

EXECUTIVE SUMMARY: FINAL EVALUATION REPORT

SAGE 2YC: FACULTY AS CHANGE AGENTS

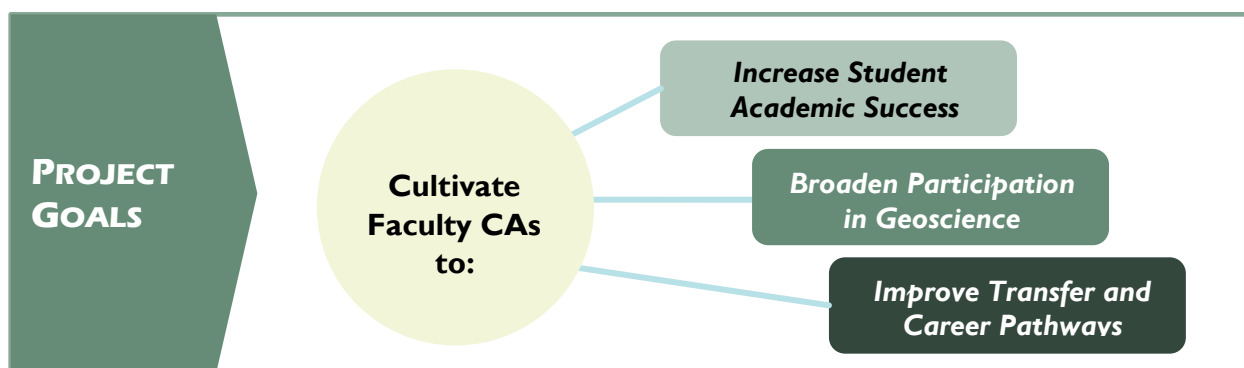
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The *Supporting and Advancing Geoscience Education in Two-year Colleges: Faculty as Change Agents* (SAGE 2YC) project sought to engage faculty in changing and improving geoscience education to increase student success in community colleges. Through a strategically designed professional development (PD) model, faculty change agents (CAs) implemented change through their own efforts and through networking with other CAs to form a community of practice (CoP) dedicated to change. SAGE 2YC also focused on developing CA faculty leadership, implementing and scaling evidence-based educational practices, and building a national network of community college geoscience faculty. The three goals articulated consistently by project leaders to guide the project are:

- 1) build a sustainable national network of 2YC faculty CAs who catalyze change at multiple levels, from the micro-level of their courses to the mid-level program/departments to the macro-level of colleges and regions, as well as the profession;
- 2) implement high-impact practices aligned with three main areas of change (supporting student success, broadening participation, and facilitating students' professional pathways); and
- 3) investigate PD models for 2YC geoscience faculty that promote a reflective cycle of innovation.

In addition to developing faculty CAs, the project facilitated faculty engagement in leadership at the program, campus, and regional levels. An important element of SAGE 2YC was the engagement of campus administrators to help cultivate and scale practice changes focusing on 1) improving teaching and learning to increase student academic success, 2) broadening participation in geoscience education (as integral to improving STEM education), and 3) enhancing students' pathways to transfer and career opportunities in the geosciences or geoscience-related employment.

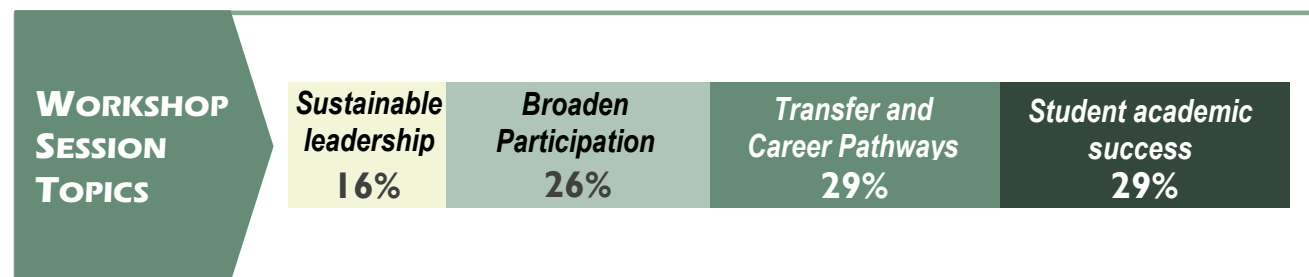


The PD model for SAGE 2YC evolved through a continuous cycle of planning, implementing, learning, and improving. This iterative process encouraged feedback loops to bring about change in practice, including scaffolding evidence-based change; promoting and supporting CoPs; forming and growing a practitioner-centered network; leading regional workshops and annual meeting workshops; gathering data and curating results on course success rates; and deliberately exemplifying and disseminating lessons learned to help scale systemic improvements to community college geoscience education.

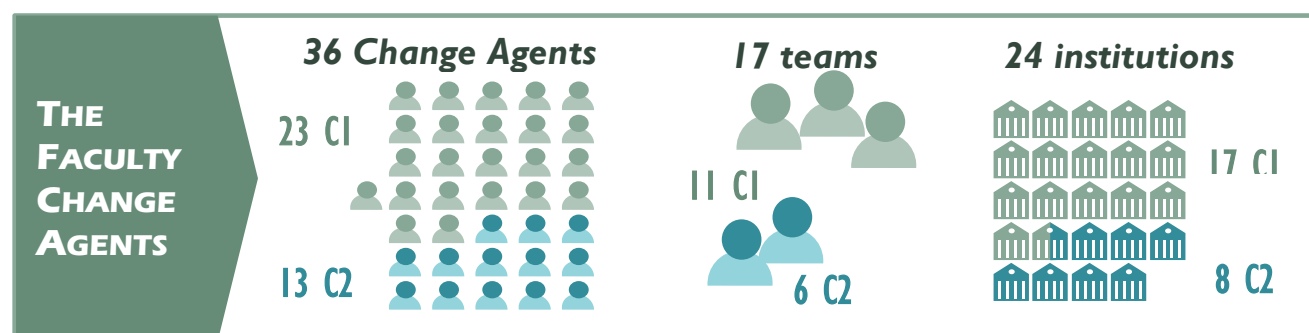
THE FACULTY CHANGE AGENTS

Two cohorts of faculty CAs were recruited during initial funding period of the SAGE 2YC grant, with cohort 1 recruited at the beginning of the grant in 2015 (some of these individuals were identified when the proposal was written), and a second cohort recruited approximately two years later, in 2017. This recruitment strategy meant the first cohort had approximately twice the time of engagement in SAGE 2YC as cohort 2, plus the format for cohort 1 was a mix of in-person and virtual modalities while cohort 2 was primarily virtual. Since these two cohorts were formed, a third cohort was recruited through a supplementary NSF grant, but this evaluation report focuses on the first two cohorts only.

The PD model for SAGE 2YC was comprehensive and multi-faceted for both cohorts, but there were some important differences between the two. Some changes were anticipated to the PD for cohort 2 from the start of the project but some emerged through lessons the project leadership team learned in working with cohort 1. This first cohort participated in PD that used face-to-face (f2f) and virtual modalities whereas the PD for cohort 2 was primarily virtual, with one f2f workshop at the end of the grant. The PD for cohort 1 included four multi-day f2f workshops (most in the summer), a culminating f2f workshop, and virtual activities (e.g., book discussions, journal clubs, and implementation groups) each fall and spring. By comparison, the PD for cohort 2 included a fall and spring virtual workshop (with both synchronous and asynchronous work) in their first year, virtual activities with cohort 1 in their second year, and finally, the culminating f2f workshop with cohort 1 at the conclusion of their time in the grant. Campus administrators also participated in the summer f2f workshops. In addition, each year CA teams met virtually with the leader team to discuss action plans, and they had the opportunity to attend workshops offered by the SAGE 2YC project at professional society meetings. The CAs also led one-day regional workshops that taught geoscience educators about evidence-based practices to improve student success in their settings.



Looking at cohorts 1 and 2, we documented a total of 36 faculty CAs affiliated with 17 teams located in 24 community colleges in 12 states. Though the project experienced a modest amount of turnover when the two cohorts formed (more so with cohort 2 than cohort 1), we saw little or no turnover once the cohorts solidified. Cohort 1 was larger than cohort 2, with cohort 1 having 23 faculty CAs affiliated with 11 teams, and cohort 2 having 13 faculty CAs associated with 6 teams.



MAJOR INTERNAL EVALUATION RESULTS

The internal evaluation focused on questions dealing with changes that CAs made in programmatic, institutional, and regional practice. This aspect of the evaluation asked how adjustments made by the CAs aligned with SAGE 2YC program themes and activities, and the extent to which CAs attributed changes to the PD and program elements associated with SAGE 2YC. What contextual adaptations were made by the CAs to bring about changes in their practice was also documented, as well as their attitudes toward those changes. The following major findings stand out as especially important to the internal evaluation.

- The CAs began the project from their own starting points, with several having backgrounds in prior PD workshops (e.g., the first SAGE 2YC grant) but some having little experience with PD or working closely with other faculty in a project like SAGE 2YC. These differences contributed to how the CAs implemented their action plans to reach their desired outcomes. Ultimately, all CAs reported making changes in their own instructional practice, and they also encouraged other geoscience faculty on their campuses or in their regions to adopt evidence-based strategies directed at increasing student success.
- Classroom observations of cohort 1 CAs using the Reformed Teacher Observation Protocol (RTOP) revealed shifts toward student-centered practice, and these findings aligned with instructional practice results reported by CAs in surveys designed by the project leaders and Evaluation and Research team members. In addition, CAs from both cohorts reported higher levels of interaction with others to implement practice changes relative to their peers on the *National Geoscience Faculty Survey*.
- Changes that the CAs made to departmental and programmatic practices were well aligned to the major themes and elements of SAGE 2YC, such as integrating meta-cognition, using active learning in geoscience courses (e.g., field trips and laboratories focusing on current issues) and engagement with diverse scientists to promote enrollment. By the end of the grant, the majority of CAs reported using data to improve their practices, attributing the SAGE 2YC grant with inspiration for the adaptations they were making in their classrooms and institutional contexts.

MAJOR RESEARCH RESULTS

The research component of the SAGE 2YC project focused on two major questions. The first question asked how CAs thought of themselves as leaders of change during the SAGE 2YC grant. To this end, we sought to understand the role of context in the change process, and differences between cohort 1 and 2 in leadership development. To gain a deeper understanding of faculty development, we also studied factors that contributed to these differences. The second major question focused on influences of CoPs on CAs' attitudes, beliefs, knowledge, and practices, and how innovation was shared through CoPs associated with both cohorts. Major findings related to these research questions follow.

- Using the Bolman and Deal leadership questionnaire to gather self-report data on leadership at two points in time, with the first time being relatively early in each cohort's participation in SAGE 2YC (in spring 2016 for cohort 1 and fall 2017 for cohort 2), and the second administration being in summer 2019 near the end of the project. Comparing these two administrations, we found CAs in both cohort 1 and 2 reporting a

preference for using a multi-framed approach to leadership by the summer of 2019. In using a multi-framed approach the CAs were able to use different leadership perspectives to motivate and engage their colleagues in practice changes associated with their team's action plans.

- The CAs stated the adoption of evidence-based practices increased their confidence in sharing what they learned about working with others. These experiences contributed to their being able to see themselves grow as faculty leaders, with some CAs taking on formal assignments as department chairs or mentoring to help others learn and change their practices. The grant also contributed to increased regional and professional engagement among geoscience educators that was facilitated by the PD model. For example, the regional workshops and opportunities to participate in professional associations enabled CAs to grow CoPs that were part of the evolving SAGE 2YC network.
- Some CAs reported their understanding of community college functions and change initiatives within their colleges was strengthened through the support of campus administrators. Intentionally involving administrators in SAGE 2YC opened doors to knowledge that the CAs did not have about how their colleges work and how their contributions could be part of larger reform efforts. Interestingly, subtle differences in leadership between cohort 1 and cohort 2 emerged in this aspect of the project. More cohort 1 CAs adopted a multi-framed approach to leadership and also moved into more formally named leadership positions than cohort 2, possibly because of their longer affiliation with the grant. However, by the end, a majority of cohort 2 CAs also identified themselves as using multiple leadership frames.
- CA confidence grew in their ability to change, as well as their commitment to and sense of agency in making changes, helping them envision themselves as faculty leaders on their campuses, in the region, and among other professionals. Qualitative data confirmed some CAs engaged actively as faculty leaders on their campuses, which manifested in different ways. This type of mid-level, multi-framed leadership is increasingly important as community colleges face growing complexities, including this time when the health crisis of COVID-19 is spreading nationwide. Through SAGE 2YC, CAs were better prepared to assume leadership roles in their increasingly complex college contexts (Garza Mitchell & Amey, 2020; Iverson, Bragg & Eddy, 2020).

MAJOR EXTERNAL EVALUATION RESULTS

The last component of the Evaluation and Research team's work focused on external evaluation that addressed questions dealing with implementation of the PD model, implementation of geoscience course changes and student success in changed courses, and evolution of the SAGE 2YC network. Major results pertaining to these questions include the following:

- Intentionality was present in conceiving and implementing the PD model from the beginning, but there was also considerable evolution of the model as project leaders and faculty CAs learned about evidence-based practices and deepened in their experience with implementation of reforms. Key elements such as the cohort and team structure; deliberate and consistent focus on instructional strategies, broadening participation, and pathway progression; implementation of regional workshops and

professional associations; and engagement in data-utilization were critical to the model. A high level of implementation of these elements was evident in the CAs practices and in their self-perceptions of how they were growing and changing as faculty leaders (i.e., change agents) throughout the project.

- The regional workshops drew participants from other 2YCs and educational institutions (K-12 education, universities) in their areas of the country. The majority of CA teams reported using at least one regional workshop to strengthen connections to four-year colleges and universities (4YCUs). Improving transfer and career pathways for students was an important focus of these workshops, coming later in the sequence of regional workshops that often started with evidence-based strategies to improve classroom instruction. Half of the CA teams also reported participation by industry professionals, and a smaller set of CA teams reported registrations by high school instructors that they believed helped to strengthen secondary-to-postsecondary geoscience connections.
- Nearly 300 geoscience course sections were changed on campuses associated with SAGE 2YC by the end of the grant. Almost all changes were made to course sections taught by the CAs rather than course sections taught by non-CAs (who were informed about evidence-based strategies). Changes in practice reported by the CAs included metacognition, active learning, group learning, career connections, and various other reforms. More course section changes were made by cohort 1 than cohort 2, probably due to their longer involvement in the SAGE 2YC project, but substantial proportions of course sections were changed by cohort 2 CAs as well. By the end of the grant, the course sections changed by the cohort 1 and 2 CAs totaled nearly 5,000 student enrollments (approximately 4,300 for cohort 1 and 700 for cohort 2).
- Results pertaining to geoscience course success rates revealed a 5% increase (68% to 73) in the geoscience course success rate (completion with C or above) from year 2 to year 4 for cohort 1. For cohort 2, the overall course success rate was substantially higher than cohort 1 from the start of the grant and this higher rate continued into the second year. In the two years cohort 2 participated in the grant, 90% of students successfully completed their course section in year 3 and 87% successfully completed their section in year 4. In the time each cohort had in the grant, the overall average course success rate for cohort 1 was 71% (over 3 years data were collected) and 88% (over 2 years of data collection) for cohort 2. The reason for this 17% difference is unknown and may have more to do with factors outside than inside the grant, and more research is needed to address this important question.
- Examining course success rates by student sub-groups revealed additional important findings. For cohort 1 from year 2 to year 4, the course success rate rose 7% for females, 12% for racially minoritized students, 9% for non-traditional age students, and 8% for Pell-eligible students. For all groups except the racially minoritized group, the average course success rate approximated or exceeded the overall course completion rate by year 4 of the grant. For the racially minoritized group, the course success rate closed to a gap of 7% by year 4 (64% for the racially minoritized group in year 4 compared to 71% for overall success).

- For cohort 2 the course success rates for females and Pell-eligible students were comparable during the two years in the grant, with both groups showing high course success rates near the overall course success rate of 87%. In addition, results for two other sub-groups are especially important to note, with data showing the success rate of racially minoritized students increasing by 8% over two years, from 82% to 90%, and for non-traditional age students increasing by 11%, from 82% to 93%. These course success rates reflect an impressive level of improvement that is important to understand on even deeper levels to continue to enhance the SAGE 2YC PD model.
- Data collected through purposefully designed and conducted student focus groups with 10 of the 17 CA teams (6 from cohort 1 and 4 from cohort 2) illuminated important themes concerning student perspectives on their geoscience courses. For example, students mentioned numerous reasons for enrolling in geoscience classes but fulfilling a science requirement to transfer was especially prevalent among their responses. Students who engaged in field trips and active learning mentioned valuing learning about science that they can readily apply in their daily lives. Students also appreciated faculty who knew their names and created welcoming classroom environments. Faculty members who expressed words of encouragement were identified as motivating students to be even more engaged in their learning processes. Concerns mentioned by some students were that advising was limited or inaccurate regarding graduate requirements and transfer options, and these concerns were sometimes attributed with lengthening time to complete a college degree and costing more money.
- Connections between CAs strengthened as the SAGE 2YC network evolved. In the beginning, the cohort 1 CAs connected mostly with members of their own team, but movement to integrate across teams was evident in later social network analysis (SNA) maps. Project leaders and managers, as well as ERI team members were integral to connecting CAs to one another and supporting these connections in a variety of ways. When cohort 2 joined the project in 2017, they were located in a specific section of the SNA map but like cohort 1, by the second administration of the SNA questionnaire, some cohort 2 CAs were integrating into the network. These quantitative results coupled to qualitative data suggest networking was beneficial to both cohorts. Nearly all CAs reported that the SAGE 2YC network was important to changing their own practice, in part by helping them see how they were part of something bigger than themselves.

LESSONS LEARNED

Looking at the totality of the SAGE 2YC project, we present six lessons learned that are supported by the comprehensive, multiple-methods research and evaluation design used by the Evaluation and Research team.

Lesson #1: Intentional project leadership strengthens faculty engagement. From the beginning, the PI team envisioned major elements of the PD model (e.g., clear goals, single and multi-college teams, regional workshops) that became the backbone and connective tissue for the project. Envisioned from the start, two CA cohorts of geoscience faculty provided the test bed for additional cohorts of CAs who could learn through others’

experiences, as well as their own. Coupling deliberate elements of the PD model to CA learning, leading and improving over time created momentum for even more change.

Lesson #2: Change takes time. When asked what factor made the most difference in the success of SAGE 2YC, participants pointed to a range of very meaningful factors but one factor stood out. Almost everyone said the extended length of time that they had to engage in SAGE 2YC made the most difference in their ability to change. The four years of funding that was extended to five with a no-cost extension was important to the overall accomplishments of the CAs, giving them time to execute the changes they sought to make and then seeing the fruits of their labor come to pass.

Lesson #3: No one changes alone. CoPs were integral to the CA change effort happening on and across college campuses affiliated with SAGE 2YC. The evolving SAGE 2YC network provided support for changes in practice, using collaborative learning and peer mentoring to support evidence-based reform. The PD model fostered community through virtual activities that brought the CAs together to learn, complementing in-person PD. Encouraging CAs to facilitate the learning of other geoscience faculty through regional workshops that extended social networking helped to grow impact even more widely.

Lessons #4: Learning by doing is as powerful for faculty as it is for students. SAGE 2YC project leaders practiced what they preached. They modeled evidence-based practices, and they supported CAs in engaging in similar practices. They encouraged the use of data-driven Implementation so that the CAs could know what was happening to their practice and to their students and use that knowledge to make even more improvements. Administrator involvement in the action planning of CA teams gave them a window into faculty work, which allowed CAs to see their colleges from a larger, institutional perspective. Through these experiences, faculty leadership developed and grew.

Lesson #5: Faculty leadership is developed through opportunity to practice. The SAGE 2YC PD model offered a variety of opportunities for faculty to practice leadership. Leading regional workshops gave the CAs the chance to cultivate new leadership skills (i.e., multi-framed leadership approaches), including seeing themselves as leading evidence-based practice on their campuses. These empowering experiences were instrumental to other faculty leadership changes occurring on campuses. Reflection of participants on their own leadership frames strengthened their knowledge of how to lead, and built self-efficacy that is essential to bringing about larger and more transformational change.

Lesson #6: Grounding changes in practice in the cycle of Innovation is imperative to scaling even larger change. The SAGE 2YC project was intentional about scaling change from beginning to end. Using multiple methods to achieve this goal, including team- and college-based action planning, regional workshops, professional affiliations, virtual modalities, and social media, the SAGE 2YC project kept an eye on what was happening within the project while also looking to the larger context to gain insights into what more could be done to improve 2YC geoscience education.

RECOMMENDATIONS

The Evaluation and Research team offers three recommendations for practitioners, researchers, and the National Science Foundation (NSF).

- 1. Focus on faculty:** The explicit, intentional and consistent focus on faculty in SAGE 2YC provides a model for how to reform community college geoscience education, and we suspect this model will work well in other areas of STEM and other disciplines as well. We begin with this recommendation about the centrality of the SAGE 2YC project's focus on faculty because it contrasts so vividly from other reform agendas associated with career, academic, and guided pathways that tend to concentrate on what administrators do more than what faculty do. SAGE 2YC provides a tangible example of change that can happen when college faculty is spotlighted, encouraged, and supported to bring about changes in practice. Other reforms of community college education would do well to examine closely the ways in which SAGE 2YC nurtured and grew faculty leaders who were instrumental to improving practice and student success on their campuses.
- 2. Encourage and grow intentional change:** In SAGE 2YC, the project leadership identified a range of evidence-based practices that were introduced, modeled, scaffolded, and evaluated as they unfolded as the CAs implemented change on their campuses and in their regions of the country. Whereas many changes in practice were identified and encouraged up front, many others evolved as the CAs, as well as project leaders, learned collectively over time about what kinds of changes were being employed by CAs and how these reforms were going. Recognizing how nuanced contexts influenced the actions CAs took in their work, future reformers of geoscience education would do well to take a page from the SAGE 2YC playbook to learn how to improve practice. These lessons begin with being sure change strategies are defined clearly so they can be documented and assessed, and so they can be shared with others to promote learning and on-going improvement.
- 3. Use rigorous evaluation and research designs to measure change.** The SAGE 2YC leadership introduced data-based approaches to documenting change and student success as the grant unfolded. These approaches enriched the CAs' and others' understanding of what was changing and how change was experienced by students, and it was foundational to telling the story of SAGE 2YC. Future iterations of the PD model will benefit from even more rigorous designs that enable the measurement of the impact of the SAGE 2YC PD model. Using more sophisticated designs including experimental and quasi-experimental designs will produce results on what works that others can replicate as the journey to scale change in 2YC geoscience education continues.