2021

Gateway Scholarships in Biological Sciences: Year 4 Annual Report

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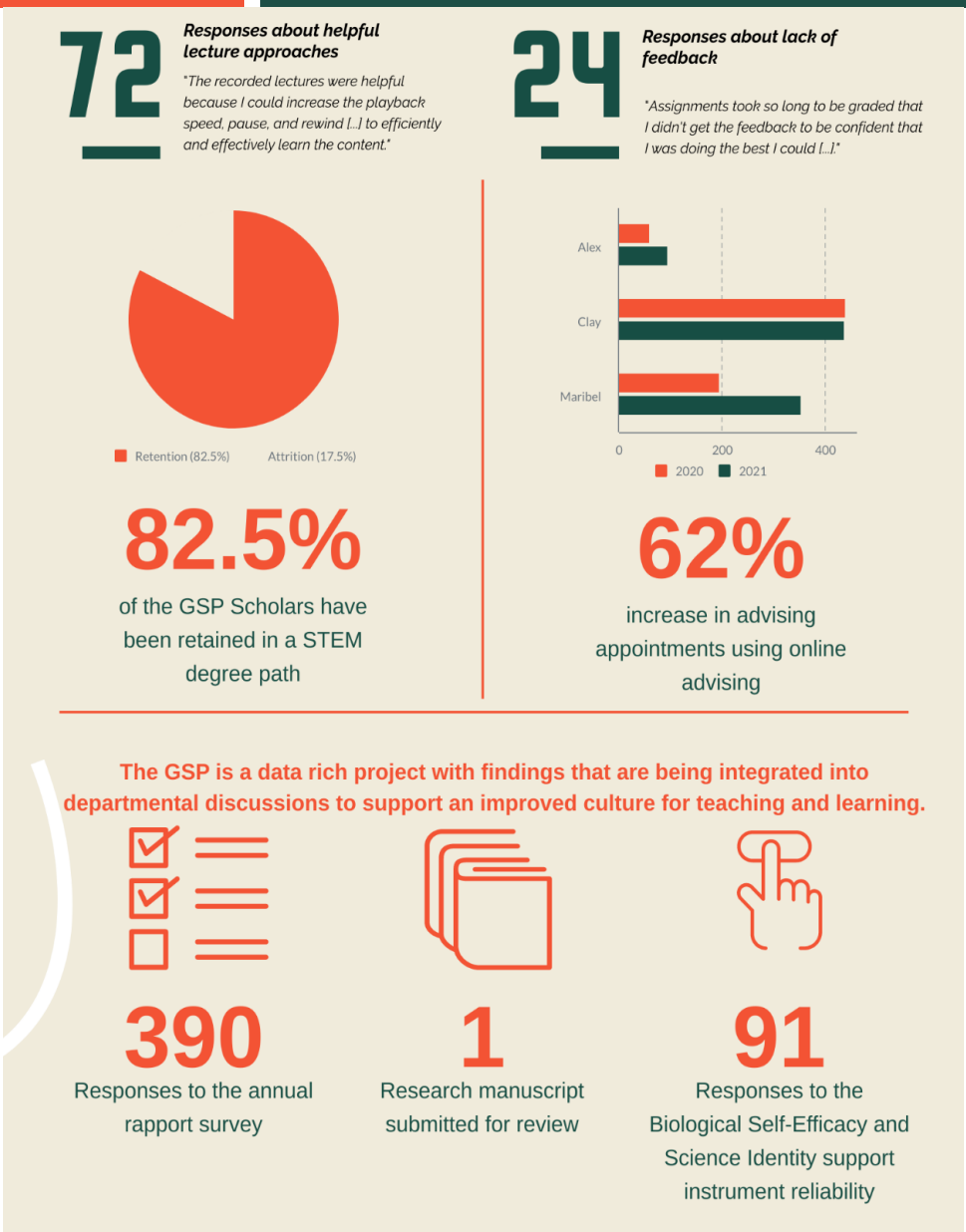
Publication Information

Stieha, Vicki; Oxford, Julia; Ulappa, Amy; Earl, Brittnee; Forbey, Jennifer; Bond, Laura; Feris, Kevin; and Cullers, Jocelyn; and Hartman, Caleb. (2021). "Gateway Scholarships in Biological Sciences: Year 4 Annual Report" (pp. 1-52). Biology Faculty Publications and Presentations.
https://scholarworks.boisestate.edu/bio_facpubs/709/

National Science Foundation S-STEM Gateway Scholarships in Biological Sciences

2/15/2017-2/14/2022

Year 4 Annual Report (Summer 2021)



The Gateway Scholarships for Biological Sciences (NSF DUE 1644233) is funded by the National Science Foundation (February 15, 2017-January 31, 2022).

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Please cite as:

Stieha, V., Oxford, J., Ulappa, A., Earl, B., Forbey, J., Bond, L., Feris, K., Cullers, J., & Hartman, C. (2021). *Gateway Scholarships in Biological Sciences: Year 4 Annual Report*. Boise State University.

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SUMMARY

The Gateway Scholars Program (GSP) has provided meaningful support for students in the biological sciences by awarding **266** semester scholarships to a total of 41 people, mentorship for scholars, a focus on evidence-based teaching practices **impacting 4920 students**[1], encouraging undergraduate research opportunities, risk-based advising, and co-curricular activities designed to support greater understanding of opportunities for biology graduates. These efforts have been described as beneficial by the students surveyed and interviewed for this project. Our focus this year was to leverage lessons learned to impact the broader Biological Sciences Departmental culture since most of our GSP students are nearing the completion of their program.

The grant activities have helped the department identify areas for improvement and to leverage the grant with the university leadership and partners. The major accomplishments and broader impacts of the grant cumulatively are:

- Reduced the student to advisor ratio by adding ½ FTE professional advisor and ¼ FTE faculty advisor.
- Leveraged centralized early alert (as described in objective 2)
- Created a "student group" to track undergraduate research participation in the student information system
- Transitioned the introduction to Biology course from only GSP cohort students to include any biology student, offering it through a hybrid mode in the fall 2020.
- Collaboration between the GSP leadership team and the biology club has strengthened the co-curricular offerings of the department
- Expanded faculty and mentor training to include student engagement, and diversity/inclusion discussion topics as a regular feature of faculty meetings
- The DFW rates in core biology courses are inversely related to the increased use of evidence-based instructional practices (EBIPs) by biology faculty members. This finding is consistent with the scholarship on the use of EBIPs as effective pedagogy for all students (objectives 3 and 5). The research objective demonstrates greater student belonging (rapport) scores and lower DFW rates in courses using EBIPs.
- Developed a biological sciences self-efficacy and professional identity scale (objective 5)
- A manuscript is currently under review including findings related to belonging in core biology classes and evidence-based instructional practices.

A primary objective of our grant activities is to shift the culture of the Department of Biological Sciences (DBS) to increase learning-centeredness and focus on engaging students. The activities included in this project, in addition to efforts in the department resulting from other funded work, are positively impacting GSP students and other biology majors. In this annual report, we present evidence of progress toward this

larger goal. Although the impact of the pandemic is evident, the department continued making progress toward the stated goals.

[1] Impacted students based on fall and spring semester enrollments in core biology courses from fall 2017 to present.

OBJECTIVE 1: FACULTY-MENTORED COHORT PROGRAM

Objective 1 focuses on establishing and managing a faculty-mentored cohort program that provides scholarships and a coherent ecosystem of support for low-income, academically talented Department of Biological Sciences (DBS) students.

We created the following goals to support objective 1:

1.a. Annually recruit students so that we can maintain 20-25 scholars in our cohort
1.b. Each student will meet with a mentor twice per year
1.c. Provide structures and supports for student-mentor program including:
    1.c.i. Shared focus on SMART goals
    1.c.ii. Mentor readings (e.g., helping students get the most out of college)
    1.c.iii. Hold professionally facilitated mentor training annually
1.d. We will measure performance on this objective through student self-report forms documenting meetings with their mentor

Objective 1 Activities in 2020-21

Student Recruitment to Maintain 20-25 Scholars in the Cohort [1.a.]

We have recruited and retained a cohort of low-income, academically talented students in each year of the grant to maintain 20-25 students active in the program (see Table 1). Between fall 2020 and spring 2021, 10 additional scholars graduated from Boise State for a total of 21 students since we launched the program. We are also proud that one of our scholars was recognized among the Boise State University Top Ten Scholars. **Our cumulative retention rate (including students who have graduated) of the Gateway Scholars students is 83%,** two students have changed from BIOL to a non-STEM major and are counted as attrited for GSP grant purposes. Two students have changed to other STEM degree programs and remain enrolled at the university, hence are counted as retained. A total of five students left the university without a degree over the grant period.

Table 1 Status of Recruited GSP Students as of Spring 2021

	2021 Spring
Active	17

Changed major to other STEM	2
Changed major to non-STEM	2
Leave of absence	5
Graduated	21
Senior	5
Junior	5
Sophomore	1
Freshman	0
Total awards	41

While our grant does not specify a focus on underrepresented groups in STEM, we are concentrating carefully on student diversity in our cohort.

Table 2 Gateway Scholars Students by First-Generation, Gender, and Underrepresented Status

	2017 Y1	**2018 Y2**	**2019 Y3**	**2020 Y4**
First in family	13 (65%)	15 (47%)	19 (48%)	19 (46%)
Female	15 (75%)	23 (72%)	27 (68%)	28 (68%)
URM	9 (45%)	11 (34%)	13 (33%)	13 (32%)
% Need met	25%	23%	85%	91%

Note: These data are cumulative regardless of active S-STEM status. % need met is based on data reported to FAFSA (% Need met by NSF S-STEM Scholarship = NSF Scholarship award$/(COA*-EFC*)
*Cost of Attendance (COA); Expected Family Contribution (EFC)
First in family means that neither of the student's parents has earned a Baccalaureate degree; these data are self-reported.
URM definition follows the definition of the NSF (2019).

In fall 2020, we renewed 21 awards ($5,000 per for the academic year) and did not take in new scholars. In spring 2021, we added awards for two students who returned from a leave of absence. In total we awarded $87,189 in scholarships and met 91% of the unmet need. We administered the Gateway Scholars survey in spring 2021 to understand how the financial aid was helping scholars pursue their Biological Sciences degree. Six of 22 scholars responded, a low (27%) response rate, however, the responses to the question, "How would you characterize the financial impact of the scholarship associated with the DBS Gateway Scholars program on your career at Boise State University?" are below:

"The financial impact of the scholarship allows me to focus completely on school without having to worry about needing to get a job to reduce debt after graduation."

"The scholarship associated with the Gateway Scholars Program is one of the main reasons why I was able to continue my education at Boise State, and pursue my degree in Biology."

"Having this scholarship has allowed me to worry less about working and [...pursue] interests that are not paid."

"The financial impact of the scholarship associated with the DBS Gateway Scholars program was incredibly crucial to my success here at Boise State. With the financial help, I did not need to worry about working as much during the semester. Instead, I could focus on my studies, keep my grades up, and take part in various extracurricular activities (i.e. volunteering and undergraduate research)."

As we move into the fifth year of the grant, we will continue to support the 14 students who remain in the GSP cohort.

Student-Mentor Support [1.b. and 1.c.]

There were no new students in the program (two students re-joined the cohort after a leave of absence) so returning students were reminded to meet with their mentors and we encouraged the mentors and students to set up meetings with each other. We have found that reminding mentors and mentees to schedule the meetings is really important, thus we sent a reminder email in October 2020 and March 2021. Rather than rely upon faculty to report back to us about mentoring meetings, we continued the use of an online form for the students to record when they met with their mentors.

Measuring Student-Faculty Mentorship [1.d.]

Between August 2020 and May 2021, 10 different students have documented at least one meeting with their mentor and one documented additional meetings. Meetings lasted on average 30 min, via Zoom or email communication. We sent a reminder to faculty and students in the spring semester at the start of March to have mentor meetings. However, we suspect that Zoom fatigue impacted how many student/mentor meetings took place this year. Feedback about the mentor meetings from the students were always positive and included discussions of undergraduate research opportunities, course planning and strategies for success. Conversations about "how school is going" and plans for the upcoming term were common in these reports. The students aso shared that they frequently discussed graduate school, particularly for the students who were nearing commencement. One graduating student shared the following:

> *The time that I spent with my mentor was incalculably valuable to me. It was reassuring that I could check in with them at least once a semester and make sure that I was on track to graduate with sufficient grades and undergraduate experience. I cannot place a "price tag" on how valuable it was to me.*

The program coordinator reached out to the scholars each semester this year with a personal message to check in. 59% (13 of 22) of our scholars responded to these emails in the fall and 61% (11 of 18) in the spring. The email responses included topics like updates on undergraduate research, how courses were going, or questions related to financial aid or semester planning. These emails facilitated a way for students to ask questions or report how they were doing. Based on the responses, we see this method of outreach as successful.

Table 3 Gateway Scholar Student-Faculty Mentor Meetings (2020-2021)

Student self-report mentor meetings 2020-21	
Student-Mentor Meetings	
Unique Students	10
>1 meeting with mentor	1

PLANS FOR YEAR 5:

We would like to make sure students and mentors reconnect when the fall semester begins. The transition back to mostly in-person courses may be difficult for students to navigate so our aim is for students to meet with their mentors in the first few weeks of the fall semester. Many of our scholars are nearing the last year of their degree so a focus on discussions of future goals and how to prepare for careers after college (including getting feedback from mentors on resumes or cover letters) may be a beneficial way to spend time. Given the success of personal check-ins from the program coordinator, we plan to continue that approach as well.

Objective 1 Insights

1.a. Annually recruit students so that we can maintain 20-25 scholars in our cohort. We are pleased that we have been able to meet this objective from the first through fourth year. This goal will change in year five as we support the remaining students through the completion of their program.

1.b. Each student will meet with a mentor twice per year. The pandemic seemed to have impacted the student-mentor meetings, however, we were encouraged that students and faculty used remote methods to continue their meetings.

1.c. Provide structures and supports for student-mentor program. As the scholars move toward graduation, the mentors are offering one on one advice for professional pathways and graduate schools.

1.d. We will measure performance on this objective through student self-report forms documenting meetings with their mentor. The student self-report strategy continues to be effective.

OBJECTIVE 2: RISK-BASED ADVISING SYSTEM WITH PROACTIVE ADVISING FOR GATEWAY SCHOLARS

Objective 2 focuses on advising the Gateway Scholars cohort while working to apply best practices to all DBS students, as feasible. Our work on objective 2 in 2020-21 focused on the following goals and measures:

2.a. Monitor on/off track students using the advising dashboard, reach out to students, and document via advising notes.

2.b. Hold advisor meetings with all Gateway Scholars each semester.

2.c. The advisor or their designee will update advising notes documenting advisee meetings, including annotations about outreach to at-risk students.

2.d. Include discussions about advising related issues with faculty at department faculty/committee meetings.

Objective 2 Activities in 2020-21

Monitoring On/Off Track Students [2.a.]

In the Year 3 report we described the shift that we made to support monitoring students who were on/off track in the major due to system changes at the university. We are now using a report pulling data from an advising report in PeopleSoft.

Due to the COVID-19 pandemic, DBS advising was conducted 100% remotely. The three DBS advisors were able to meet with 773 students during the academic year (distinct counts of students-advisor meetings are displayed in Table 4). We note that the comparison for advising in 2019-2020 was 580. The DBS advisors **met with 193 more students in 2020-21** suggesting that the virtual meetings were not a deterrent to students. It is possible that virtual advising facilitates these meetings.

Table 4 Student-Advisor Meetings with Year to Year Comparison

Advisor	2019-2020 Appointments	2020-2021 Appointments
Alex (0.25 FTE)	61	95
Clay (1.0 FTE)	439	437
Maribel (0.6 FTE to BIOL)	196	354
Total 1.85 FTE	580	773

Note: Distinct count of student appointments per advisor per year.

Strategy Changes to Better Meet the Needs of Struggling Students

We have shifted the protocol for outreach to students over the grant period. The GSP has afforded us the opportunity to try out various strategies.

Years 1-2 (2017-2019)*:* The advising office initiated a request to core BIOL faculty to report students who were "at risk" in BIOL 191, 192, 304, or 310. Advisors reached out to students in these courses and the rate of response from identified students was very low, approximately 10% responded to the outreach.

Year 3 (2019-2020):

- Lab instructors reached out to students with missing assignments in core courses during weeks 6-7.
- Nearly 50% of the students resolved missing work or made a plan to succeed in the course.

Year 4 (2020-21)

- Faculty in all courses were broadly encouraged to complete academic alert reports if they had any concern about a student (academic or personal). During the spring term 17 academic alerts were made.
- Lab assistants in BIOL 191, 192 and 304 initiated an outreach to students in that class who were missing assignments.
- The GSP Cohort Coordinator reached out individually to all cohort students to check in during fall 2020 and spring 2021.

Because courses outside of the department can also create an obstacle to persistence, we reviewed all cases in which students were referred for academic support. The Spring 2021 data are presented in Table 5 including the courses of concern, students' responses to outreach, and outcome of the academic report. An interaction may include an appointment or follow up conversation. Positive outcomes include a passing grade in the class (C+ or better) and/or good academic standing. A negative outcome includes a failing grade and/or poor academic standing. Of the 17 student/course reports, 7 were resolved positively and ten negatively. Of those who engaged with the academic support team, 58% had a positive outcome.

Table 5 Academic Alert for BIOL Majors During Spring 2021

Course concern	No response	Interaction	Positive outcome	Negative outcome
ANTH 102		1		1
ANTH 307	1	0	1	
BIOL 191 Lab		5		5
BIOL 192	2	5	3	4
BIOL 304	1	0	1	
THEA 101		1	1	
UF 100	1	0	1	
Total	**5**	**12**	**7**	**10**

The **BIOL 191** TAs conducted a similar outreach to 45 students (24% of enrolled students) via email when students were showing signs of struggle (missing lab or assignment). Ten academic alert reports were submitted for this group. In addition, one of the faculty members teaching a lecture section reported that

they had personally contacted students struggling in the lecture section based on a missing homework assignment or low exam grade.

The **BIOL 192** TAs adopted an outreach strategy as well. Their process involved checking the grade book every two weeks to identify students who had missed assignments in that interval. They contacted them via email to check in and offer support to those students. They contacted 24 students in the fall and 23 in the spring. In the spring, the team added a week 8 check to identify consistently struggling students so the instructor of the course could check in personally or refer students via an academic alert for additional support. Additionally, in the spring, the instructor contacted 13 students and 7 of those were referred to academic services.

In Fall 2020, the **BIOL 304** lab TAs sent outreach emails to 12 students (out of 108 total) to check in. Outreach occurred most often due to missing lab assignments since attendance at the lab Zoom meetings was not mandatory. 83% (10) of the students responded to the TAs' emails and five went on to pass the course while seven did not. We filed two Academic Alerts in the fall and one of those students ultimately passed the course.

In Spring 2021, we ramped up outreach efforts, monitoring for potential signs of struggle or disengagement starting earlier in the semester. The TAs and one of the lecture instructors reached out to 32 students (out of 98 total). Of those students, 75% (24) responded. We filed a CARE report for one student who did not end up passing the course (see Table 5). In total **69% (22) of the students engaged through outreach ultimately passed the course**.

Over half of our **Gateway Scholars** responded to personal check-in emails from the program coordinator (13/22 in the fall and 11/18 in the spring). The email responses included topics like updates on undergraduate research, how courses were going, or questions related to financial aid or semester planning. These emails opened dialog so that students could ask questions or report how they were doing.

BROADER IMPACT
Initially, the Gateway Scholars activities included midterm grades for scholars and outreach to create a safety net for these students. The outreach efforts described in 2.a. are an outcome of those activities and thought processes. This is a broader impact of the GSP grant.

Advising Meetings with Gateway Scholars [2.b. and 2.c.]

Goals 2.b. and 2.c. require frequent advising (at least one meeting per semester) with Gateway Scholar students. 13 of the 23 students active in the GSP cohort met with a DBS advisor this year. In an interview with advisor Clay Cox, he explained his approach to advising the GSP cohort students. As in prior years, Cox sent an email inviting students to meet to review their progress to degree. As these students are mainly in

the upper division classes, their well-designed degree checklists appear to be providing the support they need, hence advising contact is less relevant to them. Moving forward, Cox suggests that the emphasis for advising outreach is best focused on the students in BIOL 191, 192, 304, and 310 as the system we have in BIOL is relatively transactional.

Cox has found that students are meeting with faculty to discuss professional development and graduate school questions, which seems to be a more appropriate source for professional advising than the advising staff. Further, given the student to advisor ratio in the department, faculty mentors who also know the students from classes and research labs are better positioned to offer professional/career advice.

In the past, the advising office was requesting a list of midterm grades from faculty and then reaching out directly to students via email to offer academic support. Student response to the advisor email messages was very low, reducing the return on investment for the effort. In its place, the advising office has focused on strengthening faculty referrals directly to Advising and Academic Support (see 2.d.).

Discussing Advising Related Issues with Faculty [2.d.]

Multiple faculty meetings during the 2020-21 academic year focused on student support/success. These discussions were mostly focused around outreach to students, keeping an open mind and eye to folks that might be struggling with COVID directly, isolation due to the pandemic, or other factors that came into play due to the unusual nature of last fall. Faculty have been very responsive to a departmental request to be alert for signs that students are struggling (academically and/or personally) and encouragement to refer students to the Advising and Academic Support Center. These referrals have increased during the 2020-2021 academic year and students appear to be more responsive to this strategy.

Additionally, faculty conversations about student support morphed into faculty support. These conversations prompted faculty sharing their experiences, struggles, and successes. We see a possible correlation between these conversations and increased supports for student success in the overall academic performance during the fall term (see Tables 6 and 7).

Empirical evidence has demonstrated that removing curricular roadblocks to student persistence will increase STEM degree attainment (Seymour & Hunter, 2019). Advisor Cox worked with the faculty curriculum committee to approve several important curriculum changes that will support student progress to degree. These changes include:

- Approving changing the required mathematics general education course from calculus to statistics (Math 254). Doing so encourages students to take statistics earlier, which will support their Biology coursework. as understanding data analysis is a huge part of the degree. This change takes effect Fall 2021.
- Changing the prerequisite for Genetics from Chemistry to General Biology removed an obstacle to upper division Biology courses. The change will allow students to gain more academic maturity before tackling required chemistry courses, which have been identified as obstacles to students' degree attainment.

Objective 2 Insights

- The GSP has helped the department readjust the student-advisor ratio through increased capacity.
- While we initially established a goal of one meeting per semester with an academic advisor, as students move into upper division courses, a blend of contact between the advising office, faculty mentors, and other faculty is more effective.
- The number of students supported through DBS advising increased in 2020-21 through the use of virtual meeting availability.
- The GSP has demonstrated the important role that faculty can play in student outreach and referral removing the need for the advising office to intervene. The system appears to be more efficiently serving students. Changes in strategies have demonstrated more effective methods by pairing faculty and professional advisor outreach. In Objective 3 we discuss the D, W, F rates, which show a much lower rate in the spring than in the fall. It is likely that the lab assistant and faculty outreach efforts were efficacious.
- Advisor input into curricular challenges that students are having beyond the Biology courses (e.g. mathematics and chemistry) has helped faculty make evidence-based changes to the curriculum. These changes are aligned with best practices to support STEM degree attainment.

OBJECTIVE 3: INTEGRATE EVIDENCE-BASED INSTRUCTIONAL PRACTICES (EBIPS) IN THE DBS CORE

Objective 3 focuses on the program elements designed to support faculty integration of evidence-based practices in core biology courses.

The goals and measures designed for objective 3 are:

3.a. Encourage EBIP usage in core courses and labs

3.b. Measure impact of EBIPs in core courses

3.b.i. Rapport scale

3.b.ii. Instructional practices used

3.c. Close the loop through data sharing meetings with faculty

3.d. Foster greater success in BIOL courses and measure these efforts through analysis of grades (previously focused on learning assistance)

Objective 3 Activities in 2018-19

Encourage EBIP Usage in Core Courses and Labs [3.a.]

Throughout the academic year, discussions during faculty meetings included a focus on supporting students through the pandemic and in general. However, Sarah Dalrymple facilitated a workshop specifically related to the goals of this grant including integrating evidence-based instructional practices and improving the

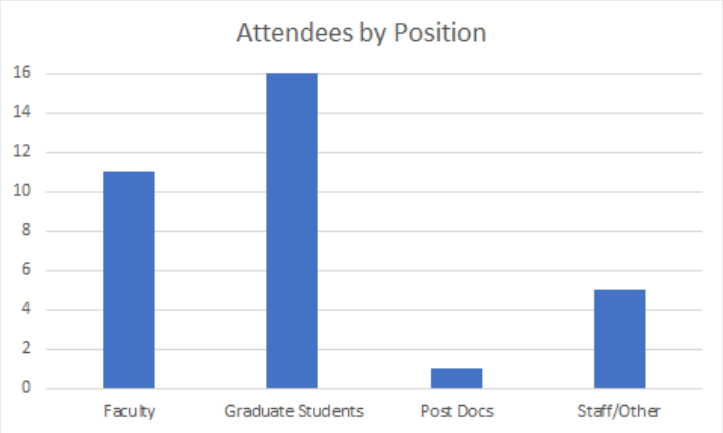
departmental culture for learning. The workshop, "Microaggressions in Science" (March 2021), goals included:

1. Recognize microaggressions when they occur.
2. Apply specific communication frameworks to address microaggressions and create an inclusive environment in your courses or lab.

The participants prepared for the interactive seminar by watching two videos about microaggressions. During the workshop, the participants participated actively in Zoom breakout rooms to help them process their learning from the videos, verify readiness to learn about microaggressions, and to increase buy-in for the activity. A full description of the workshop is included in Appendix C.

Impact: In total, 33 people participated in the seminar including 5 of the core course teaching faculty (including the facilitator) and three of the core course lab instructors attended. The content will impact the focal courses for these grant activities and extend to their lab activities.

Figure 2 Microaggressions Seminar Attendees by Position



Measuring EBIP Use in Core BIOL Courses [3.b.i and 3.b.ii]

The COVID-19 pandemic made classroom observations impossible, so our only data regarding EBIP use in the core BIOL courses is through students' open response on the rapport survey. In spring 2020, we integrated questions about practices that were and were not helpful to students in the rapport survey. These questions were repeated in the fall 2020 and spring 2021 surveys.

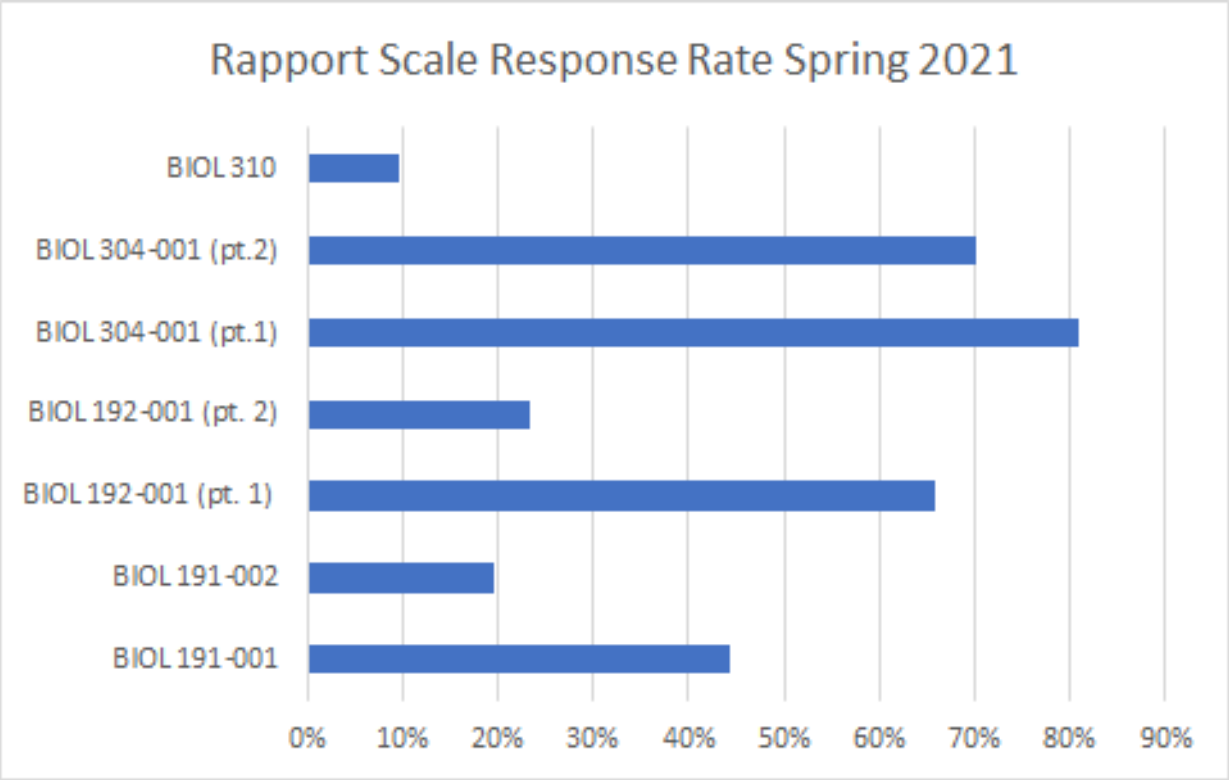
The four core BIOL courses were surveyed during the spring of 2021. The response rate for the Rapport Survey ranged from a low of 10% to a high of 81%, with an overall response rate of 43.86%. Students completed the survey through the Blackboard site for their course. Two course sections (BIOL 191-001 and BIOL 304) provided extra credit for students completing the survey. In comparison to other years, the survey yielded a lower response rate in general, as depicted in Figure 3. Given the number of responses, however, the rate of response still provides us a solid sample for our analysis.

In Appendix C we detail the students report of instructional practices used and in Objective 5 we discuss the implication of the practices. The next section discusses response rates, summarizes the qualitative data about teaching methods and student learning, and then discusses rapport scale findings.

Rapport Instrument Response Rates

Student responses in the spring 2021 survey also indicate that there were methods that worked against their learning (see Appendix C) and these methods are also corrosive to rapport (e.g. inadequate feedback, lack of meaningful interaction, low quality video lectures, and persistent technical difficulties).

Figure 3 Response Rates to the Rapport Scale (Spring, 2021)



A total of 312 students included feedback on the open-ended questions about the methods that were and were not helpful for their learning. We have filtered out responses that were mentioned only once or twice in the list to focus on those that were mentioned more often. The analysis of these findings focuses on the strategies that are supportive of student learning and those that are not.

Analysis of Open-Ended Questions about Most/Least Helpful Methods

In reviewing students' open responses to the most helpful methods, students highlight the methods that **support interaction**, **increase accessibility/flexibility**, and **support their learning process**.

Methods that supported interaction were considered to be helpful. This interaction was mainly observed in three different ways: student-professor interaction, student-material interaction, and student-student

interaction. Overall, the method that best supported student-professor interaction was for faculty to offer synchronous Zoom lectures. This method offered students a consistent and structured opportunity to be guided through information, to clarify unclear concepts, and to interact with their professor. There were several methods that were identified as supporting student-material interaction, such as guided note-taking, interactive eLearning, recorded lectures, supplementary materials, and review sessions. Methods that supported student-student interaction included discussion post requirements and Zoom breakout groups.

> **"*I liked having active zoom classes because it felt more interactive and kept me accountable for my learning*."**

Methods that supported the accessibility and flexibility of course content were also considered by students to be helpful. In particular, it was noted that offering recorded lectures helped students access their learning on their own time in their own way. Students enjoyed being able to manipulate these recorded lectures to suit their own learning style by pausing, slowing down, speeding up, replaying sections, etc. Further, offering recorded lectures facilitated the ability of students to engage in repeat viewings.

Methods that supported learning procedures were also identified as helpful. These included clear and frequent communication, consistent scheduling, and emailed reminders. Presumably, a remote style of student learning is more self-directed than regular, in-person instruction. Methods that support students in their self-direction are important in a remote learning environment.

Students' responses that pertain to problematic methods also illustrate a number of negative outcomes:

- Methods that produce an information gap
- Methods that produce attention and engagement difficulties
- Methods that produce technical difficulties

Methods that produced an information gap could roughly be divided into two aspects. First, many responses indicated that the information presented in lectures, their textbooks, and other materials, did not correspond with the information that students were assessed on in quizzes and tests. Second, feedback following quizzes, tests, assignments, and discussion board posts, was also frequently found to be inadequate or absent. The informational gap, in combination with the previously mentioned self-directed nature of remote learning, resulted in some students feeling lost or otherwise not supported in their learning.

Methods that resulted in attention and engagement difficulties also corresponded to inadequate feedback as well. Furthermore, students reported that some aspects of their course, like discussion board posts, didn't feel meaningful or relevant because of a lack of meaningful interaction. Students often perceived

these discussion board posts as "busy work" instead of meaningful opportunities for professor-student and student-student interaction. In addition, it was noted that one course did not offer synchronous Zoom lectures, instead only offering optional review sessions as the sole synchronous option. While the course did offer recorded lectures, students reported that the lack of instructor-led guidance and interaction made learning more difficult.

Methods that resulted in technical difficulties that impacted students' learning were, unsurprisingly, tied to the relatively new nature of remote learning. However, responses do indicate that technical difficulties became less prevalent as the academic year progressed.

Rapport Scale Data

A review of literature suggests that active learning and evidence-based instructional practices (EBIPs) and methods support students' senses of competence, peer relatedness, and professor relatedness (National Research Council, 2012). Collaborative learning methods are referenced in the STEM education research literature with outcomes that are positively correlated with students' sense of their own competence and relatedness with others (e.g. Springer et al., 1999; Trenshaw et al., 2016). The DBS has been working toward increasing EBIP use in core courses to support positive student outcomes. However, the coronavirus pandemic necessitated a remote learning environment and challenged the momentum of those efforts. This section will discuss the evidence of positive outcomes including competence and relatedness (our rapport measures). As previously mentioned, the pandemic made classroom observations impossible, so our data regarding EBIP utilization in core BIOL courses is through students' open response on the rapport survey.

A total of 43.86% (390) of undergraduate BIOL students submitted responses on the rapport survey instrument. Of the responses, 378 self-reported demographic data. 67.2% identified as female and 27.4% identified as male. 15.1% of students identified as an underrepresented minority in STEM. 68.7% of students identified as a Biology major and 25.1% of students identified as a first-generation college student.

The constructs for perceived competence, professor-relatedness, and peer-relatedness have high reliability (Cronbach's alpha 0.90, 0.91, 0.72 respectively). The two questions constituting the effort construct yielded a moderate Cronbach's alpha of 0.60. For the purposes of this year's report, we will be focusing on the competence, professor-relatedness, and peer-relatedness constructs. The rapport scale ranges from 1 (strongly disagree) to 4 (strongly agree).

Competence

As demonstrated in Table 10, mean scores for students' perceived competence rendered by a one-way ANOVA resulted in one overlapping group among all instructors. There was a significant difference found between INST 6 and INST 2 as well as between INST 6 and INST 8. The open response data suggests a didactic instructional approach that relied on prerecorded asynchronous lectures as a main method was least effective in developing students' sense of competence, resulting in the lowest mean score of any spring 2021 instructor of 2.99. Whereas INST 2 and INST 8 utilized interactive lecture EBIPs and methods (e.g. synchronous Zoom meetings) and student-centered instructional practices (e.g. required discussion board posts and recording synchronous Zoom meetings) that resulted in significantly different average mean scores for student competence of 3.44 (INST 2) and 3.33 (INST 8). We found no statistically significant differences within demographic variables for students' perceived competence.

Didactic instructional approaches (e.g. using asynchronous pre-recorded lectures yielded the **lowest** student competence scores.

Synchronous Zoom, interaction in discussion boards, available recordings via Zoom yielded the **highest** competence scores.

Professor Relatedness

As Table 11 demonstrates, mean scores for students' perceived sense of relatedness to their professor resulted in three significant groupings with overlap between them. In the first grouping, student responses for INST 10, INST 6, and INST 4 produced lower average mean scores of 2.60, 2.77, and 2.96 respectively. In the second grouping, responses for INST 3 and INST 2 indicated average response scores for professor-relatedness of 3.18 and 3.28, with INST 6 and 4 overlapping. In the third grouping, responses for INST 12 and INST 8 indicated higher average mean scores of 3.52 and 3.53, with INST 3 and INST 2 overlapping. Additionally, demographic data analysis indicated that females' perceived professor-relatedness in all courses combined was higher than that of males (p = 0.046). There was not a statistically significant difference found for any other demographic variables.

Interactive approaches increase instructor immediacy, presence, and perception of professor's involvement in students' learning.

Similar to perceived competence, the open response data suggests that instructional approaches that are **didactic** in nature (e.g. offering non-interactive asynchronous recorded lectures) resulted in **lower professor-relatedness scores on average**. This finding is compared to INST 12 and INST 8, professors who were perceived as more relatable, who offered lecture styles that were more interactive. This interaction was typically live, synchronous Zoom opportunities in which the professors would utilize process-oriented guided-inquiry learning (POGIL) and other active learning strategies. For example, students' open responses indicate that guiding student learning by providing editable PowerPoints for students to complete in coordination with the professor as well as leading students through material review was

beneficial to their sense of professor-relatedness. These EBIPs served an interactive function that increased instructor immediacy, presence, and involvement in their students' learning. D. These findings are consistent with the positive outcomes of professor immediacy reported in the literature (Benson et al., 2005; Harper et al., 2019; Lowman, 1994).

Peer Relatedness

The peer relatedness means for INST 10 and INST 4 were lowest. A second group (INST 6, INST 3, INST 2, and INST 8) had means ranging from 1.93 to 2.15. INST 12 produced the highest peer-relatedness average of 2.33. Table 12 displays the overlap between these groups. Overall, STEM majors' mean score of peer-relatedness was statistically significantly as compared to non-STEM majors ($p < .05$). There was not a statistically significant difference found in any other demographic variables.

As Table 13 demonstrates, peer-relatedness responses to the survey instrument in spring of 2021 were lower on average than previous years. EBIPs and methods that supported peer-relatedness were minimal across all courses, likely as a result of a shift to remote instruction due to the coronavirus pandemic. However, similarly to the strategies that supported professor-relatedness, interactive lecture styles increased peer-relatedness means. Further, student-centered instructional practices, such as required discussion board posts, correlated with higher peer-relatedness.

Close the Loop Through Data Sharing Meetings with Faculty [3.c.]

Reports drawn from the annual review of data are shared with the faculty. In fall 2021, the GSP leadership team shared a report demonstrating the correlation between EBIPs and higher student competence and professor rapport scores (see PDF copy of report).

A summary of the fall 2020 rapport survey student feedback about methods that were helpful and not helpful from students was shared by department chair (K. Ferris) with the faculty as part of the student success discussions.

Copies of the GSP Annual Reports are archived on the Boise State Scholarworks page for the Department of Biological Sciences.

Support for Learning in Core Biology Courses [3.d.]

This objective is closely related to outreach efforts discussed in objective 2.a. Since all of the core Biology courses were offered online in the fall and spring, and the pandemic was disrupting students' lives in unprecedented ways, instructors were encouraged to increase outreach efforts using indicators that students might be struggling. We have data on these efforts from BIOL 191, 192, and 304 regarding personalized emails to check in on students.

A review of student D, F, and W grades spanning from 2015-2020 indicates that while these failure rates had fallen from 2015 to 2019, 2020 marked a steep increase. It is likely that this upward tic is due to the

pandemic. See Tables 6 and 7 for the aggregate comparison by semester of the rate and number of students earning failing grades or taking withdrawals from core Biology courses over the last five years. Because BIOL 304 was first offered in 2018, we have only three semesters of fall data and two semesters of spring data. While it is important to view students' failures in light of the larger context for teaching and learning, it is also important to consider them in light of the instructional methods used so that we may improve upon these outcomes.

The fall and spring DFW rates in BIOL 191 rose in comparison to the prior two years. The primary instructional methods referenced by students in this course were Zoom lectures (with recordings) and homework exercises. These were the same methods used in the face to face course which were translated to the online environment. There is no mention of peer interaction in this course. As for problematic methods, students primarily reported an informational gap between the content the textbook presented and the content assessed on exams and quizzes.[1] Secondarily, students reported deficiencies in their ability to pay attention and engage in Zoom lectures. Particularly given the higher proportion of first and second year students in the class, this could have contributed to a higher DFW rate.

The fall and spring DFW rates in BIOL 192 were much lower than the other courses and much lower than they have been in prior years. Students reference Zoom lectures (with recordings) but also add that there are opportunities to engage and ask questions. They were described as "interactive" in multiple comments. Additionally, students mentioned "Monday Zoom Reviews" and homework assignments were also cited as helping students understand the content. In terms of problematic methods, students primarily reported an informational gap between content presented in lectures and the content assessed on exams and quizzes.[1] Further, students reported attention deficiencies in utilizing the asynchronous recorded Zoom lectures, particularly when there weren't synchronous Zoom opportunities. Students also reported receiving inadequate feedback from assessments as well as a lack of opportunities to interact with other students in the course.

The fall and spring DFW rates in BIOL 304 were fairly consistent with prior years' rates, although the spring 2021 rate was 33% higher than the fall. Students referenced being able to engage with the faculty members during lectures; they also referenced engaging in "student-student discussions" or discussed collaboration with other students. None of the other classes included references to peer learning methods. However, looking at what students reported as problematic methods within the course, inadequate feedback following discussions was mentioned as well as a sense that some of their peers weren't meaningfully engaged and contributing in discussions.

The fall DFW rate for BIOL 310 is 45% higher than it has been averaging, although the spring rate is relatively consistent. The response rate to the survey was very low for this course, so our input on the

[1] Regardless of mode of instruction, students commonly perceive a gap between the content discussed and that which is assessed.

methods as helpful or not is limited. Students noted the study guides and notes as helpful in the spring data. Students also noted a problematic lack of engagement and interaction in the course.

Table 6 Fall to Fall 5 Year Comparison of DWF Rates for Core Biology Course

Courses	Term	# Enrolled	# Earned D, F, W	DFW Rate
BIOL 191				
	Fall 2015	248	55	22%
	Fall 2016	258	67	26%
	Fall 2017	327	48	15%
	Fall 2018	353	38	11%
	Fall 2019	370	44	12%
	Fall 2020	294	62	21%[1]
BIOL 192				
	Fall 2015	167	30	18%
	Fall 2016	126	23	18%
	Fall 2017	146	21	14%
	Fall 2018	158	31	20%
	Fall 2019	158	32	20%
	Fall 2020	157	15	10%[2]
BIOL 304				

	Fall 2018	84	7	8%
	Fall 2019	90	8	9%
	Fall 2020	109	11	10%
BIOL 310				
	Fall 2015	70	7	10%
	Fall 2016	93	4	4%
	Fall 2017	86	6	7%
	Fall 2018	112	7	6%
	Fall 2019	121	6	5%
	Fall 2020	158	18	11%[1]

Notes: [1]DFW rates for BIOL 191 and 310 are much higher than the typical rate for the fall term. [2]DFW rates for BIOL 192 are much lower than the typical rate.

Table 7 Spring to Spring 5 Year Comparison of DWF Rates for Core Biology Course

Courses	Term	# Enrolled	# Earned D, F, W	DFW Rate
BIOL 191				
	Spring 2015	225	56	25%
	Spring 2016	227	69	30%
	Spring 2017	220	52	24%
	Spring 2018	245	72	29%

	Spring 2019	217	63	29%
	Spring 2020	208	50	24%
BIOL 192				
	Spring 2015	161	37	23%
	Spring 2016	156	35	22%
	Spring 2017	147	14	10%
	Spring 2018	183	26	14%
	Spring 2019	164	30	18%
	Spring 2020	167	16	10%[1]
BIOL 304				
	Spring 2019	90	5	6%
	Spring 2020	87	8	9%
BIOL 310				
	Spring 2015	112	7	6%
	Spring 2016	118	10	9%
	Spring 2017	94	1	1%
	Spring 2018	114	2	2%
	Spring 2019	139	6	4%

Spring 2020	122	5	4%

Note: [1]DFW rates for BIOL 192 are much lower than the typical rate. All other courses are on par with typical spring DFW rates for the 5-year period.

Objective 3 Insights

Reviewing the data collected to understand the culture for teaching and learning in the DBS, we note the following insights:

- A concerted effort to employ viable strategies for faculty to implement outreach to students who are at risk of failing is discussed in Objective 2. The differences in approaches appear to be reflected in the data presented in Objective 3. Outreach signals a level of caring and it is reasonable that it would appear in the students' professor rapport responses.
- Where students are experiencing inclusive and active teaching strategies and outreach, their scores on rapport measures (competence, professor-relatedness, and peer-relatedness) are higher. Our research findings (Stieha et al., under review) empirically demonstrates this relationship between variables in our 2019 data as well.
- We expect that Increased DFW rates will likely return to their pre-pandemic levels when faculty resume teaching using face to face methods.
- Particular teaching methods that were identified by students as helpful including the ability to review live lectures (videos) and to participate in structured review sessions via Zoom. These strategies can be implemented in face to face courses as well through classroom capture and hybrid options. DBS faculty are encouraged to maintain these inclusive strategies.

OBJECTIVE 4: ENGAGE STUDENTS IN CO-CURRICULAR ACTIVITIES REPRESENTING DIVERSE CAREER PATHS

Objective 4 focuses on developing a cohort experience for Gateway Scholars Program participants so that this group of students will engage in a variety of learning experiences exposing or immersing them in activities related to the diverse career paths that a biology major may pursue. Objective 4 is supported by the following goals and measures:

4.a. Continue offering BIOL 198
4.b. The GSP program will provide co-curricular events to help scholars explore diverse career paths
4.c. The GSP will provide two or more field trips per year designed to support career exploration and cohort building
4.d. Encourage and document student engagement in undergraduate research experiences (UREs) with a target of 25% of GSP students participating in a URE

Objective 4 Activities in 2020-21

Biology 198 Supporting DBS Student Development [4.a.]

A goal of the Gateway Scholars grant is to expand successful components developed through the program to benefit all students. Given prior data in which Gateway Scholars students had indicated Biol 198 was a positive experience in preparing them for a degree in biology, the department opened the course to other students. In Fall 2020, 30 freshmen and sophomores who were interested in Biology enrolled in Biol 198 (see syllabus). The course content was similar to that of previous years including:

- neurobiology of learning
- careers in biology
- discussion panels with juniors and seniors
- speakers discussing Vertically Integrated Projects (VIP) and undergraduate research
- applying for undergrad positions

The course also included a lesson on how to write an email to a faculty member to express interest in undergraduate research and how to apply for various undergraduate research programs. We developed these sessions to increase the diversity of student research applicants.

Outcome Measures from BIOL 198.

A pre-post survey administered in BIOL 198 indicates that students' awareness of campus resources increased. On a scale of 1 (not aware) to 5 (very aware) the mean score increased from 2.47 to 4.26. The post-test asked students to rate their awareness of career types related to biology on a scale of 1 (fewer than I thought) to 5 (more than I thought). The mean score on the career awareness question was 4.74. There were two open ended questions at the end of the survey. Responses to a question about the resources students perceived as most useful to all biology students varied, however multiple students shared the opportunities for engagement in Vertically Integrated Projects (VIP) and undergraduate research opportunities. For example:

- "... the VIP classes will help get to know your peers and instructors better as well as get to be "known" during your undergraduate career."
- "Research opportunities and reaching out to potential mentors/lead researchers because all students should get involved in something that gives them knowledge about their field as well as gives them an opportunity to be mentored by someone of higher power and position. Reaching out to potential mentors can maximize opportunities and open several doors."

Other students referenced ideas drawn from the neurobiology of learning discussion. For example, one student commented that learning is difficult and "a failing grade shouldn't mean you should quit. You just weren't ready!" Another commented, "I really enjoyed in the first couple weeks learning about how our brains learn new topics. This was very interesting to me, and gave me more motivation to practice topics more that I may be struggling with."

Students also commented on their expanded understanding of the variety of career opportunities they could pursue with a bachelor's degree in the biological sciences. For example, one student noted, "the discussion [of] different careers in biology [was useful] because I think a lot of bio majors don't know what else they can use their major for except for medical school or research." Another linked the career planning panel (discussed below) to the course and their expanded awareness of career options saying, "Knowing and speaking with people who are in different fields is a great way to figure out what career path we want to take. :)"

Figure 4 GSP Co-Curricular Events to Help Scholars Explore Diverse Career Paths [4.b.]

Based on feedback from our external evaluator, we decreased the number of cohort events to one per semester. We administered a poll asking our scholars about the types of events they deemed most beneficial at the start of fall 2020. The most popular events were related to interacting with other Gateway Scholars students and career planning advice. In the fall, we hosted a peer panel discussion for students in the program focused on advice about getting involved in undergraduate research and navigating remote learning. In the spring, we collaborated with the Bridges to Baccalaureate program to host a department wide panel discussion with early career professionals in 4 fields.

Outcome Measures from the Career Planning Panel Discussion.

Attendance: 22 students
Program duration: 1.5 hours
Feedback comments:

> "Hearing everyone's different career paths and the importance of networking was really informative. Grateful this webinar was available. The most useful topic for me was hearing they ways the panelists had reached out to people. Like simply sending an email and really talking with other people. I feel more confident in simple talking to others and trying to learn more to help me decide what I'd like to do."
>
> "I appreciated that you had a variety of panelist in the various fields to answer questions and discuss their jobs. There are so many avenues to take in biology and getting a wide variety of experiences was extremely helpful. I found hearing about the day to day job and identifying the best and worst parts of their jobs the most useful. It provided an insight to allow me to know that I was on the right track because the answers to these questions got me excited about job outlooks."

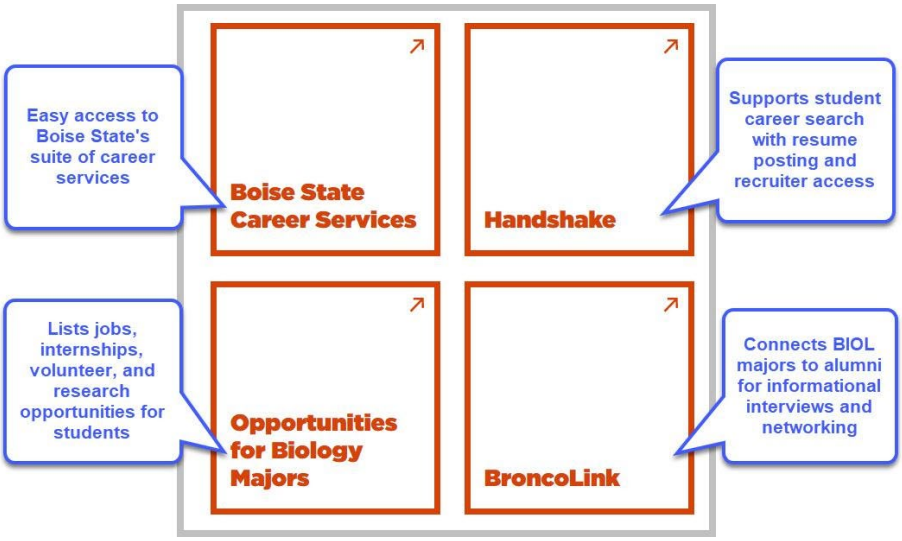
Supporting Career Exploration [4.c.]

Due to the Covid-19 pandemic we were unable to host field trips for the GSP in 2020-2021.

The pandemic prompted creativity as the department began increasing activities to support all Biology majors' professional/career development through partnerships and web resources. The Student Opportunities website was redesigned in Summer 2020 including:

- A renewed partnership with the Boise State Career Services including internship placement.
- The "Handshake" and through an augmented web presence with Biology specific career information on the Student Opportunities website -- students and alumni can exchange email messages or meet virtually too.
- The advising office emails students opportunities for internships and organizations that are interested in hiring Biology students. These offerings are posted on the Student Opportunities website.

Figure 5 Screen Capture of the Student Opportunities Website



Encourage and Document Student Engagement in Undergraduate Research Experiences (UREs) with a Target of 25% of GSP Students Participating in an URE [4.d.]

The Gateway Scholars survey was administered in the spring 2021 in lieu of the focus group. Five of the students in the cohort responded to the survey to share details about their engagement in the program this year. The following questions and answers provide input regarding the types of engagement related interactions the students reported.

In what ways do you connect to the Department of Biological Sciences community (faculty, staff, students) other than through the GSP?

- S1: I communicate with a variety of faculty, staff, and other biology students. I also attend the research seminars.
- S2: I connect to the Department of Biological Sciences community through the Biology Club at Boise State University.

- S3: I currently do research for [Biology faculty member] as a part of his VIP program and have formed a study group with students from the biology club.
- S4: I work in a research lab with a faculty member.
- S5: Through research.

According to the departmental records, in the fall we had 4 scholars in undergraduate research and 4 in the spring. There were a total of 6 unique students involved in research in those semesters (35% of the active GSP cohort).

Although only partial data, this survey suggests that GSP students are engaging with the program through a variety of enrichment activities which provide them access to professional identity support.

Objective 4 Insights

- Enhancements for students' career/professional development support have been made through faculty mentorship, as demonstrated by the GSP scholars experience.
- The Biology department has partnered with Boise State Career Services to support student internships in positions related to the biological sciences.
- The department has devoted resources to building a more robust website to share professional development opportunities and links for students.
- Although opportunities for field trips and seminars were limited this year, the options open to students provided benefits. Maintaining one to two events per semester with one that is either offered as a hybrid or online is recommended.
- Even with fewer opportunities for UREs during the year, 35% of the GSP cohort engaged in undergraduate research during the year.

Objective 5: Summarize and Reflect

The focus of objective 5 is to summarize and reflect on the effects of the overall project and activities implemented in objectives 1-4 regarding retention, student success, degree attainment, and diversity. In meeting this objective, we will create project outcomes to provide broader impacts, draw conclusions, and make program plan adjustments.

5.a. Measure progress on objectives by collecting data and measuring via:
- 5.a.i. Annual Focus Group (objective 1, 2, 3, and 4)
- 5.a.ii. COPUS Instrument (objective 3)
- 5.a.iii. Rapport Survey Data (objective 3)
- 5.a.iv. Biological Self-efficacy and Sciences Identity (BSESI) Assessment (objective 4)

5.b. Student retention, academic performance, degree attainment data (objective 1, 2, 3, and 4)

5.c. Distribute a summary of the annual report to faculty for feedback and future action

5.d. Summarize and disseminate broader impacts

Objective 5 Activities in 2018-19

Annual Focus Group [5.a.i.]

While our annual plan specifies conducting focus group conversations each spring with Gateway Scholars to understand the impact of program activities on their academic persistence, biological science identity development, and sense of belonging, the COVID-19 pandemic disrupted these planned activities. We opted, instead, to add open-ended questions on the Gateway Scholars survey collected to inform objective 5. We have gathered data relative to students' perception of useful supports (mentorship relationships, opportunities to connect to other students via Biology Club, and seminars) in addition to helpful advising related practices.

Data Collection and Analysis (Indirect and Direct Assessment) [5.a.ii–5.a.iii]

During 2020-2021 co-PI Stieha collaborated with Brittnee Earl, Laura Bond, Amy Ulappa, and Julie Oxford to finalize a manuscript analyzing findings about the belonging measures and teaching practices collected (objective 3) during year 3. Those findings help frame our review of the data in the rapport survey during 2020-2021 (see Appendix E for the manuscript citation and abstract).

We collected and analyzed data from the Gateway Scholars survey, rapport survey and from the Biological Self-Efficacy and Science Identity instrument. These data are summarized in this report.

Biological Self-Efficacy and Science Identity (BSESI) [5.a.iv]

This year, we conducted a more thorough analysis of the Biological Self-Efficacy and Science Identity (BSESI) instrument, focusing on cumulative data collected during years 1-4. Since it was first administered in 2018, we have collected 92 responses to the instrument. The scholars are invited to complete surveys each year.

Nine (9) items are designed to measure Biological self-efficacy using a 4-point scale which ranges from not at all confident (1) to completely confident (4):

1. I can relate results and explanations of one research study to another research study.
2. I can apply the scientific method of analysis.
3. I can critically assess data and ideas found in scientific research literature.
4. I can use scientific language and terminology to explain biologically-related facts and theories.
5. I can use technical science skills in a biology laboratory.
6. I can use quantitative and technical skills to collect, analyze, and graph data.
7. I can carefully observe people, the environment, and organisms to recognize patterns.
8. I can contribute to a research team conducting original biologically-related research.
9. I can inform or teach fellow citizens about biological facts and theories related to everyday societal controversies.

Five (5) items are designed to measure science identity using a five point scale from strongly disagree (1) to strongly agree (5):

1. In general, being a scientist is an important part of my self-image.
2. I feel like I belong in the field of science.
3. Being a scientist is an important reflection of who I am.
4. I have a strong sense of belonging to the community of scientists.
5. I am a scientist.

A factor analysis with varimax rotation confirmed that the scale includes two constructs (self-efficacy and identity) with 60.6% of the variance explained. Cronbach's alpha for the Biological Self-Efficacy (α = .90) and Science Identity (α = .864) are both high; removing any of the items will decrease the alpha. The items for the Biological Self-Efficacy are designed based on the Vision and Change in Undergraduate Biology (2015) report.

Of the 39 unique respondents to the survey, only two responded each of the five possible years between 2017 and 2021. Table 8 displays the frequency of the number of responses each of the cohort members contributed over their active years in the program, most responded 1-3 times.

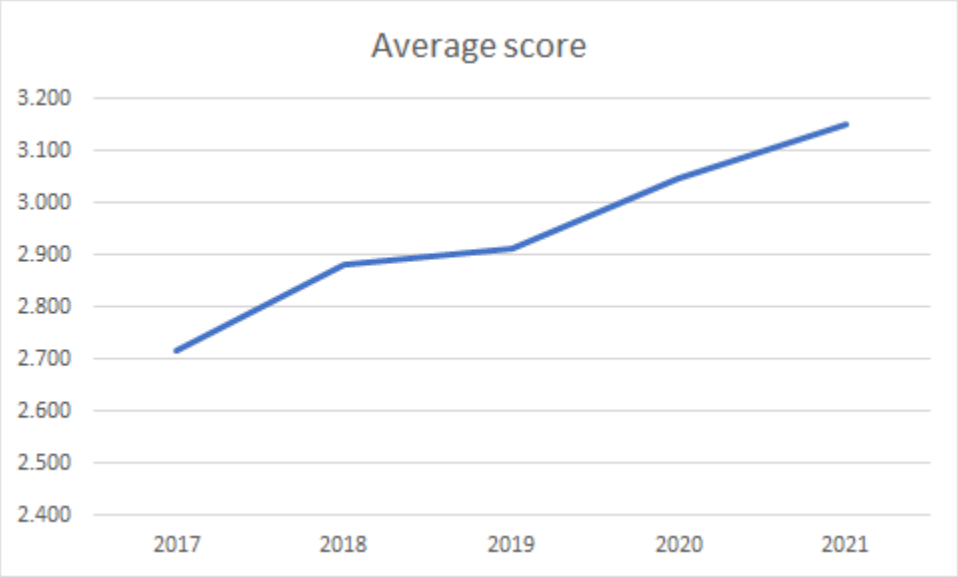
Table 8 Frequency Table of the Number of Responses to the BSESI Instrument

Repeated responses	Count
1	**12**
2	**11**
3	**9**
4	**5**
5	**2**
Total	**39**

The average score for the cohort by year ranges from 2.71 in 2017 to 3.15 in 2021 (on scale of 1-4). The average scores on the combined BSESI scale do show a gradual increase as students moved through the degree, which would be expected (see Figure 6). We note that the scores for several students when they first complete the scale are higher than their second submission. It is not uncommon for students' self-

efficacy to be higher as they enter college and to dip slightly as they encounter challenges, but then rise again as they demonstrate competence in the field.

Figure 6 Average Biological Self-Efficacy Score for the GSP Cohort Between 2017 and 2021



We analyzed the means for the self-efficacy (BSE) and science identity (SI) constructs comparing the average means by demographic group. We used an independent samples t test to compare the means for each scale by the available demographic variables (gender, URM status, and first-generation status). There were no differences found for either construct by gender or URM status. There was a significant difference when we compared the means for first-generation college students (FGCS) to those who are not first-generation (Non FGCS). As the data in Table 9 demonstrates, the BSE and SI means for FCGS group are lower on both constructs and that difference is significant.

Table 9 Means Comparison by Generational Status for Students on the BSE and SI Constructs

	FGCS	Non FGCS
Biological Self-Efficacy	**2.69 (.104) 40***	**3.09 (.076) 49***
Science Identity	**3.90 (.145) 40***	**4.33 (.079) 49***

* The difference between the means for each group on each construct are significant. BSE (p = .012) and SI (p = .003)

Implications of BSESI Findings

We know from the STEM education literature that first-generation status is correlated with a higher attrition rate (Chelberg & Bosman, 2019; Weston et al., 2019). Examining the records of the five students in

the cohort who left Boise State without earning a degree, we note that three are first-generation college students and two of them come from underrepresented backgrounds. As we look at the BSE means for the students who left without a degree, all are below the average of the cohort. Three of the five have a SI score that is below the average. While a small sample, the trend in this subgroup is consistent with the general findings that are well established in the literature. The importance of mentors and the steps that faculty can take to integrate EBIPs and inclusive teaching cannot be overstated if the program is to better meet the challenge of retaining first-generation and underrepresented college students.

Students' Expressions of Relationships in DBS [5.a.iv]

Our third research question asks how students perceive the student-faculty and the peer to peer relationships in the DBS. Two sources of data inform this question--the rapport survey quantitative data and open response comments, and the Gateway Scholars survey (which replaces the focus group and the Biology 198 survey).

As discussed above, the **peer relatedness** means on the rapport scale fell from spring 2020 (*m* = 2.58) to spring 2021 (*m* = 1.95) (see Table 5b). Professor relatedness means, however, were relatively unchanged as 2020 (*m* = 2.93) and 2021 (*m* = 3.12). It is possible that students' interactions with the professors through Zoom classes actually decreased their social distance and that the direct outreach by faculty increased the perception of care they experienced. Response rates during the pandemic were lower than they have been when we collected these data in face to face classrooms and the necessity for remote learning doubtlessly played into the very low rates this year. It is clear from the students' self-reported instructional methods that peer to peer interaction was either negligible or non-existent in most classes (BIOL 304 was the exception).

Student Retention, Academic Performance, Degree Attainment Data [5.b.]

Through the grant period DBS has experimented with various methods to effectively engage students who are at risk or off track. The shift in year 4 to a blend of faculty outreach with support from the professional academic support systems the university offers has proven beneficial. The rates of students' responses to TAs and faculty are higher than they are to the advisors. The academic alert system can effectively support faculty as they work to support students. Appendix E provides an infographic on overall outcomes for the Academic Alert program university wide and includes two BIOL courses as those most frequently reporting students. While it is not necessarily positive to have a high number of students at risk, the fact that BIOL faculty are making good use of an effective service indicates that DBS efforts to support students are impactful.

Our data tracking for the GSP asks the enrollment status of cohort students as DBS majors from the census date[2] of a given term to the census date of the next term. If a student changes their major after the census date during a given term, that change is reported as of the census date of the next term.

The goal of the GSP is to retain and graduate students in BIOL or another STEM major. If a student switches their degree to another STEM major, they are counted as "retained in STEM." As noted in objective 1, seven students have changed from BIOL to a non-STEM major and are counted as attrited for GSP grant purposes. Six students have changed to other STEM degree programs and remain enrolled at the university, hence are counted as retained.

As we reported in the findings for objective 1, we are achieving our goals for student recruitment, retention, and graduation with special attention to first-generation students and URM students:

Cumulative retention (2017-2021):	82.5%
% of need met (2019-2021):	91.0%
Recruit first-generation students:	46.0%
Recruit URM students:	32.0%

Distribute Summary of Annual Report to Faculty for Feedback and Future Action [5.c.]

As discussed in Objective 3.c. reports generated from the annual review of the GSP objectives, including data analysis, are shared with the faculty each year and integrated into faculty meetings focusing on student success. In addition to preparing and submitting a manuscript for publication, this year we made annual reports available through Boise State scholarworks. These documents are produced in accordance with our data management plan. See also, 5.d.

Summarize and Disseminate Broader Impacts [5.d.]

As noted above, findings from the GSP related research activities have been submitted for review by CBE Life Sciences Education (May 2021) and we are awaiting a response from the reviewers.

The GSP Annual Reports have been archived and are publicly searchable via Boise State's Scholarworks pages:

Stieha, V., Oxford, J., Ulappa, A., Earl, B., Forbey, J., Feris, K., & Cullers, J. (2019). *Gateway Scholarships in Biological Sciences: Year 2 Annual Repor*t. Boise State University. https://scholarworks.boisestate.edu/bio_facpubs/646/

[2] The Boise State census date for the fall semester is October 15th, and the spring semester census date is March 15th. There is no defined census date for the summer term.

Stieha, V., Oxford, J., Ulappa, A., Earl, B., Bond, L., Forbey, J., Feris, K., & Cullers, J. (2020). *Gateway Scholarships in Biological Sciences: Year 3 Annual Report*. Boise State University. https://scholarworks.boisestate.edu/bio_facpubs/645

Additionally the Biological Self-Efficacy and Science Identity instrument (Stieha, Forbey, Ulappa, Ferris, and Oxford) has been shared with another grant team (GEM3) and will be adapted for "SCIENTIA: Communicating STEM Research in Languages other than English." See https://www.idahogem3.org/spanish-translation-scientia for details.

Objective 5 Insights

The GSP is meeting its goals this year. Despite challenges during the pandemic, the program marks these achievements:

- Gateway Scholars are earning and progressing toward degrees as expected.
- The DBS faculty are actively engaged in efforts to support student success in classrooms and labs.
- The instruments generated to support this research are returning valuable insights about the student experience.
- We are disseminating findings that can be applied to increase the impact of this NSF grant at Boise State and elsewhere.

GOALS FOR YEAR 5: 2021-22

Objective 1 Manage a faculty-mentored cohort program that provides scholarships and a coherent ecosystem of support for low-income, academically talented DBS students.

In the fifth year of the GSP we will:

1.a. Continue support for existing GSP cohort students to complete their degree programs.
1.b. Continue providing support for students to meet with their faculty mentor twice per year and add a focus on transitioning from undergraduate to graduate school or career. The faculty are encouraged to continue offering either face to face or online meetings based on their own and the students' needs in the coming year.
1.c. Review mentor activities that have been successful and recommend ongoing protocols for faculty to use when mentoring undergraduate students.
1.d. Continue measuring performance on this objective through student self-report forms.

Objective 2 Risk-based advising system with proactive advising for Gateway Scholars

In the fifth year of the GSP we will:

2.a. Work with faculty to standardize outreach efforts and document those efforts. We note that the efforts of faculty to directly reach out to students and to report students who are at risk through the academic alert system appear to be efficacious and we hope to be able to demonstrate this. **RECOMMENDATION**: BIOL 310 does not appear to be engaged in early alert activities and rapport scores are lower than all other classes. Creating an appropriate strategy for this class is highly encouraged. Outreach to students who are showing signs of lower performance can express caring and help them know their success matters.

2.b. Continue to invite Gateway Scholars to meet with an advisor each semester. The checklists for majors appear to be serving students well. As the GSP cohort continues to complete degree requirements offering advising support remains important, however, the faculty mentoring meetings for professional/graduate school planning are likely more important for the cohort members.

2.c. The advisor or their designee will update advising notes documenting advisee meetings, including annotations about outreach to at-risk students. This activity is working well and will be continued.

2.d. Include discussions about advising related issues with faculty at department faculty/committee meetings. As the department resumes face to face activities, these activities will continue as they appear to be effective.

Objective 3 Integrate evidence-based instructional practices (EBIPs) in the DBS core

In the fifth year of the GSP, we will:

3.a. Encourage EBIP usage in core courses and labs by sharing the practices that have been supportive even during the pandemic. As noted above, we will recommend integrating technologies used during 2020-21 to afford greater flexibility and accessibility.

3.b. Measure impact of EBIPs in core courses

3.b.i. Rapport scale. The rapport scale will be repeated in year 5. We will remove the effort questions which have a low alpha. We will add questions that pertain to autonomy as this is a recommendation based self-determination scale findings elsewhere.

3.b.ii. Instructional practices used. We will not be conducting COPUS observations in 2021-22 unless they are requested. We have found consistency in the outcomes that suggest administering it less frequently and relying upon the correlation with rapport is a useful proxy for engaged teaching (Stieha et al., under review).

3.c. Close the loop through data sharing meetings with faculty. This annual report is furnished to the DBS chair who shares findings with the faculty.

3.d. Foster greater success in BIOL courses and measure these efforts through analysis of grades (previously focused on learning assistance). We will continue to analyze the DWF rates and encourage faculty to utilize outreach efforts which have been correlated in this report with lower rates of failure.

Objective 4 Engage GSP students in co-curricular activities to support cohort building

In the fifth year of the GSP:

4.a. Continue offering BIOL 198 as an elective course for all majors.

4.b. The GSP program will provide 2 co-curricular events during the year to help scholars explore diverse career paths and/or graduate degree options.

4.c. As this is the final year of the grant and most of the students in the cohort are nearing graduation, we will not pursue a goal of field trips. We will, however, continue to partner with the Biology Club and promote events (including field trips) to encourage all majors to engage and strengthen their community experience.

4.d. Encourage and document student engagement in undergraduate research experiences (UREs) with a target of 25% of GSP students participating in a URE's or internships.

Objective 5 Summarize progress toward program goals and reflect

In the fifth year of the GSP we will:

5.a. Seek to collect rapport data and BSESI data in other DBS courses to consider the overall level of rapport in the department.

5.b. Continue to gather student data in accordance with the GSP objectives. Our research focus includes a review of the BSESI. Additionally, the GSP team will seek another S-STEM work to build on the progress made through this grant.

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APPENDIX

Appendix A: Faculty-Student Mentor Supporting Material

The following document was sent to all faculty mentors to provide information about the importance of mentors reaching out to students and to provide boilerplate language for them to use.

Hi mentors,

In normal semesters, weeks 8 and 9 are stressful for students as they are mid-way thru their classes and this semester, it may be even more stressful. I wanted to ask you to check in with your mentee for the S-STEM program (see below). In the past, they have been responsible for reaching out to you so this reversed invite is meant to increase student/mentor meetings.

Recent research shows that check-ins from faculty members can positively impact feelings of belonging and support for students. Also, some good news is that some students have reported that having a meeting via Zoom is easier for them than visiting an office visit. I have included a link to a podcast episode from "Teaching in Higher Education" about learning and supporting students in the pandemic (HERE) and one about mental health on college campuses (HERE), if you are further interested in this topic.

It is a good time to reach out to your student to invite them to meet via Zoom with you and discuss how the semester is going for them and talk about any strategies for managing this semester and planning for the spring.

I have included your mentee name and email here and below is a generic outreach email you can cut and paste then send to them to save time!
[Table redacted to protect student privacy]

Thank you for participating as a mentor in the NSF Scholarships in STEM Gateway Scholars program. Most of you were able to meet with your student a few times since they began in the program and the feedback we had from students about these meetings was all positive, they loved talking with you one on one!

Please let me know if you have any questions or concerns and thank you for your involvement in this program!

Amy

Student check-in email to cut and paste (then send!):

Hi,

I wanted to reach out and invite you to meet with me this semester via Zoom, as your NSF S-STEM Gateway Scholars program mentor. I know it is a busy time of year and am happy to chat about anything that would be helpful, including; course planning, career next steps, learning and life balance, study tips, or helping you find solutions to any barriers you are experiencing.

Just email me some dates/times that will work for you and I will send you a google calendar invite for a Zoom meeting.

Looking forward to chatting,

FYI – Faculty info about this program:
This year (yr 4 of the grant) we have 20 current awardees and recently have had many graduates! The goal of this program is to help support students in our department so they can make progress to their future goals.

Your role as a mentor is to be a resource for your mentee by meeting with them twice a semester. You all have specialized knowledge of how to navigate the university and also have a wide network of people (your colleagues, grad student or undergrads in your lab) that you can connect to your mentee.

Scholars in our program are academically high achieving and are an under-represented group in STEM (i.e. first-generation in college, minorities, women). One topic all students can benefit from is learning how to get the most out of college. This New York Times article is a good one and reading it may help give you ideas for what to discuss with your student.

https://www.nytimes.com/2018/08/17/opinion/college-students.html

Appendix B: Proactive Risk-Based Advising System for Gateway Scholars

Objective 2.a. Monitoring On/Off Track Students: Supporting Material

To pilot a system of faculty outreach to students, Co-PI Ulappa used the following message to send individually to each student each semester:

Personal email check in from program coordinator to each scholar.

Sent inn fall on Nov. 23, 2020:

Hi XXX,

I just wanted to check in during this fall break to see how the semester is going for you. This has been an exceptionally difficult year and it is normal that new challenges might arise. Please let me know if you have any questions or concerns as you prepare for the spring semester.

I am happy to help you navigate preparing for the spring or connect with a peer or your faculty mentor if you have not been able to this year.

Here's to a restful fall break and 3 more successful weeks of the fall semester!

Sent in spring on Mar. 7, 2021

Hi XXX,

I just wanted to check in mid-semester to see how the semester is going for you. This has been an exceptionally difficult year and it is normal that new challenges might arise. Please let me know if you have any questions or concerns as you are working through this spring semester.

I am happy to help you navigate preparing for the summer or next year or connect with a peer or your faculty mentor if you have not been able to this year.

Here's to warmer weather!

Appendix C: Integrating EBIPs into the DBS Core Supplemental Material

Objective 3.b. Open Responses to Most/Least Helpful Methods Questions on the Rapport Instrument

The findings about the methods that students find helpful and unhelpful discussed in students' responses (n=312) to the open ended questions are elaborated upon in this section. The discussion of these data and their implications are included in Objective 3.b.

Helpful Methods Insights:

- 59 responses specifically mention that participating in a synchronous Zoom lecture kept them engaged in their learning. Other methods that encourage student-to-student and student-to-professor interaction and engagement were also mentioned as being helpful, including required discussion board posts, Zoom breakout group sessions, and synchronous review sessions.
    - Synchronous Zoom:
        - *I liked having active zoom classes because it felt more interactive and kept me accountable for my learning.*
        - *The live lectures were very helpful because I could ask questions in real-time.*
        - *The live zooms are helpful because you can ask questions in real-time and it prompts discussions which seem most beneficial to my learning.*
    - Discussion Board:
        - *The discussion boards gave me the opportunity to articulate what I'd learned.*
        - *Honestly the discussion boards [...] have been really helpful to me. It was great to hear feedback from some of my classmates and also then go over the concepts in full during the zoom lectures. I really enjoyed getting to interact with my classmates though, it made it so that I could still individually learn but then get feed back [sic] when I needed it. It also definitely helped me keep on track, or else I would procrastinate everything.*
        - *The discussion boards, because we posted weekly about the lecture material and the group assignment. We were able to communicate with each other and get clarification on topics we covered in class.*
        - *Discussion board posts in a group that requires 2 initial posts and 3 replies each week on homework assignment. It's been helpful to gain new thoughts from others and confirm our thoughts are on a similar page.*
    - Review Session/Breakout Group:
        - *It was really helpful to have Zoom sessions to review the material and be able to ask questions. Having my questions (and those of my classmates) answered was helpful, as were the polls during the sessions and breakout rooms. It was nice to have some structure to these sessions so we didn't get off topic or have nothing to talk about.*
- 72 responses indicate that recorded lectures provided by the professor were helpful in terms of allowing flexibility, both in terms of how and when students accessed the lecture as well as their ability to play, pause, and repeat certain parts of the lecture. 31 responses specifically mention the value that recorded lectures offered in repeat viewings, which allowed students to refine their understanding.

- *Lecture videos - able to learn the material at my own pace.*
- *The recorded lectures were helpful because I could increase the playback speed, pause, and rewind [...] to efficiently and effectively learn the content.*
- *I love recorded lectures because I can pause, google something, watch an extra video, if needed, to understand a concept I don't understand before moving through the rest of the lecture. My studying becomes less intense too, because the learning in lecture was already more at my pace and in depth.*
- *I found the recorded lectures the most helpful as I can go back and rewatch the lectures if needed.*

- A variety of methods that supported student note-taking were also mentioned. These included providing notes in advance of lectures, incorporating Powerpoints that supported note-taking, as well as professor-guided annotation.
  - *Although it was online, the Zoom meetings are something I looked forward to because I'm a visual learner. I saw her write notes with us which I liked.*
  - *It also made note taking easier, because I could write what she was writing, as well as add some of the other stuff she was saying.*
  - *Additionally, the interactive PowerPoint slides were LIFE SAVERS because it ensured I was still following along with the lecture but saved me tons of time because I wasn't taking notes "the old fashioned way"*
- Online assignments, such as those posted on the learning management system Blackboard, as well as eLearning activities, were mentioned as being helpful. Offline assignments, done by hand on paper, were also thought of to be helpful in students' learning. Respondents also found value in assessments, such as quizzes, in an effort to check their understanding.
  - *The recorded lectures and associated assignment is as helpful as remote learning lectures can be I think!*
  - *I found [...] comprehension questions present throughout each lecture particularly helpful because they allowed me to apply and practice using the information I had just learned!*
  - *I liked the individual assignments, as they really flexed my understanding of the material in a fun and creative way.*
  - *Individual assignments. I'm in charge of my own work and ensuring that I find and work on any holes in my knowledge.*
  - *The interactive website e-learning because it gave me more of a hands on approach with the material and that is how I learn the best.*
- Respondents also mentioned procedural methods supporting their learning (e.g. clear communication, consistent scheduling, regular reminders sent via email, and previewing information in advance of the next class).
  - *She was very clear with her expectation and communication. This help me know exactly what she wanted from us and helped me learn.*

- *The specific objectives and posting the powerpoints so I can make a document that follows along the important information for the class.*
- *I would say when she sent out emails reminding of things that were due. Also, giving the general idea about what the next class was going to be about.*
- *I think keeping a consistent, set, schedule was helpful for and gave me a sense of stability with this course.*

- Supplementary materials such as videos and additional assignments were also viewed as helpful.
  - *I think that it was very useful how my instructor would add in videos to the recorded lectures that related to the content we were learning. It helped me visualize the content and it was entertaining at the same time.*
  - *additional worksheets, because they help solidify and simplify complex material [sic]*

Problematic Methods Insights:

- 27 responses mention a gap between the information presented (textbook, lectures, other instructional materials) and the information that students were assessed on in quizzes and tests.
  - *What is gone over in the recorded lectures and the book are not efficient enough to answer the questions on the tests or assignments. The questions on the tests/weekly assignments are not straight forward at all and often leaves me confused and makes me question if I am learning the correct material.*
- 24 responses indicate inadequate feedback as being problematic.
  - *Assignments took so long to be graded that I did not get the feedback to be confident that I was doing the best I could on future assignments because of feedback on previous assignments helps me do better in the future. I learn a lot from feed back.*
  - *The only issue I had was not being able to view which questions we got wrong on our weekly homework assignments. That is probably a Black Board issue, but it's unfortunate not to see what we need to work on.*
  - *Just the multiple choice questions doesn't feel really challenging, but it is somewhat useful for learning terms and such [sic]. I would like to see which ones I got wrong for it.*
- Required online discussion board posts were also frequently deemed as problematic for a couple different reasons.
  - Inadequate Feedback:
    - *If I had to choose one, I would say discussion board assignments have not benefited me at all. [...] I try to tackle some of the more complex questions and its generally the one post that didn't get feedback.*
    - *The discussion boards were a bit problematic, since the answer [sic] are not particularly graded on accuracy.*
  - Inadequate Meaningful Interaction:
    - *Discussion board posts were sometimes difficult - in particular if there wasn't much on the group discussion activities that I was confused about, or if my classmates*

hadn't posted anything that I could give a meaningful response to. It could be hard to find ways to reply beyond just saying that I agreed with an answer, if questions posted were some of the simpler questions from the activity.
        - *Using discussion posts that had required number of posts and replies did not help my learning and felt like busy work.*
        - *Many [students] didn't do well to discuss, thought they knew everything, or waited until the last second to post.*
- 21 responses indicate problematic methods manifesting in attention deficiencies impacting learning.
    - 16 specifically mention recorded lectures as being the source:
        - *At the same time the prerecorded lectures were problematic because it did make the class taught at my own pace. I have a bad habit of procrastinating so a lot of the time I was rushing and it felt like I wasn't holding myself to learning/processing the material.*
        - *Recorded zoom lectures are very difficult to stay engaged with.*
        - *Sometimes the lectures were hard to follow along with or I didn't thoroughly understand the concepts taught.*
    - Only offering recorded lectures for the bulk of professor-led instruction was found to be problematic:
        - *The recorded zoom lectures aren't for me and I am a little disappointed in this class because they are pre recorded lectures. I signed up for a live-zoom class and went in expecting what I signed up for, this wasn't the case. I am spending hours taking notes and watching the lecture videos over and over to try and understand the material. It would be so much easier if this class was a live-zoom lecture like what we all signed up for and not a pre-recorded class.*
        - *I think that having the recorded lectures was hard to follow along with because they weren't live over zoom. I would have much rather preferred this because it was hard to sit down and take notes on a video rather than having a live video feed and knowing that there is an actual person talking to me that wasn't pre-recorded.*
        - *I would really rather prefer having a lecture over zoom rather than a recorded lecture because it is easier to stay on top of the class and pay attention. Recorded lectures allow time to slack.*
- 12 responses articulate problematic technical difficulties in a variety of capacities (e.g. Zoom meetings and recordings, iClicker responses, and navigating software).
    - *I'd say the only problem was when zoom would randomly cut out and about half the lecture wouldn't record correctly.*
    - *I did not really like the clicker questions. I actually thought the questions themselves were really helpful and I learned how to do well on test questions through them too, BUT the technological issues that came with them were terrible. There were sometimes where I*

would get it right or know the answer but the clicker questions wouldn't load or just said I didn't answer. It added so much stress on me that I was way more worried about whether my clicker would work that day than what can I gain from this question.

- *There was a lot of glitches and times when [Zoom] classes would have to be cancelled because of it.*

Table 10 Means Comparison of Students' Perceived Competence Scores

INST 6	INST 4	INST 10	INST 3	INST 8	INST 12	INST 2
2.99 (0.06)	**3.07 (0.12)**	**3.26 (0.18)**	**3.33 (0.09)**	**3.33 (0.08)**	**3.40 (0.23)**	**3.44 (0.06)**
127[a,b]	**42**	**15**	**45**	**70[b]**	**10**	**81[a]**

There was a statistically significant difference between groups as demonstrated by one-way ANOVA ($F(6,383) = 4.86$, $p = .000$). There is a significant difference between INST 6 and INST 2 as well as INST 6 and INST 8. There are overlapping groups among all instructors.

Table 11 Means Comparison of Professor-Relatedness Scores

INST 10	INST 6	INST 4	INST 3	INST 2	INST 12	INST 8
2.60 (0.28)	**2.77 (0.07)**	**2.96 (0.12)**	**3.18 (0.09)**	**3.28 (0.08)**	**3.52 (0.16)**	**3.53 (0.07)**
15[a]	**127[a,b]**	**42[a,b]**	**45[b,c]**	**81[b,c]**	**10[c]**	**70[c]**

There was a statistically significant difference between groups as demonstrated by one-way ANOVA ($F(6,383) = 12.069$, $p = .000$). A Tukey post hoc test revealed three significant groupings with overlap between them.

Examining differences by gender for all courses combined we see that females' perceived professor-relatedness is higher than that of males ($p = 0.046$). We find no statistically significant differences within courses for any other demographic variables.

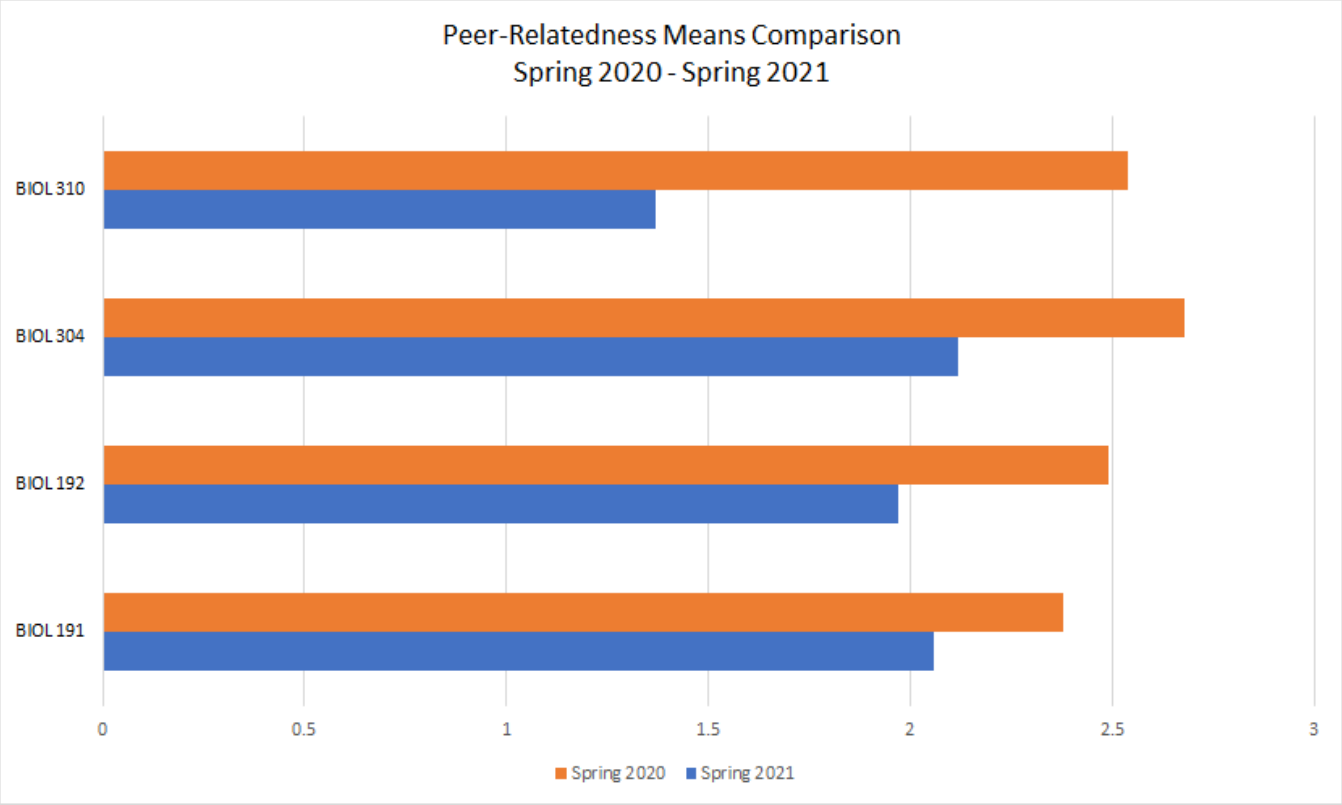
Table 12 Means Comparison of Peer-Relatedness Scores

INST 10	INST 4	INST 6	INST 3	INST 2	INST 8	INST 12
1.37 (0.12)	1.78 (0.09)	1.93 (0.05)	2.00 (0.11)	2.09 (0.09)	2.15 (0.09)	2.33 (0.19)
15[a]	42[a,b]	127[b,c]	45[b,c]	81[b,c]	70[b,c]	10[c]

There was a statistically significant difference between groups as demonstrated by one-way ANOVA ($F(6,383) = 4.074$, $p = .001$). A Tukey post hoc test revealed three significant groupings with overlap between them.

Overall, STEM majors' mean score peer-relatedness is higher than other majors ($p < .05$).

Table 13 Peer-Relatedness Means Comparison (Spring 2020 - Spring 2021)



Peer-relatedness fell lower, on average across all courses, from spring 2020 ($m = 2.50$) to spring 2021 ($m = 1.88$).

Table 15 Means Comparison of Effort Scores

INST 4	INST 2	INST 8	INST 10	INST 6	INST 3	INST 12
3.27 (0.09)	**3.31 (0.07)**	**3.32 (0.08)**	**3.43 (0.15)**	**3.47 (0.05)**	**3.50 (0.07)**	**3.85 (0.11)**
42[a]	**81[a]**	**70[a]**	**15[a,b]**	**127[a,b]**	**45[a,b]**	**10[b]**

There was a statistically significant difference between groups as demonstrated by one-way ANOVA ($F(6,383) = 2.436$, $p = .025$). A Tukey post hoc test revealed two significant groupings with overlap between them.

Differences by gender indicate that females' perceived effort is higher than that of males ($p = 0.015$).

Close the Loop Through Data Sharing Meetings with Faculty Workshop Goals and Activities [3c]

The following description of a spring 2021 departmental workshop focusing on understanding and removing microaggressions is an example of one of the activities that the department included this year to help close the loop with faculty. Our data throughout the grant has indicated that peer rapport is lower than the other belonging related constructs. Faculty management of the instructional sphere is an important factor to reducing students' negative belonging experiences.

Microaggressions in Science
Department of Biological Sciences Seminar
March 11, 2021

Facilitated by Sarah Dalrymple

WORKSHOP GOALS

By the end of the session, you should be able to:

- Recognize microaggressions when they occur
- Apply specific communication frameworks to address microaggressions and create an inclusive environment in your courses or lab.

SUMMARY

To prepare for the interactive seminar, participants were asked to view two videos. One was a recorded video of a SABER (Society for the Advancement of Biology Education) seminar about racial microaggressions. It was led

by Dr. Colin Harrison, who is an Academic Professional at Georgia Tech. The other recording was an Instagram video posted by Dr. Danielle Lee, who is an Assistant Professor at Southern Indiana University.

Once participants had joined the Zoom meeting, we started by establishing community agreements and reviewing the definition of a microaggression. The participants were then sent to breakout rooms in small groups (3-4 people) to discuss the following prompts:

- What was the most important thing you learned?
- What was the hardest thing to hear?
- What are a couple of your key takeaways from the videos?

After 15 minutes, we returned to the main room to hear from different groups. The purpose of this discussion was to make sure everyone knew what microaggressions were and had tangible examples of the harm that they cause. I think this helped increase buy-in for the subsequent activity.

Following that discussion, I presented two different communication frameworks that can be used to respond to microaggressions or other difficult situations. Then participants worked in small groups to practice applying the frameworks to different microaggression examples. There were three total examples that were drawn from the SABER presentation, and each group considered just one of the examples for the activity. Participants worked in this google document to draft their responses and then we came back to the main room for different groups to share how they applied one of the frameworks to a scenario.

Appendix E. Summarize and Reflect

Objective 5.a.ii. and 5.a.ii

Stieha, V., Earl, B., Bond, L., Ulappa, A., & Oxford, J. (Under Review). The nexus of active learning and student belonging in STEM. *CBE Life Sciences Education*.

Abstract

Supporting faculty adoption of evidence-based instructional practices and active learning (AL) has proven challenging despite a large body of literature demonstrating the positive outcomes of such practices. Studies suggest faculty may be reluctant to adopt these evidence-based practices for various reasons (e.g. fear of student resistance, belief in traditional method). At the same time, we know that most faculty are interested in student persistence in STEM. The Biology department in a large research university sought to increase the use of AL and inclusive practices and boost student persistent. The results of this mixed method research study involving 987 students and 7 faculty demonstrate the positive correlation between AL practices and student belonging. It provides a mechanism to help faculty connect teaching practice to positive student outcomes including a sense of belonging drawing upon self-determination theory constructs that are correlated with persistence in STEM. Paired with the belonging measure we analyze data from the Classroom Observation Protocol for Undergraduate STEM

(COPUS) to document instructional profiles. This study demonstrates that using these tools in combination provides reliable feedback focused on course design, instructional practices, and students' sense of belonging.

Objective 5.b. Student Retention, Academic Performance, Degree Attainment Data (Objective 1, 2, 3, and 4)

Figure 7 reports data from the academic alert system at Boise State and highlights the efforts of Biology faculty teaching BIOL 191 and 192 to support students who are at risk by referring them for assistance to address academic or personal challenges.

Figure 7 Spring 2021 Academic Alerts for Boise State