

A Model for Successful Cross-Campus Collaboration for Engaging Potentially At-Risk Students in Mentored Undergraduate Research Early in Their College Career

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Abstract

The authors discuss the Research Apprenticeship Program (RAP) at University of Wisconsin–Whitewater, which pairs beginning students with mentors as paid research apprentices for one academic year. It seeks to encourage participation of students from underserved groups who are at higher risk of dropping out of college. RAP introduces students to mentored research, helps mitigate some of their financial needs, and gives students a sense of belonging and self-efficacy early in their academic careers. It also provides a first- to final-year pathway for students by fostering their transition to the Undergraduate Research Program and other applied learning experiences, thus ensuring their continuous engagement in high-impact practices. Preliminary data indicate that students and mentors value the program, and second- and third-year retention rates for RAP participants are higher than the campus retention rates.

Keywords: *beginning researchers, cross-campus collaboration, first-generation students, low-income students, minority students, student retention*

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Undergraduate research (UR) is one of the high-impact practices (Kuh 2008) identified as increasing students' engagement in their own education, especially in students from historically underserved backgrounds (Sweat et al. 2013), and enhancing retention and graduation rates (Mandernach 2015). A Gallup survey (Ray and Kafka 2014) shows that students who felt emotionally supported by at least one faculty mentor and were engaged in experiential learning activities have a much higher chance of

engagement at work and of having higher overall quality of life. However, studies (e.g., Finley and McNair 2013; Ishiyama and Hopkins 2003) show that traditionally underserved student groups engage less in UR and have lower graduation rates. A significant percentage of students attending the University of Wisconsin–Whitewater—one of 11 comprehensive, primarily undergraduate institutions within the University of Wisconsin system—belong to underserved groups (used here to collectively indicate students from underrepresented minority [URM] groups, first-generation students, students eligible to receive Pell Grants and/or subsidized federal loans, and transfer students). The needs of these students were taken into account when the Research Apprenticeship Program (RAP) was established for beginning students who may have little or no academic preparation or research experience. It was theorized that a program designed for engaging students early in UR as paid research assistants, without regard to their academic preparation, would afford them the greatest and longest lasting benefits, especially for those considered academically at risk. Discussed below are a brief history and rationale for RAP, successes and challenges, and lessons learned.

The Path to Establishing the Research Apprenticeship Program

The Undergraduate Research Program (URP) on campus traditionally serves students who have reached their second, third, or fourth years; have identified instructors in their chosen disciplines to serve as their research mentors; and have a minimum cumulative GPA of 2.75. These conditions arise out of the notion that UR is best reserved for students who have already demonstrated that they possess the habits required for a successful college

experience. Hence, the traditional approach is not geared to serve students new to campus, students who do not meet the minimum GPA requirement, and/or students who have not yet connected with faculty/staff mentors. Beginning students, especially those who may be academically at risk, can benefit tremendously from engaging in mentored UR experience (e.g., Nagda et al. 1998; Yeager and Walton 2011; Sweat et al. 2013; Eddy and Hogan 2014; Freeman et al. 2014), but serving those students is beyond the scope of the traditional URP. RAP was developed to address this need, seeking to promote inclusivity and broaden participation to new, transfer, nontraditional, and international exchange students, without considering their academic backgrounds.

RAP had four sources of inspiration. The first two largely corresponded to identified campus needs. Despite rapid program growth, the majority of URP participants before 2009 came from a narrow range of disciplines. Science and performing/visual arts majors participated regularly in UR with a slow increase in the number of projects in the humanities and social sciences. URP recognized the need for expanding applied research opportunities and models for students in professional degree programs, particularly in business and education.

Second, a vast majority of UR participants had reached their third or fourth year of college. However, in exit surveys, UR participants repeatedly noted their wish to have conducted mentored research earlier in their college careers.

The University of Michigan's award-winning Undergraduate Research Opportunities Program (UROP) provided additional inspiration by offering a model for supporting students' research through student work-study allocations. Emulating this approach to finance early research experiences required a partnership with the campus's financial aid office. Studies of student engagement in the UROP also demonstrated the impact of these early research experiences on minority student retention and commitment to their respective programs of study, as these paid research experiences offer "the informal as well as formal interactions enable students to envision a future self and increase their confidence and comfort in these settings" (Gregerman 2009, 255). Using mentored research as a vehicle for increasing minority student retention aligned well with the campus strategic goals.

A soft launch of RAP occurred in fall 2009 with the recruitment of seven interested first- and second-year students, who were matched to faculty mentors new to UR. Students committed to providing five hours of research assistance per week and were paid primarily with work-study funds. Although the results were encouraging, it became clear that this initiative required extensive administrative support and

structure to support novice researchers and their mentors. URP, therefore, solicited internal funding to pilot a more formal and integrated program that might leverage other campus programs for first- and second-year students, and allow better accommodation of underrepresented disciplines and student populations.

The pilot program initiated in fall 2011 was limited to 20 students per year in the College of Business and Economics, and the College of Education and Professional Studies. These colleges were selected because of their lower rate of participation in UR and their desire to collaborate with URP in implementing new models of student engagement to increase recruitment and retention of underserved students. RAP built on various summer bridge programs developed by those two colleges targeting underrepresented students and provided a sustained faculty and peer-mentor support network during the school year using discretionary funding provided by these colleges. Based on the success of the pilot program, administrative leaders agreed to institutionalize RAP in 2012. This support has been sustained as RAP aligns well with the campus commitment to the LEAP (Liberal Education and America's Promise) essential learning outcomes of the Association of American Colleges and Universities (AAC&U) and the university's strategic plan. Currently, the RAP budget can support 70 students annually with funding from the provost's office. Collaboration with the financial aid office allows for the use of work-study funds to support additional students, so that more than 90 participate each year. Collaborations with other campus offices and programs, such as Residence Life, the Center for Students with Disabilities, and the McNair Scholars Program, have assisted in recruiting and supporting RAP participants.

Overview of RAP

RAP matches student applicants with research mentors according to their mutual interests and expertise. Students assist their mentors' research agenda during the academic year; learn and improve basic research skills; and develop a support network essential for their personal, academic, and professional success. RAP focuses more on sustaining students' interests and curiosity than rewarding academic achievement. RAP students receive an hourly stipend for their work so that financial barriers to participation may be reduced. This aspect of RAP attracts students who might not otherwise have considered conducting research and is an important recruitment tool for RAP. Students are encouraged to present their work during on-campus celebrations of URP/RAP and to attend off-campus UR symposia. These venues further expose them to the culture of research and professionalism. Toward the end of the program, mentors and the URP leadership team advise and support RAP students to pursue additional research and related experiential learning opportunities to continue their deep engagement with their disciplines and the university.

RAP students are required to complete the online, self-paced course Research Methods and Ethics created by staff librarians and faculty from different disciplinary backgrounds. This course provides an overview of basic research skills common for all disciplines, such as conducting literature reviews. It introduces students to different research methods used in different disciplines, such as quantitative research, qualitative research, scientific research conducted in field and/or laboratory settings, and research using large datasets. The course also has a module on the importance of ethical conduct for researchers. It provides a common set of skills that all RAP students can use in a variety of contexts, helps cultivate buy-ins from mentors, and sets up the foundation for further research RAP students might undertake. Although each individual module in this course contains quizzes and other instruments for assessing student learning, more systematic data are needed to measure the overall impact of this course on developing research skills of novice researchers.

RAP Student Demographics

RAP is promoted through websites, social media, and targeted interaction with students through presentations in first-year classes and underrepresented student organizations. Previous RAP participants play an important role in promoting RAP and recruiting future participants. Students self-select to participate. Acceptance in RAP does not depend on academic standing, GPA, or SAT/ACT scores. This is quite different from many other first-year research assistantship programs that employ high school academic achievement measures to screen student applicants and attract academically high-achieving

students. In contrast, the ACT scores of RAP participants are largely comparable to other first-year students at UW–Whitewater, conforming to the scores of more than 80 percent of first-year students (ACT scores between 17–21 and 22–26). This suggests that RAP students have very similar academic preparation as other first-year students at UW–Whitewater (see Figures 1 and 2).

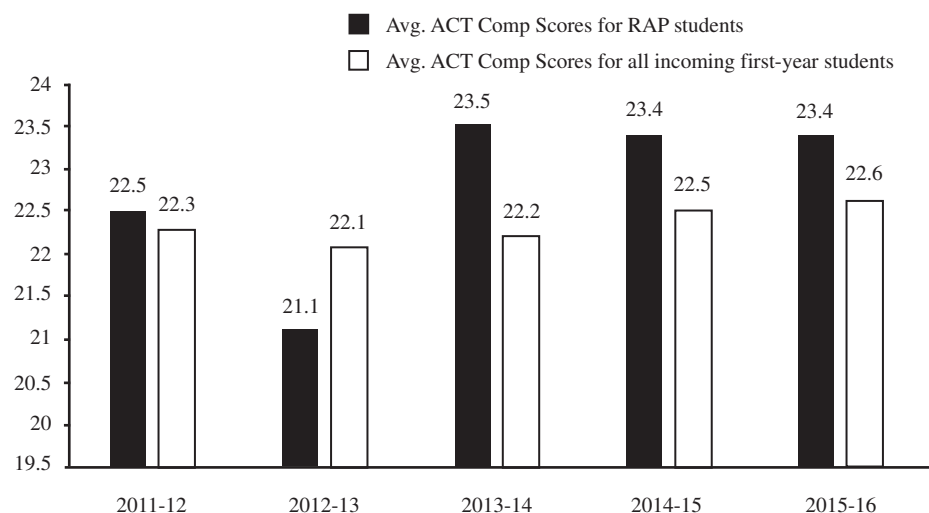
Due to the intentional focus on recruiting underserved students, those groups are overrepresented in RAP compared to the general campus population. Between the 2011–2012 and 2015–2016 academic years, 245 RAP students were served. The student demographic data (see Tables 1 and 2) reveal that the program has been successful in engaging beginning students and those from various underserved populations in mentored research activities. This aligns with the recommendations of the “Principles of Excellence” outlined by AAC&U (n.d.).

Outcomes of RAP

One original goal for RAP was to increase recruitment of minority students, and the data in Table 1 and Table 2 show that this goal was achieved. Some preliminary retention data for various underserved student groups indicate that, overall, 87.3 percent of RAP students (including first-year, second-year, and transfer students) who joined the program in 2011–2012 to 2014–2015 were retained for at least one academic year after they participated in RAP.

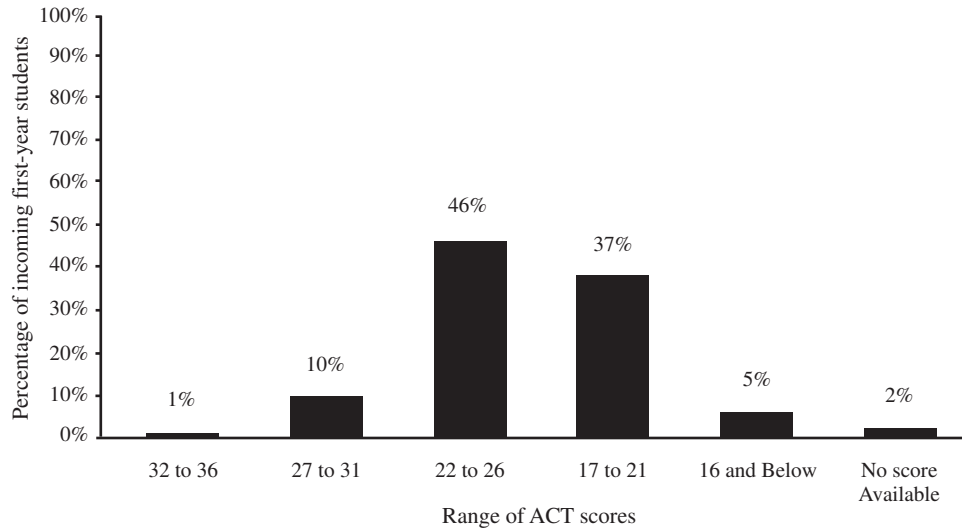
Furthermore, chi-square and Fisher’s exact tests were conducted to see whether first-time, first-year students participating in RAP are statistically significantly more

FIGURE 1. Average ACT Composite Scores for RAP Students Compared to All Incoming First-Year Students, 2011–2012 to 2015–2016



Note: Data from the Office of Institutional Research and Planning, UW–Whitewater

FIGURE 2. ACT Composite Score Distribution for New First-Year Students, 2005–2014



Note: Data from the Office of Institutional Research and Planning, UW–Whitewater ($n = 20,164$ students)

TABLE 1. Demographics of RAP Students According to Their Years in College (Fall 2011–Fall 2015)

Student status	No. of students and percentage
First-year students	126 (51.4%)
Second-year students	65 (26.5%)
Transfer students	27 (11.0%)
Exemptions on a case-by-case basis (students outside of first-year/second-year/transfer status but have unique personal circumstances, including returning adults and veterans)	18 (7.4%)
Others (including postbaccalaureate students and international exchange students)	9 (3.7%)

Note: $n = 245$

likely to be retained in the academic year following their RAP experience compared to students not participating in RAP (see Tables 3 and 4). Fisher’s exact test was conducted, because many of the cells in the contingency tables that used to compute these statistics had frequency values under 5. In addition, Fisher’s exact test is more conservative than the chi-square test, and any significant differences between groups can be regarded as meaningful.

The student demographics were broken down into five groups: students who belong to underrepresented minority (URM) groups, first-generation students, students who

TABLE 2. Demographic Composition of RAP Students Compared to the Overall Campus Populations over the Same Time Frame (Fall 2011–Fall 2015)

Student status	RAP students ^a (total 240)	All UW-W students ^b (total 14,075)
Underrepresented minority (URM)	29.2%	13.5%
Confirmed first-generation status ^c	47.0%	45.8%
Pell Grant and/or federal subsidized loan recipients	50.7%	54.5%

Note: Data derived from publicly available information provided by the Office of Institutional Research and Planning, UW–Whitewater.

^aRAP students = First-time, full-time, first-year students and transfer students

^bAll UW–W students = first-time, full-time, first-year and transfer students

^cStudents with unknown/unreported first-generation status were excluded from this analysis.

receive Pell Grants and/or federally subsidized loans, students who do not belong to any URM groups, and students who do not receive Pell Grants and/or federal subsidized loans. At the time of data collection, retention rates for students joining RAP during the 2015–2016 academic year or later were not publicly available; therefore, the data presented here excludes these students. In addition, distinct retention data is not available for those who were not first-generation students (sometimes referred to as continuous-generation students) and those for whom the university has no relevant data in this category. Thus, the results presented do not include retention rates for continuous-

TABLE 3. Second-Year Retention Rates for First-Year RAP Participants, Compared with Retention Rates for All UW-Whitewater Students from Similar Demographics, Including Those from Underserved Backgrounds

	Second-year retention rate	Chi-square	<i>p</i> -value	Fisher's exact test values	
				Two-sided <i>p</i> -value	One-sided <i>p</i> -value
URM students in RAP	87.88% (N = 33)	3.93	<i>p</i> < 0.05	0.071	0.033
All URM students enrolled at UW-W (weighted average)	72.52% (N = 1165)				
First-generation students in RAP	90.24% (N = 41)	3.614	0.1 > <i>p</i> > 0.05	0.041	0.026
All first-generation students enrolled at UW-W (weighted average)	76.95% (N = 3687)				
Students receiving Pell Grant and/or federal subsidized loans in RAP	92.16% (N = 51)	5.74	<i>p</i> < 0.02	0.015	0.008
All students receiving Pell Grant and/or federal subsidized loans enrolled at UW-W (weighted average)	78.3% (N = 4553)				
Non-URM students in RAP	90.57% (N = 53)	3.1	0.1 > <i>p</i> > 0.05	0.079	0.043
All non-URM students enrolled at UW-W (weighted average)	80.75% (N = 7169)				
Students not receiving Pell Grant and/or federal subsidized loans in RAP	85.71% (N = 35)	0.72	<i>p</i> > 0.2	0.664	0.337
All students not receiving Pell Grant and/or federal subsidized loans enrolled at UW-W (weighted average)	81.25% (N = 3832)				

Note: Data derived from publicly available information provided by the Office of Institutional Research and Planning, UW-Whitewater. Items in bold font indicate statistically significant differences. Students from underserved backgrounds include those from underrepresented minorities (URM), those from first-generation backgrounds, and those from low-income households (defined as Pell Grant and/or federal loan recipients).

generation students and those with unreported/unknown first-generation status. The results are shown in Table 3.

It was assumed that participation in RAP would only improve student retention. Therefore, even though the common practice is to compute two-sided *p*-values for Fisher's exact test, one-sided *p*-values also were computed. With that assumption, it can be seen that all underserved student populations are significantly more likely to be retained in their second year compared to students from similar backgrounds who are not RAP participants. Non-URM RAP participants are also statistically significantly more likely to be retained than their non-RAP counterparts. However, there is no statistically significant difference in second-year retention rates between RAP and non-RAP students who do not receive Pell Grants and/or federal subsidized loans.

The sample size for students who joined RAP as second-year students is too small for drawing any conclusion about third-year retention rates, but preliminary results (see Table 4) show encouraging trends. The program, however, is too new for systematic, six-year graduation data collection.

Unsolicited testimonials from students and mentors underscore the academic impacts of RAP. In general, RAP students appreciate various benefits of the program:

...I think that RAP is a good way for people to get into and understand research. Most of my friends don't understand how I do my research and neither did I before RAP. After going through the program I now understand how to do research and construct a poster for presentation.

I would recommend this program [to my friends] for sure ... because it is a good way to get involved with a professor, to do something you are interested, gain experience, and get paid as well.

About 10 percent of RAP students continue into traditional URP offerings, including the competitive Summer Undergraduate Research Fellowship (SURF). Additionally, eligible RAP students join the McNair Scholars Program, externally funded research projects led by individual mentors, off- and on-campus internships, and other applied learning opportunities. The latest applicants to the Barry Goldwater Scholarship—a prestigious national recognition for undergraduate majors in STEM (science, technology,

TABLE 4. Third-Year Retention Rates for Second-Year RAP Students, Compared with Retention Rates for All UW–Whitewater Students from Similar Demographics, Including Those from Underserved Backgrounds

Student category	Third-year retention rate
URM students in RAP	100.00% (N = 10)
All URM students enrolled at UW–W (weighted average)	60.61% (N = 1165)
Non-URM students in RAP	100.00% (N = 30)
All non-URM students enrolled at UW–W (weighted average)	71.15% (N = 7165)
First-generation students in RAP	100.00% (N = 13)
All first-generation students enrolled at UW–W (weighted average)	66.39% (N = 3687)
Students receiving Pell Grant and/or federal subsidized loans in RAP	100.00% (N = 19)
All students receiving Pell Grant and/or federal subsidized loans enrolled at UW–W (weighted average)	67.65% (N = 4553)
Students receiving neither Pell Grant nor federal subsidized loans in RAP	100.00% (N = 21)
All students receiving neither Pell Grant nor federal subsidized loans enrolled at UW–W (weighted average)	72.05% (N = 3832)

Note: Data derived from publicly available information provided by the Office of Institutional Research and Planning, UW–Whitewater. Students from underserved backgrounds include those from underrepresented minorities (URM), those from first-generation backgrounds, and those from low-income households (defined as Pell Grant and/or federal loan recipients).

engineering, mathematics)—all began as RAP students and continued their research endeavors with their RAP mentors. One of those students received the scholarship in 2016 (see Figure 3), and two more received honorable mentions in 2017. Since the program was institutionalized, several RAP students went on to receive highly competitive national-level summer research opportunities, including the MTBI summer program at Arizona State University, as well as internships at the Smithsonian National Museum of Natural History, the Naval Academy, and the Mayo Clinic. All these students participated in more substantial and in-depth research experiences beyond their initial exposure to mentored research via RAP, and they all credit RAP for introducing them to the benefits of UR and helping them establish their career goals.

RAP mentors value beginning student researchers bringing in fresh perspectives and staying with their research programs for multiple years. Unsolicited testimonials from mentors include the following:

... With her input we tailored a project that could also garner outside funds for her ..., AND direct me to develop my own new grant (funded by the way).
... in discussion with her we started to explore issues ... that we had not previously considered.

Since fall 2014, RAP students have participated in surveys to self-assess their learning and skills gains from conducting mentored research. The surveys are conducted three times during their RAP participation year (at the time of acceptance, after the first semester, and at the end of the academic year). Detailed analyses of the student self-assessment as well as mentor evaluation data for student learning and program effectiveness, however, are beyond the scope of this article.

Campus support for RAP remains strong as active and intentional mentor recruitment efforts help strengthen the overall mentor pool, broaden participation of historically less active disciplines in UR, and increase both ethnic and disciplinary diversity of mentors and role models for emerging scholars. A vast majority (more than 90 percent) of undergraduate departments currently participate in UR. For example, during 2014–2015, 19.2 percent of all RAP mentors came from the social sciences, followed by physical sciences (17.3 percent), professional studies (13.5 percent), education (9.6 percent), and life sciences (9.6 percent). These findings represent a good disciplinary breadth and help counter the notion that UR is primarily for STEM students.

Since many beginning researchers lack concrete ideas about research or the projects in which they wish to

FIGURE 3. Geology major Melanie Sorman searches for fossils in Falls City, Nebraska, as part of her research with UW–Whitewater associate professor Rex Hanger.



A RAP student, Sorman received support from URP throughout her undergraduate years and received the Barry Goldwater Scholarship in 2016. A 2017 UW–Whitewater graduate, she is pursuing graduate studies at Miami University of Ohio. Photo courtesy of Rex Hanger.

participate, a substantial portion of them (41 percent in 2014–2015) work on projects not directly related to their intended fields of study. For example, a social work faculty mentor collaborating with a RAP major in biology developed one RAP project that resulted in a professional presentation. Such cross-pollination has the unexpected benefit of encouraging students and mentors to think beyond their traditional disciplinary boundaries and promoting transdisciplinary research. Feedback from students working on such projects has been overwhelmingly positive.

Recipe for Success 1: Effective Recruitment Strategies

RAP uses a watershed approach for recruiting students from various programs and affiliations on campus. Examples include the Office of Student Diversity, Engagement, and Success; the Office of First-Year Experience; and student retention programs administered by specific colleges, as well as external grant-funded programs serving multicultural and/or underserved student populations. Student ambassadors—primarily previous RAP students and other UR students—are effective recruiters for RAP. They lead formal and informal presentations for courses and organizations serving potential recruits, especially underserved students. Data collected from 2014–2015 RAP applicants show that almost half of the applicants heard about the program from their professors, and about 20 percent of them stated that “word-of-mouth” from previous participants convinced them to apply.

Since the number of available mentors can limit the impact of RAP, attention was paid to mentor recruitment early on. RAP mentors were initially recruited from a small pool of experienced UR mentors. Workshops are regularly conducted for potential RAP mentors that feature best practices and successful examples of working with novice researchers. Experienced RAP mentors serve as program recruiters. Junior faculty members receive letters of support for their tenure dossier so that their mentoring efforts are recognized. Attention is paid to providing a healthy budget that will support research by RAP students as an incentive.

Recipe for Success 2: Cultivating Buy-in from Other Campus Units and Support from Administration

RAP acts as a pipeline for programs where previous research experience is prized, such as the McNair Scholars Program; different programs coordinated by the URP office, including SURF and traditional UR grant programs; and various on- and off-campus internships and research assistantships offered by departments and colleges. This not only helps students stay engaged but also creates a demand for RAP students and thereby supports the program.

UW–Whitewater is a LEAP campus, and the program objectives of RAP are aligned with the LEAP Principles of Excellence. Establishment of RAP coincided with the increased campus effort to promote inclusive excellence and the use of educational high-impact practices to increase student retention and success. RAP is intentional in collecting, analyzing and sharing data demonstrating success in recruiting targeted student populations and their positive academic outcomes. The importance of disseminating program information and student/mentor success stories cannot be underestimated. RAP and URP actively seeks recognition from external agencies. For instance, RAP received the Diversity Award from the UW System Board of Regents in 2015 and the Program Achievement Award from the Wisconsin State Council on Affirmative Action in 2016. URP was also a 2015 finalist for CUR’s Award for Undergraduate Research Achievement, with RAP serving as the exemplary program. These recognitions help establish the reputation and value of RAP, and are instrumental in securing support from campus administration even in times of budgetary constraints.

Challenges Overcome and Lessons Learned

RAP had to overcome student reluctance and skepticism of potential mentors. Beginning students often do not see themselves as researchers or believe that they are ready to tackle research-related tasks. Therefore, RAP emphasizes that, as the program is an apprenticeship program, no prior content knowledge or research skills are expected, and the nature of the work can be very similar to many other campus jobs helping individual faculty members or

departments. Word-of-mouth from previous RAP students highlighting various tangible and intangible benefits of conducting research, as opposed to other types of campus employment options, also played a role in convincing students. These, along with the promise that the program will help students find alternate mentors or research projects as needed without penalty, seem to convince students to get involved.

The buy-ins from mentors were initially slow but were boosted by a healthy research budget, reasonable expectations for tangible research from RAP students, success stories and testimonials from experienced mentors, and concrete strategies for working with inexperienced students. Since campus promotion and tenure requirements include evidence of scholarly and/or creative activities, the program's documentation of active mentoring has generated goodwill from the faculty, especially those on the tenure track, and academic staff.

The importance of explicit support from different campus stakeholders, evidence of high demand, and positive testimonials from students and mentors should not be underestimated for initiating, sustaining, or soliciting financial support for a program such as this one. It is vital to showcase the program's success in recruiting and retaining underserved student populations and highlight their academic achievements. Receiving national and state-wide recognitions also help secure support from campus administration. The demands on RAP administrative team are substantial, requiring the ability to coordinate and effectively communicate with a variety of stakeholders. Creating effective mentor-mentee match requires familiarity with diverse research agendas and working styles of diverse mentors, as well as skills in conflict resolution. Many RAP students are still exploring their identities and priorities as college students, and supporting their learning and growth through RAP necessitates patience and an understanding of student development. Beginning college students, especially those from disadvantaged backgrounds, may face multiple barriers, requiring RAP staff to collaborate with several different campus units to support them. However, the rewards for establishing such a program is substantial, as it clearly contributes to the overall campus goal of inclusive excellence and provides a demonstrated path for closing the equity gap between majority and minority/underserved students.

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