

**Center Name:** Catalyst Center for the Advancement of Research in Teaching and Learning  
Math and Science

**Established:** 2009

**Supported by:** College of Natural Sciences and Mathematics (CNSM) and College of Education  
(COE)

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**Director:** Joel K. Abraham, Associate Professor, Biological Science

**Associate Director (CNSM):** Michael Loverude, Professor, Physics

**Associate Director (COE):** Antoinette Linton, Assistant Professor, Science Education

**Year of Last Review:** 2015

**Submission Date:** April 30, 2018

**Report Prepared by:** Joel K. Abraham

## **1) Mission and Goals**

The Catalyst Center for the Advancement of Research in Teaching and Learning Math and Science at California State University Fullerton brings together science and math education experts across two colleges and seven departments to advance the capacity for research in teaching and learning across the entire spectrum of math and science education, from preschool through graduate education and including informal and teacher education. The Catalyst Center is a place where members can reach across disciplines to form new collaborations, receive guidance on their career and research program development, and participate in a learning community of students, postdoctoral scholars, full and contingent faculty, and administrators committed to improving classroom practice, student learning, contributing to the research knowledge base in STEM education, and policies in science and mathematics.

The mission of the Catalyst Center is to provide professional support for CSUF scholars conducting research across three key areas:

- Teaching and Learning in STEM
- Student Academic Experiences in STEM
- STEM Teacher Professional Experiences and Education

Catalyst activities that support the CSUF community and align closely with CSUF Strategic Plan Goals 1, 3, and 4 include:

- Speaker/Workshop Series
- Writing Group for Catalyst Members to Support Publication of Research
- Physical Support for Catalyst Member Research
- Review of Grant and Manuscript Drafts for Catalyst Members
- Development of Cross-departmental Externally-Funded Grant Proposals
- CSUF STEM-Ed Student Professional Development
- Use of Research Expertise to Assist in Improvement of CSUF STEM Education

Revised Catalyst goals were set Fall 2017 with the transition in leadership. Below, a list of AY 2017-2018 goals, and a brief comment on progress towards those goals, are listed.

### **Goal 1: Revise Catalyst Meeting Structure.**

We accomplished this goal in Fall 2017. Prior to the start of the semester we solicited member schedules to find the optimal meeting time. While successful, we plan to solicit this information each semester in future years. We created interest-group meetings around interests of Catalyst member research areas (e.g teacher education, STEM learning and assessment), and solicited member feedback on meeting structure/scheduling at first meeting of each semester. We also recruited members to take leadership duties for these interest meetings, to increase member buy in to the revised structure. We plan to continue with this model, although we may stagger meeting times to better meet member needs.

### **Goal 2: Update and Maintain Catalyst Website.**

This goal has not yet been met, although we have made some progress. After we started revisions to our current website, we learned that it was out of ATC compliance. This led us to halt revisions until we could get support for rebuilding the website on a new platform (OU). Sissi Li (Catalyst Research Fellow) and Joel K. Abraham (Director) recently completed the training for

the new platform, and have begun rebuilding the website. We have already collected revisions to member profiles, and will add this information once the new site is up. We estimate it will be completed by the end of June 2018.

**Goal 3: Continue Development of STEM-ED Student Support.**

Work towards this goal is ongoing. We have assembled a committee of members who have met to start planning a graduate level course in STEM education research theories and methods. Our current plan is to offer a temporary course for students in Spring 2019, and continue working to develop a permanent annual course that can serve students across NSM. Additionally, we have submitted a grant to support undergraduate students in STEM education research (see below). This grant is currently in review; if funded, we will offer stipend and research support to students, as well as support faculty professional development in research-based instructional strategies.

**Goal 4: Restart and Support Speaker/Workshop Series.**

We successfully relaunched the Catalyst Speaker Series and revised the format to appeal to a broader base of CSUF faculty. The event now includes a mix of research and practical workshop activities to support CSUF faculty and lecturers. We have had meetings with the CNSM Dean, Marie Johnson, and the development office to discuss approaches to funding. While we currently have funding through the next few years, we are focused on identifying a sustainable funding model.

**2) Activities**

**Center Specific Activities (Collaborative activities done by Catalyst members to support Catalyst goals or development)**

1. Regular Catalyst meetings (Goal 1: All)
  - A. We held an average of two meetings per month across the last academic year, including general member meetings as well as targeted meetings on Teacher Education, Research in Science Learning and Teaching, and Student Professional Development.
2. Submission of two grants (Goals 3,4: Director Joel K. Abraham, Associate Director Michael Loverude, Catalyst Research Fellow Sissi Li, Catalyst Members Gina Passante, Barbara Gonzalez)
  - A. National Science Foundation, Improving Undergraduate Science Education: Catalyst STEM Education Research Collaboratives (CSERC). *In Review*.
  - B. Institute of Education Sciences: Catalyst STEM Education Research Fellowship. *Not Funded*.
3. Website Transition (Goal 2: Director Joel K. Abraham; Catalyst Research Fellow Sissi Li)
  - A. Attended instructional workshop on new campus website platform.
  - B. Began moving website to new campus web platform to correct accessibility flaws in design (estimated time of completion, June 2018)
    - i. Add new member data and projects to website
    - ii. Add information and project highlights for STEM education undergraduate and graduate students
    - iii. Embed shared calendar for Catalyst events and reservations of Catalyst resources for research
4. Catalyst Speaker Series (Goal 4: All)

- A. Brought invited speakers to campus (one each semester) to lead hybrid research/workshop events for campus researchers and faculty.
  - i. FA 2017 (joint event with Physics): Steven Pollock, *Writing great questions and sparking peer discussion*.
  - ii. SP 2018 Ella Tour, *Helping students to make the most of the primary literature*.

### **3) Organizational Structure and Governance**

The current center leadership group is as follows:

**Director:** Joel K. Abraham, Associate Professor, Biological Science

**Associate Director (CNSM):** Michael Loverude, Professor, Physics

**Associate Director (COE):** Antoinette Linton, Assistant Professor, Science Education

In the current structure the director is supported by one associate director from each college (COE and CNSM). The director is responsible for taking the lead on setting and working towards center goals, organizing subgroups in support of those goals, and serving as the liaison to campus leaders and other centers. The director also serves as PI for most Catalyst center grants. The associate directors serve as liaisons to their respective colleges, assist in planning and leading Catalyst activities, and meet several times a year to discuss center plans and direction. Given the recent changes to the leadership team (see below), we foresee changes to the responsibilities of each member.

### **4) Resources and Sustainability**

The center receives support from campus, and is focused on increasing external support. Per a memorandum of understanding between the Colleges of NSM and Education, there is assigned time for center leadership: 6 WTU for the center director provided by Academic Affairs and 2 WTU for each associate director provided by the Colleges. As of 2017, Catalyst shares assigned space in Rooms MH-531/531A in McCarthy Hall with the Center for Computation and Applied Mathematics (CCAM). Many of the center activities over the past year have been possible through funding from CNSM; those funds have supported travel and food for Catalyst speakers. CNSM has committed to supporting Catalyst speakers and event costs for the next two years while we develop mechanisms to become self-sustaining.

Our major challenge for the center is to obtain additional funding to ensure a sustained funding stream and continue these activities. We have discussed the possibility of redirecting IDC funds from Catalyst proposals back to the center, and have worked on two federal proposals over the past two years. One proposal was not funded, and the other is still in review. Securing additional external funding is a high priority and we anticipate submitting another two proposals over the next academic year. The director has also begun conversations with the development office about the process for securing philanthropic funds, and will continue to work with the office in the coming year. Additionally, Catalyst members have found ways to make use of existing programs and funding sources on campus to help support activity. For instance, the Catalyze Science! program (see below) is funded through Educational Partnerships, a grant funded campus initiative to bring K-12 students to campus for educational experiences.

There are approximately 20 faculty who have participated in Catalyst activities over the past three years, though the core group of participants is about 7-10. Our experience has been that

faculty participation can ebb and flow depending on other factors, including scheduling and other commitments; some faculty have drifted away for various reasons, including changes in their scholarly focus. The schedules of faculty vary considerably, and the rhythms of academic terms are quite different in the two colleges, with COE courses being affected by the student teaching schedule, for example. Conversely, when Catalyst activities align with faculty research interests and needs, members make a substantial investment of time and energy into Catalyst, including grant proposal development and the creation of new campus events like Catalyze Science!

Sustainability is an issue for any center, but the commitments of space, release time, and the dedication of faculty contribute greatly to the sustainability of Catalyst. Success in securing funding to support the speaker series, student scholarships, and support for faculty travel will improve sustainability further.

### **5) Highlights and Accomplishments**

Catalyst, as a center, has had a number of accomplishments in the past three years, and Catalyst members have been active in their research fields.

#### **Catalyst Center Accomplishments and Highlights**

*Catalyst submitted grant proposals to support research and student development.*

Catalyst, as a center, submitted two federal grant proposals (see above) to support student professional development and increase the capacity for STEM education research on campus. While one proposal was not successful, the process sparked the development of new Catalyst activities. One federal grant is still in the review process. If funded, this NSF grant will support the above activities, as well as increase the capacity for STEM education research on campus. NSM faculty will receive support for assessment of classroom teaching strategies, and undergraduate NSM students will receive funding and training for research in STEM education.

1. National Science Foundation, Improving Undergraduate Science Education: Catalyst STEM Education Research Collaboratives (CSERC). 2017. *In Review*.
2. Institute of Education Sciences: Catalyst STEM Education Research Fellowship. 2017. *Not Funded*.
3. Catalyst (Joel K. Abraham and Sissi Li) was awarded a Jr./Sr. grant from CSUF for the project *Characterizing authentic teaching experiences (ATEs) in the CSU system*. Dr. Abraham and Dr. Li identified existing SI program, course-based teaching experiences for STEM majors, and faculty supporting K-12 teaching in STEM departments, and completed a draft survey to send to CSU campuses regarding their support for K-12 teaching as a pathway for STEM students. Data collection will commence by Summer 2018.

*Catalyst hosted two invited speakers this past academic year*

1. October 6, 2017. Dr. Steven Pollock (University of Colorado, Boulder) ran a workshop, co-hosted by the Physics department and Catalyst, on writing effective multiple-choice questions to support peer discussion and instruction. The event was attended by 25 NSM lecturers and tenure-track faculty members, who worked to develop or revise questions for their own courses.
2. April 23, 2018. Dr. Ella Tour (University of California, San Diego) ran a research talk/workshop on integrating primary literature. The research presentation included common student challenges in reading primary literature, and an overview of a successful approach to

help students to learn how to critically engage with the primary literature. The workshop helped faculty identify challenges in papers they use in their course, and supported the development of new approaches to help students. The event was attended by eight faculty members.

#### *Campus and Community Outreach Activities*

On April 20<sup>th</sup>, 2018 the Catalyst Center, in collaboration with Educational Partnerships, launched the first annual Catalyze Science!, an on-campus experience that supports K-12 science education through undergraduate-designed lesson plans. This one-day event serves students at the K-12, undergraduate, and secondary STEM education credential program level. Local middle school students visit campus and participate in different STEM lessons. These lessons, designed and taught by teams of STEM major and minor students at CSUF, highlight topics and research that are central to the STEM programs on campus and incorporate evidence-based teaching practices. All lessons are aligned to Next Generation Science Standards, and thus support visiting K-12 students' science literacy. CSUF credential program students and faculty observe the lessons, and provide detailed feedback to the undergraduate instructors, providing valuable information about how to improve the lesson plans, while also supporting the professional development of the pre-service teachers.

#### **Catalyst Member Research Accomplishments.**

Given that the primary goal of the center is the support of scholarship, one key metric for success is scholarly productivity. Information on publications, presentations, and grant submissions by Catalyst members is included below and in Appendix A. It is important to note that our members would have contributed many of these presentations without Catalyst support. However, faculty affiliated with Catalyst cite the value of the scholarly community and intellectual support, and we structure center activities to help faculty do what they do, more effectively. For the eight Catalyst members who submitted summaries of their activities, the following was accomplished over the period of review (please see Appendix A).

1. Publications: 19 peer-reviewed research publications (with two more in review), 1 peer-reviewed essay, 4 pragmatic publications, and 2 book chapters.
2. Grant Submissions: 3 funded NSF or NIH proposals, 7 funded CSUF/CSU proposals, 5 pending federal proposals, multiple unfunded federal proposals.
3. Presentations and Invited Seminars: Over 30 regional research presentations, over 25 national/international conferences, multiple invited seminars at academic institutions.
4. Members are active in supporting campus and professional organizations and initiatives.

#### **6) Planning and Strategic Outlook**

One of the major challenges for the Catalyst Center is to set goals for the coming years that can be accomplished across a range of funding situations. For instance, the format and scope of the Speaker Series depends not only on current funding, but on stability of funding in the future. The past year has included a number of changes to the structure and activities in Catalyst; now that the leadership team is set, we look forward to our scheduled Strategic Planning meeting in May 2018. Among the goals for the meetings are to assign tasks for the Associate Directors to take over duties from the Director (on sabbatical Fall 2018), set academic year goals for 2018-2019, reflect on the current meeting structure, and plan the fall and spring speakers.