Promoting Educational Reform through Strategic Investments in Systemic Transformation (PERSIST)

Boise State University

https://ctl.boisestate.edu/wider-persist

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Project Summary

Boise State University's Promoting Educational Reform through Strategic Investments in Systemic Transformation (PERSIST) project is focused on fundamentally changing how STEM courses are taught by applying a change model (Dormant's CACAO Model) to propagate the use of Evidence-based Instructional Practices (EBIP) among STEM faculty, departments, and curricula at Boise State while assessing the impact of increased use of EBIP on student learning and retention. The project uses a range of strategies to reach across college and departmental boundaries to provide leadership for shifting teaching norms to support the exploration and implementation of EBIPs. This includes Faculty Advocates for STEM Transformation (FAST) Team members who are department liaisons and promote dialogue around teaching and learning within their department, Partner Projects where individuals or groups of faculty are empowered to redesign courses to include EBIPs, Communities of Practice to support ongoing use of particular pedagogies, and much more. Project assessment and evaluation activities are measuring institutional changes, supporting pedagogical reform, and driving continuous improvements in teaching. The ultimate impact of the project will be 1) increases in STEM majors and bachelor's degrees, especially among women and other underrepresented groups in STEM, 2) persistence in STEM disciplines, and 3) a university culture that sustains long-term efforts of continuous improvement in STEM pedagogy. Boise State's PERSIST is providing a testing ground for how to drive institutional change in teaching practices.

Project Description

PERSIST is a Boise State project in the National Science Foundation WIDER program, which stands for Widening Implementation and Dissemination of Evidence-based Reforms. WIDER aims to substantially scale up evidence-based instructional practices (EBIPs). WIDER's ultimate goals are improved student learning and retention, and increased number and graduation of STEM (science, technology, engineering and mathematics) majors, including under-represented students. Boise State PERSIST extends WIDER's goal across the university.

PERSIST Vision Statement: The culture of teaching and learning at Boise State will be characterized by

- Ongoing exploration and adoption of evidence-based instructional practices
- Faculty engaged in continuous improvement of teaching and learning
- Dialogue around teaching supported through a community of practice
- Teaching evidenced and informed by meaningful assessment

The fulfillment of this vision will enhance our learning-centered culture and will result in increased student achievement of learning outcomes, retention, and degree attainment; especially among underrepresented populations.

The Use of a Formal Change Model: Affordances and Challenges

In order to accomplish NSF's goal of transforming institutions to support STEM faculty's adoption and use of evidence-based teaching and learning practices[1] at our institution, PERSIST is adapting the CACAO Model for change, a theory-based change model originally developed to support organizational change in business environments.[2] We chose this model in large part because we had campus expertise in it use and our team could see how it would help us frame the work we wanted to do.

The CACAO model has helped frame our work in the following way:

- The model prompted us to be clear about the change we sought, which led us to create a vision statement (below). This allowed us then to use this statement to ground and guide our efforts and also formed the foundation for our communication strategy (see next section for more about this).
- The model led us to collect departmental data which allowed us to see barriers and drivers to achieving the vision at both the departmental and institutional level. While some barriers and drivers are similar across departments, there are many distinct differences between departments. These nuances are significant enough to have guided us to use a combination of strategies, some of which have been tailored to each department.
- The model helped us to identify the different types of actors who needed to be engaged in the institutional transformation process. We have observed that strong departmental opinion leaders and change champions are critical in our efforts. Departments with faculty who can play these roles appear to make more progress toward our vision. The identification of different actors directly impacted our data collection and communication strategy
- The model incorporated useful theories that helped us to see that there are different stages and rates of adoption among individual and groups of faculty. Faculty at different stages have different needs, and strategies should be adopted accordingly to reach different populations of faculty.

However, since the CACAO model was developed to be used in a business setting, we needed to make adaptations for it to work in our academic context:

- The model specifically provides signals for when a leadership team should abandon (or not venture into) a transformation project because it may not be completely successful. In our setting, once you receive funding, you proceed even if the foundational cultural work has not been completed. Further, we see that incomplete progress toward our goal is still progress.

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[1] National Science Foundation. (2006). Widening the Implementation and Demonstration of Evidence-based Reforms: Program Solicitation. Retrieved from https://www.nsf.gov/pubs/2013/nsf13552/nsf13552.htm.

[2] Dormant, D. (2011). *The chocolate model of change*. San Bernardino, CA: Author.

- In a business setting, there are more direct ways to achieve buy-in amongst the employees and others who are impacted by the proposed change. In the academy, the levers of change are subtler and in this context working with tenured faculty requires more time and coaching. Therefore, relationship building, embedding teams within departments, and allowing a higher level of individualization for how the change will proceed are all necessary elements of the transformation process. Here is an example: As part of our efforts to nucleate activity within each department, we engaged a department liaison from each STEM department. These individuals, members of the "FAST team" (Faculty Advocates for STEM Transformation), were charged with communicating information between their department and the larger project, as well as stimulating dialogue and explorations of teaching practices. While the CACAO change model suggested the Leadership Team, as the primary change agents, should create an action plan to help adopters learn about and incorporate changes, we chose to direct action planning at the department level by supporting FAST Team members to work with their chairs and other faculty to create action plans to promote dialogue and exploration within the department around teaching, learning, assessment, and EBIPs.

Project Initiatives

The project uses a range of strategies to reach across college and departmental boundaries to provide leadership for shifting teaching norms to support the exploration and implementation of EBIPs. This includes Faculty Advocates for STEM Transformation (FAST) Team members who are department liaisons and promote dialogue around teaching and learning within their department, Partner Projects where individuals or groups of faculty are empowered to redesign courses to include EBIPs, Communities of Practice to support ongoing use of particular pedagogies, and much more.

Faculty involved in funded projects serve as leaders in stimulating change in the teaching culture within their department or unit. This can include sharing ideas, knowledge, and best practices regarding innovating teaching practice with colleagues and by participating in brown bags, workshops and other venues.

Due to this need for greater attention to relationship building and embedded projects that met the needs of the individuals in the different departments, the communication strategy for the project was of utmost importance. There were several elements of this strategy:

- *Continued, high level engagement:* The leadership team has met nearly every week for four years, facilitating the process of keeping this work "front and center." This also allowed the Deans on the team to integrate the vision message into everything else they did – from working with departments and individual faculty to their work on university-wide efforts (like promotion and tenure policies, faculty offer letter templates, and program review processes). In every setting, campus constituents heard about the PERSIST project and its vision and activities.

- *Department meetings:* The project team met with the faculty of each STEM department to collect data about their perceptions of barriers and drivers pertaining to the change. However, beyond data collection, these meetings served to communicate with all STEM faculty the elements of the PERSIST project and its goals.

- *Calls for projects and funding opportunities:* After articulating our vision of change and collecting data related to faculty's perceptions of barriers and drivers pertaining to the change, we began to identify initial strategies that would help create momentum toward the change. For example, faculty reported "time constraints" as a barrier to change. Thus, faculty were invited to submit proposals outlining projects focused on adopting EBIPs in a particular course or department and then PERSIST would buy the faculty's time so they could complete their project. These "Partner Projects" have engaged over 125 faculty (~30% of STEM faculty), impacting 62 courses and 3,500+ students.

- *Town Hall Meetings:* As the project past its midpoint, the leadership team held town hall meetings to learn from the STEM faculty and administrators where they felt more resources and attention were needed. Once again, while this was advertised and served as a data gathering exercise, it also was a communication event where the faculty were reminded of the PERSIST vision and goals.

Context

For more than a decade, there have been efforts to support effective teaching in STEM at Boise State. Over this time, activity moved from being focused mostly in engineering, to activity which built partnerships between and among faculty and leaders in engineering, math, science, and our Center for Teaching and Learning, and broadened to focus on the success of all STEM students. The most immediate foundation for the current project was laid by focusing on faculty development and course design as part of an NSF-funded STEP award. However, while previous efforts had been focused on specific programs (e.g., faculty learning communities), our current project, PERSIST, focuses on using a change model to shift culture around teaching and learning.

The challenges facing our institution that led to the PERSIST project include low student persistence in STEM disciplines, and high drop, fail, and withdrawal (DFW) rates in STEM courses. The PERSIST team decided to address these challenges by working to create an environment that shifted the dialogue around STEM teaching and learning, and enabled faculty exploration and adoption of evidence-based instructional practices (EBIPs). EBIPs have not only been shown to facilitate learning more effectively, compared to a traditional lecture for students in general, but also significant increases in student success for underrepresented minorities and women have been documented.[3],[4] It has been our goal that these efforts are synergistic with other efforts to support students of diverse backgrounds on our campus.

Prior to the initiation of the current project, the PERSIST project team had built successful working relationships in the context of a number of other initiatives, including STEM student success efforts, as well as campus general education reform. The team was originally comprised of the Director of the CTL (and faculty in chemistry), the Deans of Arts & Sciences and Engineering, and faculty/staff

[3] Snyder, J., Sloane, J. D., Dunk, R. D. P., and Wiles, J. R. (2016). Peer-led team learning helps minority students succeed. *PLoS Biology*. Retrieved from http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1002398

[4] Rath, K. A., Peterfreund, A., R., Xenos, S. P., Bayliss, F., and Carnal, N. (2007). Supplemental instruction in introductory biology I: enhancing the performance and retention of underrepresented minority students. *CBE- Life Sciences Education*, 6, 203-216.

from geosciences, psychology, and mathematics. In addition, the team welcomed a colleague from our "Organizational Performance and Workplace Learning" program with expertise in the change model we selected for our project. Over time, we added a Project Manager to the leadership team. Department chairs and faculty members have been engaged in the transformation through various project-related activities (see below).

Beyond the team composition, the strong relationships built prior to the start of this project have helped keep the project team engaged for the past four years. Further, the fact that the project team included several institutional leaders, who are well respected on campus, created initial momentum, which also helped to keep the project team motivated. Lastly, all project team members view the work being done on the project as critical to the university's success and therefore, it is naturally part of their role at the institution to contribute to the project and sustain engagement.

Evaluation

Faculty Practice

We survey faculty annually to track faculty teaching practice, indicators of institutional climate, and individual's stage of EBIP adoption using the following instruments: the Postsecondary Instructional Practices Survey (PIPS)[5], the Current Instructional Climate Survey (CICS), and the EBIP Adoption scale. The latter two instruments were developed as part of our project. Four years of data for PIPS and CICS show positive trends in changes to faculty practice; the EBIP adoption scale has only been used once so far. Finally, we are also using the Classroom Observation Protocol for Undergraduate STEM (COPUS)[6] to collect snapshots of current teaching practices. COPUS data, thus far, show that on average faculty are using active learning for 37% of the time in a given class period.

Student Success

We use institutional data and reports to assess the overall impact on student success with an emphasis on underrepresented minorities and women. Common measures of student success include Drop, Fail, and Withdrawal rates, pass rates between critical course sequences, student persistence within disciplines, retention, and degree attainment. For example, Computer Science (CS) faculty incorporated Team-based Learning (TBL) into the first introductory course in a three-course sequence. With the help of the Data Team (a collaborative multi-unit team created by this project and charged with helping faculty assess teaching) we were able to demonstrate increases in student success. The adoption of TBL in CS resulted in nearly a 10% increase in pass rates as well as a 12% increase in pass rates for the subsequent course in the sequence for students who had the TBL classes compared to those students who did not. These results led all other faculty who teach in the course sequence to incorporate TBL in their courses. In addition, assessment of a project to reform Calculus I yielded decent gains in post calculus retention for students who took the reformed Calculus courses. These gains were especially prominent among women and URM students in

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[5] [3]Beach, A. L., Henderson, C., Walter, E. M., & Williams, C. (n.d.). *Post-secondary Instructional Practices Scale* (NSF #1256505). Kalamazoo, MI: Western Michigan University.

[6] Smith, M. K., Jones, H. M., Gilbert, S. L., & Wieman, C. E. (2013). The Classroom Observation Protocol for Undergraduate STEM (COPUS): A New Instrument to Characterize University STEM Classroom Practices. *CBE- Life Sciences Education, 12*, 618- 627.

STEM fields[7]. These results indicate that our project is not only addressing student success rates, but it is also creating classroom conditions that support diversity and inclusion.

Institutional Culture around Teaching

In addition to the framing of our project that emerged from the CACAO Model, we have also used the four-quadrant model (Henderson, Beach, and Finkelstein, 2010)[8] to help us consider the strategies we are using. This analysis revealed that we had relatively few strategies that were related to policy which subsequently led the team to discuss the impact of current policies as they related to our vision and identify additional strategies focused on aligning institutional policies and our project goals.

Changes in institutional policies and procedures now provide evidence of our project's impact on the institutional culture around teaching. For example, new faculty candidates in engineering, science and math are now specifically asked about their current teaching practices and experience with EBIPs. Further, all offer letters for tenure track faculty members now include the following: "Faculty members are expected to adopt evidence-based instructional practices, develop and demonstrate twenty-first century teaching methodologies…" And finally, one college has revised their tenure and promotion policy to require the departmental review process to incentivize and reward experimentation with and implementation of EBIPs, and other colleges are beginning to follow suit.

Challenges

Maintaining Momentum

The CACAO model uses Rogers' *Diffusion of Innovation* to describe how the adoption of innovations spreads through a population starting with innovators, then early adopters, early majority, late majority, and finally reaches the traditionalists. Further, the CACAO model builds on Rogers' Diffusion of Innovation to describe the typical stages through which individuals move as they adopt a change: awareness, curiosity, mental tryout, hands-on tryout, and finally adoption/use. The first few years of our project seemed to connect most easily with faculty already in the mid-late stages of adoption. Currently, our team is focused on reaching those faculty in the awareness and curiosity stages to support their movement to the next stage. It is challenging to identify and implement strategies that specifically focus on moving faculty along the adoption curve who are not engaged by our vision for teaching and learning. While some are resistant, there are many that simply chose to put their time and effort into other faculty activities.

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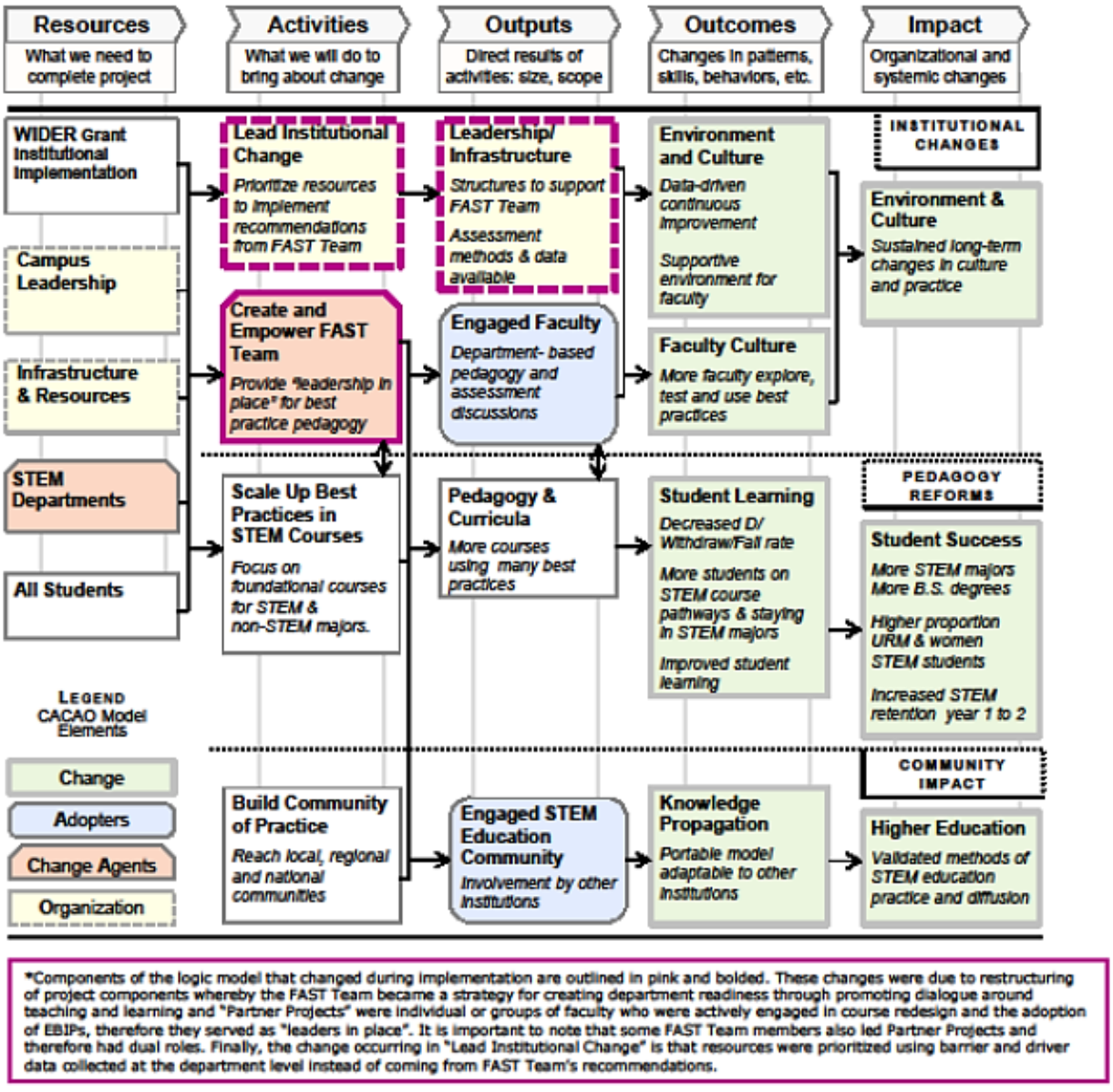
[7] Bullock, D., Callahan, J., Cullers, J. (2017). Calculus Reform -- Increasing STEM Retention and Post-Requisite Course Success While Closing the Retention Gap for Women and Underrepresented Minority Students. Paper presented at 2017 American Society for Engineering Education Annual Conference. Columbus, OH.

[8] Henderson, Beach, & Finkelstein. (2010). Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature, *Journal of Research in Science Teaching, 48*(8), 952-984.

Sustainability

In addition, we are committed to continue our efforts and maintain momentum toward our goals, which requires components of our project to be institutionalized. At this point we have been successful in institutionalizing parts of our project, specifically programing that targets various stages of adoption; for example, the CTL will take over the administration of our teaching visits program which targets individuals in the curiosity and mental tryout stages by providing faculty an opportunity to watch one of their colleagues teaching with EBIPs. However, there are other important components of the project that we are still working to institutionalize (e.g., how to incorporate student success reports created by the Data Team into the institution's Program Assessment efforts).

Figure 1. Logic Model for Boise State PERSIST incorporating CACAO Change Model



*Components of the logic model that changed during implementation are outlined in pink and bolded. These changes were due to restructuring of project components whereby the FAST Team became a strategy for creating department readiness through promoting dialogue around teaching and learning and "Partner Projects" were individual or groups of faculty who were actively engaged in course redesign and the adoption of EBIPs, therefore they served as "leaders in place". It is important to note that some FAST Team members also led Partner Projects and therefore had dual roles. Finally, the change occurring in "Lead Institutional Change" is that resources were prioritized using barrier and driver data collected at the department level instead of coming from FAST Team's recommendations.