S-STEM Student Reflections and IDP Process

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S-STEM Student Reflections and IDP Process

Introduction

Student reflections and using individual development plans (IDPs) for mentoring have been an integral part of an NSF S-STEM project focusing on students pursuing baccalaureate degrees in Engineering Technology (ET). The Engineering Technology Scholars – IMProving Retention and Student Success (ETS-IMPRESS) project provides financial support and offers students several high-impact curricular and co-curricular activities to increase the success of academically talented students. This interdisciplinary project brings together the College of Computing Electrical Engineering Technology, and Computer Network and System Administration programs in the College of Computing and, the College of Engineering's Mechanical Engineering Technology program, with programs in the [honors college], an inclusive and unique college designed around high-impact educational practices.

An IDP is commonly used in business and industry to assist employees in meeting short- and long-term goals in their professional career. This tool has been adapted for use in the educational setting in a faculty mentoring capacity. The ET program advisors assign the freshman or transfer S-STEM student scholars with faculty mentors to match their area of research interest. The faculty mentors meet with the students a minimum of three to four times a year to review their IDP, make suggestions, and provide input for reaching their goals. The goals of the IDP process are to; develop a deeper more meaningful relationship between advisor and student, reflect and develop a strategy for the scholar's educational and career, and manage expectations and identify opportunities. In the initial meeting there are several prompts for the student to write about their goals, strengths, weaknesses and perceived challenges. In subsequent meetings the advisor and student revisit the IDP to discuss progress towards those goals.

This study will describe some outcomes of the IDP process providing specific examples from each of the ET programs. Although it is difficult to measure the effect of these relationships, it is one of the high impact practices that have been noted as increasing student engagement and retention. The consequences of COVID-19 introducing a virtual environment to the IDP process will also be examined from the viewpoint of both student and advisor. An advantage of the IDP meetings for students is that advisors may provide personal business connections for internship opportunities and/or research projects that otherwise would not be discussed in a typical office hour or classroom session.

One of the innovations of the ETS-IMPRESS program was requiring participation in the Honors Pathway Program, which generally emphasizes intrinsic motivation (and does not use GPA in admissions or awarding of credentials). The honors program consists of three seminar classes and four experiential components; for all of these, students write reflections designed to promote their development of self-authorship. Preliminary survey results show no difference between ETS and other honors students in the areas of student motivation, intention to persist, and professional skill development. ETS students see a closer link between their current major and their future career than non-ETS honors students.

This paper investigates the student experience in the ETS-IMPRESS program in three ways. To capture student experience of the use of the IDP and the faculty mentor relations, we solicited long-form responses to anonymous surveys. Analysis of reflections submitted in courses and components allows for a window into longitudinal student development as well as their direct reflections on the effects of the program. Finally, analysis of student questionnaires, a full report of which appears as an appendix, sheds light on student development. We find that students benefit from this program and encourage the incorporation of IDPs and other means of reflection into engineering curricula, particularly as a regular practice.

Background on the ETS-IMPRESS Program

The ETS-IMPRESS Program has three major goals to achieve over a five year period. *Goal 1: Expand the number and diversity of academically talented and financially disadvantaged individuals entering the Engineering Technology STEM pipeline; recruit and retain these individuals in STEM programs. Goal 2: Add to the body of knowledge regarding best practices in engineering technology education and promote the employment of engineering technology graduates. And Goal 3: Contribute to research on self-efficacy and best practices.* A first-year progress report was previously presented at ASEE [1]. Currently, the project is in the third year having successfully graduated one student who is employed in a STEM field of study. Three cohorts of selected scholars (both first-year and transfer students) have started the program from 2018-20. There are thirteen students actively participating in program activities including ongoing mentoring and advising.

The remaining two years of the program will target awarding new scholarships solely to transfer students from regional technical and community colleges. The awarding of transfer scholarships has been challenging due to the narrow STEM fields of MET, EET and CNSA combined with the financial need requirements. The applicant evaluation includes 10 points for each of the following (for a total of 60 points): 1) high school GPA, or college GPA, 2) level of unmet financial need, 3) honors/awards, 4) personal statement, 5) essay, and 6) letter of recommendation. In the summer of 2020 there were no new transfer scholarship students eligible to participate. From the applicant pool of 11 there were four first year scholarship awardees selected that were notified in May 2020. An unsuccessful attempt was made prior to the beginning of fall 2020 semester to identify eligible enrolled transfer students that had not applied for the scholarship. None of the transfer students enrolled in MET, EET, or CNSA qualified for financial need eligibility.

Moving forward in 2021 will require a more coordinated recruitment effort by program advisors and faculty to target the community college student pipeline. An effort is underway by the [university] Center for Educational Outreach to develop ongoing and new transfer articulations with 2-year degree granting institutions. The selection criterion for 2020 was relaxed to not require a completed associates degree, but this did not increase the number of applicants as expected. The project may require a no cost extension to award the remaining number of transfer student scholarships available.

Background on the [honors college]

The ETS-IMPRESS Program requires students to enroll, and remain in good standing, in the [honors college]'s Honors Pathway Program. In a sense, requiring students to participate in this program creates tension with some of the program's founding principles. Designed to be inclusive and to foster student's self-authorship [2, 3], the honors program focuses on building students' intrinsic motivation and self-knowledge. In a groundbreaking move, the honors program does not use student GPA at any stage: neither for admission nor for determining a credential [4, 5]. Previous studies of student reflections have demonstrated that students in this program see a great deal of value in the program for their own personal growth, and these studies found signs that students grew in self-authorship [5, 6]. However, the self-selecting nature of the program raises questions about the program's role in developing this growth. Were the students who selected [name of honors college] bound to succeed anyway? The ETS-IMPRESS program allows the opportunity to track the effect of the program as a requirement.

IDPs

MET, EET & CNSA program faculty provide mentoring and advising for all student scholars (both first-year and transfer students) to ensure academic success. An IDP form and protocol is used by faculty mentors to guide and track advising meetings. The IDP process is applicable in many fields of business, science, government and/or academia and can be very beneficial as noted by researchers [7, 8]. The process is helpful to organize thoughts before the meeting, remember what topics to discuss during the meeting, and to record what was discussed. The IDP form was implemented in Spring 2020 to provide a strong foundation for faculty mentors to work from as they build relationships and support their mentees in their future endeavors.

Faculty mentoring of student scholars has resulted in some prime examples of the impact the IDP process can have on student careers. The CNSA program only has two scholarship students at this time, but both students have met with their advisor several times. Discussions for each student revolved around IDP, course registration (for fall and spring semester), potential internships, and undergraduate research opportunities. The CNSA advisor also introduced the mentee to the [university] Summer Undergraduate Research Fellowship (SURF) student application process and potential project that otherwise may not have been on this student's radar. Mentor meetings with one EET student indicates that the student was introduced to certifications in robotics and the availability of the MS in Mechatronics that align with the student's interests. The remaining scholarship students are in the MET program area where there are four faculty mentors. Each faculty member has two to three mentees that they advise each

semester. The relationships many times revolve around the student's career goals and how they can be addressed during their time on campus. One example that has occurred is that students have joined [university] Enterprise teams (a multi-disciplinary, multi-year capstone replacement) given the encouragement from the mentor. Several Enterprise groups like the Advanced Metals Enterprise (AME) cater to the hands-on interests of MET students. With the encouragement of the mentor one MET student was hired in the department machine shop as a student employee and will continue this position as a summer intern.

Survey Results

A recent survey of ETS-IMPRESS students resulted in 10 responses from the 13 total fall scholarship recipients. Of the students surveyed all 100% had met to discuss their IDP with their faculty mentors. In spring 2020 86% of the students reported meeting with their faculty mentor 2-3 times during the semester, while during fall 2020 50% reported meeting with their faculty mentor 2-3 times. Students were asked to share what was beneficial, what was learned, and what decisions were influenced by meeting with their advisors. A few of the responses are included here:

> "I thought this experience was good. It was beneficial to look at my IDP again and see what has or has not changed. It was also nice to make sure my goals were up to date and still relevant to me. I learned that my strengths and weaknesses have grown and I am still taking actions to improve myself. My decisions have remained the same and I am still going to pursue this."
>
> "They helped me to decide on adding a minor. These meetings also helped me determine which enterprise to join and determine classes for these semesters."
>
> "These meetings were very beneficial. My faculty advisor provided me with insight and resources on internships as well as looking into the future at opportunities such as Master programs and being a TA. I wasn't planning on starting to look at internships so early but now I am going to try to apply for some."

The student responses to the open ended question supported what the faculty mentors reported about their IDP meetings. The process does help as an organization tool and a record of what was discussed as the literature review indicated. The process also develops a closer relationship between the faculty member and student so that internship, co-op, enterprise and/or scholarship opportunities are introduced and encouraged.

Analysis of Reflections

In the Honors Pathway Program, students write reflections frequently. The three one-credit seminars that compose the main curricular component (HON 2150, 3150 and 4150) include near-weekly reflections, and three of the four components contain additional reflections. First-year ETS students are also required to enroll in HON 1150, which prepares students for the program as a whole and contains some foundational reflections. All reflections are written and follow a "What/So What/Now What" format that instructors also describe as "Present, Analyze, What's

Next?" The goal of reflection is to help students process their experiences, gain perspective on them, and use them as basis for future action.

Students generally see benefit from the reflections [6] and are often quite frank in their content. An "ungrading" approach, introduced in Fall 2019, seeks to foster that by marking reflections as "complete" or "incomplete" rather than assigning them specific scores. This frankness sheds light on the required nature of the program. In a "Failure Resume" exercise in HON 3150, several students questioned their major choices, including two who mentioned the influence of a scholarship on their major (including one ETS and one non). However, one student left the ETS program but continued in the Honors Pathway Program. For that student, at least, the benefits of the honors program transcended the requirements.

The theme of being required to have this experience occurs frequently in reflections from the ETS cohort. This is often presented alongside other rationales and descriptions of motivations. One student, whom we'll call Student A, stated in their application video, "I want to join [name of honors college]so… 'cause I have to. Um, I have an ETS Scholarship, so I also want to get connections to research and [name of honors college] has other opportunities that they have." Clearly the student has difficulty reconciling the different expectations and messaging that they are receiving about Pavlis: syntactically these ideas are not linked. Student A immediately goes on to describe things they hope to get out of the experience -- research connections -- but even grammatically the relationship between these two attitudes is not resolved.

In their final reflection for HON2150, Student A reports a moment of epiphany partway through the semester -- but in so doing, discusses the ways in which they retrospectively characterize their previous reflections as inadequate and grade-motivated:

> I knew from the beginning of this class that would [sic] need to really work on my reflective practice this semester. Completing reflections in 1150 was a daunting task at times since I mostly did not see the point of them and had trouble getting my ideas down on paper. In 1150, I put minimal effort in them just so I could get a grade and I started out with the same attitude this semester. However, by the end of this semester, my reflective practice had greatly improved.

The student describes their moment of epiphany:

> The point where my reflective practice stepped up to the next level was when I didn't get credit for my self-portrait redux reflection. I realized I had to change my approach if I was going to get the most out of what this class had to offer. At this point, I had also begun to recognize the value of this reflection practice. I also changed my focus to expressing my point of view instead of completing the assignment to get credit. After this turning point, my reflections became deeper and more thorough since I began to put more effort in time into them.

Notably, grades and requirements make a significant shift in the student's thinking. Paradoxically, a poor grade inspires the student to shift "focus" away from grades. On the one hand, the student may in part be delivering the narrative they think the class is trying to solicit -- the reflection leads up to an argument that the student is "now at the proficient stage of [their] reflective practice." However, the syntax and content of the reflection is indeed deeper and more in line with what the program seeks to solicit, compared to the student's first reflection for the same class. The sentences are longer with a more varied structure and closer syntactical

connection between them. The student also probes their own emotional state and deeper motivations: “when I can’t clearly draw a connection to real world application in a class, I tend to put in minimal effort to get by; it is easy for me to get in the mindset that the things I perceive as less important are detracting time from the things I really want to learn. Sometimes, it takes that extra push or outside perspective for me to realize the value of something I don’t think is worth my time.” While the student doesn’t have the depth of reflective practice that other students may, they certainly do seem to have made a leap. In general, this student bears some resemblance to the students in the earlier longitudinal study of non-ETS-IMPRESS [name of honors college] Pathway students, who showed strong “following-formula” emphasis in the first semester and seemed similarly to be telling graders what they thought they wanted to hear. Those students all grew significantly by the end of the third seminar.

To illustrate an example of more advanced reflection and greater evidence of progress toward self-authorship, we need look no farther than another ETS-IMPRESS student at the same point in the semester: the final reflection in HON2150. The first distinction is simply in length: at 892 words, Student A’s reflection closes with a length justification (again with an eye to a grade): “Though I have not quite achieved the expected word count for this reflection, I believe what I have written concisely conveys my point of view and demonstrates the aspects of a proficient reflective practice.” Student B’s reflection clocks in at 1447 words. The prompt was not exactly the same; instead of asking students to place themselves on a scale of reflective proficiency, the prompt asked students to revisit their goals. Student B does rate themselves as achieving these markers, but in a way that is clearly subsidiary to the personal development that the student clearly values:

> After achieving what I had set out to do, along with developing more skills and self-development that I had originally planned, I honestly feel great. I have personally developed over this semester to the point where I am able to feel comfortable with myself and truly understand what it is I wasn't to do and who I want to be.

The majority of the reflection is focused around ways that the student expanded their knowledge of themselves and the way they relate to others, with an emphasis on the change from the beginning of the semester to its end. The student clearly articulates a structure to the reflection: “The first major view change that I had was a change in how I view others…. The second view that this course helped to shape was the view of myself...The final view change that was brought by this course was through my changing view on my goals as an individual.” In each of these categories, the student gives examples and traces changes, for instance articulating how they realized that they had made judgments about fellow class members that further experience overturned.

Student B’s final extensive example pertains to the development of their self-authorship:

> Previously, I had signed up for these courses and opportunities because “It's related to my major it's what I do”. However, now more than ever I am addressing the situations not based on their relative to a certain thing I like/do but based on what MY goals are. One trait of this that can be easily seen is through my planning out my years here at Tech. Originally, I had just defaulted to following the typical [major] flowchart and “getting what needs to be done”. Now I am planning my next few years around not only what I need to get done, but also through what I want to do in order to be who I want to be.

The student is beginning to define their goals and activities by their own sense of themselves rather than accepting an external definition of what they "should" do based on their major. They feel more agency in their choice of activities.

Of course, a major challenge to student agency came in the spring of 2020, when the pandemic changed many student plans. [name of honors college] offered students the opportunity to "immerse in place." While the immersion usually asks students to step outside their comfort zone, everyone in summer 2020 was being pushed outside their comfort zone (and then some), like it or not. Student B participated in the 2020 Summer Immersion cohort and wrote a 2.5-page (single-spaced) reflection that concluded with this meta-reflection:

> In all honesty, if I hadn't engaged in the self-reflection and push to better myself, I most likely would not be as successful as I am now. Overall, while I may not be perfect, now that I can manage my stress better I feel significantly more confident and mentally healthy to take on what tomorrow has (Whatever it maybe). While my progress during these seemingly never-ending months has helped me to where I am now, the tools I learned throughout this immersion are going to help me significantly when this pandemic is over. Even though the situation has brought on a lot of negatives, being able to step back and see the benefits I've had with my personal development brought a silver lining to this ginormous cloud. Thank you for helping me to get where I am now.

This consisted of a leap in Student B's reflection even from the previous seminar. In terms of explicit content, they credit the reflective activities with allowing for greater perspective, self-confidence, and mental health. Even in this short excerpt, Student B both recognizes their own achievements and acknowledges room for further growth and does so in a more seamlessly integrated fashion than in the reflection at the end of HON 2150.

An advanced student ("Student C") developed a long reflection late in the program that took stock of the development they underwent over the course of the program. Reflection itself forms a significant portion of the benefit they describe from the program:

> [name of honors college] asks us to reflect on virtually all aspects of our lives, careers, education, family and friends. These reflections seem a bit strange at first and it took me a bit to figure out how to see and realize the important aspects of whatever it is that I am doing. Taking the time to sit down and write out a reflection on something you did really helps solidify that type of thinking as you continue to grow. In a way at first, it was like I would be thinking about the situation in a way that would allow me to write something substantial enough for the assignments. Then, after some amount of time, that thinking changed to become more reflexive in nature. Instead of consciously thinking about what was happening to be able to write it down later, it changed to subconsciously taking note of those things, while being able to be more focused and in the moment. Instead of focusing on my thoughts and what would be valuable to write down, I was able to learn how to focus more intently on the situation while my subconscious took note of and stored away some of the more important pieces. That was something I was not expecting as I had gone through the seminars and began completing the larger activities.

The student also praises the "community" and "friendship" that [name of honors college] encourages between students, crediting it with their decision to pursue a master's degree:

> Now, it seems, [name of honors college] has helped push my decisions a bit further as I am beginning my master's program [immediately after graduation]. I really doubt that I

would have had the confidence or a group of people who were and are so supportive of that choice, without Pavlis. For me, I think that is one of the most influential parts of my journey with [name of honors college]and [university] in general.

For ETS-IMPRESS students in particular, a benefit to the honors program is being part of a community that draws a range of students, including those attracted by the impression of a more "traditional" honors program.

Analysis of Learning in College Survey Data

A full report is attached, describing the analysis of survey data collected from students in the Honors Pathway Program, both from the ETS cohort and the more general Honors cohort. The Learning in College questionnaire consists of elements of four surveys: 1) The Motivated Strategies for Learning Questionnaire [9] making use of seven subscales, including intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, critical thinking, and metacognitive self-regulation; 2) the Change-Readiness Assessment [10] which assess 7 subscales, including adventurousness, confidence, adaptability, drive, optimism, resourcefulness, and tolerance for ambiguity; 3) Persistence Measures [11] which measures 3 responses including graduate study, career, and intent to change major; and 4) the Longitudinal Assessment in Engineering Self-Efficacy [12] which provides results in six subscales, including self-efficacy, sense of belonging, and career expectations. All of the questions are related to the course and/or learning environment. These questionnaires employ 7-point Likert scales. 1 refers to "not at all true of me", while 7 denotes "very true of me." Table 1 shows the demographics of the students in the ETS-IMPRESS program.

Table1: ETS-IMPRESS Student Demographics

ETS-IMPRESS Scholars	N	Age	Gender	Race/Ethnicity
First-Year Scholars	8	19~21 (M=20)	M=7, F=1	White (non-Hispanic)=6 African American (non-Hispanic)=1 Asian/Pacific Islander=1
Transfer Scholars	6	22~32 (M=24.5)	M=5, F=1	White (non-Hispanic)=5 Not Reported=1
Total	14	19~32	M=12, F=2	W=11, AA=1,A/PI=1,NR=1

In general, the survey results revealed no statistically significant differences between ETS students and Non-ETS students in overall means of student motivation, intention to persist, professional skill development, and self-efficacy. It demonstrates the effectiveness of PHCPP in supporting ETS students with their future career needs as well as providing a comparable experience for them. However, there were significant differences in two career-relevant subscales: ETS students saw a closer link between their current technology major and future career as compared to graduate study, and they had higher engineering career expectations in

comparison with Non-ETS students. This is not surprising, as ETS IMPRESS student scholarships are dependent upon students remaining in a technology major, and technology majors are more hands-on majors linked more directly to particular post-graduate career pathways.

Regarding student professional skill development, ETS students on average scored low (below 4) in optimism and adventurousness while Non-ETS students only scored low in adventurousness. In addition, ETS students reported lower self-efficacy than non-ETS students in subscales of self-efficacy, feelings of inclusion, and mathematical outcomes expectations. In terms of optimism, we propose to continue observing these responses to test whether these scores shift as students advance in their programs. The non-ETS students are relatively early in the program as yet, and are being compared with students who span all years of the undergraduate college experience.

In terms of feeling of inclusion, a large number of ETS students are transfer students (compared to the non-ETS cohort). This may contribute to a lower feeling of inclusion as these students have spent less time at [university] and struggle within their more advanced courses to meet the expectations of faculty when compared with students who entered the campus as first year students. This sense may also relate to being required to enroll in the honors program. However, it is worthwhile to note that ETS students showed a gradual progress in their feeling of inclusion, revealing that the PHCPP showed an effect on fostering ETS students' feeling of inclusion as the surveys were taken pre-HON2150 and then post-HON2150 (at the beginning of HON3150). It is possible that continued seminars may help with students' feeling of inclusion, either in the honors program or in the university as a whole.

Addressing differences in mathematical outcomes expectations, ETS students are low income, and it is possible that they may have enrolled in high schools offering fewer opportunities for advanced mathematics. In addition, the mathematical requirements for students in technology majors are not as rigorous as those in engineering, thus ETS students may have lower expectations around mathematics in comparison to the majority of students in the non-ETS group. Given this, we suggest that faculty mentors may specifically want to focus some of their mentoring on discussions around strategies for improving math performance.

Overall, these findings reaffirm the significant investments of the ETS-Impress program to help promising low income students prepare for careers, increase feeling of inclusion and self-efficacy, and develop professional skills in the STEM field. As we move forward, we will continue to monitor student progress throughout the program through the collection of ancillary data and surveys. In addition, more thorough testing of the comparison cohort will be completed as well as an inter-group analysis between the ETS students with the comparison cohort.

Conclusion

This paper investigates the experience of students in a scholarship program that requires substantial amounts of reflection: in three or four seminar courses, in additional components, and in IDPs and conversations with faculty mentors in their respective engineering technology majors. An essential question was: would students benefit from reflection when it came as part of a structured, required program? Through the mixed methods of analysis we see above, the answer seems to be that students do benefit from reflection.

The benefits seem to vary somewhat student-to-student, as might be expected, yet students as a whole grow in their ability to craft reflections and their feelings of inclusion (as measured by a survey instrument). Students find the program helpful in envisioning their future development, citing conversations with faculty and peers as essential in helping them consider their career options. Graduate school particularly comes up: these students are less likely than their mixed-major peers to think of graduate school (according to our survey), and several students reported being prompted to think of it more as a result of this program. The IDP process has impacted student involvement in co-op, internship, enterprise group, and scholarship opportunities through conversations with mentors.

On the strength of these findings, we recommend that colleagues in other institutions and programs consider adding reflection to their curricula. This program contains a large amount of reflection, ranging from weekly to a few times a semester for the students' entire tenure at the university (for transfer students) or almost every semester for students admitted as first-years. While this extent of reflection may not be necessary for full benefit, we have seen that one student had their "lightbulb moment" about how to do reflection mid-way through their second semester of frequent reflections. As Student C indicates above, for students well advanced in this program, reflection becomes a practice, fundamentally changing their methods of thinking and processing their experiences. Students in the "hands-on" fields of engineering technology see the benefits to reflective practices. Introducing regular reflection into their curricula can help their personal and professional development, and we all benefit from more thoughtful engineers.

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Appendix A: Research Report

ETS-IMPRESS Research Report
December 2020

1. Introduction

The goal of this project is to undertake a longitudinal study to examine student retention and success for the ETS IMPRESS Scholars as measured by student motivation, self-efficacy, intentions to persist, professional skill development, performance, retention, and graduation rate. These measures serve as a tool to better understand the experience of students in engineering technology disciplines who are academically talented and financially underserved. This report provides an overview of the first three

years of this analysis, including the primary research questions, research design and methodology, overall discussion of the experimental results, as well as the work yet to be completed.

1.1 Research Questions

Research questions for this project are:

Q1: How does the introduction of an inclusive honors college curriculum and support structure affect student motivation, performance, retention, intentions to persist and professional skill development of academically talented, financially needy underserved and underrepresented students?

Q2: Does a clearly articulated and supported transfer pathway to engineering technology positively influence transfer student performance, retention and time to graduation as compared to a traditional engineering transfer pathway?

1.2 IRB Exempt

The research project has undergone review and has been determined to be exempt by [university]nological University's Institutional Review Board (IRB).

2. Design & Methodology

We conducted two studies in this project. Study 1 addresses the first research question and Study 2 responses to the second research question.

2.1 Participants

The participants included in Study 1 are eight ETS-IMPRESS scholars who enrolled in the [honors college] Pathway Program (PHCPP) and 261 non-ETS students who also enrolled in the PHCPP. For Study 2, participants included Six ETS transfer scholars who enrolled in the PHCPP and a control cohort of 21 selected non-ETS transfer students who enrolled in traditional engineering majors. There were 14 ETS students (aged from 19 to 32, 12 males and 2 females), including 2 minority students (African American and Asian/Pacific Islander), 22 white students, and 1 student who did not report his race/ethnicity (Table 1).

Table1: ETS-IMPRESS Student Demographics

ETS-IMPRESS Scholars	N	Age	Gender	Race/Ethnicity
First-Year Scholars (Study 1)	8	19~21 (M=20)	M=7, F=1	White (non-Hispanic)=6 African American (non-Hispanic)=1

				Asian/Pacific Islander=1
Transfer Scholars (Studies 1 & 2)	6	22~32 (M=24.5)	M=5, F=1	White (non-Hispanic)=5 Not Reported=1
Total	14	19~32	M=12, F=2	W=11, AA=1,A/PI=1,NR=1

2.2 Design & Procedure

2.2.1 Study 1

Study 1 utilizes a within-subjects design where all students enrolled in the PHCPP seminars complete what we have entitled the Learning in College (LiC) Questionnaires multiple times during their undergraduate degree program. These questionnaires allow us to longitudinally track student motivation, self-efficacy, and self-authorship capacity in order to assess the effectiveness of the honors program in achieving its goals. The results of these questionnaires form the basis of the analysis provided for Study 1.

As part of the [honors college] Seminar Courses, students complete the LiC at the beginning of the Honors seminar courses, including HON1150, HON2150 and HON3150, as well as when they complete the last seminar, HON4150.

The LiC questionnaire consists of elements of four surveys: 1) The Motivated Strategies for Learning Questionnaire (MSLQ: Pintrich, Smith, Garcia, & McKeachie, 1991) making use of seven subscales, including intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, critical thinking, and metacognitive self-regulation; 2) the Change-Readiness Assessment (Kriegel & Brandt, 1996) which assess 7 subscales, including adventurousness, confidence, adaptability, drive, optimism, resourcefulness, and tolerance for ambiguity; 3) Persistence Measures (Schmader, Johns & Barquissau, 2004) which measures 3 responses including graduate study, career, and intent to change major; and 4) the Longitudinal Assessment in Engineering Self-Efficacy (LAESE, Marra & Bogue, 2006) which provides results in six subscales, including self-efficacy, sense of belonging, and career expectations. All of the questions are related to the course and/or learning environment (Appendix A).

These questionnaires employed 7-point Likert scales. 1 refers to “not at all true of me”, while 7 denotes “very true of me.” The report will share findings of the questionnaires and provide some discussion based on the data collected.

To answer research question 1, ETS-IMPRESS students are compared with other students who participate in the same PHCPP programming to determine whether ETS students are provided with a comparable experience. In addition, ancillary data is collected for ETS students to determine whether their performance, retention and graduation rate have improved compared to previously published data.

2.2.2 Study 2

For Study 2, we created a randomly selected cohort of transfer students as a comparison cohort. The procedure for constructing the cohort was:

1) We identified all transfer students who had entered [university] from 2-year institutions and selected to pursue engineering majors using the [university] Student Affairs Information System;
2) We reduced the transfer student pool to only include the students in the traditional engineering majors that aligned with the technology majors in which ETS scholars were enrolled;
3) We then continued to downsize the control cohort by choosing students who transferred from the same colleges as ETS students and had similar expected terms to graduation;
4) In addition to the criteria of selecting transfer students from the same 2-year institutions, we then randomly selected transfer students who were from other 2-year institutes who had comparable overall GPAs and expected terms to graduate as ETS students; finally,
5) We performed two Welch two-sample t-tests to assure that the two groups were independent and comparable in terms of overall GPAs.

The data obtained (i.e., GPA performance, retention and expected time to graduation) for this control cohort is compared with the ETS-IMPRESS students as a means to explore whether the technology transfer pathway in [honors college] improves these outcomes for ETS transfer students.

2.3 Apparatus, Materials

We use an online survey development cloud-based software, SurveyMonkey, to administer the LiC surveys. In addition, we use a free statistical computing and graphics software, R programming language, for data management, analysis and visualization.

3. Results of Study 1

3.1 Student Motivation

3.1.1 Overall Student Motivation

In general, both ETS and Non ETS students across all time points exhibited high means (scored 4 and above) in task value, intrinsic value, and extrinsic value as measured by the MSLQ (Figure 1) with no statistically significant difference between the cohorts.

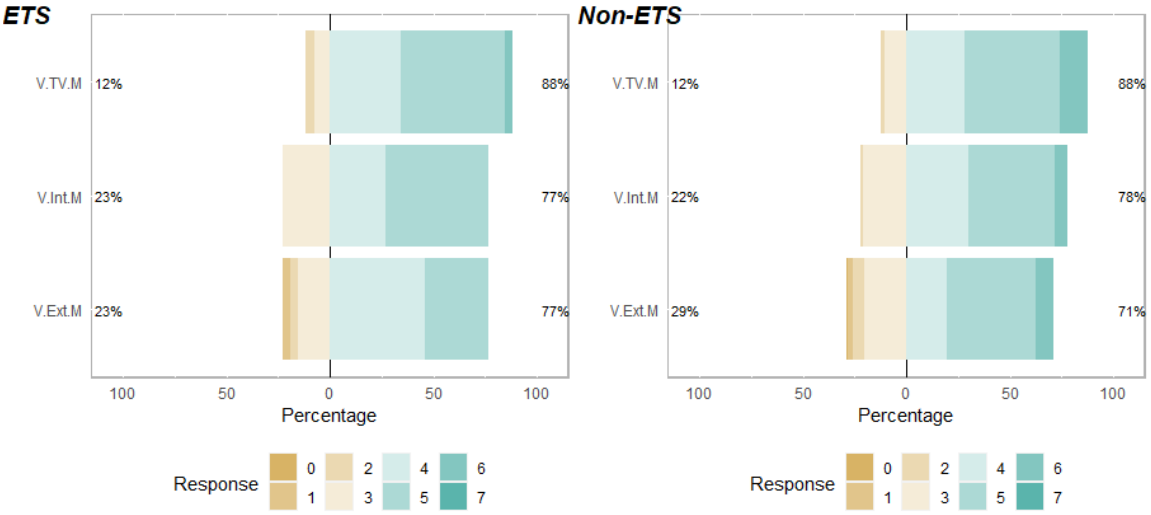

Figure 1: Histogram of student motivation overall results between ETS (left panel) and Non-ETS students (right panel) in the categories of task value, intrinsic value, and extrinsic value.

3.1.2 Group Comparison between HON2150 & HON3150 Time Points

An analysis of student data collected at 2 time points showed a similar trend wherein the means of the motivation measures were very high at both time points (Figure 2). According to Welch two-sample t tests, there were no statistically significant differences between ETS and Non-ETS students in any of student motivation measures (Table 2).

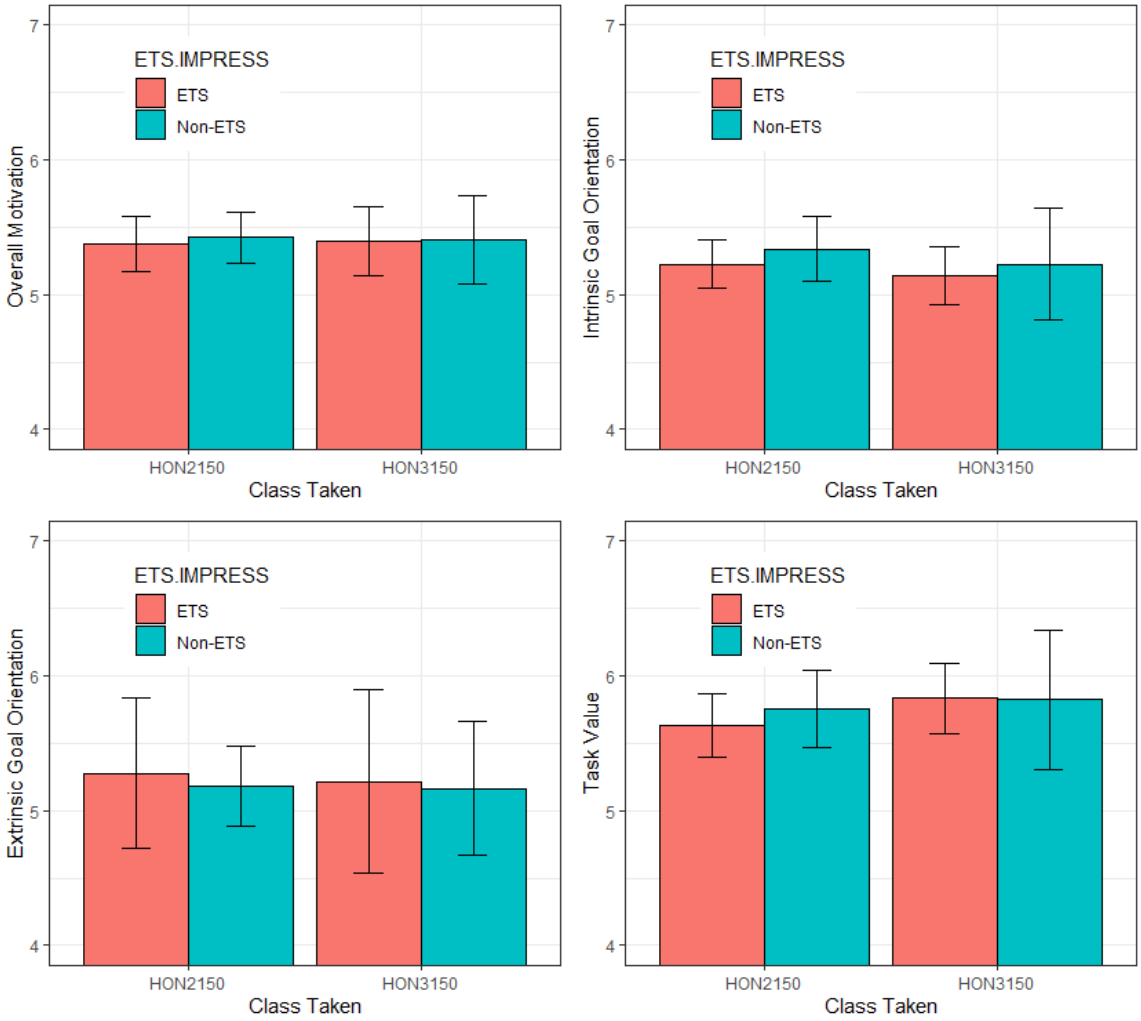

Figure 2: Student mean scores and standard deviations by class taken between ETS and Non-ETS students. Student overall motivation, intrinsic goal orientation, extrinsic goal orientation, and task value are located in the top-left, top-right, bottom-left, and bottom-right panels.

Table 2: Welch two-sample t tests in student motivation

Factors	Mean of ETS	Mean of Non-ETS	95% CI Lower	95% CI Upper	t	df	p-value
Intrinsic Goal Orientation	5.19	5.31	-0.52	0.28	-0.58	185	0.5590
Extrinsic Goal Orientation	5.25	5.17	-0.27	0.42	0.43	185	0.6671
Task Value	5.72	5.77	-0.46	0.35	-0.27	185	0.7873

3.2 Student Intentions to Persist

3.2.1 Student Intent to Persist Overall results

In general, both ETS and Non ETS students across all time points showed similar patterns in their intentions to persist, with 100% of ETS and 89% of Non-ETS students reporting lower ratings indicating that they were not intent on changing their majors. About 21% more non-ETS students than ETS students reported that they were more likely to pursue graduate study related to their major while about 15% more ETS students than non-ETS students reported were more likely to connect their future career with their majors (Figure 3).

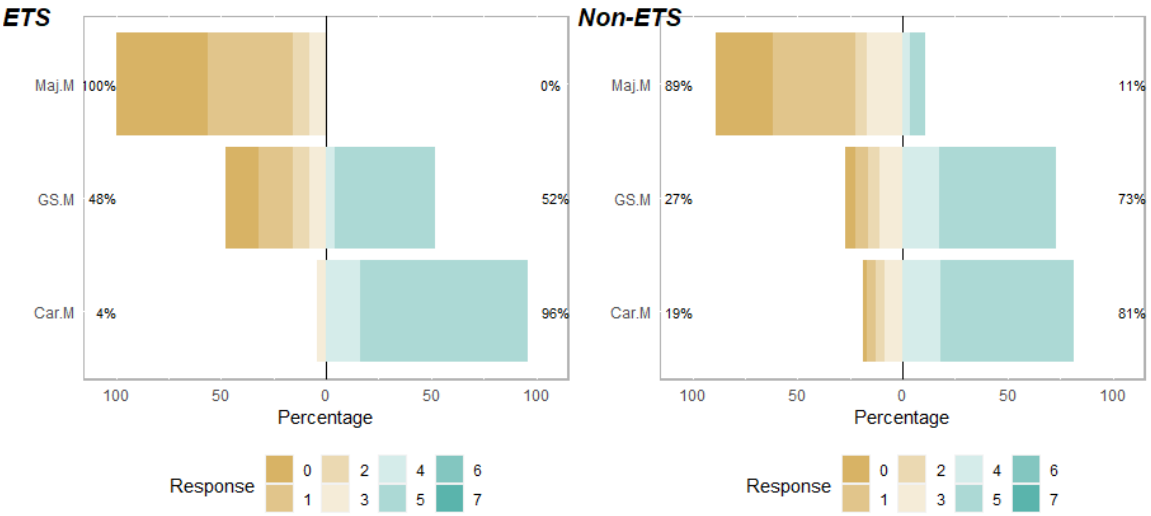

Figure 3: Percentage distributions of student intentions to persist in three subscales, including major, graduate study, and career, between ETS (left panel) and Non-ETS (right panel) students.

3.2.2 Group Comparison between HON2150 & HON 3150

An examination of student motivation by time point reveals that ETS and Non-ETS students show a similar trend in that they had lower intentions to change major at both time points (top-right panel in Figure 4). As for persistence in graduate study, the results reveal a trend such that ETS students are less likely to pursue graduate study pertaining to their majors compared to Non-ETS students; however, there is no significant differences between the time points (bottom-left panel in Figure 4). When students were asked whether their eventual career after graduation will directly pertain to their major, ETS students were significantly more likely to pursue a future career relevant to their majors than Non-ETS students ($p=0.0343$) (Table 3).

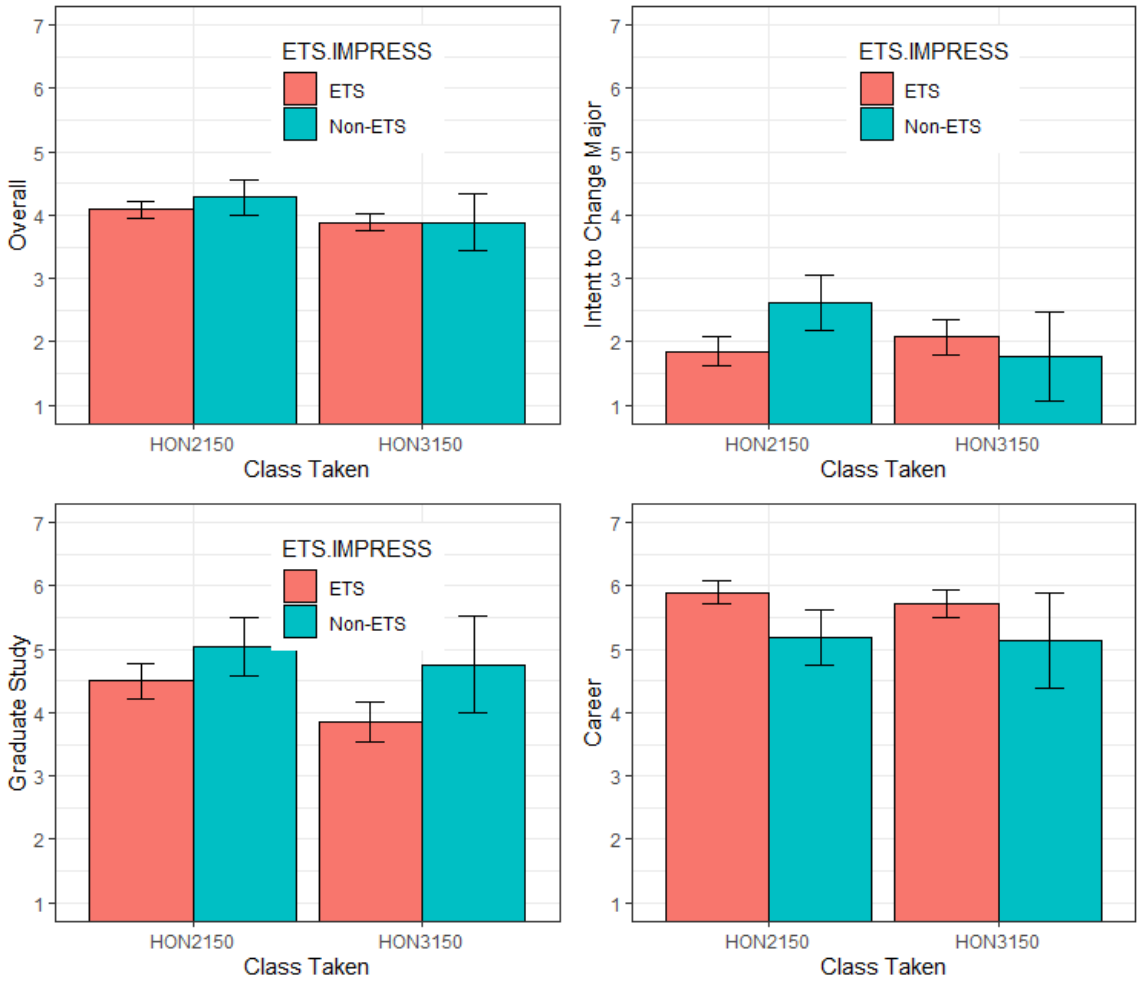

Figure 4: Student mean scores and standard deviations by class taken between ETS and Non-ETS. Student overall intent to persist, intent to change major, persistence to graduate study, and persistence to career choice are in the top-left, top-right, bottom-left, and bottom-right panels, consecutively.

Table 3: Welch two-sample t test in student intent to persist

Factors	mean of ETS	Mean of Non-ETS	95% CI Lower	95% CI Upper	t	df	p-value
Intent to Change Major	1.94	2.39	-1.17	0.27	-1.23	185	0.2184
Graduate Study	4.24	4.96	-1.50	0.04	-1.87	185	0.0624
Career	5.82	5.18	0.05	1.25	2.13	185	**0.0343***

3.3 Student Professional Skill Development

We performed a factor analysis of the question sets in the change readiness assessment to understand the internal consistency within the factors. We found that responses within each category of questions were highly correlated, except three factors in the question sets which had low Cronbach Alpha reliability

estimate (<0.7), including adaptability (alpha=0.4330), drive (alpha=0.6020), and tolerance for ambiguity (alpha=0.6020). Thus, we will remove these above mentioned factors in the following data analysis.

3.3.1 Student Professional Skill Development Overall results

An analysis of student professional skill development between ETS and Non-ETS students shows similar patterns in that most of the ETS and Non-ETS students reported high means in the measures of self-efficacy and learning belief. However, most of the student cohorts report low means in self-regulation and critical thinking (Figure 5).

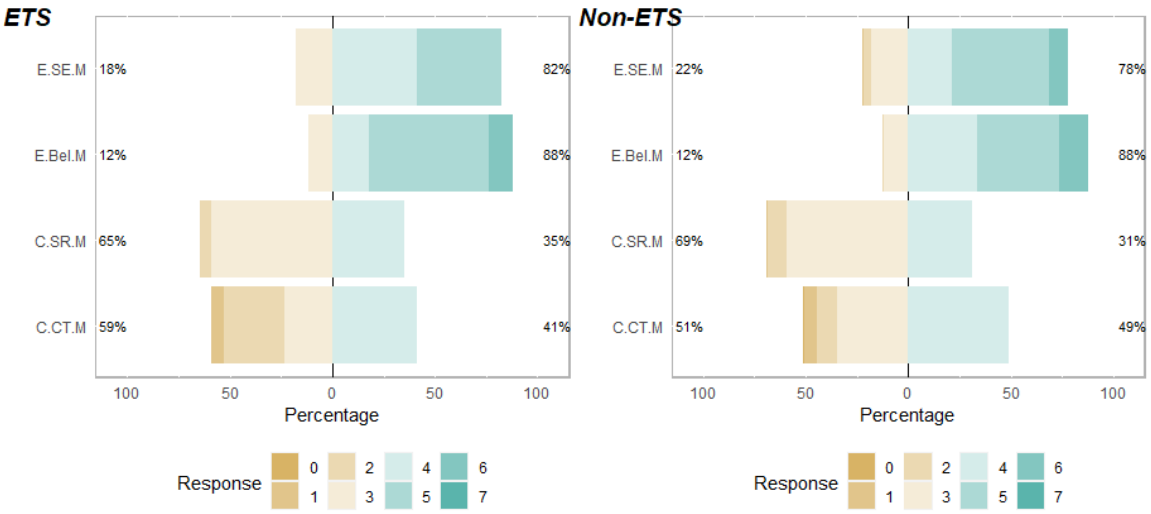

Figure 5: Percentage distributions of student professional skill development results in four subscales, including self-efficacy, learning belief, self-regulation, and critical thinking between ETS (left panel) and Non-ETS (right panel) students.

When students were asked about the measure of change-readiness (Kriegel & Brandt, 1996), most of the ETS and Non-ETS students regarded themselves as resourceful persons. However, ETS and Non-ETS students reported lower mean scores in the measures of optimism, confidence, and adventurousness.

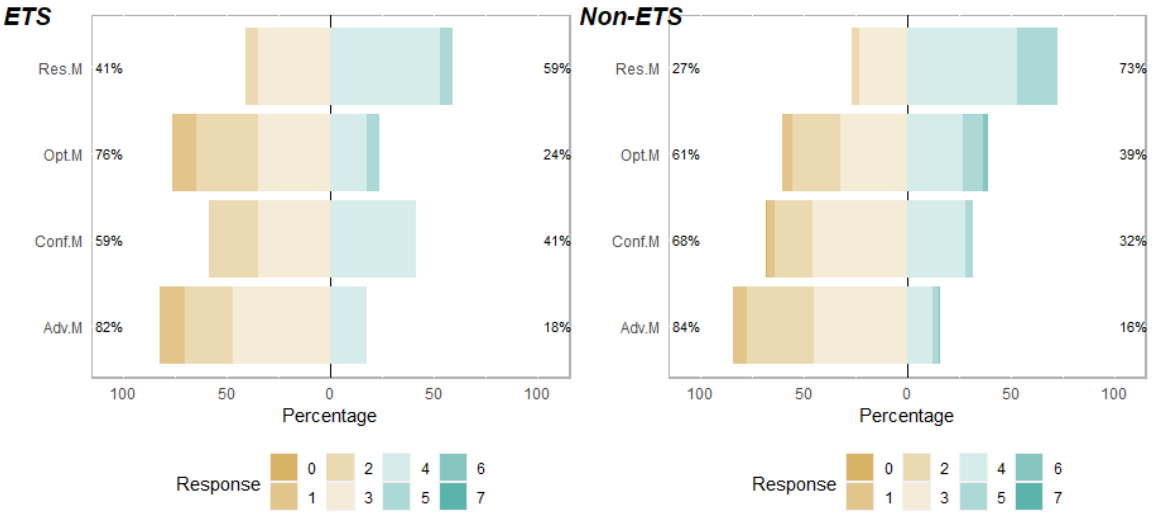

Figure 6: Percentage distributions of student professional skill development results in the subscales of resourcefulness, optimism, confidence, and adventurousness, between ETS (left panel) and Non-ETS (right panel) students.

3.3.2 Group Comparison between HON2150 & HON 3150

An analysis of the mean differences between two student cohorts at two time points reveals that on average ETS students scored slightly lower than Non-ETS students in the measures of optimism, critical thinking, and adventurousness in HON2150 (at the first time point), as well as low in the measures of optimism, self-efficacy, learning belief, and critical thinking in HON3150 (the second time point) (Figure 7). However, the results of Welch two-sample tests suggested that there were no statistically significant differences between two cohort students at both time points. In addition, there were no statistically significant differences in the professional skill development measure (Table 4).

Table 4: Welch two-sample t-tests in student professional skill development

Factors	Mean of ETS	Mean of Non-ETS	95% CI Lower	95% CI Upper	t	df	p-value
Resourcefulness	4.78	4.87	-0.46	0.26	-0.53	185	0.5968
Optimism	3.72	4.17	-1.01	0.10	-1.61	185	0.1081
Self-Efficacy	5.18	5.38	-0.70	0.29	-0.80	185	0.4221
Learning Beliefs	5.59	5.56	-0.41	0.48	0.14	185	0.8858
Confidence	4.07	4.08	-0.43	0.41	-0.06	185	0.9525
Self-Regulation	4.28	4.20	-0.20	0.35	0.55	185	0.5842
Critical Thinking	4.02	4.22	-0.63	0.24	-0.90	185	0.3694
Adventurousness	3.61	3.81	-0.63	0.24	-0.90	185	0.3712

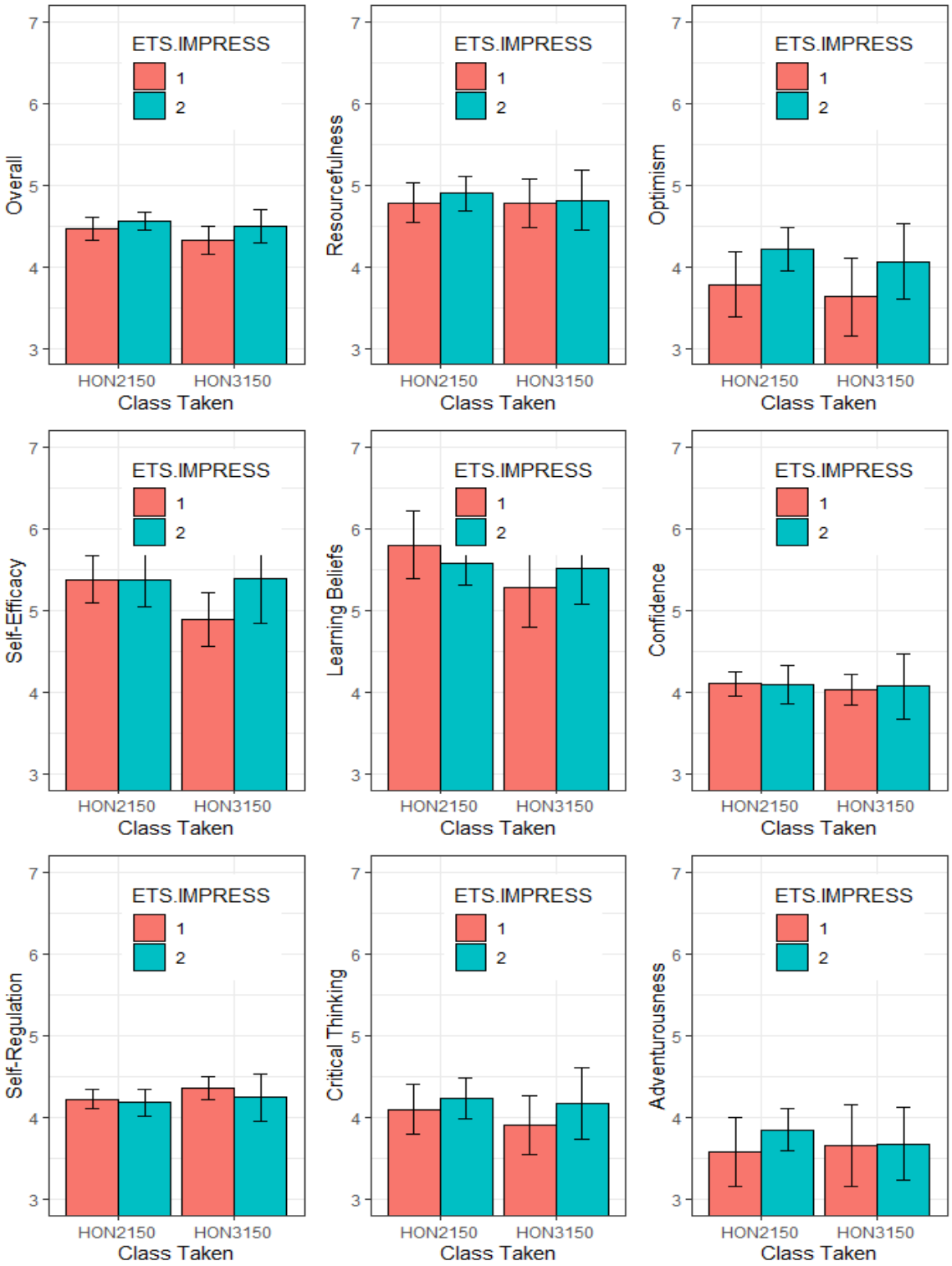

Figure 7: Student mean scores and standard deviations by class taken between ETS and Non-ETS. Student overall professional skill development, learning belief, confidence, self-regulation, critical thinking, and adventurousness are in the top-left, top-middle, top-right, bottom-left, bottom-middle, and bottom-right panels, consecutively.

3.4 Student Self-Efficacy

3.4.1 Student Self-Efficacy Overall Results

An analysis of student self-efficacy overall results across different time points showed that both ETS and non-ETS students reported overall higher agreement on the measure of self-efficacy, including the subscales of mathematics outcome expectations, feeling of inclusion, engineering self-efficacy I & II, engineering career success expectations, and coping self-efficacy. Further investigating the subscale of feeling of inclusion, nearly half of ETS students (47%) reported less feeling of inclusion while most of the non-ETS students (82%) reported a higher feeling of inclusion, revealing that ETS students felt less in common and less related with the other students in their classes.

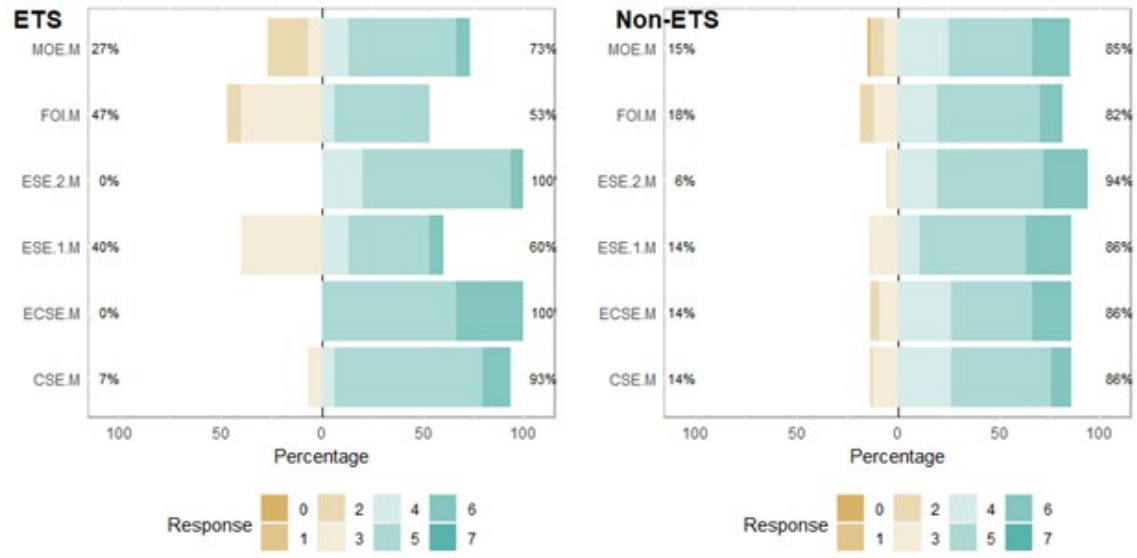

Figure 8: Percentage distributions of student self-efficacy results in the subscales of mathematics outcome expectations, feeling of inclusion, engineering self-efficacy 1 & II, engineering career success expectations, and coping self-efficacy, between ETS (left panel) and Non-ETS (right panel) students.

3.4.2 Group Comparison between HON2150 & HON3150

An examination of student self-efficacy between two time points reveals that there were no statistically significant differences between ETS and non-ETS students in the constructs of engineering self-efficacy I & II, feeling of inclusion, coping self-efficacy, and math outcomes expectations, except in the construct of engineering career success expectations. ETS students had significantly higher career success expectations compared to non-ETS studetns (M=6.32 vs. 5.63, p=0.0103, Table 5). The results also showed trends that ETS students reported higher self-efficacy in the subscale of coping self-efficacy but lower self-efficacy in the subscales of engineering self-efficacy and feeling of inclusion, and math

outcomes expectations. Though, ETS students' feeling of inclusion is on average lower than non-ETS students (not reaching a significant difference), they showed a gradual progress between two educational levels (two time points).

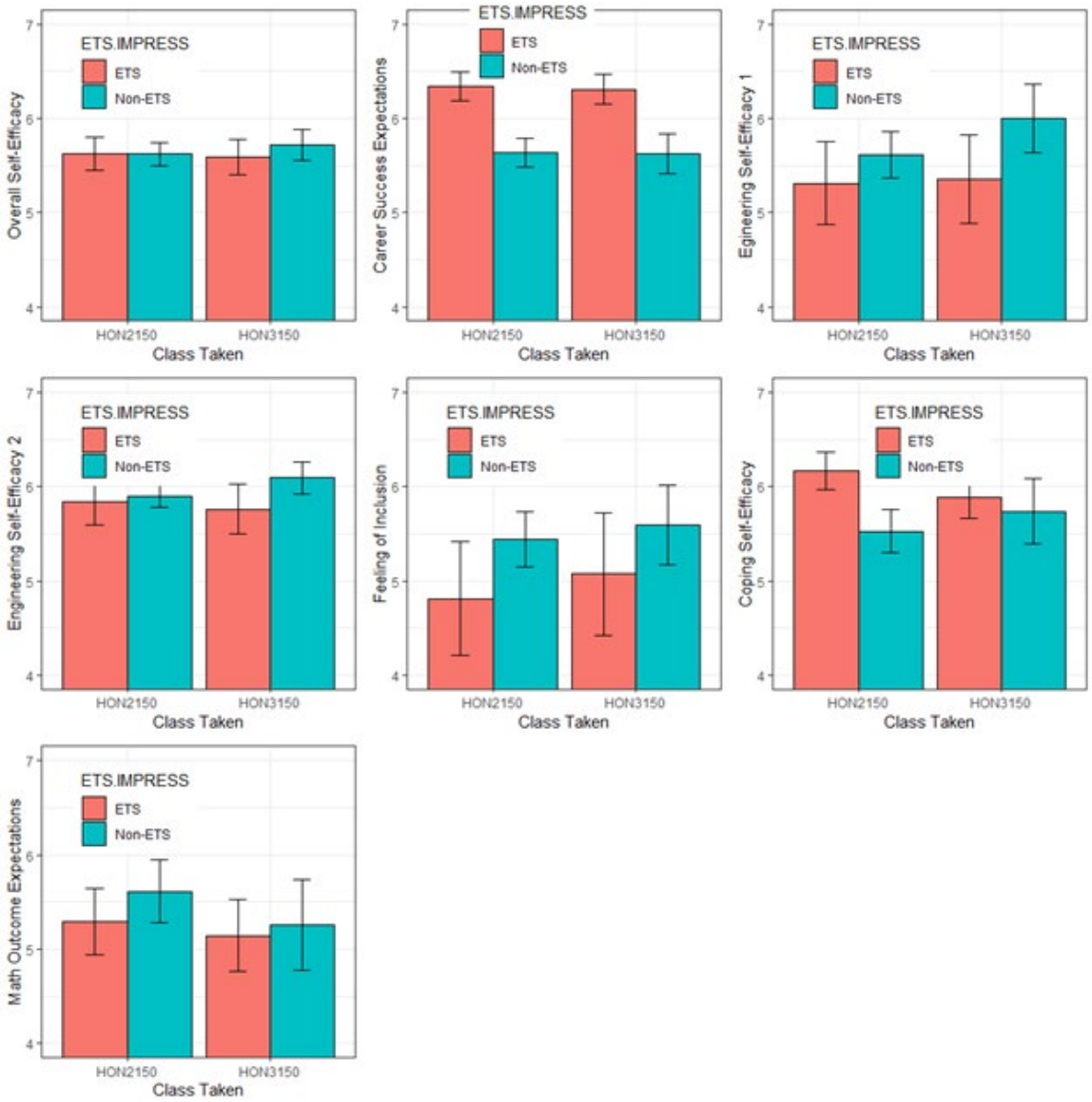

Figure 9: Student mean scores and standard deviations by class taken (two time points) between ETS and Non-ETS. Student overall self-efficacy, career success expectations. engineering self-efficacy 1, engineering self-efficacy 2, feeling of inclusion, coping self-efficacy, and Math outcome expectations are in the top-left, top-middle, top-right, middle-left, middle, middle-right, and bottom-left, consecutively.

Table 5: Welch two-sample t-tests in student self-efficacy

Factors	Mean (ETS)	Mean (non-ETS)	95% CI Lower	95% CI Upper	t	df	p-value
Engineering Career Success Expectations	6.32	5.63	0.17	1.22	2.61	100	**0.0103***
Engineering Self-Efficacy 1	5.33	5.73	-1.09	0.30	-1.14	100	0.2584
Engineering Self-Efficacy 2	5.80	5.96	-0.57	0.25	-0.76	100	0.4462
Feeling of Inclusion	4.93	5.49	-1.14	0.04	-1.86	100	0.0659
Coping Self-Efficacy	6.03	5.59	-0.01	0.89	1.92	100	0.0575
Math Outcome Expectations	5.22	5.50	-0.93	0.37	-0.85	100	0.3970

4. Results for Study 2

As mentioned in the Design and Procedure section, we have constructed a control cohort of engineering transfer students. The results of Welch two-sample t tests indicated no significantly overall GPA differences between ETS and non-ETS student cohorts in the year of 2018 (M=3.11 vs. 2.90, t=0.88, df=7.89, p=0.404) and the year of 2019 (M=3.06 vs. 3.19, t=-0.42, df=5, p=0.694).

To date, we have only 1 graduate of the ETS IMPRESS Scholars program. Thus, the examination and comparison of student overall performance, retention, and time to graduation between ETS and non-ETS cohorts will be conducted later in the project period.

5. Discussion and Continuing Work

In general, the survey results in Study 1 revealed no statistically significant differences between ETS students and Non-ETS students in overall means of student motivation, intention to persist, professional skill development, and self-efficacy. It demonstrates the effectiveness of PHCPP in supporting ETS

students with their future career needs as well as providing a comparable experience for them. However, there were significant differences in two career-relevant subscales: ETS students saw a closer link between their current technology major and future career as compared to graduate study, and they had higher engineering career expectations in comparison with Non-ETS students. This is not surprising, as ETS IMPRESS student scholarships are dependent upon students remaining in a technology major, and technology majors are more hands-on majors linked more directly to particular post-graduate career pathways.

Regarding student professional skill development, ETS students on average scored low (below 4) in optimism and adventurousness while Non-ETS students only scored low in adventurousness. In addition, ETS students reported lower self-efficacy than non-ETS students in subscales of self-efficacy, feelings of inclusion, and mathematical outcomes expectations. In terms of optimism, we propose to continue observing these responses to test whether these scores shift as students advance in their programs. The non-ETS students are relatively early in the program as yet, and are being compared with students who span all years of the undergraduate college experience.

In terms of feeling of inclusion, a large number of ETS students are transfer students (compared to the non-ETS cohort). This may contribute to a lower feeling of inclusion as these students have spent less time at [university] and struggle within their more advanced courses to meet the expectations of faculty when compared with students who entered the campus as first year students. However, it is worthwhile to note that ETS students showed a gradual progress in their feeling of inclusion, revealing that the PHCPP showed an effect on fostering ETS students' feeling of inclusion as the surveys were taken pre-HON2150 and then post-HON2150 (at the beginning of HON3150).

Addressing differences in mathematical outcomes expectations, ETS students are low income, and it is possible that they may have enrolled in high schools offering fewer opportunities for advanced mathematics. In addition, the mathematical requirements for students in technology majors are not as rigorous as those in engineering, thus ETS students may have lower expectations around mathematics in comparison to the majority of students in the non-ETS group. Given this, we suggest that faculty mentors may specifically want to focus some of their mentoring on discussions around strategies for improving math performance.

Overall, these findings reaffirm the significant investments of the ETS-Impress program to help promising low income students prepare for careers, increase feeling of inclusion, and develop professional skills in the STEM field. As we move forward, we will continue to monitor student progress throughout the program through the collection of ancillary data and surveys. In addition, more thorough testing of the comparison cohort will be completed as well as an inter-group analysis between the ETS students with the comparison cohort.

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Appendix A: Learning in College Questionnaires

1) Motivated Strategies for Learning Questionnaire (MSLQ) – Pintrich, Smith, Gardia & McKeachie, 1991			
	No.	Items	Scales
a) Value Component – Intrinsic Goal Orientation	1	I prefer course material that really challenges me so I can learn new things.	Likert Scale 1 (not at all true of me) to 7 (very true of me)
	16	I prefer course material that arouses my curiosity, even if it is difficult to learn.	
	22	The most satisfying thing for me in my courses is trying to understand the content as thoroughly as possible.	
	24	When I have the opportunity in my classes, I choose course assignments that I can learn from even if they don't guarantee a good grade.	
b) Value Component – Extrinsic Goal Orientation	7	Getting a good grade in class is the most satisfying thing for me right now.	
	11	The most important thing for me right now is improving my overall grade point average, so my main concern in class is getting a good grade.	
	13	If I can, I want to get better grades in class than most of the other students.	
	30	I want to do well in class because it is important to show my ability to my family, friends, employer, or others.	
c) Value Component: Task Value	4	I think I will be able to use what I learn in my courses this semester in other courses.	
	10	It is important for me to learn the course material in my classes this semester.	

	17	I am very interested in the content area of my courses this semester.	
	23	I think the course material in my classes this semester is useful for me to learn.	
	26	I like the subject matter of my courses this semester.	
	27	Understanding the subject matter of my courses this semester is very important to me.	
d) Expectancy Component: Control of Learning Beliefs	2	If I study in appropriate ways, then I will be able to learn the material in my courses.	
	9	It is my own fault if I don't learn the material in my courses.	
	18	If I try hard enough, then I will understand the course material.	
	25	If I don't understand the course material, it is because I didn't try hard enough.	
e) Expectancy Component: Self-Efficacy for Learning and Performance	5	I believe I will receive excellent grades in my classes this semester.	
	6	I'm certain I can understand the most difficult material presented in the readings for my courses this semester.	
	12	I'm confident I can understand the basic concepts taught in my courses this semester.	
	15	I'm confident I can understand the most complex material presented by the instructors in my courses this semester.	
	20	I'm confident I can do an excellent job on the assignments and tests in my courses this semester.	

	21	I expect to do well in my courses this semester.	
	29	I'm certain I can master the skills being taught in my courses this semester.	
	31	Considering the difficulty of my courses, the teachers, and my skills, I think I will do well in my classes this semester.	
f) Cognitive and Metacognitive Strategies: Critical Thinking	38	I often find myself questioning things I hear or read in my courses to decide if I find them convincing.	
	47	When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence.	
	51	I treat course material as a starting point and try to develop my own ideas about it.	
	66	I try to play around with ideas of my own related to what I am learning in my courses.	
	71	Whenever I read or hear an assertion or conclusion in class, I think about possible alternatives.	
g) Cognitive and Metacognitive Strategies: Metacognitive Self-Regulation	33	During class time I often miss important points because I'm thinking of other things. (REVERSED)	
	36	When reading for my courses, I make up questions to help focus my reading.	
	41	When I become confused about something I'm reading for class, I go back and try to figure it out.	
	44	If course materials are difficult to understand, I change the way I read the material.	
	54	Before I study new course material thoroughly, I often skim it to see how it is organized.	

	55	I ask myself questions to make sure I understand the material I have been studying in my classes.	
	56	I try to change the way I study in order to fit the course requirements and instructor's teaching style.	
	57	I often find that I have been reading for class but don't know what it was all about. (REVERSED)	
	61	I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.	
	76	When studying for a course I try to determine which concepts I don't understand well.	
	78	When I study for class, I set goals for myself in order to direct my activities in each study period.	
	79	If I get confused taking notes in class, I make sure I sort it out afterwards.	

2) Change-Readiness Assessment - Kriegel & Brandt, 1996			
Construct	No.	Items	Scales
a) Adventurousness	1	I prefer the familiar to the unknown. (REVERSED)	Likert Scale 1 (not at all true of me) to 7 (very true of me)
	8	I'm inclined to establish routines and stay with them. (REVERSED)	
	15	I prefer work that is familiar and within my comfort zone. (REVERSED)	
	22	It pays to stay with the tried and true. (REVERSED)	

	29	I prefer the main highway to the backroad. (REVERSED)	
b) Confidence	2	I rarely second guess myself.	
	9	I can make any situation work for me.	
	16	I can handle anything that comes along.	
	23	I focus on my strengths, not my weaknesses.	
	30	My faith in my abilities is unshakable	
c) Adaptability	3	I'm unlikely to change plans once they're set. (REVERSED)	
	10	When something important doesn't work out, it takes me time to adjust. (REVERSED)	
	17	Once I've made up my mind, I don't easily change it. (REVERSED)	
	24	I find it hard to give on something even if it's not working out. (REVERSED)	
	31	When in Rome, do as the Romans do. (REVERSED)	
d) Drive	4	I can't wait for the day to get started.	
	11	I have a hard time relaxing and doing nothing.	
	18	I push myself to the max.	
	25	I'm restless and full of energy.	

	32	I'm a vigorous and passionate person.	
e) Optimism	5	I believe in not getting your hopes too high. (REVERSED)	
	12	If something can go wrong, it usually does. (REVERSED)	
	19	My tendency is to focus on what can go wrong. (REVERSED)	
	26	Things rarely work out the way you want them to. (REVERSED)	
	33	I'm more likely to see problems than opportunities. (REVERSED)	
f) Resourcefulness	6	If something's broken, I'll find a way to fix it.	
	13	When I get stuck I'm inclined to improvise solutions.	
	20	When people need solutions to problems, they call on me.	
	27	My strength is to find ways around obstacles.	
	34	I look in unusual places to find solutions.	
g) Tolerance for Ambiguity	7	I get impatient when there are not clear answers. (REVERSED)	
	14	I get frustrated when I can't get a grip on something. (REVERSED)	
	21	When an issue is unclear, my impulse is to clarify it right away. (REVERSED)	
	28	I can't stand to leave things unfinished. (REVERSED)	

	35	I don't perform well when there are vague expectations and goals. (REVERSED)	

3) Persistence Measures - Schmader, Johns & Barquissau, 2004			
Construct	No.	Items	Scales
a) Graduate Study	36	How likely is it that you will pursue graduate study related to your major?	Likert Scale 1 (Not at all likely) to 7 (Very likely)
b) Career	37	How likely is it that your eventual career after graduation will directly pertain to mathematics or science?	
c) Intent to Change Major	38	How often do you think about changing your major?	Likert Scale 1 (Not at all) to 7 (Very Often)
	39	How likely is it that you will change your major	Likert Scale 1 (Not at all likely) to 7 (Very likely)

4) The Longitudinal Assessment in Engineering Self-Efficacy (LAESE) – Marra & Bogue, 2006)			
a) Engineering Self-Efficacy I	2	I can succeed in an engineering/technology curriculum.	Likert scale 1 (strongly disagree) to 7 (strongly agree)
	6	I can succeed in an engineering/technology curriculum while not having to give up participation in my outside interests (e.g. extracurricular activities, family, & sports).	
b) Engineering Self-Efficacy I	8	I can complete the math requirements for most engineering/technology majors.	

	11	I can excel in an engineering/technology major during the current academic year.	
	13	I can complete any engineering/technology degree at this institution.	
	19	I can complete the physics requirements for most engineering/technology majors.	
	24	I can persist in an engineering/technology major during the next year.	
	28	I can complete the chemistry requirements for most engineering/technology majors.	
c) Engineering Career Success Expectations	4	Someone like me can succeed in an engineering/technology career.	
	10	A degree in engineering/technology will allow me to obtain a well-paying job.	
	12	I will be treated fairly on the job. That is, I expect to be given the same opportunities for pay raises and promotions as my fellow workers if I enter engineering/technology.	
	15	A degree in engineering/technology will give me the kind of lifestyle I want.	
	18	I will feel “part of the group” on my job if I enter engineering/technology.	
	22	A degree in engineering/technology will allow me to get a job where I can use my talents and creativity.	
	27	A degree in engineering/technology will allow me to obtain a job that I like.	
d) Feeling of Inclusion	1	I can relate to the people around me in my classes	

	3	I have a lot in common with the other students in my classes.	
	5	The other students in my classes share my personal interests.	
	7	I can relate to the people around me in my extracurricular activities.	
e) Coping Self-Efficacy	14	I can cope with not doing well on a test.	
	16	I can make friends with people from different backgrounds and/or values.	
	21	I can cope with friends' disapproval of my chosen major.	
	23	I can cope with being the only person of my race/ethnicity in my class.	
	25	I can approach a faculty or staff member to get assistance with academic problems.	
	26	I can adjust to a new campus environment.	
f) Mathematics Outcome Expectations	9	Doing well at math will enhance my career/job opportunities.	
	17	Doing well at math will increase my sense of self-worth.	
	20	Taking math courses will help me to keep my career options open.	