

## **Greater Equity, Access, and Readiness for Engineering and Technology (GEARSET)**

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Lesley Berhan is currently the Associate Dean of Diversity, Inclusion, and Community Engagement for the College of Engineering and an Associate Professor in the department of Mechanical, Industrial, and Manufacturing Engineering at The University of Toledo. Her research interests are in the areas of composites and fibrous materials and engineering education. She received her B.Sc. in Civil Engineering from the University of the West Indies in St. Augustine, Trinidad, her M.S. in Civil Engineering from the Massachusetts Institute of Technology, and her Ph.D. in Mechanical Engineering from the University of Michigan, Ann Arbor. She joined the faculty at the University of Toledo in 2004. As the Associate Dean of Diversity, Inclusion, and Community Engagement she leads the development and execution of initiatives and programs to facilitate the recruitment, retention, and success of women, students from underrepresented groups and first generation students. These duties are well aligned with her current research interests and external funding in engineering education.

### **Mr. Bryan Thomas Bosch, The University of Toledo**

Bryan Bosch holds a B.S. in Civil and Environmental Engineering and a M.A. in Educational Psychology ('14), both from the University of Cincinnati. Along with his current role as the Manager of Diversity, Inclusion, and Community Engagement for the College of Engineering at the University of Toledo, he is a part-time instructor in the College and has held positions in Student Advising, Admissions and Recruitment, Student Organizational Advising, and Digital Market Research throughout his 6 years at the University of Toledo and 9 years across multiple institutions in the state of Ohio.

## **WIP Paper: A Pre-Engineering Program for Underprepared Students**

The primary objective of the Greater Equity, Access, and Readiness for Engineering and Technology (GEARSET) Program is to enhance the student learning, academic pathways, academic performance, professional preparation, retention, and graduation of low-income, academically talented (LIAT) students aspiring to engineering careers. By recruiting a diverse pool of students with demonstrated academic talent, and by facilitating a pathway to engineering and technology majors for students who must first complete required pre-engineering courses, we also seek to increase the equity and diversity of the institution's College of Engineering. The project will contribute to the existing knowledge of the impact of financial aid, mentoring, academic support, and professional development on the engineering career choices, student success, motivation and sense of belonging, competence and efficacy of all students who do not meet the admissions criteria to the College of Engineering.

### **Introduction**

This paper provides a preliminary examination of the GEARSET program using the outcomes from both the initial pilot academic year (August 2019-May 2020) and the first year of the NSF S-STEM funded program (August 2020-May 2021), both of which follow the same framework. While these results are preliminary and focus on just two cohorts within a large six year study timeframe, they are promising results that showcase a correlation between the practices provided by the program and a direct impact on retention, persistence, and success of students both prior to and after their transfer to a STEM major. While the NSF S-STEM grant specifically focuses on the impact of LIAT students, this population encompasses a fully representative population, one that we aim to carry over to the entire College of Engineering, something that has been an area of concern and growth for STEM majors/colleges everywhere. Within the two cohorts, underrepresented minority students account for 38% of the total student population, the female population is 44% of total population, and roughly 38% of students in the program are identified as having high financial need through their Pell eligibility.

The GEARSET program was designed as a defined pathway to Engineering for students who did not fulfill the standard admissions criteria for the college of engineering and who instead are admitted to the Exploratory Studies program within the institution's University College. In the past, students within this population were required to follow a basic introductory course map designed for all incoming students who were deemed not admissible by the colleges they applied to within the institution. Thus these students did not receive any college-specific support, major-specific coursework, or curriculum designed specifically to expedite their transfer to and success within their major of choice. By utilizing a year-long experience based on recognized principals and programs dedicated to address these specific gaps in support for students within this population, there has been promising and significantly positive immediate feedback. As college bound populations continue to change, this program has shown results that may allow schools with decrease enrollment to better support underprepared students in their own academic quests, increasing retention and graduation rates along the way.

### **Method**

This program has focused on two specific areas which were lacking with this student population, curricular focus on areas of interest and co-curricular support programming, to help foster a

greater sense of belonging while instilling self-efficacy in the most significant problem areas for underprepared STEM students, mathematics and science. Utilizing two newly developed courses, the curriculum effectively transfers students to their majors one semester earlier than previously possible, thus also expediting time to degree.

The program also utilizes co-curricular programming in the form of faculty and student mentoring, a learning community, dedicated tutoring and success coaching support, financial literacy tutoring, and industry directed alternative instructional breaks to develop stronger sense of belonging and self-efficacy in various important areas of STEM.

## Results

For the purposes of dissemination of data, the 2019-2020 Cohort of GEARSET students will be identified as G1 and the 2020-2021 Cohort of GEARSET students will be identified as G2.

The primary sought out and recorded outcomes of the GEARSET program are: student retention after one-year, transfer into program of choice, transfer into engineering program, and student persistence at the University (2<sup>nd</sup> to 3<sup>rd</sup> year retention). These specific outcomes were compared to two distinct controls to measure rate of success, outlined below.

UNDT Population (Control One): Population of students who were admitted to the College of Engineering, but not to their chosen major based on the admissions criteria outlined previously. Most students were not admitted to their major based on their ACT/SAT score.

Exploratory Studies population (Control Two): These students were not admitted to the College of Engineering based on their admissions criteria, and were enrolled in University College prior to the inception of the GEARSET program (comparative data to prior year outcomes).

Tables 1 and 2 reflect the raw data for past cohorts within these controls for students above and below a 3.00 GPA (baseline admissions criteria for GEARSET as outlined above) while Table 3 showcases the same outcomes for both G1 and G2.

| <b>UNDT STUDENTS</b> |            |               |               |       |                     |       |
|----------------------|------------|---------------|---------------|-------|---------------------|-------|
|                      |            | Enrolled      | Retained      |       | Transition to Major |       |
|                      |            | # of Students | # of Students | %     | # of Students       | %     |
| Fall 2019            | Total      | 40            | 23            | 57.5% | 12                  | 30.0% |
|                      | Above 3.00 | 23            | 18            | 78.3% | 10                  | 43.5% |
|                      | Below 3.00 | 17            | 5             | 29.4% | 2                   | 11.8% |
| Fall 2018            | Total      | 43            | 28            | 65.1% | 11                  | 25.6% |
|                      | Above 3.00 | 27            | 20            | 74.1% | 9                   | 33.3% |
|                      | Below 3.00 | 16            | 8             | 50.0% | 2                   | 12.5% |
| Fall 2017            | Total      | 25            | 17            | 68.0% | 8                   | 32.0% |
|                      | Above 3.00 | 15            | 12            | 80.0% | 5                   | 33.3% |
|                      | Below 3.00 | 10            | 5             | 50.0% | 3                   | 30.0% |
| Fall 2016            | Total      | 13            | 10            | 76.9% | 4                   | 30.8% |
|                      | Above 3.00 | 9             | 7             | 77.8% | 2                   | 22.2% |
|                      | Below 3.00 | 4             | 3             | 75.0% | 2                   | 50.0% |
| Fall 2015            | Total      | 20            | 13            | 65.0% | 7                   | 35.0% |
|                      | Above 3.00 | 7             | 4             | 57.1% | 3                   | 42.9% |
|                      | Below 3.00 | 13            | 9             | 69.2% | 4                   | 30.8% |

Table 1: Past Retention Information for Control One

| <b>UCollege STUDENTS</b> |            |               |               |       |                     |       |
|--------------------------|------------|---------------|---------------|-------|---------------------|-------|
|                          |            | Enrolled      | Retained      |       | Transition to Major |       |
|                          |            | # of Students | # of Students | %     | # of Students       | %     |
| Fall 2019                | Total      | 101           | 58            | 57.4% | 22                  | 21.8% |
|                          | Above 3.00 | 16            | 10            | 62.5% | 5                   | 31.3% |
|                          | Below 3.00 | 85            | 48            | 56.5% | 17                  | 20.0% |
| Fall 2018                | Total      | 126           | 61            | 48.4% | 36                  | 28.6% |
|                          | Above 3.00 | 70            | 42            | 60.0% | 30                  | 42.9% |
|                          | Below 3.00 | 56            | 18            | 32.1% | 6                   | 10.7% |
| Fall 2017                | Total      | 150           | 71            | 47.3% | 31                  | 20.7% |
|                          | Above 3.00 | 59            | 40            | 67.8% | 26                  | 44.1% |
|                          | Below 3.00 | 91            | 31            | 34.1% | 5                   | 5.5%  |
| Fall 2016                | Total      | 151           | 78            | 51.7% | 34                  | 22.5% |
|                          | Above 3.00 | 62            | 42            | 67.7% | 25                  | 40.3% |
|                          | Below 3.00 | 89            | 36            | 40.4% | 9                   | 10.1% |
| Fall 2015                | Total      | 112           | 57            | 50.9% | 24                  | 21.4% |
|                          | Above 3.00 | 54            | 33            | 61.1% | 16                  | 29.6% |
|                          | Below 3.00 | 58            | 24            | 41.4% | 8                   | 13.8% |

Table 2: Past Retention Information for Control Two

| <b>GEARSET STUDENTS</b> |       |               |               |       |                     |       |
|-------------------------|-------|---------------|---------------|-------|---------------------|-------|
|                         |       | Enrolled      | Retained      |       | Transition to Major |       |
|                         |       | # of Students | # of Students | %     | # of Students       | %     |
| Fall 2020               | Total | 15            | 11            | 73.3% | 9                   | 60.0% |
| Fall 2019               | Total | 32            | 26            | 81.3% | 19                  | 59.4% |

Table 3: Retention information for G1 and G2

## Discussion

As shown in the data, the GEARSET program has effectively increased the retention rate of less-qualified students by roughly 20% per year when compared to both control populations while nearly doubling the rate with which students transfer to their desired majors within these populations. This effect persisted into the 2020-21 academic term where we expected significant declines in both values due to the web-based instruction and lack of structured fall programs due to University restrictions pertaining to the Covid-19 Pandemic.

We believe this data, carried over the first two cohorts shows significant evidence that the instructional adjustments and curricular-based portions of the program have made strong impacts on producing positive results in the key areas of retention and transferability of LIAT students. As an additional note, in both G1 and G2, the underrepresented minority (URM) populations (31% and 33% respectively) far outpaced those of the College as a whole (17% and 18%) and Control 1 (18% and 14%) in the same academic terms, thus achieving our secondary goal of increasing the recruitment and retention of URM students within the College of Engineering.

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