Board 312: Increasing Retention for Rural and Underrepresented STEM Students

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Increasing Retention for Rural and Underrepresented STEM Students

The need to increase the number of science, technology, engineering, and math (STEM) graduates by tapping into the underrepresented and rural populations is well documented. An examination of school districts in the USA highlights that there are 57% are rural [1], with over 6.5 million rural students enrolled [1, 2]. The area in the US that is historically most impacted by a lack of STEM professionals has been the southeast, which includes Arkansas [2]. However, little literature exists on how to best recruit and retain rural STEM students.

Rural students face significant struggles with academic persistence in college due to many factors. Often, they have insufficient funds to attend college due to rural area residents' higher poverty rates [3]. Rural students typically live further away from educational institutions and research institutions that offer STEM degrees and opportunities. This creates transportation challenges and increases the cost of attending [2]. This distance also creates a significant impact on the family where students are often expected to live at home, help financially support the family, and take care of their younger siblings. The social and support impact on friend networks and family networks is also impacted by the increased distance [4].

Rural students are often provided poor academic preparation from their small financially struggling schools that have trouble retaining quality teachers. These schools often do not have the funds to offer advanced STEM preparation courses and/or AP courses [5]. Internet access can also be an issue in rural areas which often have poor and unreliable internet or no internet at all. This can negatively impact their ability to access digital learning and resources [6].

Low parental expectations and little social support due to the lack of college-going culture in rural communities can impact student interest and opportunity in STEM engagement [1, 2, 7]. Rural students often lack exposure and opportunities for STEM exposure during K-12, which can impact their motivation and readiness for STEM majors and careers. [8, 1, 2, 9]. In addition, rural students often have difficulty transitioning to a more urban setting where universities and research institutions are typically located [10]. Many of the same situations related to student achievement exist in both urban schools in large cities and rural area schools, however, urban schools typically have significantly more aid for educational programs than their rural school counterparts [2, 11].

Researchers at the University of Arkansas (UA) created a program, *Closing the STEM Labor Gap through a Path to Graduation (PTG) for Low Income, Rural Students*, funded by an NSF S-STEM grant (#1742496). The program aims to better understand ways to recruit, retain, and graduate with STEM degrees the often-overlooked and under-tapped population of rural and underrepresented students. PTG first developed a targeted recruitment process to help rural students, teachers, and families learn about STEM opportunities and careers, and to help them understand how to access STEM degree programs. The PTG team selected scholars through an application process. Once admitted into PTG, the program provides students with scholarships and a retention program involving multiple forms of advising and mentoring.

The PTG initiative [12, 13, 14] strategically targets and supports rural, financially disadvantaged students with promising academic abilities, who lack the qualifications for traditional university

scholarships. The program's objective is to enhance the enrollment and success rates of these students in engineering and science disciplines. PTG achieves this by employing a two-pronged approach: first, by actively recruiting from rural areas where potential candidates are often overlooked, focusing on students with moderate standardized test scores but demonstrable academic potential; and second, by providing a comprehensive support system, including honors programming and resources, tailored to the unique needs of these students.

Recruitment and Selection of Candidates

PTG recruited its first of three cohorts in Fall 2018. Collaboration with the UA's Office of Admissions yielded a list of applicants meeting specific desired criteria: a high school GPA above 3.5, ACT scores between 23 and 27 (or SAT between 1130 and 1300), and a rural zip code residency. Additional identification of eligible students occurred through university recruitment events and collaborations with UA offices working with rural students, teachers, and counselors. The program's online presence, alongside direct communication efforts, augmented recruitment. Candidates were invited to apply, with the application process involving university admission, a PTG-specific application, and financial need assessment via the FAFSA. All PTG scholars had to be Pell Grant eligible.

For recruitment of the second and third cohorts, interviews were added as a final step in the PTG scholar selection process to better identify which applicants held the most promise of persisting in the program. Each student's 15-minute interview was held on the last day of an informational PTG recruitment weekend paid for by the Honors College and the College of Engineering where finalists were accommodated in the residence halls and parents or guardians were provided with hotel accommodations. [13, 14]

Student Success Focused Components

Scholarships: PTG addresses financial challenges by offering scholarships, essential for students demonstrating substantial financial need. These scholarships, totaling up to $4,500 for non-Honors College students and $5,500 for honors-affiliated students, qualify the students for in-state tuition rates and are renewable for up to four years. All PTG scholars receive Pell Grants amounting, on average, $5,100/year. Current UA tuition and fees are approximately $9,700/year. Although PTG scholars have ACT scores lower than allowed for Honors College eligibility upon entry to the UA, if their CGPA increases to at least 3.50 once at the UA, they are eligible for honors studies. For the students' sophomore through junior years, renewal to continue in PTG requires maintaining a minimum 3.0 CGPA, active participation in PTG, and enrollment with continued progress in an NSF-listed STEM major. Students facing GPA challenges may request a probationary period while remaining in the program to allow them a chance to improve their academic standing up to PTG levels.

Credit-bearing bridge program: A bridge program held prior to the students' first semester at the UA allowed PTG scholars to adjust to the more urban environment while also helping them acclimate to campus and adjust to university-level expectations. All expenses for the bridge program were paid by the grant. Initially, the bridge program was a 6-week summer program aligned with the UA second summer session between high school and their first-year fall semester.

However, this caused some hardship for many of these students with severe financial need. It caused students to quit their summer jobs which they needed to help save money for college and in some cases to help support their families. For some families, it added the financial burden of childcare for PTG scholars' younger siblings. Participants did find the bridge program was extremely helpful in acclimating to the UA, so it was an important component of the program, but the timing issue needed to be addressed. For the third cohort, both due to COVID-19 and to help reduce these burdens, the bridge program was moved to the intersession that began two weeks immediately prior to the fall semester. It still allowed time for students to acclimate, create a cohort dynamic, and gain 3 credit hours of coursework. The bridge program course focused on research, including the scientific method and ethical conduct, and culminated in the development of a research proposal, enhancing students' research skills, and understanding. Bridge program co-curricular activities supplemented academic learning with personal and social development activities. Small group formations led by residential peer mentors facilitated discussions on academic and campus life topics. Additionally, extracurricular activities and speaker series presentations complement this holistic approach.

First-Year LLC: PTG scholars, although initially not eligible for Honors College membership, were required to reside in the honors residence hall. This arrangement surrounded PTG scholars with students who were serious about learning and allowed them to participate in the academic and social events of the community. This interaction encouraged many of the students to join the honors program when eligible for an enhanced academic experience.

Success Advising: PTG scholars benefit from professional mentoring by PTG staff and peer mentoring from upper-class PTG scholars and other senior honors students. These mentoring sessions focus on academic progress, campus engagement, and future planning, aiming to provide a comprehensive support network. Staff professional mentors meet regularly 1-on-1 with the students to ensure they are on the right track academically and socially, and that they are emotionally healthy. Professional mentors also provide interventional advising as needed and refer students to campus and other resources to help with academic, social, or other life issues.

PTG Monthly Meetings: Mandatory monthly meetings cover critical topics for student success (e.g., navigating the college experience, how to be a mentee, interacting with faculty, academic planning, and diversity training). These sessions, led by PTG staff or campus experts, aim to integrate PTG scholars into broader university initiatives while fostering community building. These topics change as the cohort progresses. First-year and sophomore-year topics relate to areas that include academic planning, communicating with faculty, diversity, student success skills, and campus engagement. Junior and senior topics include research, careers, graduate school, interviewing, and negotiating job offers.

Faculty Mentoring: Initially, subgroups of PTG scholars were matched with select faculty mentors around a research topic of common interest. These clusters were designed to meet bi-monthly and were aimed to integrate students into the research community through seminars and lab tours. The faculty mentors agreed to create opportunities for PTG scholars to interact with their research team and provide opportunities such as visiting labs and having field trips together. This did not work at all. First-year STEM students have many labs, and their course scheduling did not allow schedules to line up during the daytime, and although they originally indicated that evening

engagements were acceptable, faculty did not want to engage with PTG scholars after 5:00 pm. Many of these students also worked to help support themselves and their families back home which further filled their schedules. Recognizing these issues, faculty mentoring was redesigned and moved to a 1-on-1 faculty mentoring focused on career and research engagement. Although now a successful part of PTG with surveys showing only two graduates (18%) being dissatisfied or very dissatisfied, this component has the lowest student satisfaction of the PTG components. In part, this is because the other components rate so highly. Of those dissatisfied, they felt that their faculty mentor was not available as much as they desired.

PTG Scholar Population and Retention

Three cohorts of 14, 13, and 11 students, respectively, comprise the 38-student PTG scholar population. All PTG scholars are Pell Grant recipients with high school CGPA of at least 3.50 and ACT in the 23 to 27 range (or SAT 1130 to 1300). Of the PTG scholars, 28 students (74%) major in engineering, 3 students (8%) in computer science, 3 students (11%) in biology, 1 student (3%) in chemistry, 1 student (3%) in physics and 1 student (3%) in math.

PTG has successfully tapped into the rural and underrepresented student population with recruitment. For PTG scholars, 58% are from rural areas compared to only 15% of the entire university's STEM population being from rural areas. Relative to historically underrepresented groups (HUG) (formerly termed underrepresented minority), 68% of PTG scholars are from this population compared to only 19% of the university's STEM students.

Below are the demographics of the PTG scholars. Arkansas requires the use of weighted high school GPAs for scholarship consideration. The weighted GPA methodology employs a uniform credit value of 4.0 for all courses, except for Advanced Placement (AP), International Baccalaureate (IB) courses, honors, or concurrent credit college courses, which are weighted on a 5.0 scale. Therefore, HS GPA can be greater than 4.00 as seen with cohorts 2 and 3 in the table below.

Table 1. Recruited Cohort Demographics

	Cohort 1		**Cohort 2**		**Cohort 3**		**Overall**	
	n = 14		*n* = 13		*n* = 11		*N* = 38	
Variable	*SD*	%	*n*	%	*n*	%	*n*	%
Rural	11	78.75	7	53.85	6	54.55	24	63.16
HUG	8	57.14	8	61.54	10	90.91	26	68.42
Women	5	35.71	4	30.77	6	54.55	15	39.47
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
HS GPA	3.90	0.20	4.01	0.23	4.05	0.18	3.98	0.21
ACT	26.07	1.64	26.54	0.78	27.00	1.55	26.50	1.39

The first PTG cohort had a 4-year graduation rate of 36% and all these students who graduated did so in 4 years. The PTG second cohort has a 62% retention rate to date. The third PTG cohort has a 55% retention rate to date. Retention details can be seen in Table 2 below.

Table 2. Retention Rate

	Initial recruited	**1st Year**	**2nd Year**	**3rd Year**	**4th Year**	**5th Year**	**# Grads to date**
Cohort 1	14	11 (78.6%)	6 (42.86%)	5 (35.7%)	5 (35.7%)	–	**5**
Cohort 2	13	12 (92.3%)	10 (76.9%)	10 (76.9%)	10 (76.9%)	9 (62.2%)	**6**
Cohort 3	11	10 (90.9%)	8 (72.7%)	7 (63.6%)	6 (54.6%)	–	NA

PTG scholars are not honors-eligible as determined during the INNOV acceptance process, so reaching an honors level of academic achievement (3.50+ UA CGPA) is substantial, particularly if achieved within their first year while adjusting to college. In cohort 1, 21% met honors enrollment requirements, which increased to 69% of cohort 2 and 55% of cohort 3 students.

The first-year success of the cohorts has improved with each cohort. PTG staff and faculty mentors have learned how to better serve rural and HUG student populations resulting in better retention and GPA than earlier in the grant. PTG scholars are being exposed to professional development and experiences that will help them be more prepared to enter the workforce or graduate school.

Lessons Learned

It has also been found that for this group of rural, historically underrepresented Pell Grant students, other factors come into play that have now been addressed and have helped increase PTG retention. One extremely important lesson learned was that the PTG population needs reassurance and conversation centered around their worthiness to be at the university. There needed to be more work centered around a sense of belonging. As mentioned, most PTG scholars come from under-resourced schools. They are typically first-generation, so their family does not have the college experience to support them through the trials of college. Because they are financially disadvantaged as Pell Grant students, they cannot afford the material items that other students have, such as expensive cell phones, laptops, and clothing. Having a conversation and creating a space where these students can be reminded that although they may be the only one in a class like themselves, their cohort gives support and therefore they are not alone.

An important supplement for this group of scholars was to provide the peer mentors with more resources and packets with specific topics to reference. This also allowed the peer mentors access to the information that they needed after normal work hours, so they could address mentee needs as soon as possible.

The lack of academic preparation due to under-resourced schools had to be addressed by proactively helping the scholars access tutoring and being comfortable with the idea of needing tutoring. In addition, the normal STEM first semester course lineup was adjusted so that PTG

scholars did not take calculus, chemistry, and physics together all in the first semester since they are playing academic catch-up.

It was found that PTG scholars also typically need more direction about time management than other students, and more in-depth information on student responsibilities with their classes and coursework.

Although it is too early to have definitive data, research studies are showing that the pandemic has resulted in the inability of students to control their effort and attention in the face of distraction and uninteresting tasks. In our third cohort, our annual survey showed issues in these areas.

Covid has, of course, been a factor in retention. Although it is too early to have definitive data, research studies are preliminarily showing that the pandemic has resulted in the inability of students to control their effort and attention in the face of distraction and uninteresting tasks. Our third cohort of PTG scholars began in Fall 2020. Our annual survey showed issues in these areas for this cohort, supporting that theory of inability.

Graduating Scholars Survey Findings

To help assess the program, the PTG team deployed a survey to its graduates as of May 2023. Cohorts 1 and 2 had 5 and 6 graduate responses, respectively. No statistically significant differences were found between the two cohort's responses. Key findings from the survey include: Eleven of the twelve graduates completed an exit survey.

- 100% were very satisfied (10) or satisfied (1) with the program overall.
- 100% strongly agreed (11) that the program provided a positive impact on their academic performance and on completing their degree.
- 82% strongly agreed (7) or agreed (2) that the program was important to completing their degree programs (2 non-response).
- 100% were very satisfied (10) or satisfied (1) with the bridge program.
- 100% were very satisfied (10) or satisfied (1) with the professional mentoring.
- 100% were very satisfied (7) or satisfied (4) with the monthly meetings.
- 100% strongly agreed the program promoted their sense of belonging at the university.
- 64% were very satisfied (4) or satisfied (3) with the faculty mentoring. 18% were neutral (2). 18% were dissatisfied (1) or very dissatisfied (1).

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