

WIP: Accelerating Growth of Non-Traditional Engineering Students Through a Holistic Ecosystem of Programs, Courses, Activities and Partnerships

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Abstract—This Work In Progress (WIP) paper about the innovative practice for a complete ecosystem for non-traditional student success. This paper highlights the early successes of a student taking advantage of a robust program that combines, traditional support services, experiential learning in and out of the classroom and industry partnerships. This paper is written jointly from the perspective of the program chair and a student fully participating in the overall set of programs. It will highlight the significant acceleration of both skills and confidence that this student has experienced in their first year. His experience is helping to make a more robust set of pathways for students that will follow him. The paper will walk through the student's journey from completion of their GED at our community college, their initial year and project the future pathway beyond that initial year. The paper will show how the programs are designed and implemented by the people running them. It will provide highlights and insights from the student in terms of what worked well and potential improvements. Details are provided about support services such as the Ocean County College (OCC) EOF program which provides: a community of like learners, comprehensive service and support, private academic coaching, academic advising, a financial grant and continued eligibility at NJ senior institutions. Another support program: The Student Support Services (TRIO) at Ocean County College whose mission is to assist and encourage first-generation college students, income-eligible college students, and/or college students with disabilities through the completion of a credential. We operate in a holistic, inclusive, and collaborative environment while delivering services that will immerse students in a challenging and engaging student experience. TRIO emboldens students to be self-driven; to discover their own barriers, seek out solutions, and develop a positive mindset in their journey toward success. This is complimented by an engineering degree program with a heavy emphasis on experiential learning where every course must dedicate a minimum of 10% of the grade to engineering project work. Finally, all of this is complimented with outreach, both from Industry as well as students encouraging K-12 students to pursue STEM.

Keywords— Engineering Education; Non-traditional Students; Experiential Learning; Career Skills; Work Readiness (key words)

I. BACKGROUND

This paper provides a case study that aligns with the Inputs, Outputs and Short Term Outcomes of a cocurricular support model as shown in FIGURE 1 from [1]. Unlike [1], this Work In Progress begins with the student pursuing a non-traditional pathway starting with the Ocean County College (OCC) GED program then transitioning to the support services and academic programs ultimately leading to a career in engineering.

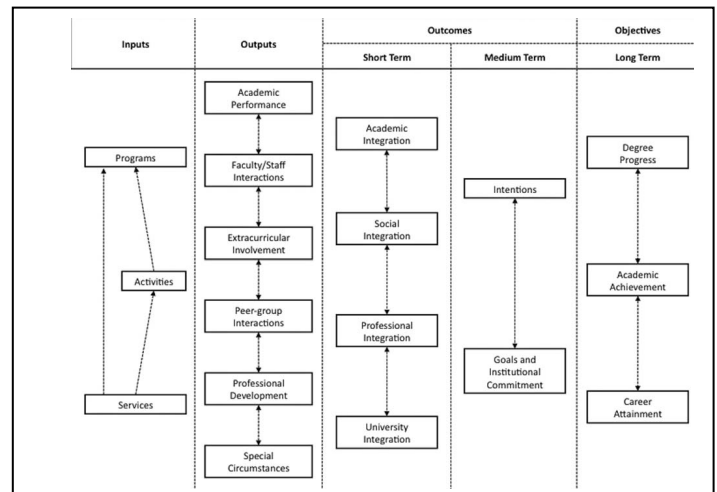


FIGURE 1 Model of Co-Curricular Support for Undergraduate Engineering Students [1]

To better understand the impact of this eco-system of programs and implementation of collaborative and integrated support for non-traditional engineering students, we must first start by

understanding the role and benefits of community colleges in higher education. As stated in [2]:

“Beyond their number, community colleges are distinctive for their "open door" admissions policy. Community colleges usually require only that entrants have a high school diploma or be 18 years of age. As a result, community college students are more heavily working class, minority, female, and older than are four-year college students.....Given its appeal to "nontraditional" students, efforts to increase equality of educational opportunity often put the community college at their center.”

For this Work In Progress we opened the door even wider by starting with a program that enables the achievement of the fundamental entrance criteria, the high school diploma. In the subsequent sections of this paper the authors will describe the foundational programs, the unique design of the Engineering & Industrial/Technical Studies program and how they work together to support, encourage and meet the needs of the students. Finally, a practical assessment will be provided by a student's summary of their experience.

II. DESCRIPTION OF FOUNDATION PROGRAMS

The foundational programs or “wind beneath the wings” to help our non-traditional students soar to success are described below.

A. GED Program

This first program provides students with the ability to meet the entrance criteria for access to higher education. The GED program prepares students for the high school equivalency tests with the skills necessary to get a high school diploma and assists in paying for the fees required at the testing centers. The following is the description from the Ocean County College Website[3]:

“High school diploma equivalency classes assist individuals in preparing to take the GED exam to earn a State of New Jersey High School Diploma..... All Services are Free*... *Paid for by grant funding”

B. EOF

This second foundational program provides for the needs of the students to access higher education. EOF assists students with financial support, tutoring, academic coaching and advising. The following is the description from the Ocean County College Website[4]:

“The Educational Opportunity Fund (EOF) is a state-funded program designed to provide academic and financial support to students economically and educationally affected by a history of poverty.”

C. TRIO (SSS)

Finally, the third foundational program also provides for the needs of students to access higher education. TRIO also assists students with financial support, coaching, tutoring services, and

academic advising The following is the description from the Ocean County College Website[5]:

“The mission of Student Support Services at Ocean County College is to assist and encourage first-generation college students, income-eligible college students, and/or college students with disabilities through the completion of a credential. We operate in a holistic, inclusive, and collaborative environment while delivering services that will immerse students in a challenging and engaging student experience. SSS emboldens students to be self-driven; to discover their own barriers, seek out solutions, and develop a positive mindset in their journey toward success.”

III. UNIQUE DESIGN OF OCC ENGINEERING & INDUSTRIAL/TECHNICAL STUDIES PROGRAM

As was seen in [6], the Ocean County College Engineering & Industrial/Technical Studies programs place a heavy emphasis on experiential learning. Given that engineers, technologists and technicians are applied scientist and mathematicians, it is in alignment with those areas of study to encourage frequent application of theory as a key enabler to future career success.

Experiential learning (or Work Based Learning) [7] is achieved both in the classroom and outside of the classroom through the following key curriculum components, programs and policies:

- Student's in the First Year Experience course are required to do an on-site visit to a career aligned company or event
- All program courses must dedicate a minimum of 10% of the grade to engineering projects (individual and group)
- The Engineering Club provides social support, academic support, and engineering projects.
- Engineering students act as role models and staff for K – 12 STEM outreach workshops and activities
- Career-aligned job placements are available as early as a student's first semester at OCC.
- Industry Partner & Professional Society events and the Annual OCC Engineering Technical Conference

All of these, combine with strong academics to encourage and motivate students to pursue their intended degree.

Finally, as with most Community Colleges, our students have ready access to and support from their faculty, who fulfill the roles of instructor, advisor, and mentor.

IV. IMPLEMENTING A COLLABORATIVE SUPPORT SYSTEM

The programs that are described in this paper are not unique or unusual for most institutions of higher learning. What is unique is the implementation of a collaborative support community for the student. All students in the OCC Engineering & Industrial/Technical Studies program are either officially or unofficially assigned to the Program Chair for advising. Both proactive monitoring and reactive monitoring and advising sessions are offered to all students by the person

in this role. For students in the EOF and TRIO programs are also formally assigned academic advisors. If not done in a collaborative model, having multiple sources of advising can provide conflicting and confusing guidance to a student. At OCC, we still provide guidance from different vantage points and potential optimizations of different goals. When done with full participation from all programs this allows our students, who ultimately own the decision, to make a better and more well informed decision based on the pro's and con's from multiple points of view. In other words, the programs work together and honor each other's viewpoint with the ultimate joint goal of helping each individual student succeed according to their needs and abilities.

V. STUDENT EXPERIENCE

This section provides a summary of the timeline for participating in these programs, assessment of how well the programs met their stated objectives, observations of collaboration between the various programs as well as conclusions by the student.

TABLE I shows the start and completion dates for the student's progress through the various programs described in this paper. It is anticipated that the student will graduate with an AS. Engineering in Spring of 2026. Their interval for completion of the AS. Engineering degree is equivalent to most students that enter the program at the college algebra level. This student entered at a math readiness level below college algebra, thus showing how these programs are accelerating this student's progress towards graduation. Most students that complete this degree program in two years, enter the program ready to take Calculus I, which is a minimum requirement for traditional four-year engineering programs. Community colleges are open enrollment [2], so there is no minimum math level that is required to start the program.

TABLE I – STUDENT TIMELINE

| | <i>Start</i> | <i>Completion</i> |
|------------------------------------|----------------|-------------------|
| GED | October 2022 | April 2023 |
| EOF | June 2023 | Spring 2026 |
| TRIO | January 2024 | Spring 2026 |
| OCC ENGR Program & CLUB | September 2023 | Spring 2026 |

To analyze the student's experience in the various programs, a five-point Likert scale was chosen [8]. The numeric values used to evaluate "How often does each program meet the individual goals?", ranged from "Always" to "Never". See TABLE II for the definitions for each numeric value of the Likert scale. The use of this scale facilitated a more consistent assessment of the programs as well as offering a quantitative method for identifying specific patterns. The Likert scale was found to be a useful instrument for evaluating the success of the

programs and finding areas for improvement by measuring the level of consistency in program execution across different student uses.

TABLE II – LIKERT SCALE RUBRIC – HOW OFTEN DOES THE PROGRAM MEET THE INDIVIDUAL GOAL

| Definition | Never | Rarely | Sometimes | Often | Always |
|---------------|-------|--------|-----------|-------|--------|
| Numeric Value | 1 | 2 | 3 | 4 | 5 |

TABLE III illustrates the extent to which each program achieved the intended objectives as perceived through the experiences of the student. The individual goals that were evaluated were:

- Skills: Ability of the program to deliver the training and enable student achievement of the stated learning objectives
- Financial Aid: Ability of the program to deliver the stated financial support
- Tutoring Services: Ability of the program to deliver supplemental tutoring services that enable the student to successfully complete their program of study
- Academic Coaching: Ability of the program to guide the student efficiently through their program of study towards their academic and career goals
- Career Networking: Ability of the program to enable the student to interact with professionals in their chosen field of study and career
- Experiential Learning (or Work Based Learning): Ability of the program to provide the student with real-world application of their skills and knowledge that align with their future career

TABLE III STUDENT ASSESSMENT OF PROGRAM GOAL ACHIEVEMENT

| Individual goals | Program Goal Achievements | | | OCC ENGR Program & CLUB |
|-----------------------|---------------------------|-----|------|-------------------------|
| | GED | EOF | TRIO | |
| Skills | 5 | 3 | 3 | 4 |
| Financial Aid | 5 | 5 | 5 | N/A |
| Tutoring services | 5 | 5 | 5 | N/A |
| Academic Coaching | N/A | 5 | 5 | N/A |
| Career Networking | N/A | N/A | N/A | 5 |
| Experiential Learning | N/A | 4 | 4 | 5 |
| Overall Mean | 5 | 4.4 | 4.4 | 4.7 |

TABLE III shows that only the GED program fully met all expectations for the student. The OCC Engineering Program and Club fell short in fully meeting all expectations with regards to skills. However, this is where the EOF and TRIO programs provided coordinated services through their tutoring to help the student successfully complete their challenging engineering program courses.

The final assessment, by the student, is shown in TABLE IV that provides examples of observed coordination between the various programs. This analysis resulted in the creation of a coordination matrix, TABLE IV, showing how each program interacts with one another. This helps to highlight key aspects of joint work that were conducted that were perceived to have high impact on the student's success.

TABLE IV – OBSERVED CROSS PROGRAM COORDINATION MATRIX

| Coordination Matrix | GED | EOF | TRIO | OCC ENGR Program & CLUB |
|---------------------|-----|-------------------|--------------------------------------|------------------------------|
| GED | | Financial Support | Time - Management | Community support |
| EOF | | | Financial Support Time Management | Academic / Transfer Advising |
| TRIO | | | | Academic / Transfer Advising |

VI. SUMMARY & RECOMMENDATIONS FOR NEXT STEPS

The Likert scale played a crucial role in quantifying the student's experiential observations about these programs. In summary, the utilization of the Likert scale demonstrated its worth as a valuable instrument in assessing the efficacy of the programs and pinpointing areas that are strengths and areas that require enhancement. The student timeline displays the projected completion of the programs by the student.

The following provides additional insights about each of the individual program goals from the perspective of the student.

A. GED Program Student Experience

The GED Program met all stated goals regarding the preparation for the high school equivalency test. It not only supported the teaching of the material but also provided financial support to pay for the fees required by the testing center at Ocean County College.

B. EOF Program Student Experience

The EOF Program exceeded all stated goals, but not only that, it added additional support like counseling, private tutoring, and personal academic coaching, as well as a large community of support.

C. Trio (SSS) Program Student Experience

The Trio Student Support Services program met all stated goals and provided additional support like financial

workshops, get-connected workshops, and tutoring for all needed subjects. Helping facilitate college workload.

D. Ocean County Community College Engineering

The Engineering Club has provided outstanding support as well as the skills necessary for engineering projects while also providing networking opportunities, annual conferences, and many workshops where the skills learned here can be used to mentor k-12 students and implement the skills learned from the engineering club.

This paper provides a case study for the implementation of an innovative practice for a complete ecosystem for non-traditional student success. The authors would propose that next steps include leveraging key methodologies and research findings outlined in [1], [9], [10], [11]] to help strengthen and scale our initial implementation. It is the hope of the authors that doing so would significantly increase the impact of the benefits that have been demonstrated in this paper to a larger population of non-traditional engineering students.

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