

CSUF

Catalyst Center

**FOR THE ADVANCEMENT OF
RESEARCH IN TEACHING AND
LEARNING MATH AND SCIENCE**

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)
Primary activities within: College of Natural Science and Mathematics and the College of
Education (COE)

Contact Information:

Mailing Address: McCarthy Hall 531, CSUF, Fullerton, CA 92831

Email: gpassante@fullerton.edu

Phone: 657-278-7403

Director: Gina Passante, Associate Professor, Physics

Year of Last Review: 2018

Submission Date: March 13, 2024

Report Prepared by: Gina Passante

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 several colleges and 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. Many of our members have few (if any) colleagues engaging in STEM education research in their departments. The Catalyst Center is the catalyst for communication, support, and collaboration between these faculty who may never have crossed paths otherwise.

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

1. Teaching and Learning in STEM
2. Student Academic Experiences in STEM
3. STEM Teacher Professional Experiences and Education

The Catalyst Center's mission directly supports the following University and College-level goals:

- University Goal 1: Enhance support for student access, learning, and academic success
- University Goal 3: Recruit, develop, and retain high-quality and diverse faculty and staff
- NSM Goal 1: Improve student success
- NSM Goal 2: Support student-faculty research

Activities

To support the mission of providing professional support to CSUF faculty performing research in and adjacent to STEM education, the Catalyst Center has engaged in the following activities since the leadership transition in Spring 2023.

Articulate Center Goals: In Spring 2023, members of Catalyst were invited to participate in brainstorming goals for Catalyst and comment on the activities they would most like to see in the coming year. Many members participated in the asynchronous brainstorming session using Google Jamboard. Comments were anonymous.

Members were asked, "What do you see as the value that Catalyst adds to our campus?" and "What do you hope Catalyst can do for you?" The responses showed three main themes on which Catalyst could focus for the next several years.

1. **Support for Discipline-based education research and STEM education faculty:**
Unstructured opportunities to network, establish interdisciplinary collaborations, and seek

external funding to support those collaborations. (See “Cross-College Collaborations” below for a recent example.)

2. **Support members research students:**

Catalyst members mentor many research students at the undergraduate and graduate levels. These students benefit from cross-departmental support in research methods as they are often some of the only education-based research students in their departments. Members articulated a desire for Catalyst to provide a community of support for student success in science and math education research that goes beyond what is available in our siloed departments.

3. **Supporting faculty in their STEM teaching:**

Many members articulated that we should act as ambassadors for research-based educational methods within our colleges. We know that adopting research-based pedagogical methods enhances student learning outcomes, which will, in turn, promote student success. As many of our members engage in research on the effectiveness of different strategies for teaching STEM, Catalyst is uniquely positioned to support STEM instructors in their teaching.

These three themes were used to prioritize the Center activities in AY 2023-24 (many articulated below).

Cross-College Collaborations: In Fall 2023, Director Gina Passante invited all Catalyst members to meet to brainstorm research collaborations. Six members attended the meeting, and 3 continued to meet and craft a collaborative research proposal. The proposal combined the research interests of two Catalyst members (Amelia Stone-Johnstone, Assistant Professor in Mathematics, and Gavin Tierney, Associate Professor in Secondary Education) and the administrative efforts of Director Gina Passante. The grant entitled “Supporting STEM faculty and student learning of equity-minded and student-centered pedagogy” was submitted to the National Science Foundation’s Improving Undergraduate Science Education (IUSE) program with a budget of \$399,896. It is currently under review. If funded, it would provide the Catalyst Center with the resources to facilitate a multi-year faculty community focused on incorporating equity-minded and student-centered instruction into their courses.

Pursuing research in science and math education: Our 26 members across three different colleges engage in research on the teaching and learning of science and mathematics at various levels. Our members have published over 40 peer-reviewed articles, received funding for more than 29 projects, and mentored more than 40 CSUF research students in the past three years.

Creating Community: Starting in Fall 2023, Catalyst members have arranged for an informal “Coffee Chat” at a member’s convenience. These casual meeting times allow faculty to get to know one another and engage in invaluable informal mentoring, especially to pre-tenured faculty.

Improved Asynchronous Communication: In an effort to improve transparency and information flow, we have supplemented in-person activities with asynchronous communication whenever possible. Our “emails that could have been a meeting” have received high member interaction.

We have also improved communication by increasing our reach. We have added 6 new members to Catalyst, up to a total of 26 currently. Additionally, we have created a secondary membership entitled “Friends of Catalyst” for campus members interested in the activities of Catalyst but do not consider themselves members engaging in STEM-education research. This list was started in Fall 2023 and currently has 9 members.

Revitalize the Catalyst Website: As a Center focused on the scholarship of teaching and learning within science and mathematics, we are uniquely positioned to support CSUF’s STEM teaching community. Our vision for the new website is a place to spotlight member activities, connect members with each other and the public, and communicate the findings of STEM-education research in a way that is easy for instructors to consume and, ideally, use in their courses. Currently, very little has changed on the website aside from some streamlining, mostly on the back end. However, we have a UO Version 4 website under development. Director Gina Passante has attended trainings on this new format and has begun re-envisioning the website and how it can better support our members and the broader CSUF community. Our goal is to have this website launched in Winter 2025.

Catalyst Speaker Series: Catalyst has a history of bringing speakers to campus every semester. With a change in funding for the center, we have opted to reduce the frequency to once a year and promote a member speaker once a year as well. In Fall 2023, we welcomed Dr. Cassandra Paul from San Jose State University, who spoke on “Equitable Grading Research & Practice”. Previously, in Fall 2022, we welcomed Dr. Elizabeth Canning from Washington State University, who spoke on “Instructors as Meaning-Makers: Growth Mindset Messages that Support Stigmatized Students”. Both talks were well-attended by the CSUF community.

Brown Bag Lunches: In Fall 2023, we started a Brown Bag lunch series, inviting faculty to come together to discuss a topic related to STEM education. Fall 2023’s session was titled “Rethinking your grading policy” to build upon Dr. Paul’s Catalyst Seminar weeks prior.

Organizational Structure and Governance

The current center leadership group is as follows:

Director: Gina Passante, Associate Professor, Physics

There is a single Director for the Center. The director is responsible for taking the lead on setting and working towards center goals, organizing activities 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. Prior to Spring 2023, the director was supported by one associate director from each college (COE and CNSM). The associate directors served as liaisons to their respective colleges and assisted in planning and leading of Catalyst activities. Given the change in leadership structure (and funding, as described in the following section), the scope of Catalyst activities needed to change accordingly, with a greater reliance on members volunteering to lead various activities.

Resources and Sustainability

Currently, the Center receives support from the College of NSM to fund a 3 WTU course release for the Catalyst Director. This is a substantial change in support, which has led to a change in the scope and activities the Center can organize. Before AY 2022-23, the assigned time for center leadership was as follows: 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 past Catalyst speakers. We currently have a modest account balance with no promised additional funding. As such, we are budgeting our events accordingly.

Our major challenge for the center is to obtain additional funding to ensure a sustained funding stream to continue our activities. We have discussed the possibility of redirecting IDC funds from Catalyst proposals back to the center and have a current federal proposal under review. The director has also begun conversations with the development office about the process for securing philanthropic funds. 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.

Just as key as financial sustainability, we need consistent membership engagement to sustain the center. As with many communities, we have seen participation in Catalyst ebb and flow over the years, depending on individual member teaching and scholarly commitments. Our large participation rate in asynchronous activities this past year highlights this as a promising way to engage with more of our members while not being restricted by their teaching schedules and other commitments.

Highlights and Accomplishments

Catalyst Center Proposal Submitted

Catalyst, as a center, submitted a federal grant proposal (see above) to facilitate an extensive multi-year professional development opportunity for STEM faculty. If funded, this NSF grant will provide a proof of concept for a model of professional development that supports faculty in making equity-minded, student-centered, and pedagogically-engaging modifications to STEM courses by providing workshops, faculty community support, reflection and iteration, and opportunities to transfer their skills in the design of an Introduction to STEM Education course. This Introduction to STEM Education course will run in NSM and provide a course early in the degree for students considering STEM education as part of their future career, whether that be through a K12 career, academia, or communication within industry.

Increased Membership

Our membership, as indicated by our email list, increased by 30% to a total of 26 in Fall 2023 from three colleges across campus (NSM, CoE, and CBE). We also expanded our reach by establishing a new Friends of Catalyst mailing list with 9 inaugural members.

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. Our members have been extraordinarily productive in publications and grant funding over the past three years. It is important to note that our members would have contributed many of these presentations without Catalyst's 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 12 Catalyst members who submitted summaries of their activities, the following was accomplished since 2021.

1. Publications: 42 peer-reviewed research publications focused on STEM education. (Several of our members also engage in other research pursuits, and publications from those projects are not included here.)
2. Internal Grant funding: 15 proposals funded through CSUF or CSU-wide funds.
3. External Grant funding: Members have served as PIs or key personnel on 14 projects funded through national sources such as the National Science Foundation.
4. Mentoring student research: Members have mentored 30 undergraduate students and 13 graduate students in research relating to education.

Planning and Strategic Outlook

As an established center, Catalyst has seen several changes in leadership and membership shifts over the past 15 years. With each shift, the activities of Catalyst reflect the interests of the currently active core participants. As we look forward, our goals are to **(i) increase the visibility of Catalyst** activities and Catalyst member scholarly and teaching activities, **(ii) create additional engagement** methods for faculty with varied and overburdened schedules, **(iii) support our STEM-education research students** by adding mentorship opportunities and communities of practice, and **(iv) improve STEM instruction** by engaging directly with STEM instructional faculty.

In addition to continuing the current slate of activities, to support the goals listed above, we have the following concrete plans for the next year.

A. Re-envisioned Website

In service of goals (i), (ii), and (iv), we are re-envisioning our website so that it highlights member research, advertises and promotes Catalyst Activities (workshops, talks, events, etc.), and provides an “innovative instruction” corner where our members can share research-supported instructional innovations that faculty can use in their STEM courses. Catalyst members and friends will collaborate to keep the website current and add content monthly on new research results and tips on incorporating innovative teaching methods into science and mathematics courses. These types of asynchronous engagement

opportunities will allow Catalyst members with restrictive schedules to participate in more center activities.

B. Create a community of student researchers:

Student research is a cornerstone of academic life at CSUF, especially within NSM. In direct support of (iii), the Catalyst Center will to apply for NSF funding to better support our student discipline-based education researchers (DBER) through mentorship outside of their home department, training in qualitative and quantitative methods, and support for travel to conferences to present their work. By tapping into the distributed expertise of our DBER faculty, we can provide world-class research mentorship for our undergraduate students.

C. Support STEM faculty by coordinating efforts with other campus teaching resources:

The Faculty Development Center (FDC) provides many workshops and resources to help faculty improve their teaching. Too often, STEM faculty overlook these resources due to a perception that they are not relevant for STEM courses. Beginning in Spring 2024, the Catalyst Center is partnering with the NSM Dean's office to create a faculty learning community for those faculty who have taken the FDC's Equitable Pedagogy Modules. This community will support faculty in taking what they have learned in the modules and applying it to their science courses. Faculty will work together to find authentic opportunities to modify their syllabi and courses to make them more equitable. This will be a trial for future STEM faculty learning communities, which could become a sustainable model for supporting STEM instructors in their teaching.