrate knowledge of at least two areas (e.g. inquiry based instruction, learning theory, assessment) that are related to, or supportive of research for their project.

2 – To enhance communication skills, both written and oral, in science education discourse.
**PLO 2.1** Students will present science and science education content in the form of graduate seminars or in the oral defense of their project (also known as the culminating experience).

**PLO 2.2** Students will organize and write the results of their project in a manner consistent with standards in professional science education publications.

### 3b. Map of PLOs to University Learning Goals (ULG)

<table>
<thead>
<tr>
<th>Program Learning Objectives</th>
<th>ULG 1.1</th>
<th>ULG 2.1</th>
<th>ULG 2.2</th>
<th>ULG 2.3</th>
<th>ULG 3.1</th>
<th>ULG 3.2</th>
<th>ULG 4.1</th>
<th>ULG 4.2</th>
<th>ULG 4.3</th>
<th>ULG 5.1</th>
<th>ULG 5.2*</th>
<th>Course</th>
</tr>
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<tbody>
<tr>
<td>1.1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>SCI 220</td>
</tr>
<tr>
<td>1.2</td>
<td>X</td>
<td>X</td>
<td></td>
<td>N/A</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>SCI 173, SCI 298/299</td>
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<tr>
<td>2.1</td>
<td>X</td>
<td>X</td>
<td></td>
<td>N/A</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>SCI 220, SCI 298/299</td>
</tr>
<tr>
<td>2.2</td>
<td>X</td>
<td>X</td>
<td></td>
<td>N/A</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>SCI 298/299</td>
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</table>

ULG 2.3 does not apply for MA programs

### 3c. Matrix of PLOs to Courses

Curriculum Map of Program Learning Outcomes Addressed by Required Courses for the MA in Science Education. The PLOs are listed along the top of the table and the course(s) that address the PLOs are listed on the side.

Y indicates that the PLO is addressed by the course.

<table>
<thead>
<tr>
<th></th>
<th>1.1</th>
<th>1.2</th>
<th>2.1</th>
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<tr>
<td>SCI 220</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td></td>
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<td>SCED 173</td>
<td></td>
<td>Y</td>
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3d. Assessment Data

The data collected for assessment of student learning and experience in the program is in the form of assignments from the required courses, and from the culminating experiences of the students. Prior to this academic year, students were assessed using the culminating experience rubric only, (see Appendix F, Table F1 for “Culminating Experience Rubric”). However, beginning in the 2014-2015 academic year, we instituted two signature assignments in SCI 220 and SCI 205 (which will be a required course for the master’s program next year). We assessed student success with these rubrics as well (see appendix for Table F3: SCI 220 Rubric and Table F4: SCI 205 Rubric).

3e. Assessment Results and Interpretation

We had 9 students graduate between spring 2012 and spring 2015. All students were evaluated using the Culminating Experience Rubric, and the results of these evaluations are included in the Appendix under Table F2. Eight of nine students performed above the level of “competence” approaching the level of “exemplary.” Only one student failed to meet the “competence” mark, and it was by a very small margin. It appears as though our students are best at oral communication of their ideas (which is not too surprising considering that most are practicing educators) and are least competent in their ability to collect and analyze data. This is somewhat troubling given the fact that they are science educators, however, the data they are analyzing outside of their scientific disciplinary expertise, which could be reason for their difficulty. Nevertheless, this is one of the reasons that we have decided to make SCI 205: Research Methods in Science Education, a required course for our masters students.

As indicated in Table F2 and F1, our PLOs match nicely with our rubric, and all students were assessed in each PLO. The results again indicate that our students are successfully meeting our PLOs.

<Interpret assessment data. If you are assessing capstone projects or portfolios, please refer to the WASC Rubrics for Capstones and Portfolios, respectively. Changes in student composition (i.e. SAT/eligibility index, URM/Non URM status) should be considered in the interpretation of the results. Evaluate (1) if students are consistently achieving PLOs upon graduation, (2) how SJSU students in program compare to students in comparable programs, if possible, and (3) if students have a positive academic experience in the program and at SJSU.>
3f. Placement of Grads

Our graduate students typically enroll in our program as part-time students as they already have a full-time teaching job. In fact, of the nine students that graduated in the past 2.5 years, most, if not all have already had jobs. Students typically enroll in the program to broaden their skill set and increase their salary level in their current job. However, we recognize that we are missing an opportunity to determine the impact of our program on our students after they graduate, and so we plan to develop and initiate an exit survey (given just after graduation) and an alumni survey (given 2 years after program completion) to measure student perceived preparedness for the workforce, as well as reflections on curricular content. See action item #1 in section 7.

4. PROGRAM METRICS AND REQUIRED DATA

The Required Data Elements discussed in this section are attached in Appendix A of this report.

4a. Enrollment, retention, graduation rates, and graduates

As noted in Appendix A, data on enrollment within Science Education M.A. courses is not reported accurately by IEA. Some of our courses carry a SCED prefix, while others are designated as SCI courses. Unfortunately, most of our MA courses have the SCI prefix and not the SCED prefix. Since the SCI designation contains a suite of far broader disciplines, our true numbers could not be teased out from this aggregation. One of our action items (listed in Section 7) is to address this by changing all of our SCI courses to SCED courses. We also have started a new system of keeping track of our graduate students through a Science Education Program Canvas shell. This way, we will not need to rely on institutional tracking of our program data.

4b. Headcount in sections

See section 4a for explanation.

4c. FTES, Induced Load Matrix

We have included a data table from Exhibit 4. We did not include all of the combinations of the induced load matrix because a brief analysis of one of the charts shows that the data are inaccurate and further analysis would prove fruitless. Referring to Exhibit 4 in the appendix,
you can see that we had 6 students enrolled in our graduate level courses, and that all of these students were EDUC majors. This is incorrect. We had eight students enrolled in our SCI 220 course in fall 2014 (the only graduate level course we offered that semester) 6 of whom were Science Education Program MA students, and 2 of whom were Physics MS students. All eight were from the college of science, and none were associated with the School of Education (EDUC). For this reason it is impossible to ascribe meaning to any of the table representations in Exhibit 4.

4d. FTEF, SFR, Percentage T/TT Faculty

See section 4a for explanation.

5. PROGRAM RESOURCES

5a. Faculty

Our M.A. Science Education Program resources include six tenure track faculty members, yet five of us are appointed to the program with only 50% of our teaching responsibilities devoted to Science Education (Drs. McGee, Messina, Kelly, Paul, and Walsh). Dr. Metzger’s appointment letter is less directive, however, she teaches courses in both Science Education and her home department, Geology. With a full time equivalent of less than 3.0 faculty, we have struggled to cover all classes we need to offer, especially considering sabbaticals, assigned time, and release time obligations. In the 2014-15 academic year alone, we have found it particularly difficult to staff course offerings to maintain a healthy M.A. program, since two faculty members have been temporarily “borrowed” to full-time appointments at SJSU’s College of Education, and to the CSU Chancellor’s Office, and our two new hires have not carried full time teaching loads yet, as per their appointment letters.

Our professors’ qualifications are outlined in Appendix F.

5b. Support staff

Administrative Support Coordinators/Analyst

Our program has been supported by three office staff in the period of review. In chronological order, Ann Baldwin, Cheryl Eng, and Nirali Patel have supported this program by maintaining databases that track student progress, updated our Web, Canvas, and Facebook Websites, purchased supplies and other supporting materials,
and served as liaisons between existing and prospective M.A. students. Each has scheduled interviews with the M.A. Coordinator and/or Program Director.

Each of our support staff were assigned to the Science Education Program no more than 20 hours per week. Of this, most of the time has traditionally been spent assisting students in the credential program; only a small fraction of their time is devoted to the M.A. Science Education course, faculty, and student support.

The faculty is highly aware that we need further support to maintain and grow our program. In order to recruit more students into our M.A., we need more human-power to support our faculty and students.

5c. Facilities
<Summarize and evaluate classrooms, laboratories, studios, offices, equipment, and other facilities available for instruction and program operation.>

As a small program, we have few resources. Our office, DH 224, houses our administrative support coordinator, our Teacher-in-Residence, one professor emerita, and student assistants (who work part-time). Within DH224, there is a conference room where we hold meetings, faculty conduct research, and we interview/advise students. One secure storage area within DH224 holds hard copies of confidential student and faculty records.

One classroom in Duncan Hall (DH 246) is our main classroom, although we have had to ask for alternate rooms when classes overlap. Since our program is geared to the needs of practicing teachers, our classes are held in late afternoons and evenings. However, this is also the time at which most of our pre-service credential courses take place. Luckily, we have been able to schedule “over lapped” classes nearby, given the greater flexibility in locating unused classrooms at night.

Because the last three hires in Science Education (Kelly, Paul & Walsh) all do research that requires interviews with students, and examining sensitive student information, the program would greatly benefit from a shared lab space where research could be conducted, equipment could be housed, and sensitive data could be stored. This lab space does not need to be very large (the equivalent of office space for two would be adequate) and could be jointly shared across active researchers in the Science Education program.

6. OTHER STRENGTHS, WEAKNESSES, OPPORTUNITIES, AND CHALLENGES

Strengths
SJSU Science Education is a program in which teaching practice is informed by educational research and practical experience. We are fairly unique to the CSUs, in that the Program is under the leadership of the College of Science. All tenure track faculty are
specialists within an academic field (geology, physics and astronomy, meteorology and climate science, chemistry, biological sciences), sharing an appointment between their “home departments” and the Science Education Program. As described earlier, the majority of our professors teach 50% within their home department, and 50% within Science Education.

Our collective research includes the work of Dr. Cassandra Paul, who was awarded an NSF grant (PRIME 1337069 $250k) with the goal of developing a classroom observing protocol aligned with best practices in STEM specifically designed to help faculty at SJSU understand what is happening in their classrooms. The protocol consists of an interactive web application that allows faculty to visualize how time is spent in class, and how classroom activities are aligned with positive student learning outcomes. The idea is to help faculty make informed improvements in their teaching practice. Paul hired Post-doctoral scholar, Dr. Katrina Roseler to assist in these efforts between 2/14 and 9/15. The pair ran two workshop series in the fall of 2014 and spring of 2015, current has one paper submitted for review to the Journal of Research in Science Teaching (the most prestigious journal focusing on science specifically on education research), and two other papers in progress with targeted submission dates of summer 2015.

Dr. Elly Walsh runs the Climate Change Learning Group, one of the only research groups in the country to use a sociocultural, equity-focused lens to examine pressing issues around climate change education. Undergraduate and graduate researchers partner with community, university and corporate groups such as CommUniverCity, PG&E and the Green Ninja Project to bring together scientists, educators and community partners in collaborative design and implementation of education projects. Of particular concern is understanding the strengths and barriers of communities with respect to resiliency to climate impacts and participation in climate science, and leveraging the knowledge, values and practices of diverse communities to solving problems. Recently, Dr. Walsh co-authored a piece on the role of the social controversy in how individuals learn climate science, published in Nature Climate Change, the top-ranked journal in Earth Science.

Dr. Resa Kelly is a chemical education researcher who works on visualization design. She has presented nationally and internationally on her research examining the effects of visualization scaffolding, segmentation and metacognitive reflection on students’ learning. In 2010, she was awarded a grant of $200,000 from the National Science Foundation - Division of Undergraduate Education Course, Curriculum and Laboratory Improvement (CCLI) Phase I for the proposal: “Design of Electronic Learning Tools to Supplement General Chemistry Experiments” (NSF 0941203). The award has lead to the creation of a website: www.chemteam.net and online tutorials focused on helping students learn about precipitation reactions and electrical conduction tests of a variety of chemicals. In addition to her research, Dr. Kelly, a former high school teacher, has taught at both the secondary and tertiary level for over 20 years. She has served as Chair of Secondary Education and Director of the Single Subject Credential program. She was elected Secretary and Councilor to the American Chemical Society’s Division of Chemical Education and is currently in her second term. Dr.
Kelly has been recognized by the University of Northern Colorado as a distinguished alumna who has made significant contributions to the field of Chemical Education Research.

Above is a sample of the types of research conducted by the Science Education Program faculty. Enumerating all endeavors would easily exceed the limits of the size of this report. Curriculum vitae contain detailed descriptions of our individual and collective work.

Our pragmatic approach to education is founded in the prior K-12 classroom experience, possessed by Drs. Kelly and Messina. Noteworthy is Paula Messina, the program’s current director, who taught high school Earth science for 20 years prior to her appointment to SJSU’s faculty.

We maintain a cutting edge in progress toward implementation of the Next Generation Science Standards (NGSS, now adopted by California and 12 other states) through Dr. Messina’s ongoing independent consultant work with Achieve, Inc. (Washington, D.C.). Achieve is the organization that was endowed by the Carnegie Foundation to construct K-12 science standards based on the National Research Council’s Framework (see Section 1a). Messina spent over two years collaborating with 40 other educators, research scientists, and state and school district science administrators as a member of the writing team for NGSS. Her continued involvement with Achieve, Inc. in implementation and assessment of NGSS has benefited our programs tremendously, by bringing this new approach to our M.A. students. Our M.A. students, as current teacher-practitioners, serve as mentors to colleagues and administrators in their own schools, thus posturing SJSU as the leading institution⁴ in California with expertise toward this end. Our Science Education faculty continue to lead NGSS Workshops for regional teachers, and Messina has been invited to deliver workshops for educators as far away as the Middle East and Northern Africa, whose American Schools are in the process of adopting the Common Core and NGSS.

The Science Education Program faculty are active in seeking external funding to support the MA Science Education program by involving students in faculty research. External awards are enumerated in Appendix F.

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⁴ Messina was one of only two members of the NGSS Writing Team from California, and is the only professor who represented our state.
Externally funded programs help to provide projects for our graduate students. For example, a grant from the Clarence E. Heller Foundation led to projects for two M.A. students who studied teacher understanding of the concept of sustainability and barriers to bringing sustainability-themed education to K-12 classrooms.

Although we have been unable to provide summer courses, the Bay Area Environmental STEM Institute offers Saturday and summer professional development workshops and field trips for which participants may earn credit that can be applied to the MA Science Education program. These workshops also serve to recruit in-service teachers to the MA program. For example, more than half (5/9) of recent graduates learned about the M.A. in Science Education at BAESI events.

Weaknesses

As a Program within the College of Science, our group does not receive a traditional budget, as do Departments. Our Program is funded by the College of Science, but it is not dependent on course enrollments (FTES). As a result, we are not provided with a base of consistent financial support, leaving the program without the ability to prioritize or make autonomous decisions based on need.

Without any faculty appointed to Science Education as full-time employees, our faculties’ foci are continually split between their home departments and our program. We have suffered from a lack of continuity/consistency since program directors are elected for 3-year terms, and during those terms, their teaching responsibilities lie within the realm of their home departments (thus using their 50% commitment to Science Education in leadership -- but not teaching -- roles). Each of us suffers from “limited bandwidth,” since we have to juggle the dual roles to which we have been appointed.

Representative Alumni Accomplishments

Alumna Cristina Chang (M.A. recipient) presented at an American Chemical Society conference and she is first author on a recently accepted book chapter co-authored with Drs. Kelly and Metzger.

M.A. Science Education graduate Gerald Schwartz has been hired as a lecturer within the Geology Department to teach Geology 103 in the Fall, 2015 semester.

Faculty accomplishments are enumerated in Appendix F.
7. DEPARTMENT ACTION PLAN

Ideas in no particular order:

1. **Gather longitudinal data from alumni**
   As indicated in Section 3f, we believe that we could improve the quality and usefulness of our program by administering an exit survey for our graduates. It has been several years since an alumni survey was administered, and we have not made this a steady practice. However, now as we are entering a period of growth, it is more important than ever to get feedback from our alumni about what aspects of our program are particularly useful to their careers and what aspects could use improvement. Furthermore, as we look for ways to maintain a profitable status as we transition to department, we want to ask our alumni what types of certificate programs would be most useful to them. The alumni of our MA program and their peers represent an excellent recruitment pool for certificate programs, as teacher salaries increase the more courses they take, and this could potentially be a nice way to fund our MA program as the certificate program can boast higher enrollments than our masters core courses, and the certificate program does not require faculty advisers which can be costly. To create the survey, the SCED program will establish a committee of two faculty members who will create a survey based on previously issued surveys, and the potential future directions of the department. The committee will get contact information for recent graduates from the program from the graduate coordinator. The committee work will be assigned and survey administered during the Fall of 2015.

2. **Transition from “Program” to “Department” Status**
   We are just beginning to take the first steps toward moving from a Science Education Program to a Science Education Department. As we do this, it's essential that we make a plan to become a self-sustaining entity in the College of Science. At several faculty meetings over the Spring 2015 semester we have discussed multiple avenues to accomplish this endeavor. Current ideas on the table include: taking on the SCI 2 and SCI 90T service courses, increasing MA program enrollment, creating a learning assistant program (service course(s) for CoS), increase summer course offerings, and add certificate program(s). Many of these changes will require an increase in staffing in the program/department, especially considering the loss of our Teacher in Residence Position, and the beginning of Messina's FERP in fall 2015. Thus many initiatives must be balanced on a detailed timeline in order to create a solid sustainable long-term plan.
Steps have already been taken by Science Education faculty to account for the teaching responsibilities over the next few years, and the faculty will meet in the Fall of 2015 to create a 5 year plan with detailed information on teaching assignments, course additions, enrollment targets, and a unified vision for the future. To accomplish this, the entire faculty will rank priorities during a faculty meeting, and then a committee of two faculty members will take these priorities and work out a plan to achieve them over a 5-year timeline.

3. Distribute Role of Teacher in Residence over Other Positions/ Hire New Full-time Faculty in Science Education

For over 20 years, the Science Education Program has benefited tremendously from its “Teacher in Residence” (TIR) position. We have been able to “borrow” a local area secondary educator to teach within our credential program. This person traditionally teaches the “Methods” course (SCED 173, which may be transferred into our M.A. degree program), and he/she runs a Science Education Colloquium (SCED 375), which most recently serves as intensive support for students conducting their student teaching requirements. As part of student teaching responsibilities, SCED 375 students must pass the Performance Assessment for California Teachers (PACT); our TIR has served as an invaluable coach toward success on that assessment for our students.

However, in Spring 2015, we were devastated that our current TIR, Rachel Peters, could not renew her one-year contract at SJSU. As a result, many of the responsibilities that were carried out by that position will have to be distributed among existing members of Science Education in the short-term. As a small program with no more than 3.0 FTEF, absorbing an entire full-time “line” into our credential and M.A. program responsibilities will spread us even thinner than we already are.

A longer-term solution will be to hire a full-time tenure-track faculty member who can coordinate many of the credential program’s responsibilities, as the Teacher in Residence used to do.

4. Change all SCI courses in our program to SCED.

As indicated in Section 4, the accounting for our program has been difficult to this point because we teach courses with the SCI and SCED prefix. Thus, all automatic counting has been inaccurate. We are moving towards changing the prefix for all courses taught by faculty in the Science Education Program (soon to be Science Education Department) to SCED. In the spring of 2015, we have already submitted minor curriculum changes for masters level courses SCI 220, 205, 285 and 298 to change to SCED 220, 205, 285 and 298. We intend to submit the changes for the rest of the courses we cover that are still named SCI in the Fall of 2015. This will allow us to keep better track of our FTES and make budget decisions concerning these data.
8. APPENDICES
   A. Required Data Elements

EXHIBIT 1: Number of Course Sections
(N.B. Data for Fall and Spring semesters, shown below, are for all SCI-prefixed courses and for SCED courses. Some courses in our M.A. degree are designated with SCI prefixes. Changing these designations -- which is in process -- to SCED will facilitate more-accurate reporting in the future.)
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Average Headcount per Section - Data Exhibit 2
Prefix SCED - Science Education

Cross listed course redistributions are included in this report

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<th>Fall 2004</th>
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<th>Fall 2006</th>
<th>Fall 2007</th>
<th>Fall 2008</th>
<th>Fall 2009</th>
<th>Fall 2010</th>
<th>Fall 2011</th>
<th>Fall 2012</th>
<th>Fall 2013</th>
<th>Fall 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Division</td>
<td>8.5</td>
<td>5.5</td>
<td>10.0</td>
<td>11.0</td>
<td>12.0</td>
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<td>13.0</td>
<td>10.0</td>
<td>14.0</td>
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</tr>
<tr>
<td>All Level</td>
<td>8.5</td>
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<td>10.0</td>
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<td>12.0</td>
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### Supervision Courses (SUP)

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<th>Fall 2010</th>
<th>Fall 2011</th>
<th>Fall 2012</th>
<th>Fall 2013</th>
<th>Fall 2014</th>
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</thead>
<tbody>
<tr>
<td>Upper Division</td>
<td>14.7</td>
<td>8.2</td>
<td>9.0</td>
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<td>10.7</td>
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<td>4.7</td>
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<td>8.3</td>
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<tr>
<td>All Level</td>
<td>14.7</td>
<td>8.2</td>
<td>9.0</td>
<td>10.7</td>
<td>10.7</td>
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<td>10.7</td>
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</tr>
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</table>
**EXHIBIT 3: STUDENT TO FACULTY RATIO**

**Data Exhibit 3**  
Student to Faculty Ratio (SFR)  
Course Prefix: SCED

<table>
<thead>
<tr>
<th></th>
<th>Fall 2006</th>
<th>Fall 2007</th>
<th>Fall 2008</th>
<th>Fall 2009</th>
<th>Fall 2010</th>
<th>Fall 2011</th>
<th>Fall 2012</th>
<th>Fall 2013</th>
<th>Fall 2014</th>
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</thead>
<tbody>
<tr>
<td><strong>SFR</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>Upper Division</td>
<td>10.0</td>
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<td>8.3</td>
<td>6.6</td>
<td>7.3</td>
<td>9.4</td>
<td>7.9</td>
<td>9.3</td>
<td>8.1</td>
</tr>
<tr>
<td>Graduate Division</td>
<td>16.3</td>
<td>12.0</td>
<td>7.0</td>
<td>19.3</td>
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<td>14.7</td>
<td>9.0</td>
<td>10.0</td>
<td>6.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td>8.2</td>
<td>7.3</td>
<td>7.1</td>
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<td>8.0</td>
<td>10.1</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Note: Student/Faculty Ratio (SFR) = Full-time Equivalent Students (FTES) / Full-time Equivalent Faculty (FTEF).

<table>
<thead>
<tr>
<th></th>
<th>Fall 2006</th>
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<th>Fall 2010</th>
<th>Fall 2011</th>
<th>Fall 2012</th>
<th>Fall 2013</th>
<th>Fall 2014</th>
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<tbody>
<tr>
<td><strong>FTEF</strong></td>
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<td></td>
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<td>1.7</td>
<td>1.3</td>
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Course data shown here come from the same prefix.

**Data Exhibit 3**  
Student to Faculty Ratio (SFR)  
Course Prefix: SCED

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<td>4.7</td>
<td>5.3</td>
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<td>7.1</td>
<td>9.1</td>
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</table>

Note: Student/Faculty Ratio (SFR) = Full-time Equivalent Students (FTES) / Full-time Equivalent Faculty (FTEF).

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
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<td><strong>FTEF</strong></td>
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<td>Upper Division</td>
<td>12.2</td>
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<td>10.2</td>
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<td>5.8</td>
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<td>4.7</td>
<td>5.5</td>
<td>9.7</td>
</tr>
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<td>0.9</td>
<td>0.9</td>
<td>0.7</td>
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<td>1.6</td>
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<td>5.6</td>
<td>6.2</td>
<td>11.3</td>
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</tbody>
</table>

Course data shown here come from the same prefix.
### Induced Course Load Matrix (ICLM) - # Seats Occupied
#### Spring 2015 Graduate Courses Offered with Prefix: SCED

Cross listed course redistributions are included in this report.

<table>
<thead>
<tr>
<th>Student College</th>
<th>Courses Offered</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Undp,Hc</td>
<td>Graduate</td>
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<tr>
<td>EDUC</td>
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<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

#### Translation for course prefix & Major code
#### How to read a Course Prefix level ICLM

#### Semester
- Spring 2015

#### Count Type
- FTES Traditional
- FTES Rebenched
- # Seats Occupied
- SCUs

#### Course Type
- All Courses
- Lower Division Courses
- Upper Division Courses
- Graduate Courses

---

### Induced Course Load Matrix (ICLM) - # Seats Occupied
#### Fall 2014 Graduate Courses Offered with Prefix: SCED

Cross listed course redistributions are included in this report.

<table>
<thead>
<tr>
<th>Student College</th>
<th>Courses Offered</th>
<th>Total</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Undp,Hc</td>
<td>Graduate</td>
</tr>
<tr>
<td>EDUC</td>
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<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td><strong>6</strong></td>
</tr>
</tbody>
</table>

#### Translation for course prefix & Major code
#### How to read a Course Prefix level ICLM

#### Semester
- Fall 2014

#### Count Type
- FTES Traditional
- FTES Rebenched
- # Seats Occupied
- SCUs

#### Course Type
- All Courses
- Lower Division Courses
- Upper Division Courses
- Graduate Courses

Finish
## Induced Course Load Matrix (ICLM) - # Seats Occupied
### Spring 2014 Graduate Courses Offered with Prefix: SCED

Cross listed course redistributions are included in this report.

<table>
<thead>
<tr>
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### Induced Course Load Matrix (ICLM) - # Seats Occupied
### Fall 2013 Graduate Courses Offered with Prefix: SCED

Cross listed course redistributions are included in this report.

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</thead>
<tbody>
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### Induced Course Load Matrix (ICLM) - # Seats Occupied
#### Spring 2013 Graduate Courses Offered with Prefix: SCED

Cross listed course redistributions are included in this report.

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</tr>
<tr>
<td></td>
<td>Graduate</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>7</strong></td>
</tr>
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### Induced Course Load Matrix (ICLM) - # Seats Occupied
#### Fall 2012 Graduate Courses Offered with Prefix: SCED

Cross listed course redistributions are included in this report.

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</thead>
<tbody>
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<td>EDUC</td>
<td>Urban, HC</td>
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<td></td>
<td>Graduate</td>
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<td><strong>Total</strong></td>
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### Induced Course Load Matrix (ICLM) - # Seats Occupied
**Spring 2012 Graduate Courses Offered with Prefix: SCED**

Cross listed course redistributions are included in this report.

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<td>Graduate</td>
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<td>EDUC</td>
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<tr>
<td>Total</td>
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### Induced Course Load Matrix (ICLM) - # Seats Occupied
**Fall 2011 Graduate Courses Offered with Prefix: SCED**

Cross listed course redistributions are included in this report.

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<th>Courses Offered</th>
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<tbody>
<tr>
<td></td>
<td>Undp., HC</td>
<td>Graduate</td>
</tr>
<tr>
<td>EDUC</td>
<td>13</td>
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<tr>
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## Induced Course Load Matrix (ICLM) - # Seats Occupied
### Spring 2011 Graduate Courses Offered with Prefix: SCED

Cross listed course redistributions are included in this report.

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<td>EDUC</td>
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<td>7</td>
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</tr>
<tr>
<td>Total</td>
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</tr>
</tbody>
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## Induced Course Load Matrix (ICLM) - # Seats Occupied
### Fall 2010 Graduate Courses Offered with Prefix: SCED

Cross listed course redistributions are included in this report.

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<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
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**EXHIBIT 5: Applied, Admitted, Enrolled by Cohort Group**

**Program: SCED - Science Education**

<table>
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<tr>
<th>Headcount</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Applied</td>
<td>admit rate</td>
<td>enroll rate</td>
<td>show rate</td>
<td>Applied</td>
<td>admit rate</td>
</tr>
<tr>
<td>First-time Graduate</td>
<td>6</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>5</td>
<td>100%</td>
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<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>5</td>
<td>100%</td>
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<table>
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<tbody>
<tr>
<td></td>
<td>Applied Indicator</td>
<td>admit rate</td>
<td>enroll rate</td>
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<tr>
<td>First-time Graduate</td>
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<td>100%</td>
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<tr>
<td>Total</td>
<td>2</td>
<td>100%</td>
<td>100%</td>
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**Admit Rate (Adm/App)  Enrollment Rate (Enr/App)  Show Rate (Enr/Adm)**

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<td>Total</td>
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<td>5</td>
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EXHIBIT 6: Enrollment by Class Level with FTES

Enrollment by Class Level
Full Time Equivalent Students  - Rebenched (for Major Only)
Program: SCED - Science Education

<table>
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<tr>
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<th>Fall 2012</th>
<th>Fall 2013</th>
<th>Fall 2014</th>
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<td>Graduates</td>
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<td>10</td>
<td>7</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Total Headcount</td>
<td>11</td>
<td>10</td>
<td>7</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Total FTE Enrollment</td>
<td>5.42</td>
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<td>1.42</td>
<td>3.33</td>
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</table>

<table>
<thead>
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<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
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<tr>
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<td>10</td>
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<tr>
<td>Total FTE Enrollment</td>
<td>3.58</td>
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<td>0.50</td>
<td>2.17</td>
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Total FTE Enrollment:

Exhibit 7 Enrollment by Major and Concentration
Enrollment by Degree Type, Concentration and Degree Type
Program: SCED - Science Education

Exhibit 8 Degrees Awarded

Degrees Awarded by Major & Concentration
Broken down by None
Science Education

From www.iea.sjsu.edu/RetnGrad/default.cfm#Prefix, select your program

Exhibit 9 First Year Retention Rates
### Traditional Approach

**1st Year Retention Analysis: First-Time Graduate**

**Academic Program:** Science Education, CA Resident, Non-Res Domestic, Nr International

---

**Note:** Student’s residence status was assigned for fee purposes.

<table>
<thead>
<tr>
<th></th>
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<th>Fall 1999</th>
<th>Fall 2000</th>
<th>Fall 2001</th>
<th>Fall 2002</th>
<th>Fall 2003</th>
<th>Fall 2004</th>
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<tr>
<td>Female</td>
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<td></td>
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<tr>
<td>Male</td>
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</table>
### Exhibit 10 Graduation Rates

#### Traditional Approach

3rd Year Graduation Analysis: First-Time Graduate

Academic Program: Science Education, CA Resident, Non-Res Domestic, Nr International

*Note: Student's resident status was assigned for fee purposes.*

<table>
<thead>
<tr>
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<th>Fall 1998</th>
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<tbody>
<tr>
<td><strong>Number Entering</strong></td>
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<td>2</td>
<td>3</td>
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<td>3</td>
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<td><strong>Overall Rate</strong></td>
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<td><strong>Male</strong></td>
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### T/TT Instructional Faculty Percentage

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<th>Total</th>
</tr>
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</tbody>
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33
The links (below) led to a list of Departments, from which Science Education was not a part. (See screen shot, right.)

Also calculate T/TT instructional faculty percentage. From www.iea.sjsu.edu/Faculty/default.cfm#Dept, select your department. Under "Instructional Faculty – FTEF", select “by Tenure Status”. Add together “Tenured” and “Probationary” numbers, and divide sum by “Total”. >

B. Accreditation Report (if applicable) (Not applicable)

C. (Example) List of PLOs for each program (Not applicable)

D. (Example) Data (Not applicable)

E. Curriculum flow charts, and mappings

Example track #1: Science Education Master’s PART TIME tuition, 30 unit program total.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Fall</th>
<th>SCED 173 (3)*</th>
<th>Spring</th>
<th>SCI 285 (3)</th>
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<tr>
<td></td>
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<td>Elective (3)</td>
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<td>Elective (3)</td>
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<tr>
<td>Year 2</td>
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<td>SCI 220 (3)*</td>
<td>Spring</td>
<td>SCI 205 (3)*</td>
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<tr>
<td></td>
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<td>SCI 298 (1)*</td>
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<td>SCI 298 (1)</td>
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<tr>
<td>Year 3</td>
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<td>SCI 255 (3)</td>
<td>Spring</td>
<td>Elective (3)</td>
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<td></td>
<td></td>
<td>SCI 298 (2)</td>
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<td>SCI 298 (2)</td>
</tr>
</tbody>
</table>

Notes: SCI 220, SCI 205 and 6 units of 298 are required. Project Proposal due at end year 2, Project completed and culminating experience fulfilled by end of year 3.
Example #2: Transfer in with SJSU Credential: part-time, 12 units transfer in w/ 3 being from SCED 173

NOTE CREDENTIAL UNITS HAVE 7-YEAR EXPIRATION DATE

<table>
<thead>
<tr>
<th>Year 1</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Fall</td>
<td>SCI 220 (3)*</td>
<td></td>
<td>Spring</td>
</tr>
<tr>
<td></td>
<td>SCI 298 (1)*</td>
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<td>SCI 298 (1)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2</th>
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<tbody>
<tr>
<td>Fall</td>
<td>SCI 255 (3)</td>
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<td>Spring</td>
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<tr>
<td></td>
<td>SCI 298 (2)</td>
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<td>SCI 298 (2)</td>
</tr>
</tbody>
</table>

Notes: SCI 220, SCI 205 and 6 units of 298 are required. So is SCED 173, which is a credential program requirement. Project Proposal due at end of year one, Project completed and culminating experience fulfilled by end of year 2.

F.

Table F1: Culminating Experience Rubric

<table>
<thead>
<tr>
<th>Project or Research Focus Rationale, Significance (PLO 2.2)</th>
<th>Level 1 Not Acceptable</th>
<th>Level 2 Emergent Competence</th>
<th>Level 3 Competent</th>
<th>Level 4 Exemplary</th>
</tr>
</thead>
<tbody>
<tr>
<td>i Topic(s) not timely or relevant to the teaching and/or learning of content areas.</td>
<td>i Topic(s) timely or relevant to the teaching and/or learning of the content area(s), but not both</td>
<td>i Topic(s) timely and relevant to the teaching and/or learning of content areas</td>
<td>i Topic(s) could potentially make a contribution to the field.</td>
<td></td>
</tr>
<tr>
<td>i Description of the context for the project or thesis is lacking.</td>
<td>i Description of the context for the thesis or project is unclear or</td>
<td>i Description of the context for the thesis or project is clear</td>
<td>i Topic(s) relevant, timely and offers new insights into the area of research.</td>
<td></td>
</tr>
</tbody>
</table>
### Project Background/Literature Review (PLO 1.1 & 1.2)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature review doesn’t cite salient research or theory or research and theory cited is inadequate.</td>
<td>Literature review cites salient research and theory in the field of study that is salient or comprehensive but not both.</td>
</tr>
<tr>
<td>Literature reviewed does not include contemporary research in the area.</td>
<td>Literature reviewed includes some contemporary research in the area.</td>
</tr>
<tr>
<td>Literature review does not identify the gap in the research that demands further study.</td>
<td>Literature review identifies the gap in the research that demands further study but does not support it well with research.</td>
</tr>
<tr>
<td>Shows complete lack of understanding of theoretical basis of project.</td>
<td>Theoretical basis of project is superficial and/or partially incorrect.</td>
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<tr>
<td></td>
<td>Review is superficial and fails to demonstrate an understanding of the relationship between existing research in the field and the proposed project.</td>
</tr>
</tbody>
</table>

### Methodology or Procedures (PLO 2.2)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan for studying research question(s) is not clear and systematic</td>
<td>Plan for studying research question(s) is clear OR systematic but not both.</td>
</tr>
<tr>
<td>Plan for studying research question(s) is clear</td>
<td>Plan for studying research question(s) is clear and systematic.</td>
</tr>
<tr>
<td>Rationale for methodology is very well-developed, sophisticated</td>
<td>Plan for studying research question(s) is clear and systematic.</td>
</tr>
<tr>
<td>Curriculum Development (if applicable) (PLOs 1.1 &amp; 1.2)</td>
<td>Methods chosen are not reasonable given the research question(s) No rationale is presented for the methodology</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>Understanding of best pedagogical practices is not evident.</td>
<td>Understanding of best pedagogical practices is underdeveloped; no evidence of application.</td>
</tr>
<tr>
<td>Project is based too much on teacher lecture or other teacher-centered methods.</td>
<td>Project includes one or two established teaching modalities that enhance active learning.</td>
</tr>
<tr>
<td>The project is not applicable to science standards.</td>
<td>There are too many or too few standards for scope of project.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Collection, Analysis and Results (if applicable) (PLO 2.2)</th>
<th>Process of data collection is not systematic or thorough. Inadequate data collected. Analysis techniques</th>
<th>Process of data collection is reasonable but not thorough Data collected minimally acceptable for</th>
<th>Process of data collection is systematic and thorough Data collected are adequate for the design and</th>
<th>Data collection demonstrates extraordinary means. Design phase changes are substantiated by</th>
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37
<table>
<thead>
<tr>
<th>Design &amp; Planned Analyses</th>
<th>Justifications for any modifications to the original plan of study for new phases.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis techniques used are minimally appropriate for the purpose and scope of the research.</td>
<td>Analysis techniques used are appropriate for the purpose and scope of the research.</td>
</tr>
<tr>
<td>Results from raw data are summarized but needs a more clear and systematic format.</td>
<td>Results from raw data are summarized in a clear and systematic format.</td>
</tr>
<tr>
<td>Assessment results are used but results information is not thoroughly described.</td>
<td>Assessment data (results) are adequately described.</td>
</tr>
</tbody>
</table>

**Discussion (PLO 2.2)**

<table>
<thead>
<tr>
<th>Partial interpretation of data</th>
<th>Partial interpretation of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trends or patterns in data marginally identified</td>
<td>Trends or patterns in the data clearly identified</td>
</tr>
<tr>
<td>Marginal description of meaning of results</td>
<td>Adequate description of meaning of results</td>
</tr>
<tr>
<td>Assessment of impact of intervention is valid but minimally explained</td>
<td>Assessment of impact of intervention is valid.</td>
</tr>
<tr>
<td>Results not tied well</td>
<td>Results not tied well</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interpretation of data shows synthesis of previous and current research</th>
<th>Interpretation of data shows synthesis of previous and current research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trends or patterns clearly identified in the data</td>
<td>Trends or patterns clearly identified in the data</td>
</tr>
<tr>
<td>Description of meaning of results pushes knowledge and understanding of the subject</td>
<td>Description of meaning of results pushes knowledge and understanding of the subject</td>
</tr>
</tbody>
</table>
| **Conclusion**  
(PLO 2.2) | research | to research | refute previous research |
|---|---|---|---|
| Little or no reflection. | Reflection on research process includes some but not all:  
- what the study has shown  
- limitations (generalization, validity issues)  
- ways the research study could be improved  
- suggestions for future research  
- ways your future teaching/practice is informed | Reflection on research process includes:  
- what the study has shown  
- limitations (generalization, validity issues).  
- ways the research study could be improved.  
- suggestions for future research  
- ways future teaching/practice is informed | Reflection ties the study to new potential directions in the field |

| **Quality of Writing**  
(PLO 2.2) | Citations incorrect.  
- Academic language not used.  
- Poorly organized.  
- Unclear.  
- Numerous spelling and/or typographical errors. | Errors in form and format of citations.  
- Academic language used but focus is unclear and/or organization is weak.  
- Several typographical and/or spelling errors. | Use of proper citations.  
- Demonstrates ability to use academic language.  
- Clear focus, well organized  
- Conceptual clarity.  
- Few typographical and/or spelling errors. | Use of proper citations, command of academic language, absence of typographical and/or spelling errors.  
- Focus and organization of arguments are consistent with professional publications. |

| **Effectiveness in oral communication** | Presentation is poorly organized without evidence | Presentation is well-organized but media (e.g., Powerpoint, props | Presentation is well-organized and uses media (e.g., Powerpoint, | Presentation is well-organized and uses media (e.g., Powerpoint, |
| \textbf{n} \small{(PLO 2.1)} | of planning, etc.) does little to engage the audience and/or promote audience understanding. | props etc.) effectively and in a manner that engages the audience and promotes understanding. | props etc.) effectively and in a manner that engages the audience and promotes understanding; student addresses the audience with clarity and authority. |
|-----------------|-------------------------------------------------|-------------------------------------------------|

Table F2: Culminating experience data: Between 2012 and 2015, we had nine (9) students graduating. Each was evaluated using the culminating experience document. Their scores are included here.

<table>
<thead>
<tr>
<th></th>
<th>Kate Nichols</th>
<th>William Chavez</th>
<th>Cristina Chang</th>
<th>Juliet Hamak</th>
<th>Melissa Harker</th>
<th>Tamara Osharow</th>
<th>Roy Hamby</th>
<th>Melissa McCullough</th>
<th>Gerald Schwartz</th>
<th>Average for all students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project or Research Focus Rationale, Significance: PLO 2.2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3.44</td>
</tr>
<tr>
<td>Project Background/Literature Review: PLO 1.1 &amp; 1.2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Methodology or Procedures: PLO 2.2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>3</td>
<td>3.14</td>
</tr>
<tr>
<td>Curriculum Development (if applicable):</td>
<td>NA</td>
<td>4</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3.50</td>
</tr>
<tr>
<td>PLOs 1.1 &amp; 1.2</td>
<td>Data Collection, Analysis and Results (if applicable): PLO 2.2</td>
<td>2.5</td>
<td>N/A</td>
<td>N/A</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>---------------------------------------------------------------</td>
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<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discussion: PLO 2.2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>3</td>
<td>3.14</td>
</tr>
<tr>
<td>Conclusion: PLO 2.2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>N/A</td>
<td>3</td>
<td>3.00</td>
</tr>
<tr>
<td>Quality of Writing: PLO 2.2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3.11</td>
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<tr>
<td>Effectiveness in Oral Communication: PLO 2.1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3.56</td>
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<tr>
<td>Average out of scored categories</td>
<td>3.38</td>
<td>3.22</td>
<td>3.38</td>
<td>3.50</td>
<td>3.25</td>
<td>2.94</td>
<td>3.17</td>
<td>3.00</td>
<td>3.22</td>
<td>3.23</td>
</tr>
</tbody>
</table>

Table F3: SCI 220 Rubric for Literature Review

<table>
<thead>
<tr>
<th>Describes importance /relevance (6 Points)</th>
<th>Exemplifies expectation</th>
<th>Adequately meets expectation</th>
<th>Approaches expectation</th>
<th>Does not meet expectation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Makes a clear, concise, and important (relevant) claim that has implications for student success</td>
<td>Makes a claim that is either unclear or does not have relevance</td>
<td>Makes a claim that is both unclear and has no relevance</td>
<td>Does not make a claim</td>
<td></td>
</tr>
<tr>
<td><strong>Grammar/typos (3 Points)</strong></td>
<td>Uses correct grammar, mechanics, spelling, and citations (consistent)</td>
<td>Mostly uses correct grammar and spelling. There are some minor issues that don’t distract reader.</td>
<td>Sometimes uses correct grammar and spelling. There are one or two issues distracting to the reader.</td>
<td>Has multiple distracting grammatical errors</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td><strong>Organization (6 Points)</strong></td>
<td>Writing is well organized, has a compelling opening, an informative body and conclusion. Has appropriate paragraph format. ... Thesis statement and supporting evidence</td>
<td>Writing shows a clear beginning middle and end. Generally uses correct paragraph format.</td>
<td>Writing is usually organized, but sometimes off topic.</td>
<td>Writing is aimless and disorganized.</td>
</tr>
<tr>
<td><strong>Supporting evidence for a claim(s) (6 Points)</strong></td>
<td>Gives clear and accurate evidence in support of the claim</td>
<td>Gives evidence in support of claim but overlooks important reasons</td>
<td>Gives weak evidence which doesn’t support the claim well or is irrelevant.</td>
<td>Does not give reasons in support of the claim</td>
</tr>
<tr>
<td><strong>Connection to Science Education research/Theory (3 Points)</strong></td>
<td>Has at least fifteen peer review citations strongly connected to project. Current research is included. Based on/grounded in prior literature</td>
<td>Has fewer than fifteen peer review citations or has only tentative connections to literature.</td>
<td>Has fewer than fifteen peer-reviewed citations, and literature review is superficial.</td>
<td>Uses fewer than 10 peer-reviewed citation.</td>
</tr>
<tr>
<td><strong>Counter opinion</strong></td>
<td>Identifies</td>
<td>Identifies</td>
<td>Identifies</td>
<td>Does not</td>
</tr>
<tr>
<td>drawbacks/critique (common argument) (6 Points)</td>
<td>limitations (boundaries, and/or flaws) of previous research. Reveals conflicting ideas, and states how future or previous efforts can/were made to resolve this.</td>
<td>limitations or conflicting ideas, but does not suggest how resolution can be made.</td>
<td>limitations or conflicting ideas, but these are not well integrated into the narrative.</td>
<td>address limits or address conflicting ideas.</td>
</tr>
</tbody>
</table>

Table F4: SCI 205 Project/Research Proposal Rubric

<table>
<thead>
<tr>
<th>Literature Review (16 points)</th>
<th>Meets expectation</th>
<th>Approaching expectation</th>
<th>No Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>The literature review includes references to appropriate literature that orients the reader to the importance of or the motivation for the proposed research. The motivation is grounded in research not simply personal interest. Note: Personal motivation is not required. (4)</td>
<td>The literature review includes a discussion that orients the reader to the importance of or the motivation for the proposed research but does not include references to appropriate literature or is only personally motivated. Note: Personal motivation is not required. (2)</td>
<td>The literature review does not include a discussion that orients the reader to the importance of or the motivation for the proposed research (0)</td>
</tr>
</tbody>
</table>

| Theoretical Framework | The literature review includes the researchers theoretical framework with a minimum of 2 relevant citations (Your theoretical framework may be one of your Big | The literature review includes the researchers theoretical framework with 1 relevant citation. (2) | The literature review does not include a theoretical framework (0) |
| Review of relevant literature | The literature review includes a discussion of at least 2 topics (Big Ideas in Science Education) associated with research/project and references a minimum of 2 relevant pieces of literature for each of those topics. (6) | The literature review includes a discussion of 1 topic (Big Ideas in Science Education) associated with research/project and references a minimum of 2 relevant pieces of literature for that topic - OR - the literature review includes a discussion of at least 2 topics associated with research/project and references only 1 piece of literature for each of those topics (3) | The literature review does not include a discussion of relevant topics (Big Ideas in Science Education) associated with the literature (0) |
| Research Question(s) | The literature review includes a list of 2-5 clear comprehensive research questions and incorporates a discussion of how those questions fill a current gap in the literature (2) | The literature review includes a list of 2-5 research questions but does not discuss of how those questions fill a current gap in the literature or the research questions are vague (1) | The literature review does not include research questions, or includes extremely vague research questions which are unconnected to the literature. (0) |

|  | Ideas in Science Education - See Review of Literature). (4) |  |  |

**SCI 205 Project/Research Proposal Rubric**

<p>| Meets expectation | Approaching expectation | No Evidence |</p>
<table>
<thead>
<tr>
<th>Research Plan/Methodology (20 points)</th>
<th>Context</th>
<th>The research plan/methodology discusses the context where the research/project will be conducted with enough detail that research could be replicated (2)</th>
<th>The research plan/methodology discusses the context where the research/project will be conducted with limited detail (1)</th>
<th>The research plan/methodology does not include the context where the research/project will be conducted (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>The research plan/methodology discusses the participants that will be involved in the research/project with enough detail that research could be replicated (2)</td>
<td>The research plan/methodology discusses the participants that will be involved in the research/project with limited detail (1)</td>
<td>The research plan/methodology does not include the participants which will be involved in the research/project (0)</td>
<td></td>
</tr>
<tr>
<td>Treatment/Intervention or Design Elements</td>
<td>The research plan/methodology discusses the treatment/intervention that will be implemented in the research/project OR the development process of design elements that will be created with enough detail that research could be replicated. Specific methodologies/experimental designs are referenced by name, and citations of similar studies provided as applicable. (4)</td>
<td>The research plan/methodology discusses the treatment/intervention that will be implemented in the research/project OR the development process of design elements that will be created with limited detail (2)</td>
<td>The research plan/methodology does not discuss the treatment/intervention that will be implemented in the research/project OR the development process of design elements that will be created (0)</td>
<td></td>
</tr>
<tr>
<td>Data collection</td>
<td>The research plan/methodology discusses the plan for data collection with enough detail that the research could be replicated. Specific data collection</td>
<td>The research plan/methodology discusses the plan for data collection with limited detail and does not reference similar research (2)</td>
<td>The research plan/methodology does not include a plan for data collection (0)</td>
<td></td>
</tr>
<tr>
<td><strong>Data analysis</strong></td>
<td>The research plan/methodology discusses the plan for data analysis with enough detail that the research could be replicated. Specific analysis methods are referenced by name, and citations of similar studies provided as applicable with a minimum of 1 relevant citation. Analysis also includes possible outcomes and interpretations. (4)</td>
<td>The research plan/methodology discusses the plan for data analysis with limited detail and does not include possible outcomes or interpretations (2)</td>
<td>The research plan/methodology does not include a plan for data analysis (0)</td>
<td></td>
</tr>
<tr>
<td><strong>Timeline</strong></td>
<td>The research plan/methodology includes a timeline with enough detail that the plan could be replicated (4)</td>
<td>The research plan/methodology includes a timeline with limited detail (2)</td>
<td>The research plan/methodology does not include a timeline (0)</td>
<td></td>
</tr>
</tbody>
</table>

**SCI 205 Project/Research Proposal Rubric**

<table>
<thead>
<tr>
<th></th>
<th>Meets expectation</th>
<th>Approaching expectation</th>
<th>No Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Other</strong></td>
<td>The research/project</td>
<td>The research/project</td>
<td>The research/project</td>
</tr>
<tr>
<td>Er (10 Points)</td>
<td>Nces</td>
<td>Proposal includes a minimum of 10 in-text citations across the literature review and methods sections as well as associated references using APA or other consistent citation format (6)</td>
<td>Proposal includes at least 8 in-text citations and associated references using APA or other consistent citation format (3)</td>
</tr>
<tr>
<td>----------------</td>
<td>-------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Writing</td>
<td>The research/project proposal is a cohesive document, free from grammatical and spelling errors, that connects literature and researcher ideas together throughout the literature review, methods section and between the two. This document also includes a conclusion tying the entire proposal together (4)</td>
<td>The research/project proposal is free from grammatical and spelling errors and connects literature and researcher ideas together in the literature review and methods section but not between. This document has a conclusion (2)</td>
<td>The research/project proposal is not a cohesive document connecting literature and researcher ideas together either in the literature review or methods sections. This document does not have a conclusion (0)</td>
</tr>
</tbody>
</table>

G. (Example) Student success data summary
H. Other (as determined by the program)

Faculty CVs:
Resa M. Kelly

Dept. of Chemistry  
San Jose State University  
One Washington Square  
San José, CA 95136  
Office phone: 408-924-4940  
Email: resa.kelly@sjsu.edu

3095 Elk Ridge Court  
San José, CA 95192  
Cell Phone: 408-207-8839  
Email: rmkelly67@gmail.com

PROFESSIONAL PREPARATION

Ph.D. Chemical Education, University of Northern Colorado (August, 2005)  
Dissertation: Exploring how animations of sodium chloride dissolution affect students’ explanations.

M.S. Chemistry, University of Northern Colorado (May, 2004)  
Thesis: The development of a teaching experiment for the isolation and characterization of lactate dehydrogenase.

M.A. Science Education, University of Northern Iowa (August, 2000)  
Thesis: ‘The effects of computer animations on secondary students’ understanding of the crushing can demonstration.

B.A. Chemistry, University of Northern Iowa (May, 1992)

B.A. Psychology, University of Notre Dame (May, 1990)

PROFESSIONAL POSITIONS

Interim Chair Secondary Education, San José State University  
2014-2015

Program Director Single Subject Credential Program, San José State University  
2014-2015

Associate Professor, San José State University  
2011 – present

Program Director Science Education, San José State University  
Summer 2013 to present

Co-Program Director Science Education, San José State University  
2011- 2013

Assistant Professor, San José State University  
2005-2011

Graduate Teaching Assistant, University of Northern Colorado  
2000 - 2002

Chemistry/ Biology Teacher, Valley High School, West Des Moines, IA  
1997 - 2000

Chemistry/AP Chemistry Teacher, Burke High School, Omaha, NE  
1994 - 1997

ADDITIONAL PROFESSIONAL EXPERIENCE

Editorial Advisory Board Member – ACS Textbook – “Chemistry in Context” –  
Provide guidance and feedback to the author team.  
Summer 2014- to present
CSU Digital Ambassador/ Formerly Google CSU Ambassador for San José State University – Selected to work with a cohort of professors from several CSUs with the goal of sharing ways to infuse technology into classroom practices. Spring 2012 to present

Google’s Faculty Institute – Shared and brainstormed on the best practices in the integration of technology across campus in science, math and teacher education curricula to better prepare future secondary STEM teachers in their own classrooms. Summer 2011

NASA LIFT-OFF Program - Develop a creative teacher exchange in diverse communities that supports improved science content knowledge and ability to carry out science inquiry for teachers and students. Spring 2010

ACS National Meeting – Washington, DC Organizer and Presided for the symposium Visualizations in Chemical Education Fall 2009

Science Teacher and Researcher (STAR) Science Education Program Liaison to pre-service teachers involved in STAR Research experiences at Stanford Linear Accelerator Center Summer 2009

Reviewer for Cengage Learning and O’Donnell and Associates Participated in a review of a developing General Chemistry system Summer 2009

Reviewer for Pearson Arts and Sciences Participated in a review program involving videos and visualization in general chemistry. Summer 2009

ACS Committee on Computers in Chemical Education – Attended meetings to promote the use of computers in chemical education 2009- present

Videocases in Science Teaching (Vista) – Santa Monica, CA Participated in an NSF funded study to examine the use of videos of science teachers teaching science lessons and online modules to train pre-service teachers. 2008

Search Committee for Science Education Resource Center Director Served on the search committee to interview candidates applying for the director position. Summer 2008

Transforming Course Design for High Impact Courses – San José, CA As a team member, contributed research experience and knowledge of visualizations in chemistry education to evaluate an online chemistry-learning tool. Spring 2008

Biennial Conference in Chemical Education (BCCE) – Bloomington, IN Presided over the symposium: Organic Chemistry and Visualization. Summer 2008


NSF Appointment - Hiroshima University, Japan Fellowship awarded by the National Science Foundation and Japanese Society for the Promotion of Science to study how Japanese college students learn from molecular animations of salt dissolution. Summer 2004

Facilitator - Projects: Food, Land & People, WILD, Learning Tree, WET Summer 2003
Received training in how to lead workshops, and incorporated WET activities into an ecology course for GK-12.

**Frontiers of Science – Mentor**
Mentored a high school student in ways to characterize the enzyme LDH and presented the results in a poster and an oral presentation.  
**Significant Opportunities in Atmospheric Research – Protégé**
Conducted a qualitative research project to determine the best practices of SOARS as an academic bridge program for students of under-represented populations.

**Computer Animation Software Revision Team Member**
Reviewed software and designed laboratory worksheets to accompany animated labs in a workbook titled “Bridging to the Lab”, which accompanies the textbook, *Chemistry: Molecules, Matter, and Change* by Jones, L. & Atkins, P.

**Gordon Conference, Mount Holyoke College, MA**
Assistant to Dr. Loretta Jones, conference chair.

**OTHER WORK EXPERIENCE**

<table>
<thead>
<tr>
<th>Position</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitness Instructor, Total Corporate Wellness</td>
<td>2010 - present</td>
</tr>
<tr>
<td>Fitness Instructor, Gold’s Gym, Santa Clara, CA</td>
<td>2009 - present</td>
</tr>
<tr>
<td>Fitness Instructor, The Spa, Los Altos, CA</td>
<td>2005 - 2010</td>
</tr>
<tr>
<td>Fitness Instructor, AVAC, San Jose, CA</td>
<td>2006 - 2007</td>
</tr>
<tr>
<td>Fitness Instructor, SJSU Sports Center, San Jose, CA</td>
<td>2005 - 2006</td>
</tr>
<tr>
<td>Fitness Instructor, Better Bodies for Women, Greeley, CO Fitness Instructor, UNC</td>
<td>2002 – 2005</td>
</tr>
<tr>
<td>Recreation Center, Greeley, CO</td>
<td>2001 - 2005</td>
</tr>
<tr>
<td>Fitness Instructor, Workout West, Greeley, CO</td>
<td>2000 - 2003</td>
</tr>
<tr>
<td>Fitness Instructor, Seven Flags and New Image, Clive, IA</td>
<td>1997 - 2000</td>
</tr>
<tr>
<td>Fitness Instructor, Westroads Athletic Club, Gold’s Gym, and Prairie Life Fitness Club, Omaha, NE</td>
<td>1995 - 1997</td>
</tr>
<tr>
<td>Assistant Tennis Pro, Black Hawk Tennis Club, Waterloo, IA</td>
<td>1990 – 1995</td>
</tr>
</tbody>
</table>

**PEER REVIEWED PUBLICATIONS**

Kelly, R.M. (2014) Using variation theory with metacognitive monitoring to develop insights into how students learn from molecular visualizations. Journal of Chemical Education 91(8), 1152-1161.


PUBLICATIONS


CREATIVE PROJECTS – VISUALIZATION TOOLS

Atomic Level Maya Animations (7) of Electrical Conductivity Tests 2012-2013 http://www.youtube.com/channel/UCrv9xrb335OY9M6xqZmVsZQ

Dr. Anne Ion Cartoon Tutorials (5) about Conductivity 2012-2013 http://www.youtube.com/channel/UC0TD5wEcQuf-3EGa_QwGSBg

Technology in an Ideal World – short video conveying technology design and use in the chemistry classroom 2012 http://www.youtube.com/watch?v=mvGDIRpEcEQ

Insights into Conductivity – Electronic Worksheets – Atomic Level Constructions– 2010-2013 Click and drag tool for examining students understanding of atomic level details involved in testing electrical conductivity of a variety of substances. http://chemteam.net/Worksheets/CWorksheetD.swf

Insights into Titration Electronic Worksheet – 2010-2013 Click and drag tool for examining students understanding of atomic level details involved in an acid/base titration. http://chemteam.net/Worksheets/TWorksheet.swf

Dr. Anne Ion’s Insights into Conductivity – an electronic learning tool featuring a cartoon character that teaches about conductivity involving strong and weak electrolytes 2010-2013 http://chemteam.net/conductivity_new/index.php

Dr. NRG’s Insights into Precipitation Reaction – an electronic learning tool featuring a cartoon character that teaches about precipitation reactions with segmented atomic level animations and metacognitive fostering interactive features. 2009-2010 http://chemteam.net/ELT/elt.html

PRESENTATIONS

Gordon Research Conference – Lewiston, ME (invited speaker) 06/2015
Kelly, R. – Exploring a molecular visualization framework that incorporates examining evidence and critiquing models

University of Northern Colorado – Greeley, CO (invited speaker/award recipient) 04/2015
Kelly, R. – The nexus between chemical education research and teaching practice

Kelly, R. – Insights into how students learn from molecular visualizations through the lens of variation theory

ACS National Meeting – Denver, CO (invited speaker) 03/2015
Kelly, R. – How visualizations have affected my work and research

ACS National Meeting – Denver, CO (invited speaker) 03/2015
Jones, L. L & Kelly, R. – Visualization: the key to understanding chemistry concepts

Society for Advancement of Hispanics/Chicanos and Native Americans in Science – Los Angeles, CA (invited speaker) 10/2014
Kelly, R. - Insights into how students learn from molecular visualizations

SJSU Chemistry Department Seminar 09/2014
Kelly, R. – Exploring how general chemistry students learn from molecular visualizations of atomic level conductivity events

ACS National Meeting – San Francisco, CA 08/2014
Kelly, R. – Cross-cultural mentoring as both mentee and mentor: A personal reflection

Stanford Research Institute Seminar, Menlo Park, CA 07/2014
Kelly, R. – Learning from instructors to design atomic level visualizations of chemical events

U.C. Berkeley’s Graduate School of Education’s Monday Colloquium, Berkeley, CA (invited speaker) 04/2014
Kelly, R. – Using metacognitive monitoring to develop insights into how students learn from molecular visualizations

Science and Math Education Center Seminar – Curtin University, Perth, Australia (invited speaker) 02/2014
Kelly, R. – Insights into how students learn from digital molecular visualizations

ACS National Meeting – Dallas, TX 03/2014
Kahraman, S. & Kelly, R. - Insights from an international collaboration: A compilation study that explores learning from atomic level animations across cultures

Sacramento State University Seminar – Sacramento, CA (invited speaker) 11/2013
Kelly, R. – Students’ perceptions of molecular visualization events.

ACS Meeting – Indianapolis, IN 09/2013
Kelly, R. - Electronic worksheets with click and drag features for teaching atomic level details of an acid/base titration

Gordon Research Conference – Newport, RI - Poster 06/2013
Kelly, R. – What are they really learning from cartoon tutorials featuring atomic level animations?

ACS Meeting – New Orleans, LA – Invited Speaker 04/2013
1. Kelly, R. - Enhancing student understanding through the use of atomic level animations: Influences of Mary Nakhleh

Biennial Conference on Chemical Education (BCCE) – Symposium Organizer 07/2012
Kelly, R. - Conduction junction what’s your atomic level function?

International Conference on Chemical Education (ICCE) – Oral Presentation 07/2012
Kelly, R. – A qualitative study informing the design of an electronic learning tool of substances tested for conductivity

CSU STAR Opening Ceremony- Mountain View, CA – Guest speaker 06/2012
Kelly, R. – Infusing technology into existing science lessons

ACS Meeting – San Diego, CA – Symposium organizer 03/2012
Kelly, R. - Visualization design: The goal is clarity, but the challenge is growth

CAL Teach MSTI – Ontario, CA – Guest Speaker 02/2012
Kelly, R. – Innovations in the teaching of chemistry

ACS Meeting – Denver, CO – Invited Speaker 08/2011
Kelly, R. - Embracing an iterative approach in the design of electronic learning tools

ACS Meeting – Anaheim, CA – Oral Presentation 03/2011
Kelly, R. - Analysis of students’ use of an electronic learning tool on precipitation reactions
Purdue University Seminar – Invited Speaker
Kelly, R. - Developing and testing an electronic learning tool about precipitation reactions 10/2010

BCCE – Denton, TX – Oral Presentation
1. Kelly, R. - Bound to fail: Challenges faced in the design of molecular level visualizations 08/2010
2. Kelly, R - Developing electronic learning tools for general chemistry students using qualitative research methods. 08/2010

ACS Meeting – San Francisco, CA – Oral Presentation
Kelly, R. - Developing and testing an electronic learning tool about precipitation reactions. 03/2010

Kelly, R. - Creating an electronic learning tool showcasing the molecular nature of ionic equations and building connections to the macroscopic view of precipitation reactions. 08/2009

ACS Meeting – Salt Lake City, Utah – Oral Presentation
Kelly, R. - Examining chemistry instructors' and general chemistry students' drawn depictions of precipitation reactions to develop a scaffold for visualization design. 03/2009

BCCE – Bloomington, IN – Oral Presentation
Kelly, R. - Examining college students’ drawings of precipitation reactions for insight into visualization design. 08/2008

ICCE – Chemistry in the ICT Age: Virtual Conference on Chemical Education
Jones, L., Tversky, B., Tasker, R., Suits, J., Falvo, D., & Kelly, R. - Designing effective visualizations of molecular structure and dynamics online conference article. 07/2008

IUPAC Meeting – Turin, Italy – Invited Speaker
Kelly, R. - Students’ ability to transfer ideas learned from molecular animations of the dissolution process 08/2007

Gordon Conference – Lewiston, ME – Poster
Kelly, R. - Depicting how experts and novices segment chemical equations 06/2007

ACS National Meeting - Chicago, IL – Invited Speaker
Kelly, R. - Developing Learning Goals for a Chemistry Program and Exploring How to Assess Them 03/2007

NSF Meeting – Arlington, VA – Invited Speaker
Garcia, O., Kelly, R. & Tversky, B. - Depicting Scientific Processes: Cues to Animation Design 09/2006
Kelly, R. - Exploring how animations of NaCl dissolution affect students’ ability to explain a precipitation reaction.

Kelly, R. - Effects of a computer animation on secondary students’ understanding of the crushing can demonstration

Kelly, R. - Exploring how animations of sodium chloride dissolution affect students’ explanations.

Jones, L. L., & Kelly, R. M. - What studies of animations reveal about the gap between teaching and learning.

Kelly, R. & Tanaka, H. - Study of Japanese college students’ learning from molecular animations of salt dissolution.

Kelly, R. & Jones, L. - A qualitative study of how general chemistry students interpret features of molecular animations.


Kelly, R. M. - A study of student learning from molecular animations of salt dissolution.

BCCE – West Lafayette, IN – Invited Speaker

BCCE – West Lafayette, IN – Invited Speaker

ACS Regional Meeting – Reno, NV – Invited Speaker

NARST Annual Meeting – San Francisco, CA – Oral Presentation

Mahidol University - Bangkok, Thailand

Pacifichem Conference – Honolulu, HA – Invited Speaker

ACSNational Meeting – Washington, DC - Oral Presentation

Gordon Conference - Oxford, England - Poster

ICCE – Istanbul, Turkey

Hiroshima University – Hiroshima, Japan – Oral Presentation

BCCE - Ames, IA

08/2006

07/2006

06/2006

04/2006

02/2006

12/2005

08/2005

07/2005

08/2004

07/2004

07/2004
Kelly, R., Duis, J., & Jones, L. Probing students’ misconceptions induced by molecular animations. Oral presentation given by J. Duis.

**ACS Conference - New York City, NY – Poster**
Kelly, R. - An undergraduate teaching laboratory involving the isolation and characterization of lactate dehydrogenase.

Kelly, R. - Master’s (2000) research presented in a poster titled: The effects of computer animations on secondary students’ understanding of the crushing can chemical demonstration.

**AWARDS**

**Distinguished Alumni Award – University of Northern Colorado**
Awarded to an alumna/alumnus who has made significant contributions to the field of Chemical Education Research.

2015

**ACS Innovative Project Award**
Awarded to organize a symposium that will be held in both the United States and Canada to unite the Chemical Societies and foster collaborations on the topic of education for sustainable development and innovative technologies.

Awarded: March 20, 2014; Amount = $5,000.00

2014

**ACS-CEI Award for Incorporating Sustainability into Chemistry Education**
Awarded for work with graduate student Cristina Chang to orient pre-service teachers to climate change/sustainability issues and encourage them to consider relevant ways that sustainability threads could be incorporated in their lessons.

Awarded: Oct. 17, 2012; Amount = $750

2012

**Google Faculty Institute Award**
Awarded to support the development of a project involving an integrative approach to science/math/technology education

Awarded: Sept. 15, 2011 (unrestricted); Amount = $21,000

08/2011

**National Science Foundation - Division of Undergraduate Education (DUE) Course, Curriculum and Laboratory Improvement (CCLI) Phase I Award to fund project, “Design of Electronic Learning Tools to Supplement General Chemistry Experiments” (NSF 0941203)**
The CCLI program seeks to improve the quality of science, technology, engineering, and mathematics (STEM) education for all undergraduate students.

Award start date: Jan. 1, 2010; Award end date: June 30, 2014
Amount = $250,000

01/2010

**Junior Faculty Career Development Grant**
Awarded to support the career development interests of tenure track faculty.

04/2008

**Design Team for General Chemistry – Transforming Course Design**
Stipend awarded for participation as a member of the Design Team.

02/2008
CSU Research Funds Award 11/2006
Awarded to support faculty members in their research endeavors

Individual Professional Development Grant 05/2006
Awarded to support faculty members in their efforts to improve teaching and learning.

SJSU Lottery Grant Recipient 11/2006 & 11/2005
Awarded to support faculty members in their career endeavors.

The Graduate Dean’s Citation for Outstanding Dissertation, UNC 08/2005
Awarded to recognize excellent achievement as a candidate for an advanced degree.

Robert Sund Memorial Award 2002-2003 & 2003-2004
Awarded to an outstanding graduate student with the intent of furthering career in science education.

Jack and Marilyn MacAllister Teaching Education Scholarship 2001-2002
Awarded to a full time graduate student committed to teaching and/or leadership role in K-12 schools.

Who’s Who in America’s Teachers 1996, 1997
Nominated by former students, who were admitted to the National Dean’s list, as “a teacher who made a difference”

Notre Dame Monogram Winner (Varsity Tennis) 1986-1988 & 1990
Endowed with Notre Dame’s varsity athletic insignia in women’s tennis.

SERVICE

National
ACS Division of Chemical Education - Secretary/Councilor of the ACS Division of Chemical Education (2011-2013; 2014-2016); International Activities Committee (2013-2015); BCCE Taskforce (2015); Committee on Computers in Chemical Education (2009-2014) Committee on Computers in Chemical Education Newsletter Editor (2010); Conceptual Exam Committee (2007- 2009)
ACS - Membership Affairs Committee - (2012-2013)

San José State University
Committee on Assigned Time – representative form College of Education (2015)
University Council of Chairs (2014-2015)
SJSU Undergraduate Studies Committee (2008- 2011)
General Education Advisory Panel, Human Understanding (2006-2009)

San José State University – College of Education
Assessment assistant
Single Subject Credential Program Director (2014-2015)

San José State University – College of Science
SJSU College of Science (COS) Curriculum Committee – Chemistry Representative and Science Education Representative (2011-present)
Council of Chairs Committee (2011-present)
SJSU COS Curriculum Committee – Chemistry Representative (2007-2009)

San José State University – Department of Chemistry

**SJSU Chemistry Department:** Assessment Committee – Chair (2013- present); Elections Committee (2013-present); Recruitment (2012-present); BA Advisor (2011-2012); Sub-Committee for the Review of Temporary Faculty (2010-2011); Curriculum Committee (2005-present)

San José State University – Science Education Program

- Program Director (2013)
- Co-Program Director (2011-2013)
- NGSS Workshop Committee (2013)
- NGSS Workshop Director (2013)
- SJSU Science Education Graduate Coordinator (2010-2013)
- Hiring Committee for Science Education Tenure Track Faculty Members (2012)
- Hiring Committee for SERC director (2008)
- Science Education Program Committee (2005-present)

**Additional**

- Panelist for Center on Polymer Interfaces and Macromolecular Assemblies (CPIMA) Career Day (2009)
- Courage to Teach, participant (2005-2006)
- Graduate Committee Student Representative, UNC Dept. of Chemistry and Biochemistry (2001-2004)
- Co-Facilitator, Project WET workshops at UNC (Fall 2003 and Spring 2004)
- Science Fair Judge, Frontier High School (2003)

**PROFESSIONAL ASSOCIATION MEMBERSHIPS**

- American Chemical Society – member 12 years
- Aerobic and Fitness Association of America – member 19 years
ELIZABETH M. MCGEE
Department of Biological Sciences & Science Education
San Jose State University
San Jose, CA 95192-0100
408.924.5277 (voice) 408.924.4840 (fax)
elizabeth.mcgee@sjsu.edu

SUMMARY OF EXPERIENCE
Eighteen years’ experience in developing, implementing and administering large-scale instructional and public outreach programs at San Jose State University and in the greater San Jose area, 15 years’ experience in academic advising for undergraduates in biology and science education; 6 years’ of collaborative research experience in Madagascar, and 5 years’ experience facilitating and teaching short-term study abroad programs in France. Instructional expertise and experience in ecology, evolutionary biology, conservation, biogeography, and biodiversity stewardship with a range of students, including K-12, undergraduate, graduate, and in-service teachers. Strong grant management experience and proven record with private donors and foundations.

EDUCATION
Ph.D. State University of New York, Stony Brook, Anthropology, 1997.
M.A. State University of New York, Stony Brook, Anthropology, 1993.
M.A. University of California, Berkeley, Paleontology, 1989.
A.B. University of California, Berkeley, Anthropology, 1983.

INSTRUCTIONAL, PROFESSIONAL AND ADMINISTRATIVE EXPERIENCE
San Jose State University: 1997 - present

Administrative Experience
Facilitator, Faculty-Led Study Abroad in France, 2010 – present.
Academic advisor, Biological Sciences, 1997 – present.
Director, Biodiversity Center, 2008 – 2013.


Undergraduate Coordinator, Biological Sciences, 2007.

**Instructional Experience**

Professor, Biological Sciences and Science Education, 2010 – present.

Associate Professor, Biological Sciences and Science Education, San Jose State University, 2003 - 2010.

Assistant Professor, Biological Sciences and Science Education, San Jose State University, 1997 - 2003.

**Administrative Community Service**

Executive Director, Youth in Science at San Jose State University, San Jose State University, 1998 - 2010.

Conference Coordinator, Expanding Your Horizons, San Jose State University, 2003-2004.

Treasurer, Expanding Your Horizons, San Jose State University, 2005-2008.

**SAN JOSE STATE UNIVERSITY COMMITTEE SERVICE (STANDING APPOINTMENTS ONLY)**

**University**

International Programs & Students Committee 2009 – 2014.

Instruction & Student Affairs 2009 – 2011.


**College**


College Curriculum Committee, 2002 - 2005

**Departmental**

Retention, Tenure & Promotion Committee, 2010-2013.


REFEREED PUBLICATIONS & ABSTRACTS


GRANTS & AWARDS

Youth in Science at San Jose State University; Grants totaling over $175,000 between 1998 and 2011 from:

Michael Lee Environmental; NASA Astrobiology Institute, Education & Public Outreach (with M. Kress); Hitachi Data Systems & Foundation; Sierra Club Youth in Wilderness (with S.E. Vaughn); Yahoo! Employee Fund (with S.E. Vaughn); Wharton Foundation; Abbott Laboratories; Captain Planet Foundation; Northern California Grantmakers; Synopsys; Jeff and Mary Stai Foundation; Steve and Anita Westly Foundation; Western Digital; United Defense; Siemens Communication; ASPECT; Trimble Navigation; Applied Micro Devices (with S.E. Vaughn); Wells Fargo Foundation; IKOS; Bank of the West; American Association of University Women Community Action Grants.

Biology Research Grants

“Monitoring Change in Rainforest Ecosystems in Ranomafana National Park.” SJSU Junior Faculty Career Development Grant. 2001-2002. $6,481.


San Jose State University Professional Development 2003 - 1997 for a total of $7,310.


Science Education Grants

SJSU Provost’s Curricular Innovation Project “Pre-professional Experiences in Math and Science Teaching (with R. Kelly and C. Roddick), December 2011. $32,000.


Technology Grants


Expanding Your Horizons: Grants totaling $18,000 for 2002 and 2003 were awarded from Abbott Laboratories, Adapted, Lockheed Martin, and Seagate.
EDUCATION

Master of Philosophy, Earth and Environmental Sciences, 1997, City University of New York Graduate School and University Center.


Bachelor of Science, Geology, 1976, with minor concentration in mathematics, and secondary education.

PROFESSIONAL EXPERIENCE
San José State University, Director (2014 – present), Science Education Program. Professor (2008 – present); Associate Professor (2003 – 2008);
   Assistant Professor (1998 – 2003). San José, CA 95192-0102.


The College Board,
   Science Academic Advisory Council Member (2009 – )

TEACHING CREDENTIAL

HONORS, FELLOWSHIPS and GRANTS

SJSU eCampus:  Geology 100W Technical Writing Workshop Online Course Development ($2500, 2005).

SJSU eCampus:  Geology 103 Earth Systems and the Environment Online Course Development ($2500, 2005).

SJSU Center for Faculty Development: Responding to Student Writing Research Support ($1125, 2005).

San José State University Junior Faculty Development Award: Mapping Mono Lake’s Future ($1,180 plus 0.2 release time, spring 2002).

California State University Research Award: GIS Analysis of Geomorphic and/or Archaeological Features in Eureka Valley, CA ($7466.93, 2001-2002 academic year).

NSF Award to Facilitate Geoscience Education: Web-based Geoscience Investigations, ($50,345, 1/1/2001- 12/31/2001)

SELECTED PUBLICATIONS


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5 Paula Messina is one of the forty-one writers who authored NGSS (2011-2013)

CURRICULUM VITAE

Ellen Pletcher Metzger

Department of Geology, San José State University, San José CA 95192-0102
(408)924-5048    Fax: (408)924-5053    Ellen.Metzger@sjsu.edu

EDUCATION

University of New Orleans, B.S. in Earth Science (cum laude), 1977
Syracuse University, M.S. in Geology, 1980
Syracuse University, Ph.D. in Geology, 1984

    Advisor: Gray M. Boone.


ACADEMIC POSITIONS

San José State University, San José, California
    Professor of Geology and Science Education, 1994-present
    Director (2011-present) and Co-Director (1990-2011), Bay Area Earth Science Institute
        Director of Science Education, College of Science, 2008-2011
        Associate Professor of Geology and Science Education, 1989-1994

Stanford University
    Visiting Scholar, January-August 2012
    Visiting Scholar, January-August 2002

University of North Carolina at Wilmington
    Assistant Professor of Earth Sciences, 1984-1989

Colgate University
    Lecturer, Geology, 1983-1984

Syracuse University
Teaching Assistant and Instructor, 1977-1983

HONORS AND AWARDS

Pacific Section American Association of Petroleum Geologists Distinguished Educator Award, April 2013
National Association of Geoscience Teachers Distinguished Speaker, 2005-2008

NASA-American Society for Engineering Education- Stanford Summer Faculty Fellowship at NASA Ames Research Center, 1998

NASA-ASEE Summer Faculty Fellowship at NASA Ames Research Center, 1996
Alpha Delta Kappa Award for Excellence in Education, 1994
California Science Teachers Association Distinguished Science Teacher Award - College Level, 1994
Dean's Award for outstanding contributions as an educator in the College of Science, SJSU, 1992
Woman of Achievement Award in Science and Technology, The Women's Fund of Santa Clara County and the San José Mercury News, 1991

GRANTS

San Jose State University (with Dustin Williams), “Geochemical and Petrographic Investigation of Miocene Volcanic Rocks Near San Luis Reservoir, Central Diablo Range, California”, San Jose State University Undergraduate Research Grant ($997), 2013-2014.
City of San Jose –Silicon Valley Energy Watch (with Eugene Cordero and Elizabeth Walsh, “The Green Ninja Project”, City of San Jose - Silicon Valley Energy Watch ($59,932, 8/1/2013 to 12/31/2014)
Chevron, Intel, and other sources, Support for the Bay Area Earth Science Institute ($306,482), 2005-2013
NASA (with C. Schmidt), "NASA Earth Science for Teachers" ($187,677), 2005-2009
National Science Foundation (with R.L Sedlock), "The South Bay Geo-Diversity Project: Phase II," ($58,584) 2006-2007
NASA Joint Research Interchange (Hector D'Antoni PI), "Hindcasting Ecosystems II"
($25,507), 2005-2007
National Science Foundation (with R. Sedlock), The South Bay GeoDiversity Project
($161,436), 2003-2006
National Science Foundation (with R. L. Sedlock), "OEDG: South Bay Geo-Diversity
Project" ($70,800), 2003-2004
National Science Foundation (with R. L. Sedlock), "South Bay Geo-Diversity Project"
($70,800), 2003-2004
Santa Clara Valley Water District (D. W. Andersen, PI), "Study of Mineral Distribution in the
Santa Clara Valley Groundwater Basin, California" ($42,070), 2001-2003
Science Foundation Metzger, E. P. (with Richard Sedlock and Sharon Parsons), "The
Geo-Connect Project" ($835,000 for 5 years, ended after 3 years due to unforeseen
circumstances: final award $374,640), 1998-2003
California State University Research Funds, "Mineralogy and geochemistry of Tertiary
volcanic rocks in Henry Coe State Park, California" ($4,995), 2001-2002
University of California Berkeley (with R. L. Sedlock), "Sun-Earth Connection with the Bay
Area Earth Science Institute" ($39,998), 2000-2001
Santa Joint Research Interchange, NASA Ames Research Center Metzger, E.P.,
"Astrobiology: Rapid Rates of Change" ($10,000), 2000-2001
NASA Headquarters, Metzger, Project ALERT (Augmented Learning Environment for
Renewable Teaching) ($47,964), 1998-2001
Chevron (with Richard Sedlock), funds to support the Bay Area Earth Science Institute,
Chevron ($20,000), 1999-2000
NASA Headquarters (via CSU Long Beach),"The ALERT Project" ($15,988), 1999-2000
American Geological Institute (R. Sedlock., PI),"Professional Development Training for
EarthComm" ($40,000), 1998-1999
Chevron Corporation, funding for Bay Area Earth Science Institute ($10,000), 1998-1999
Diffraction Parameters for the Design and Operation of a Planetary-Surface Rock Analyzer"
($12,000), 1994-1995
National Science Foundation (with D. Harden, R. Sedlock, S. DeBari, J. Mehegan, W.
National Science Foundation, (E. Geary, PI), "San Francisco Bay Area Earth Science
Workshop for Junior and Senior High School Educators" ($234,535), 1990-1994
NASA-Ames University Consortium Office, Joint Research Interchanges Program
“Development of Analytical Techniques for the Geological and Exobiological Exploration of
Mars" ($7,978) 1994

AREAS OF SPECIALIZATION

Geology: Mineralogy, Geochemistry, Metamorphic Petrology
Publications

Book


Journal articles/book chapters


41. Sedlock, R. L. and Metzger, E.P., 2000, How scientists can reach teachers: Geotimes, v. 45, no. 9, p. 22-23


**Published Abstracts - Last 10 years only (+ 35 additional abstracts)**

* Indicates student author


.Cordero, Eugene, Metzger, E.P., and Smith, Grinell, 2013, Promoting action on climate change through scientific storytelling and the Green Ninja Film Academy, Abstract ED13B-0771, presented at the 2013 Fall Meeting, American Geophysical Union, San Francisco, California, 9-13 December.


Smith, G., Schmidt C., Metzger, E.P. and Cordero, E.C., 2012, Improving 6th Grade climate literacy using new media (CLINM) and teacher professional development, Abstract # ED11E-02, 2012 Fall Meeting, American Geophysical Union.


Sedlock, R., Metzger, E., and Johnson, D., 2006, A unique partnership to promote diversity in the Geosciences, San José, California, Eos Transactions, AGU, v. 87, no.52, Fall Meeting Supplement, Abstract ED33C-05.


INVITED PRESENTATIONS

“Weaving Sustainability into Your Curriculum,” 1-hour workshop for San José State University faculty, April 2013.
“A Tale of Two Tsunamis - Is the West Coast of the USA Next?,” 2006 Joint Annual Conference of the National Society of Black Physicists and the National Society of Hispanic Physicists, San José, February 2006.
“Geochemistry of mafic rocks in the Chiwaukum Schist of the Cascades core and possible correlatives: tectonic implications for the North Cascades,” Geological Society of America Cordilleran Section Meeting, Corvallis, OR, May 2002
“Forces that Shape the Bay,” Bay Area Science Project, Lawrence Hall of Science, Berkeley CA, August 2002.
“A Mineralogist’s View of Mars,” CSU Hayward Geology Club, April 1999.
“Coordinating Changes in Earth Science Research and Science Education for the Benefit of Both,” American Geophysical Union Fall meeting, San Francisco, CA (invited paper for a symposium entitled "Research Opportunities in the Solid-Earth Sciences: A Ten-Year Vision" co-convened by the National Research Council, National Science Foundation, and National Academy of Sciences), December 1998.
"Developing Appropriate Topics for the New Pre-Service Curriculum: Earth Science" invited presentation at "Hazard Education in the Curriculum: The Invisible Subject,” a symposium
sponsored by the National Center for Earthquake Engineering Research and the San José Office of Emergency Services, April 1995.
"Geoscience Education for a Changing World," Stanford University, November 1995
“The Bay Area Earth Science Institute: ‘What Can We Do For It and What Can It Do For Us?’”
“Petrology and geochemistry of metavolcanics from the Carolina slate belt, North Carolina:
California State University, Hayward Geology Club, February, 1991

COURSES TAUGHT

Geology: Planet Earth (GEOL 3), Earth Science Teacher Enhancement (GEOL 104), Earthquakes and Volcanoes (GEOL 112), Earth Systems and the Environment (GEOL 103), Fundamentals of Mineralogy (GEOL 120), Petrology (GEOL 122) Geochemistry (GEOL 135), Tectonics (GEOL 127), Advanced Igneous and Metamorphic Petrology (GEOL 213),

Science Education: Secondary School Science (Sc Ed 173; teaching methods for preservice teachers), Science, Society and Sustainability (SCI 255), supervision of student teachers

GRADUATE STUDENT SUPERVISION

M.S. in Geology

Anne Sanquini, Clast Provenance Contraints, Late Cretaceous Pigeon Point Formation, California, 2010
Cynthia Schultz, Metamorphism and Putative Bioalteration of Basaltic Glass, Coast Range Ophiolite, 2009
Pavel Kosovichev, Geology and Geochemistry of Volcanic Dikes in the Pacheco Pass Area California, 2006

MA in Science Education

Ron Hamby, Shaking It Up! Classroom Field Trips Along The San Andreas Fault Zone, 2012
Melissa McCullough, Forestry and the Carbon Cycle: A Standards-Based Thematic Unit for High School Students, 2012
Tamara Osharow, Elementary Students’ Understanding of Rock Cycle Diagrams, 2012
Heather M-Balmer, Using Maps as a Tool for Teaching Sixth Grade Science, 2008
Joan Carter, High School Earth Science Curriculum Incorporating Understanding by Design and Problem-Based Learning, 2001
Suzanne Marden, *Earth Science in Your Neighborhood*, 1999
Mary-Pat Hulse-Ratia, *Meteorology Activities and Resources for an Integrated Science Program*, 1995

**OFFICES and SERVICE in PROFESSIONAL ORGANIZATIONS**

Elected member of the Board of Directors, California Science Teachers’ Association, 2002-2004.
Chair, Geoscience Education Division of the Geological Society of America, 1996-1997

**OTHER PROFESSIONAL AFFILIATIONS**


**RELATED PROFESSIONAL ACTIVITY**

**Conference Organizer**

“Educating for Sustainability”, a half-day conference at San José State University for a diverse group of ~ 50 pre- and in-service teacher educators, K-12 teachers, and education leaders from corporate, foundation and nonprofit sectors, May 2011.
Advisory Board

Member, STEM Leadership Advisory Board, Silicon Valley Education Foundation

**External Reviewer**

National Science Foundation (served on multiple panels for undergraduate and teacher education)
Manuscript reviews for Journal of Geology, Journal of Geoscience Education
Science content reviewer for Earth Science modules, grades 1-5, California Edition of Full Option Science System (FOSS) developed by the Lawrence Hall of Science and published by Delta Education, 2006
Reviewer for California State University Northridge's Earth Science degree program, 1997

Community Outreach

Presented or co-presented numerous Saturday and multi-day summer workshops and field trips that have provided more than 2,000 teachers of grades 4-12 in the Greater San Francisco Bay Area with professional development in earth and space, life, and environmental science.
Cassandra Paul
Assistant Professor of Physics & Astronomy and Science Education at San José State University
One Washington Square · Department of Physics & Astronomy · San José, CA · cassandra.paul@sjsu.edu

EDUCATIONAL BACKGROUND

Ph.D. in Physics, September 2012, University of California-Davis, Davis, California
- Concentration: Physics Education Research
- Advanced to Candidacy Effective March 2009

M.S. in Physics, December 2005, University of Wyoming, Laramie, Wyoming
- Concentration: Astrophysics, Post-Starburst Quasars

B.A. in Physics, May 2002, Oswego State University, Oswego, New York
- Minor in Astronomy
- Honors Program Graduate

RESEARCH EXPERIENCE

Dissertation
Examined instructor-student interactions in the physics classroom; Co-developed computer program called the Real-time Instructor Observing Tool (RIOT) to categorize and record instructor-student interactions during real-time classroom observations; Developed protocol for using this tool, and examined its strengths and weaknesses; Analyzed interaction trends across different instructors, students, curriculum and over time; Investigated the effect of different interactions on student attitudes and student achievement.

Doctoral Research
- Instructor-Student Interaction effect on Student Achievement: Do certain types of interactions correlate with student exam performance? University of California-Davis, 2010-2011
- Instructor-Student Interaction Variability Study: Do instructors have similar interactions with students over the length of the course? University of California-Davis, 2009
- Instructor-Student Interaction Study: What is the range of instructor behaviors in an interactive engagement course? University of California-Davis, 2008

Masters Research

PUBLICATIONS
Peer Reviewed Journal Articles

Conference Proceedings and Bulletins
· Brotherton, M., Cales, S., Ganguly, R., Shang, Z., Canalizo, G., Paul, C., Diamond-Stanic, A.M. Post-Starburst Quasars International Astronomical Union Symposium, Vol.267 (May 2010), pp. 105-105
PRESENTATIONS & ABSTRACTS
Conference & Colloquium Talks

- **INVITED:** “SPOTing each other is a RIOT! – Using observational protocols to support pedagogical success in the classroom” - *California State University – San Marcos*, April 28th, 2015
- **INVITED:** “Adapting the UC Davis CLASP curriculum for use at SJSU” - *California State University – San Marcos*, April 28th, 2015
- **INVITED:** “RIOTing the right SPOT for STEM education reform: How observation protocols can work as a catalyst for reform in Higher Education.” – *University of California – Berkeley*, April 27th, 2015
- **INVITED:** “The Real-time Instructor Observing Tool for Future Teachers” *PhysTEC Conference* Austin, TX: May 19-20, 2014
- **Workshop:** “How interactive is your classroom?” *Astronomical Society of the Pacific – Cosmos in the classroom*, July 2013
- **“To what extent are TAs providing opportunities for students to engage in classroom discourse?”* American Association of Physics Teachers Conference, New Orleans, January 2013
- **“Observing Instructor-Student Interactions using the Real-time Instructor Observing Tool (RIOT)”* University of Washington Physics Education Research Group, June 2011
- **“Effect of TA on Student Achievement in a Reformed Setting”* Mallinson Institute for Science Education, University of Western Michigan, March, 2008

Poster Presentations

- Paul, C., Roseler, K., Ma, C., Lorelli, S. Theisen, C. “Using the Student Participation Observation Tool for Faculty Professional Development” *American Association of Physics Teachers*, San Diego, CA Winter 2015
● Reid, A., Roseler, K., Paul, C. “Examining the Impact of Assessment Format on Student Problem Solving” American Association of Physics, San Diego, CA Winter 2015


TEACHING EXPERIENCE

Assistant Professor
Duties: developed syllabus and all of course lectures; conducted lecture; held office hours; wrote quizzes and exams; graded student work

● “Advanced Natural Science” (SCI 255) San José State University, Spring 2015
● “Methods of Research in Science Education” (SCI 205) San José State University, Spring 2015
● “Theory and Practice in Science Education” (SCI 220) San José State University, Fall 2014
● “Seminar in Science Education” (SCI 285) San José State University, Spring 2014, Spring 2015
● “Secondary School Science” (SCED 173) San José State University, Spring 2013
● “Foundations of Physics” (PHY 2A) San José State University, Fall 2012, Fall 2013, Spring, 2014, Fall 2014
Foundations of Physics Lab” (PHY 2A) San José State University, Fall 2013

Associate Instructor

Duties: independently developed syllabus and all of course lectures; conducted lecture; held office hours; wrote quizzes and exams; supervised graduate student teaching assistants; conducted teaching assistant meetings; oversaw labs and all grading; assigned final grades

“College Physics” (PHY 007) Associate Instructor University of California-Davis, Summer 2008

Co-Instructor

Duties: co-developed syllabus, assessment, and lesson plans with instructor of record; lectured and conducted classroom activities/labs; graded assessments;

- “Teaching Assistant Professional Development” (PHY 371) Co-Instructor at University of California-Davis, Fall 2007, Fall 2008, Fall 2009
- “Astronomy for Teachers” Co-Instructor at University of Wyoming, Summer 2003

Teaching Assistant

Duties: conducted labs and classroom activities; graded exams/homework/labs; held office hours, ran extra help sessions; revised lab manual (Conceptual Physics)

- “Engineering Physics” Teaching Assistant at University of Wyoming, Fall 2005
- “College Physics” Teaching Assistant at University of Wyoming, Fall 2003, Spring 2004
- “Conceptual Physics” Teaching Assistant at University of Wyoming, Fall 2002, Spring 2003

Guest Lectures

- “Introductory Astronomy” Topic: Stellar Evolution; Instructor of Record; Prof. Mike Brotherton; University of Wyoming, Spring, 2006

ACADEMIC SERVICE

Graduate Program Coordinator Science Education Program San José State University (Fall 2014-Spring 2015)

Founder of “Science Education Journal Club” San José State University Spring 2013

Description: interdisciplinary collaboration of faculty, staff & students interested in current science educational research findings

Committees and Organizations

- “Faculty Recruitment Committee” Department of Physics & Astronomy San José State University (Fall 2014-Spring 2015)
“Program Assessment Committee” Science Education Program San José State University (Fall 2014-Spring 2015)
“Assessment Committee” Department of Physics & Astronomy San José State University (2013-present)
“Curriculum Committee” Department of Physics & Astronomy San José State University (2012-present)
“Graduate Education Task Force” University of California-Davis (2011-2012)
Chair of “Chancellor's Graduate and Professional Student Advisory Board” (CGPSA) University of California-Davis (2010-2011)
“Graduate Student Association Executive Council” University of California-Davis (GSA EC) (2010-2011)
“Graduate Council (Division of Academic Senate)” University of California-Davis (2010-2011)
○ Graduate Council Sub-committee: “Administrative Committee”
Duties: deliberated and voted on student appeals regarding admission and qualifying exams
○ Graduate Council Sub-committee: “Graduate Student Welfare Committee”
Duties: brought issues of graduate student concern to larger Graduate Council

Creator and Facilitator of annual “Physics Graduate Student TA Pedagogy Workshop”
Department of Physics & Astronomy San José State University (2013, 2014)
Description: Full-day workshop for all physics graduate students with teaching responsibilities.

Graduate Student Assistant to the Dean and Chancellor
University of California-Davis (2011-2012) Duties: acted as a liaison between administration and graduate student body; organized informational and community events for graduate students;

• Official Organizer for “Week of Orientation and Welcome” (WOW) for new graduate students. WOW Details: Six days of both fun and informative events for over 400 students; organized all of the presentations, and handled all aspects of food, publicity and logistics.

• Official Co-Director for the “Interdisciplinary Graduate and Professional student Symposium” (IGPS) Event Details: campus-wide interdisciplinary with over 150 presenters, and a budget of more than $20,000; Duties: coordinated all volunteer groups, solicited abstracts, assisted in paper selection,

• Effectively changed Graduate Studies policy regarding compensation plan for graduate students

Founder of “Graduate Teaching Community” University of California-Davis Spring 2009
Description: interdisciplinary collaboration of graduate students interested in improving their teaching, learning and educational skills

- **Facilitator of weekly discussions** on college teaching 2009-2010
- **Procured annual funds from Teaching Resources Center** (now: Center for Excellence in Teaching & Learning) for future facilitators of GTC to ensure program sustainability ($1500 annually)
- At year three, GTC has more than two hundred fifty members on list-serve

**Teaching Assistant Consultant Co-Coordinator**, at *University of California-Davis*, 2009-2010

Duties: planned and facilitated weekly TA consultant meetings, paired and scheduled TA requests for TA consultants, engaged in conflict management between TACs

- Effectively changed the term new Teaching Assistant Consultants are introduced from Fall to Spring so that they were more prepared to facilitate the campus-wide TA Orientation

**Teaching Assistant Consultant** at *University of California-Davis*, 2008-2009, 2009-2010

Duties: observed graduate students in the classroom, interviewed students about their graduate student instructors; met with graduate students to discuss their teaching; designed and facilitated professional development workshops, and TA orientation;

- **Facilitator of Campus-Wide Teaching Assistant Orientation** Fall 2008, Fall 2009
- **Workshop Leader:** “**Active Inclusivity: Benefit from diversity in the classroom**” Spring 2010

- **Workshop Leader:** “**Crafting your Teaching Philosophy**” Winter 2010
- **Workshop Leader:** “**Coupling Assessment with Learning Goals**” Spring 2009
- **Workshop Leader:** “**Transitioning from Graduate Student to Professor: Becoming an Engaging Lecturer.**” Winter 2009

**Graduate Student Mentoring**

- **Chair** of Masters Committee: Annie Chase MS Physics & Astronomy *San José State University* Fall 2014-present (Expected Graduation Spring 2017)
- Masters Committee: Dawn Wright MS Science Education Program *San José State University* Spring 2015-present (Expected Graduation Spring 2017)
- **Chair** of Masters Committee: Eric Hickok MS Physics & Astronomy *San José State University* Spring 2014-present (Expected Graduation Fall 2016)
- **Chair** of Masters Committee: Deborah Sater Science Education Program *San José State University* Fall 2013-present (Expected Graduation Spring 2016)
- **Chair** of Masters Committee: Andrew Reid MS Physics & Astronomy *San José State University* Spring 2013-present (Expected Graduation Spring 2015)
- Masters Committee: Saheed Mohamed MS Science Education Program *San José State University* Fall 2013-present (Expected Graduation Spring 2016)
Chair of Master Committee: Kate Nichols MS Science Education Program San José State University Fall 2012, Spring 2013 Graduated Spring 2013
“Teaching Assistant Mentorship Advantage:” Mentor for new Teaching Assistants University of California-Davis, Fall 2010

Undergraduate Student Mentoring
  o SJSU Undergraduate Research Grant Advisor
  o Advisor for AAAS student poster
  o SJSU Undergraduate Research Grant Advisor
  o Advisor for AAAS student poster
  o SJSU Undergraduate Research Grant Advisor
  o Advisor for AAAS student poster
- Undergraduate Research Advisor – Kyle Blyth (Spring 2015)
- Mentor for Undergraduate Students in “Research Experience for Undergraduates” University of Wyoming, Summer 2003 & 2004

Academic Community Positions
- American Association for the Advancement of Science member
- Astronomical Society of the Pacific member
- American Association of Physics Teachers member
  o Physics Education Research Topical Group member
- American Association of Physics Teachers Northern California & Nevada member
- Physics Education Research Job Blog editor (perjobs.blogspot.com) 2011-present

K-12 Outreach
- “Ask an Astrophysicist” Guest Speaker via skype, Fulton Junior High, Fulton NY, Fall 2011
  o Workshop Leader: “Our Extraordinary Solar System” Spring 2006
  o Workshop Leader: “Why don’t the planets fall?” Spring 2005
  o Workshop Leader: “Let’s Travel to a Black Hole!” Spring 2004
- “Gender Equity in Math and Science” Workshop Leader, Loveland, CO 2004
Assisted elementary school students with rocket building, construction in weightlessness environment (SCUBA), astrophotography and data reduction, operating computer controlled rovers
○ Workshop Leader: **Writing Science Fiction** 2004, 2005

**Science Education Teacher Support**

- **“Next Generation Science Standards Workshop”** assistant/facilitator, San José State University, San José, CA (May 5th, 2014 and Nov. 4th, 2013)
  ○ (See also “Astronomy for Teachers” under Teaching Experience)
- **“Sacramento Area Science Project,”** professional development series for high school teachers, *McClatchy High School, Sacramento CA*
  ○ Workshop Leader: **“Beginnings and Structure of the Universe”** (March 6th, 2012)
- **“Science in River City”** professional development series for elementary and high school teachers, *California State University, Sacramento CA*
  ○ Workshop Leader: **“Interactive Astronomy: Moon Phases and Seasons”** Winter 2011
  ○ Workshop Leader: **“Energy Conservation and Energy Transformation”** Spring 2009

**SERVICE IN SUPPORT OF DIVERSITY & GENDER EQUITY Committees**

- **Co-chair of “Graduate Ally Coalition”** *University of California-Davis* (2010-2011)
  Graduate Ally Coalition is an organization of graduate students and staff at UC Davis committed to fostering graduate student community, educating graduate students about the resources available to them, and ensuring accessibility of these services to graduate students of every ethnicity, race, gender, LGBT status, age, ability, etc.
  ○ Organized first annual “**Hungry for Heritage**” and “**International Student Dinner**” events;
  ○ Organized annual “**Graduate Ally Training,**” 2010, 2011 for new members;
  ○ Facilitated bi-weekly discussions devoted to increasing the accessibility of campus resources

- **“Campus Council on Community and Diversity”** *University of California-Davis* (2010-2011)

- **“Graduate Student Retention Task Force”** *University of California-Davis* (2010-2011)

**Guest talks**

- (See also: “Women in Science Day” and “Gender Equity in Math and Science under” K-12 teaching and teacher support)
Invited speaker at “Black Graduate and Professional Students Welcome Dinner,” 2010

Reports and Initiatives
· Presentation to Graduate Council regarding UC Davis Graduate Studies default compensation plan policy for graduate students (June 2011); Standard compensation plan below University of California Office of the President’s calculated cost of living
  Outcome: Minimum graduate student default compensation plan increased above cost of living in Davis, increasing accessibility (effective January 2012)
· Written Report on female pass-rate of UC Davis Physics Department graduate student written preliminary exam (Fall 2009); females fail at higher rate than males
  Outcome: Increased departmental awareness on topic.

FELLOWSHIPS & AWARDS
· Grant Development Institute, San José State University Spring 2013 ($500)
· Dissertation Year Fellowship, University of California-Davis, 2011-2012 ($20,000)
· Best Talk (1st Place) Interdisciplinary Graduate Symposium, University of California-Davis, 2010 ($250)
· Exceptional Poster (3rd Place) Interdisciplinary Graduate Symposium, University of California-Davis, 2010 ($50)
· Katherine Fadley Pusateri Memorial Travel Award University of California-Davis, 2010($600)
· Professors For the Future Graduate Studies Fellowship, University of California-Davis 2009 ($3000)
· Outstanding Graduate Student Teaching Award University of California-Davis 2009 ($250)
· Teaching Assistant Consultant Teaching Resources Center, University of California-Davis, 2008, 2009 ($3000)
· Elbogen Outstanding Teaching Assistant Award University of Wyoming, 2004 ($1600)
· Excellence in Teaching Award Physics Department, University of Wyoming, 2003($100)

GRANTS
· Research, Scholarship, and Creative Activity award: How do educators use the RIOT observation protocol to improve teaching practices? San José State University, Spring 2014 ($5000)
· Undergraduate Research Grants
  o Analysis of instructor perception of Student Participation Observation Tool – Celeste Ma, Spring 2014, ($1000)
  o Instructor observation/reflection pairs constructed through SPOT – Stephanie Lorelli, Spring 2014, ($1000)
Development of classroom interaction data visualization and analysis software – Zairac Smith, Spring 2014, ($1000)

- **Textbook Alternatives Project (TAP), San José State University** Spring 2014 ($1000)
- **PI - NSF PRIME DRL 1337069** Development of a classroom observation format and protocol to assess student participation and interactivity in undergraduate STEM courses Spring 2013 ($249,283)
- Co-author of successful **Department Student Success grant San José State University** Spring 2013 ($20,000)
- **Grant Development Institute, San José State University** Spring 2013 ($500)
- **Innovative Teaching – Course Redesign San José State University** Spring 2013 ($2000)
- Co-author of successful **Undergraduate Instruction Improvement Program Grant**: “Determining the role of TA teaching behaviors on learning outcomes in a large enrollment physics course, part II” PI: David Webb (Physics Faculty), Teaching Resources Center, University of California-Davis, 2009 ($3,153.75)
- Co-author of successful **Undergraduate Instruction Improvement Program Grant**: “Determining the role of TA teaching behaviors on learning outcomes in a large enrollment physics course, part I” PI: David Webb (Physics Faculty), Teaching Resources Center, University of California-Davis, 2008 ($12,147)

**ASTRONOMICAL OBSERVING EXPERIENCE**

**Wyoming InfraRed Observatory (WIRO) Jelm Mountain, Wyoming**
- 2.3 meter Cassegrain
- Duties: Assisted in all operations of the telescope and instruments including; opening and closing the facility; operating the movement of the telescope; instrument preparation (N$_2$ and He cooling); telescope collimation; collecting images
- Observed approximately 20 nights between 2003 and 2005

**Red Buttes Observatory (RBO) Laramie, Wyoming**
- F/8-24 Inch Reflector
- Duties: Assisted in all operations of the telescope and instruments including; opening and closing the facility; operating the movement of the telescope; collecting images; collecting spectra
- Observed approximately 10 nights between 2003 and 2005

**2.1 meter at Kitt Peak Kitt Peak, Arizona**
- F/2.6 2.1 meter Cassegrain
- Duties: opening and closing the facility; operating the movement of the telescope; collecting images
- Observed 4 nights in 2003

**NASA InfraRed Telescope Facility (IRTF) Mauna Kea, Hawaii**
- 3.0 meter telescope
- Duties: collecting images
- Observed 4 nights in 2005
• Observed 2 night (remotely) in 2004
Elizabeth M. Walsh

PROFESSIONAL PREPARATION

**B.S. Chemistry** Harvey Mudd College, Claremont, CA (May, 2004)
**M.S. Oceanography**, University of Washington, Seattle, WA (April, 2006)
**Ph.D. Learning Sciences**, University of Washington, Seattle, WA (June, 2012)
Dissertation: An Examination of Climate Scientists' Participation in Education: Implications for the Teaching and Learning of Socially Controversial Science

PROFESSIONAL APPOINTMENTS

Assistant Professor, San Jose State University 2012- Present
Graduate Research Assistant, Learning Sciences, Univ. of WA 2009 - 2012
Graduate Research Assistant, Oceanography, Univ. of WA 2004 - 2008

RELATED PRODUCTS

Walsh, E.M. and Tsurusaki, B.K. (in review at *Journal of the Learning Sciences*). “Thank You for Being Republican”: Case studies of high school students negotiating political ideologies and scientific evidence for climate change.


OTHER PRODUCTS


SYNERGISTIC ACTIVITIES
The Green Ninja Energy Project. The City of San Jose's Community Energy Champions Grant, September 2013– 2014, $59,949 as co-PI.
Preparing Teachers for Climate Change in the Next Generation Science Standards, California State University Internal Funding Award, 2013, $5,000 as PI.
Argumentation in Climate Change Internet Comments, California State University Internal Funding Award, 2014 $5,000 as PI.
Curriculum Designer and Researcher – Educurious, 2011 - 2012
   Member of R&D team designing problem-based, next generation science and English Language Arts courses for underrepresented students. Facilitated professional development for teachers.
Educational Consultant to Univ. of WA's Program on Climate Change, 2010-2012
   Advised in curriculum creation as part of a NASA Global Climate Change Education (GCCE) grant.

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