

Broadening Participation: Engaging Academically At-Risk Freshmen in Undergraduate Research

Abstract:

Collegiate Bridge (CB) is a one-year academic support program that provides small classes and a structured introduction to the university to first-year students. Participants are admitted to the University of Wisconsin-Eau Claire through the CB program because they demonstrate the potential to succeed but may need additional support as they transition to college. All participants are either first-generation college students and/or students of color and are considered academically at-risk at the point of admission due to relatively low ACT scores (average composite ACT: 19) and high-school class ranks (average rank in class: 61st percentile). There are many facets to the CB program including out-of-class activities and events, course tutoring, and academic coaching; however, this article is focused on the Collegiate Bridge Research Experience (CBRE), a course-based introduction to undergraduate research offered to students in the CB program. The research-related content is embedded within the larger context of two required study-skills courses and occurs over the course of two sequential semesters.

Three key principles drove the design and implementation of a program for potentially at-risk first-year students at the University of Wisconsin-Eau Claire, the Collegiate Bridge program. More specifically, the principles informed the design of one of the bridge program's components known as the Collegiate Bridge Research Experience (CBRE)—a course-based introduction to undergraduate research. The first principle was that the program should focus on an underserved target population; the second principle was that this population should become engaged in the program immediately upon entering the university; and third was that the curriculum should be designed to be applicable to all students, regardless of major.

In terms of the target population, this project focused specifically on underserved students—those identified as students of color and/or first-generation college students. Multiple authors have found that participation in undergraduate research increased retention, improved academic performance, and positively impacted self-perceptions among this population of students (Brownell and Swaner 2009; Nagda et al. 1998). While it is evident that high-impact practices such as undergraduate research are beneficial, Kuh (2008) reports

that access to these practices is often limited. This is especially problematic because the underserved students who often miss out on such experiences are those who would reap even more benefits from them than the general college population. For example, at California State University Northridge, graduation rates increased 27 percent among Latino/Latina individuals who participated in two high-impact practices; non-Latino/Latina students participating in two high-impact practices experienced a much smaller increase in graduation rates (13 percent) (Huber 2010).

The timing of the program was crucial. Students, the vast majority of whom were 18 or 19 years old, participated in the Collegiate Bridge Research Experience immediately upon entering the university. This was intentional and based on the idea that the introduction of this type of experience early in the academic career of a traditional-aged student would enhance the development of his or her internally driven intellectual curiosity. Both Baxter Magolda (2008) and Hunter, Laursen, and Seymour (2006) state that students at this stage of identity development often view knowledge as something that has already been fully developed by others and that is held by “experts,” such as professors, who deliver it to students. The hope is that active and authentic participation in undergraduate research, early on, will enhance students' internal locus of control related to knowledge development so they realize early in their academic careers that they play a vital part in the creation of knowledge and the construction of meaning. In addition to the developmental outcomes, there are potential student-success outcomes associated with early exposure to high-impact practices such as undergraduate research. As Kuh (2008) states, the one thing that colleges and universities can do to enhance student success is to “make it possible for every student to participate in at least two high-impact practices in his or her undergraduate program, one in the first year, and one taken later in relation to the major field” (21).

The CBRE program was designed so that the research knowledge provided to students would be applicable to all students and firmly rooted in an interdisciplinary, liberal education. Our belief was that it was not sufficient to provide potentially at-risk college students with access to undergraduate research; it was also important that the experience be well-designed and grounded in evidence regarding best

practices related to the implementation of undergraduate research. Thus, the Collegiate Bridge Research Experience was formulated according to three best practices posited by Brownell and Swaner (2009). First, the curriculum was intentionally designed to build research skills slowly and over time, prior to exposing students to more intensive and independent undergraduate research. In the CBRE, this was accomplished via a two-semester course sequence in which the first semester was dedicated to the development of knowledge regarding basic principles of social science research and hands-on, guided practice in the utilization of that knowledge, while the second semester was focused on giving students increased independence and choice regarding the research process.

A social science framework was selected based on the belief that students, regardless of major, benefit from knowledge regarding how to frame questions, collect data to answer those questions, and then interpret what that data are telling them regarding the original question. Multiple individuals were involved in the delivery of the CBRE program, all of them intent on providing the student researchers with high-quality mentoring from a variety of sources. Throughout their time in the program, students actively engaged in three types of mentoring relationships: the first with an instructional staff person who possessed specific expertise in working with academically at-risk students; the second with a faculty member who delivered content specifically focused on research methods; and the third with a student research mentor with experience in undergraduate research.

In addition, several faculty members and student researchers from a wide range of disciplines visited the CBRE classroom throughout the academic year to share information about their research experiences. These visits enhanced students'

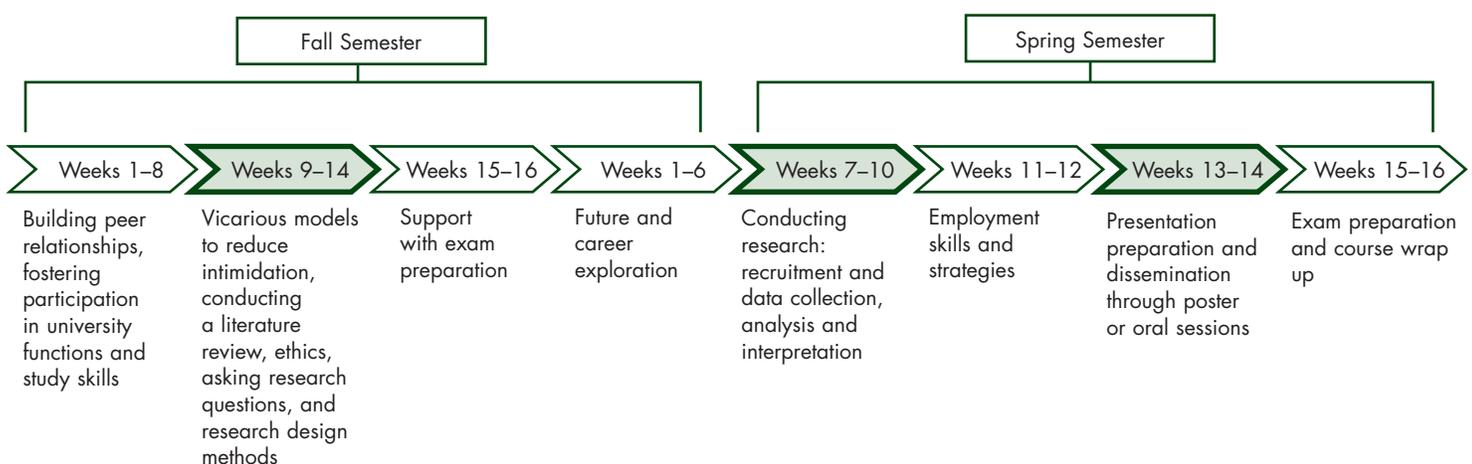
understanding of the wide range of opportunities available on campus and served as a means of connecting them to the larger academic community. Finally, CBRE students were provided with opportunities for “real-life” applications of their research skills via project implementation (including data collection and analysis) and presentation opportunities.

Implementation of CBRE

The Collegiate Bridge Research Experience is nestled in two 100-level study-skills and college-transition courses required of all Collegiate Bridge students. In the fall semester, students take GEN 100—Foundations for Academic Success—which counts as a two-credit elective. In the spring, students take a one-credit version of GEN 100 taught by the same instructor. The CBRE program consists of two sections of GEN 100 each semester with roughly half the program participants enrolled in each section.

The course-based nature of the research experience was designed to normalize engagement in undergraduate research by making it seem like a common curricular feature. The content of the course alternated between material related to study skills and material related to undergraduate research. The research component was addressed via three modules, the first one during weeks 9 to 14 of the fall semester, the second during weeks 7 to 10 of the spring semester, and the third during weeks 13 to 14 of the spring semester. During the other weeks, instruction was focused on the traditional curriculum for this study-strategies course, which includes topics such as time management, active study strategies, preparation for exams, and exploration of majors and careers. To make room in the curriculum for the material related to undergraduate research, an extensive unit about understanding oneself as a learner was cut and other ele-

Figure 1. Fall and Spring Semester Course Timelines for Collegiate Bridge Research Experience



Note: Bold arrows contain the research segments of the course.

Table 1. Researchers' Videos to Prompt Student Reflection on the Research Process

	Video 1	Video 2	Video 3	Video 4	Video 5	Video 6
Presenter (P# = presenter)	P1 was a senior who was serving as one of the CBRE research mentors and had previously served as a course peer mentor.	P2 was a sophomore with a research fellowship.	P3 was a junior sociology student, who was a previous CBRE student.	P4 was a senior who had been a CBRE student and had also completed research in her biology major.	P5 was a graduate student who was completing her master's thesis and had completed undergraduate research.	P6 was a faculty member who also was an alumnus of the university.
Experience	P1 shared her experience as a student researcher in CBRE and her research within her psychology major.	P2 shared her experience with background research, conducting an intervention study and collaborating with faculty.	P3 shared her research experience in CBRE and discussed presenting at an undergraduate research conference.	P4 discussed her research experience in CBRE and within her biology major.	P5 shared her undergraduate research experience, including presenting at a state and a national conference and how that motivated her to write a thesis.	P6 shared her experience as a master's student, within her eventual doctoral program, and as a faculty member.
Topics	How P1 got involved Expectation prior to research experience How research changed perspectives Applications to major or future Advice for students	How P2 got involved Expectations prior to research experience How experience changed perspectives Challenges encountered Applications to major or future Advice for students	How P3 got involved Expectations prior to research experience Preferred research methods Challenges encountered Collaborating with others Presenting Advice for students	How P4 got involved Expectations prior to research experience Challenges encountered Applications to major or future Learning professional skills Methods Collaborating with others Research abroad Advice for students	How P5 got involved Importance of being interested in topic Expectations prior to research experience Mixed methods What I learned Presenting Advice for students	How P6 got involved Why P6 got involved (had lots of questions) What P6 likes about research The value of research Becoming an expert Things do not always go as planned Advice for students

ments of the curriculum were shortened. See Figure 1 for a content timeline across both semesters.

The first research module focused on five main elements: (1) initial exposure to research, (2) how to ask research questions, (3) research methodology, (4) literature reviews, and (5) research ethics. Students received initial exposure to the world of research by viewing “Researcher Videos” in which student and faculty researchers discussed their reasons for becoming involved in research and provided an overview of their research projects. See Table 1 for a summary of the videos and topics. The videos were systematically shown to decrease intimidation and highlight the progression of research from freshman to doctoral levels. For example, the first, third, and fourth research videos were created by undergraduate researchers who had previously engaged in the CBRE, while the final video highlighted the work of a doctor-

al-level faculty member. Students were required to view each video, write a reflection, and participate in group debriefings to discuss their evolving perspectives on research.

Students learned how to ask research questions through multiple iterative interventions. Initially, students were required to view a screencast on research questions as a means to acquire background knowledge on the process for asking and refining research questions. Students then worked in small groups to generate potential ideas for research questions. Larger group discussions followed in order to narrow potential questions and refine them in light of several specific parameters (i.e., were the questions measurable, observable, novel, feasible, and meaningful). Initially, students exchanged their proposed questions and vetted them against the five parameters above. After narrowing potential research topics to a single consensus topic, students considered po-

tential ways to measure the question. This iterative process began with brainstorming of intuitive ways to measure the question, followed by a transition to considering potential research methods and design.

Small groups of students, assigned to review specific quantitative and qualitative research methodologies, read associated readings and viewed related screencasts. During class time, each small group shared its areas of expertise by training members of other small groups who had prepared information regarding different content areas. These discussions were supported by the instructional staff (a research faculty member, an instructional staff member, and a peer research mentor). Students considered which methodology best fit their potential questions, from a design, resource, and feasibility standpoint. By brainstorming potential methods to answer their potential research questions, students were encouraged to follow intuitive, joint problem-solving approaches. By the end of this process, small groups within the class had generated several potential research questions and each of those questions was vetted and potential methods were considered by the class. Eventually, students agreed on one research project to pursue as a class.

Formative evidence from students' written reflections and instructors' observations indicated that students were intimidated by searching for, reading, interpreting, and summarizing previous research. Therefore, those steps were delayed until students had increased confidence about the research process and instructional staff members had provided additional support for this process. This support included multiple "walk-through" screencasts to make the content more approachable, as well as support from research librarians. Once students found a peer-reviewed article, librarians assisted students with making a notecard with the article's title, a one-sentence summary, and the research methods used in the published article. This made it feasible to inventory and organize contributions from each of the students. Students then viewed a screencast on "How to read a research article" prior to completing a more thorough summary of the article. By students contributing one article and summary each, the class collectively had access to more than 20 pertinent annotations. Next, students viewed the "Research Funnel" screencast, which provided information on how to organize content contributions from broad to narrow, moving from general background toward their specific research question.

The research ethics portion of the course was designed to sensitize students to potential ethical issues associated with research and the role of the institutional review board (IRB). Students viewed a documentary video on an ethics case (*The Lobotomist*), wrote a reflection, and engaged in group discus-

sions about research ethics. Other seminal cases, including the Tuskegee Syphilis study, Guatemalan study on sexually transmitted diseases, and Willowbrook hepatitis study, were discussed in class. Discussion focused on the need for oversight and protection of human subjects. All students completed the IRB human-subjects training tutorial and were certified to conduct research at the institution.

The students utilized the knowledge and skills developed during the first module to conduct a large group research project during the second module. Since there were several student-researchers in each class, research roles were distributed among students so that all of them would gain hands-on experience. During this phase of the CBRE, the students recruited research participants, engaged in data collection, and transcribed and analyzed the data. For example, one project, which used a focus group methodology to examine freshman transition courses, distributed several roles and duties across the large group of student researchers. This included writing recruitment emails, arranging for a space to host the focus group, planning interview questions, collecting informed consent forms, and facilitating the focus group. Other students transcribed video and audio recordings and set statement boundaries to facilitate group coding. All students then worked in pairs to code statements and worked collectively to achieve consensus on statements, thus learning about the process of triangulation in qualitative research. Other projects, which used individual qualitative interviews or surveys, followed a similar process, thus distributing some researcher roles and sharing others. For a complete listing of projects and contributors, see Table 2.

The culmination of the research project occurred in the spring during the third module. The student researchers, working in conjunction with the instructional staffer, the faculty research mentor, and the student research mentor summarized outcomes and framed outcomes in the form of a presentation for dissemination. Because there were several students in each project group, the faculty research mentor submitted abstracts throughout the course of the academic year on behalf of the student researchers in order to ensure that the students had the opportunity to present their findings at both university-level and state-level forums. The student researchers presented their findings via posters and/or oral presentations.

The costs of implementing the CBRE were minimal. Because the research experience was embedded into existing courses that were part of her teaching load, the primary instructor required no additional salary. However, since that instructor had little research expertise and no experience mentoring undergraduate researchers, a faculty member was required

Table 2. Summary of Projects and Student Co-authors, by Year

Cohort Year	# of co-authors	Project Title
2011	13	Examining factors that lead to success for students in the Collegiate Bridge program
2012	14	High school to college transition experiences
2013		
Project A	16	Experiences of first-year students at UW-Eau Claire
2013		
Project B	16	An exploration of the experiences of student-athletes at UW-Eau Claire
2014		
Project A	22	The effects of GEN 100 (freshman transition) classes on social and academic outcomes
2014		
Project B	24	The effects of on-versus off-campus living on academic and social outcomes of college students

to co-teach the research-related class sessions. In the years of this program, the compensation for the faculty research mentor varied from \$1,000 to a three-credit overload for the year. Additional costs include a small stipend for the student research mentor and some supplies (primarily copying and printing costs).

Assessment

This model for infusing undergraduate research into a first-year curriculum was intended to lead to two distinct but related outcomes: (1) students would be more engaged in subsequent undergraduate research opportunities, and (2) students would be retained in college and subsequently graduate at higher rates than matched peers who did not engage in undergraduate research in their first-year curriculum. Year-to-year retention data, graduation rates, and research participation have been used to measure these two outcomes.

This program was initially piloted in 2011-12 with one section of GEN 100. There were, however, two sections of GEN 100 for students in the Collegiate Bridge program, and the second section did not participate in the CBRE. Students selected which section they would enroll in based on which section fit better into their course schedules at summer orientation, and the advisor who helped students design their

schedules was unaware that there was a difference in the curriculum. This format led to natural experimental and control groups and was continued for the first two years of the pilot. The same academic staff member was the primary instructor for all sections of GEN 100 from 2011 to 2015.

Table 3. Retention Rates of Pilot Student Cohorts

	Cohort (n)	Retained in Year 2	Retained in Year 3	Retained in Year 4	Four-Year Graduation Rate (2011 Cohort only)
Control	34	88.24%	64.71%	58.82%	0%
Experimental	25	88.0%	80.0%	80.0%	25%

Students in both the control and experimental cohorts have been tracked throughout their undergraduate careers. In the analysis detailed in Table 3, a student is considered retained if he or she enrolled in the fall semester of each academic year. Retention rates at years three and four were substantially higher in the experimental group. Data regarding the four-year graduation rates are only available at this time for the cohorts whose first year in college was the 2011-12 academic year (2011 cohort). Participants in the CBRE pilot were also asked for feedback about their perceptions of the research experience as part of their course evaluation. While this feedback was not gathered in order to conduct a qualitative analysis, initial anecdotal information indicates that the students overwhelmingly valued the research experience.

Due to the preliminary retention results and positive student feedback from course evaluations, this initiative was expanded to incorporate both sections of GEN 100 for Collegiate Bridge students beginning in the 2013-14 academic year. No longer was there a natural control group, but the number of students participating in the undergraduate research curriculum grew significantly. An analysis of the retention data for all participants in the undergraduate research curriculum is presented in Table 4. This analysis aggregates the pilot cohorts from 2011 and 2012 already mentioned (n=12 and 13, respectively) and the cohorts who began their freshman years in 2013 and 2014 (n=30 and 44, respectively). The same control data is presented again for comparison.

The expansion of the program to both sections of GEN 100 led to an overall drop in the retention rates for Years 2 and 3 once the 2013 and 2014 cohorts were added. It is unclear why the retention rates for those two cohorts were lower than they were for the experimental groups during the two pilot years. One hypothesis is that the college-readiness of students in Collegiate Bridge decreased over the years (the

Table 4. Retention Rates for All Student Cohorts

	Cohort (n)	Retained in Year 2 (2011-2014 Cohorts)	Retained in Year 3 (2011, 2012, 2013 Cohorts)	Retained in Year 4 (2011, 2012 Cohorts)	Four-Year Graduation Rate (2011 Cohort only)
Control	34	88.24%	64.71%	58.82%	0%
Experimental	99	86.87	65.45%	80.0%	25%

average ACT score for the 2013 and 2014 student cohorts dropped nearly three-quarters of a point from the pilot cohorts), leading to later cohorts being more vulnerable to leaving college. Another possible explanation could be a result of scaling up; students in the larger cohorts may have had a less intimate and engaging experience in the larger classes as opposed to the very small pilot classes.

Data were also gathered regarding whether CBRE students went on to engage in additional undergraduate research. Table 5 details the number of CBRE participants who engaged in a subsequent faculty/student collaborative research project and presented those findings in an on-campus, state-wide, or national venue. One third of the 2011 cohort and almost 10 percent of the combined experimental cohorts participated in at least one additional research project. These research projects can include internally or externally funded projects or, in some cases, research projects that a student conducted for course credit. Projects that were neither funded nor presented were not included in this data because the institution does not track such types of research projects.

These data suggest that participation in the research curriculum during the student's first year increased the likelihood that the student would engage in future faculty/student collaborative research, compared with a control group of similar

Table 5. CBRE Participants Who Engaged in Subsequent Faculty/Student Research

	Cohort (n)	Individual CBRE Students Who Participated in at Least One Faculty-Student Research Project
Control	34	0%
Experimental Cohort 2011	12	33.3%
Experimental Cohort 2012	13	15.4%
Experimental Cohort 2013	30	3.3%
Experimental Cohort 2014	44	4.5%
Experimental Cohorts Combined	99	9.1%

peers. It should be noted that the cohorts that entered UWEC in 2012, 2013, and 2014 are still enrolled at the university and are likely to participate in research during the remainder of their time at UWEC.

There are a number of reasons students who engage in this curriculum may be more likely to go on to conduct further research. One relates to the cross-campus collaborative partnerships developed as part of this initiative. The faculty and staff involved in the CBRE have actively worked to develop relationships with faculty researchers across campus in an effort to establish this program as a training ground for future student researchers. For example, the instructional staff person associated with the CBRE has worked with faculty from several disciplines to match student researchers with faculty researchers.

Another reason students who have engaged in this curriculum may go on to do additional research relates to their heightened self-efficacy relative to challenging academic tasks. While the self-efficacy of students in this program has not been measured, anonymous student feedback and anecdotal evidence suggest that students who engage in this curriculum believe it was valuable in building their confidence and skillsets. The feedback received has been overwhelmingly positive, even from students who don't care to go on to do additional research. For example, one CBRE student stated: "I really enjoyed the research project! I never knew what this kind of research was. It's so interesting and exciting when interviewing people and analyzing the data. This research project makes me feel like I did more than other freshmen who didn't do research and makes me feel confident in myself."

Conclusion

Findings from the National Survey of Student Engagement repeatedly suggest that participation in high-impact practices early in one's undergraduate career prepares students to become more engaged, intentional learners. This experience often fosters participation in further high-impact practices, which continues to nurture and develop students' intellectual curiosity and intentional learning. The CBRE is one means of engaging academically at-risk students in an early undergraduate research experience, while scaffolding their learning and decreasing the feelings of intimidation that of-

ten accompany research, through guided apprenticeship and normalization of the research experience. This meets the call for early engagement of underserved and underrepresented students. While our initial quantitative results indicate that programs such as the CBRE, when used in conjunction with a traditional college-transition and study-skills curriculum, have a positive impact on retention and engagement in future undergraduate research, the qualitative feedback received from participants is equally powerful. Said one CBRE student: "Doing research sounded very scary at first. Now it is something that I would like to do again. It really helps to be able to experience this very early in my college life." 

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