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## Main Campus and Remote Campus Engineering Technology Students: How Are They Different?

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## **Main Campus and Remote Campus Engineering Technology Students: How Are They Different?**

**Dr. Anne M. Lucietto, Purdue University**

Dr. Lucietto has focused her research in engineering technology education and the understanding of engineering technology students. She teaches in an active learning style which engages and develops practical skills in the students. Currently she is exploring the performance and attributes of engineering technology students and using that knowledge to engage them in their studies.

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## Comparing Main Campus Engineering Technology Students to Those at Remote Sites

*Engineering Technology students are underrepresented as compared to other Science, Technology, Engineering, and Mathematics (STEM) majors. In particular, they are a very small, often neglected population of which little is known to those outside their field of study. One large Midwestern University is studying their engineering technology student population to further understand how best to serve these students. The intent is to improve student services, learning opportunities, and environments with a goal of improving student skills and knowledge. The ultimate objective is to send them into the workplace more fully prepared for the challenges they will encounter. Due to the limited amount of rigorous research in engineering technology education, this data will help inform and encourage future work in this area.*

*Data for slightly over 13,500 students has been obtained and examined. Descriptive statistics are used to analyze the demographics of both the students on the central campus and on remote campuses throughout the state. This comparison will guide further research at other institutions and local program development. It is anticipated that results derived from this analysis will provide more support for those that believe engineering technology students and engineering students are demographically very different and engineering technology students at the main campus vs. remote campuses exhibit additional differences.*

*The results of the descriptive statistics summarizing demographic information are explored as they relate to available retention and degree completion data. This analysis will provide the administration and engineering technology education practitioners with information to aide in recruitment and development of a learning environment well suited to the students.*

### **Introduction**

Little rigorous research has been done in engineering technology education.<sup>1</sup> To some that is not relevant, to others, particularly those teaching in this field it is significant. Practitioners see this population underrepresented when compared to other fields in STEM.. As one reviews the literature, this issue becomes more obvious as findings in engineering are used to support pedagogy in engineering technology courses. Students become disengaged as many of these students began their higher education in engineering, later transferring to engineering technology. Based on the results of a survey given to engineering technology graduates we find that if these students were the same as engineering students, they would have stayed in engineering.<sup>2</sup>

It is time to develop a better understanding of this population of student. We characterize who these students are via the use of demographics and other data available to us using the Multiple-Institution Database for Investigating Engineering Longitudinal Development (MIDFIELD) database.<sup>3</sup> This also involves providing a distinction between students on the main campus and

those that study at the remote campuses in the engineering technology program. This study serves the purpose of providing interested parties with an understanding of the student demographics for both student groups, a contrast as well as an understanding of persistence and graduation rates for both populations. Those in engineering technology programs at other universities are able to compare to this program and evaluate their own, promoting improvement and a better learning environment for their students.

## **Literature Review**

As the review of literature for this study commenced, early findings provided justification for this work. Felder and Brent<sup>4</sup> amongst others easily point out findings from science and engineering majors. This leaves engineering technology students and those in the “T” of STEM out of the discussion. Further work by these authors continues the trend<sup>5</sup> and others in engineering<sup>6,7</sup> and others in science<sup>8</sup> with no mention of engineering technology or technology courses. To further understand why this examination is necessary, it is important to understand pedagogy, how it relates to the student and how well it is developed, and how gender and cultural differences influence our classroom environment.

The diversity of the student population is an important dimension in the preparation and execution of pedagogy in the classroom.<sup>9</sup> Therefore, to prepare for and develop an effective pedagogy for students in engineering technology their diversity or lack thereof must be understood. Felder and Bent<sup>5</sup> regardless of the focus of their paper suggest at the end that students should be characterized. This is one of a few suggestions for areas of study that support the development of effective instruction. Kierkegaard<sup>10</sup> said it best “*Instruction begins when you, the teacher, learn from the learner. Put yourself in his place so that you may understand what he learns and the way he understands it.*” This leads us toward our review of gender and cultural differences, primarily focusing on their importance in developing successful classroom pedagogy.

There is a plethora of literature on gender differences; all cite differences in the genders. These differences range from personal preferences, like or dislike for competitive situations<sup>11</sup>, desired working environments<sup>12</sup>, as well as the way situations or problems are perceived.<sup>13</sup> Not only are preferences to be considered, but the interaction of the genders in the classroom as well as the ratio of the genders to one another.<sup>14</sup> Further the interaction of different gendered instructors to a mix of students also impacts students and the classroom environment.<sup>15</sup> While this study is not focused on the intrinsic nature of gender in the classroom, the evidence of gender impact on classroom interaction is significant.<sup>16</sup> Thus, the understanding of gender differences on these two types of campus’ supports the need for distinct pedagogy development engineering technology students.

Culturally relevant pedagogy is most closely related to this discussion. Ladson-Billings<sup>17</sup> has focused on classroom successes as they relate to students who are not mainstream students. She

too found many studies on minority and foreign students specifically focusing on the lack of success. Rather through her work over multiple decades has learned that incorporating part of the student's culture in the classroom results in engagement, and demonstration of leadership regardless of the cultural make-up of the teams and class. Others while accepting this work refute it by saying that this is a continuing struggle, first requiring an understanding of a given population of students, particularly in the classroom.<sup>18</sup> Thus supporting the need for this study as the engineering technology student body is defined and recognized as its own unique population.

Clearly educational researchers of pedagogy as it relates to cultural influences or gender assert the need for identification of the student population. Available data on this population as extracted from the MIDFIELD database will provide foundational information for further recruitment and pedagogy development by the administration and faculty in engineering technology at that university. On a national basis, this study will provide a comparison for other engineering technology programs to develop their own understanding of students unique to their program.

### **Research Question**

The demographics of engineering technology students at one institution, more specifically the largest in the United States with one of the largest engineering programs on the same main campus as well as extension campus will answer the following question:

*What are the demographics of the main campus students vs. statewide students in engineering technology? Specifically focusing on the male/female ratios, and racial breakdowns for both groups.*

*Where available, what are the retention and degree complete rates as they relate to the data summarized in the demographics question?*

### **Methodology**

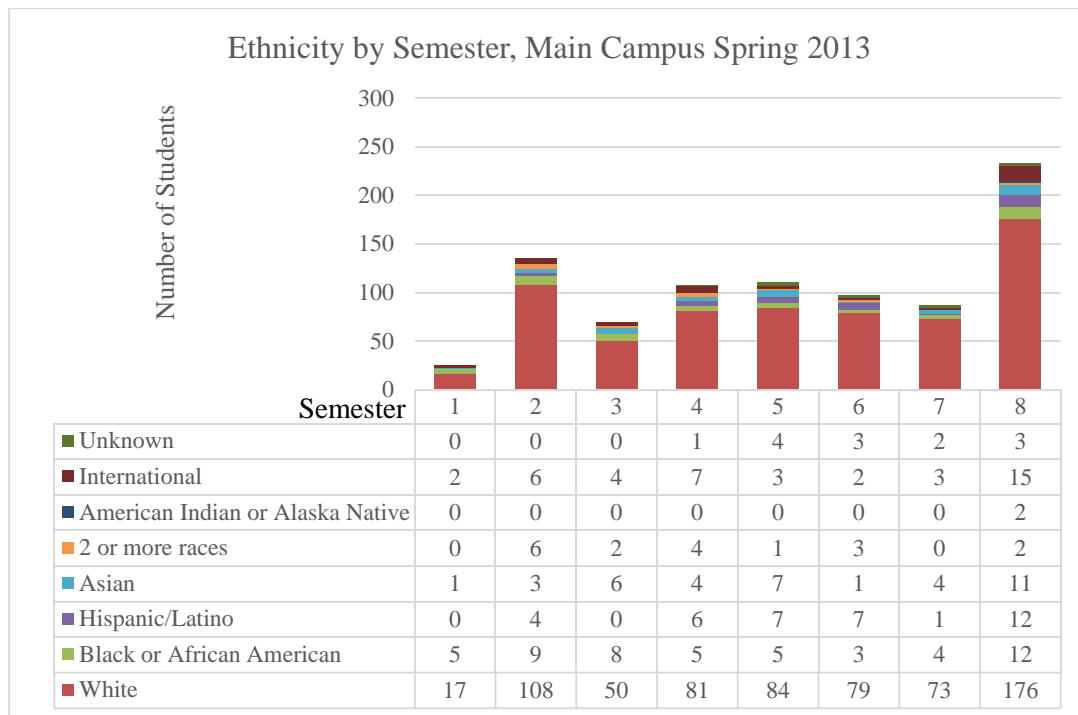
Data was provided by the MIDFIELD research group at a large midwestern university. All available data was extracted for students listed as engineering technology at a given university. The data was subsequently sorted to enable the listing and counting of student gender, race, and place of origin by semester. Demographics data was counted and entered in tables from Spring and Fall semesters in 2013 and Spring 2016 for comparison.

When evaluating persistence and retention, the amount of data available for review indicates if a student was no longer matriculated into the program. The findings on this particular facet of the data can be found in the results section.

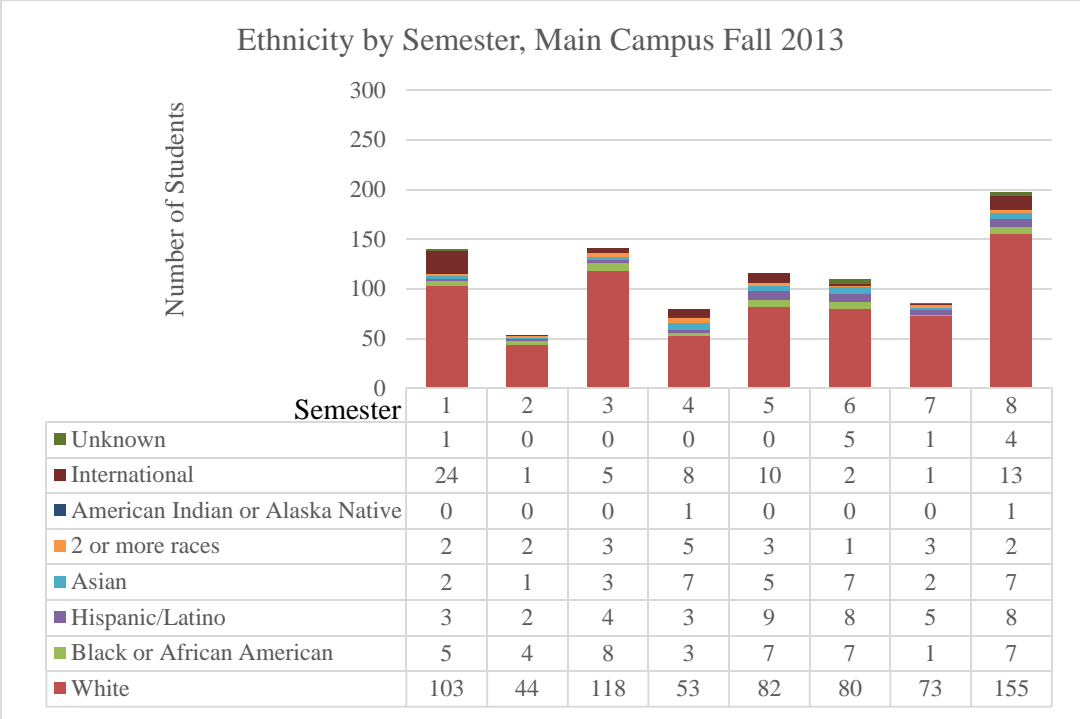
## Results

Data for the Statewide Locations includes all students enrolled in a School of Engineering Technology major at one of eight branches of that university. (Identity removed for blind review purposes.). These Statewide Locations are academically and administratively linked to the main campus. The data do not include any students at the three autonomous regional campuses of this; large Midwestern university. For the spring semesters, the number of “1<sup>st</sup> semester” students is small relative to other semesters because this represents students starting in the spring semester, out of sequence from the majority of students. The final semesters show increased student enrollment in both spring and fall analyses because as soon as students successfully earn sufficient credit hours they are classified as “8<sup>th</sup> semester” students, which continues until they graduate.

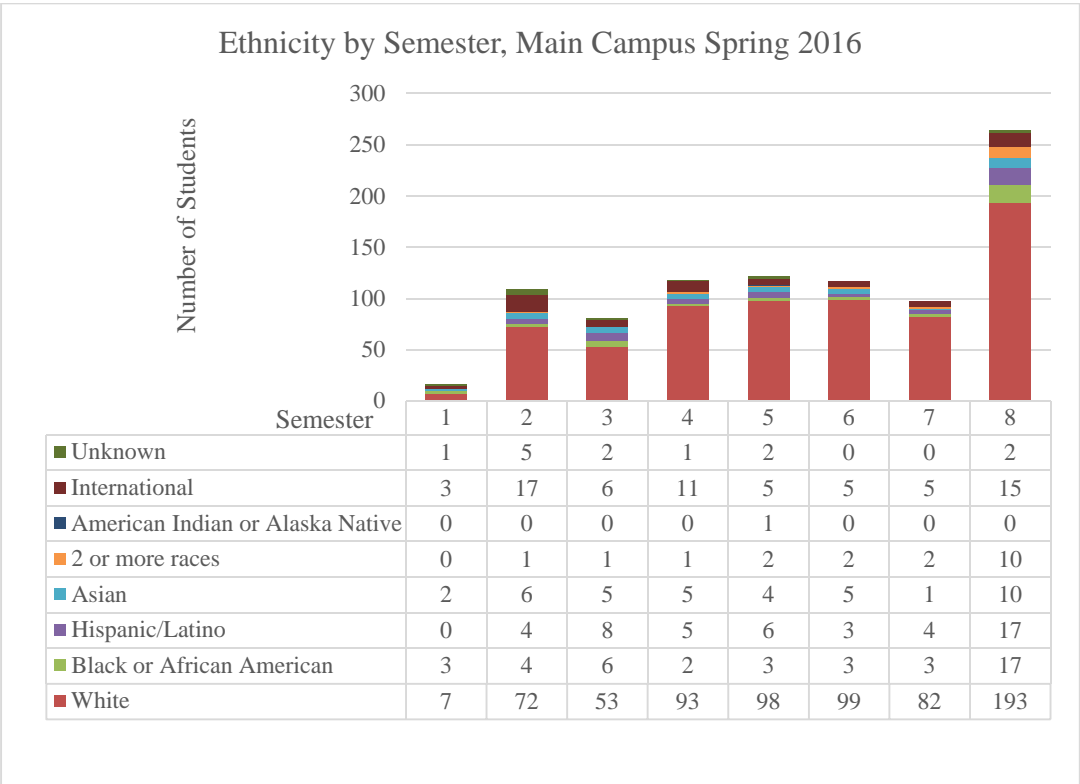
Figure 1 through Figure 6 show the number of students who self-selected each ethnic category for the spring and fall semesters of 2013, and the spring semester of 2016. The student population on the main campus is more ethnically diverse, as indicated by overall percentages of white students of 76% in the spring 2013 semester and 72% in the spring 2016 semester. In contrast, the Statewide Locations reported 89% white students in spring 2013 and 88% white students in spring 2016. For main campus, the single largest minority group, not including the international category, is Black or African American. Hispanic/Latino students make up the single largest minority group at the Statewide Locations.



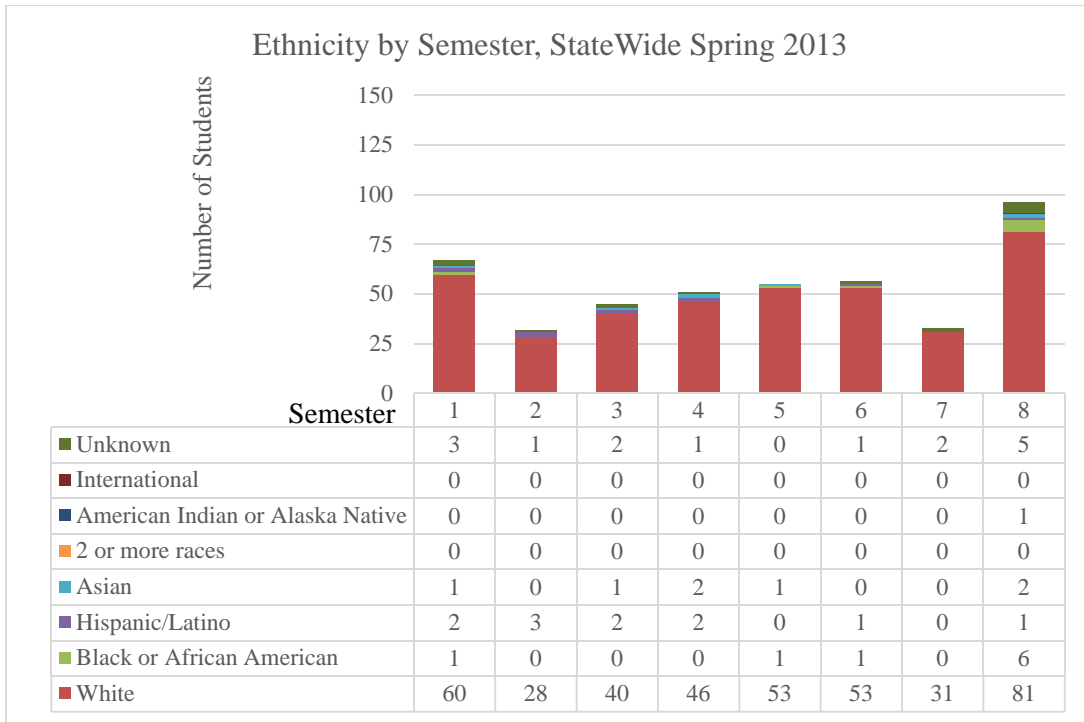
**Figure 1: Student Ethnicity by Semester, Main campus, Spring 2013**



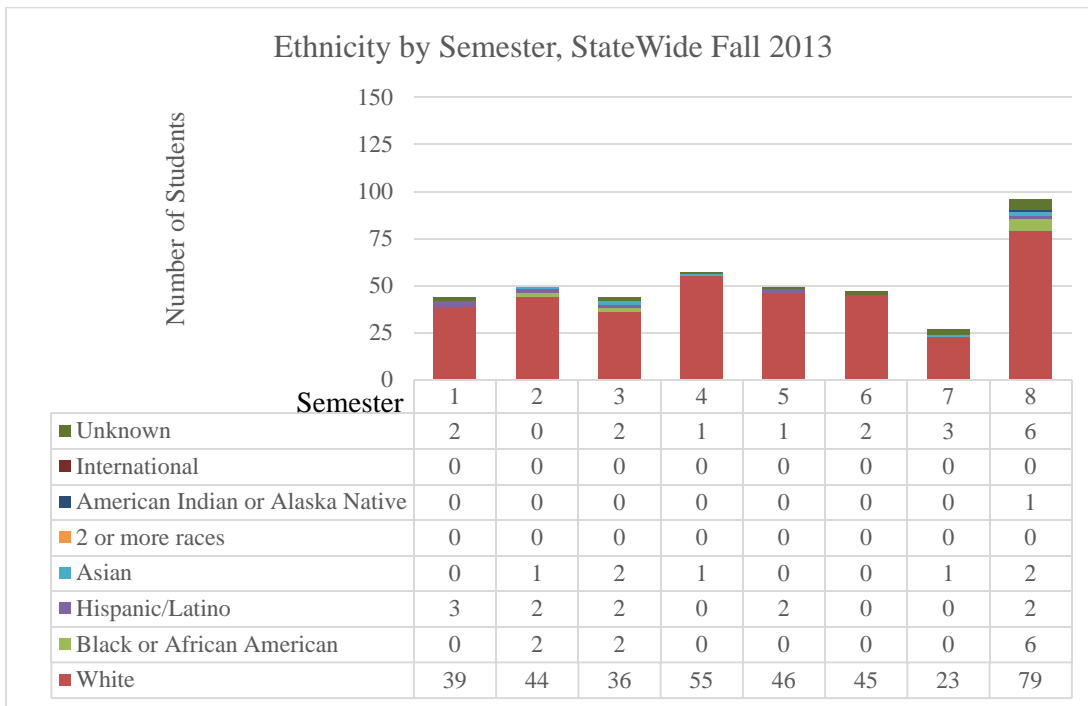
**Figure 2: Student Ethnicity by Semester, Main campus, Fall 2013**



**Figure 3: Student Ethnicity by Semester, Main campus, Spring 2016**

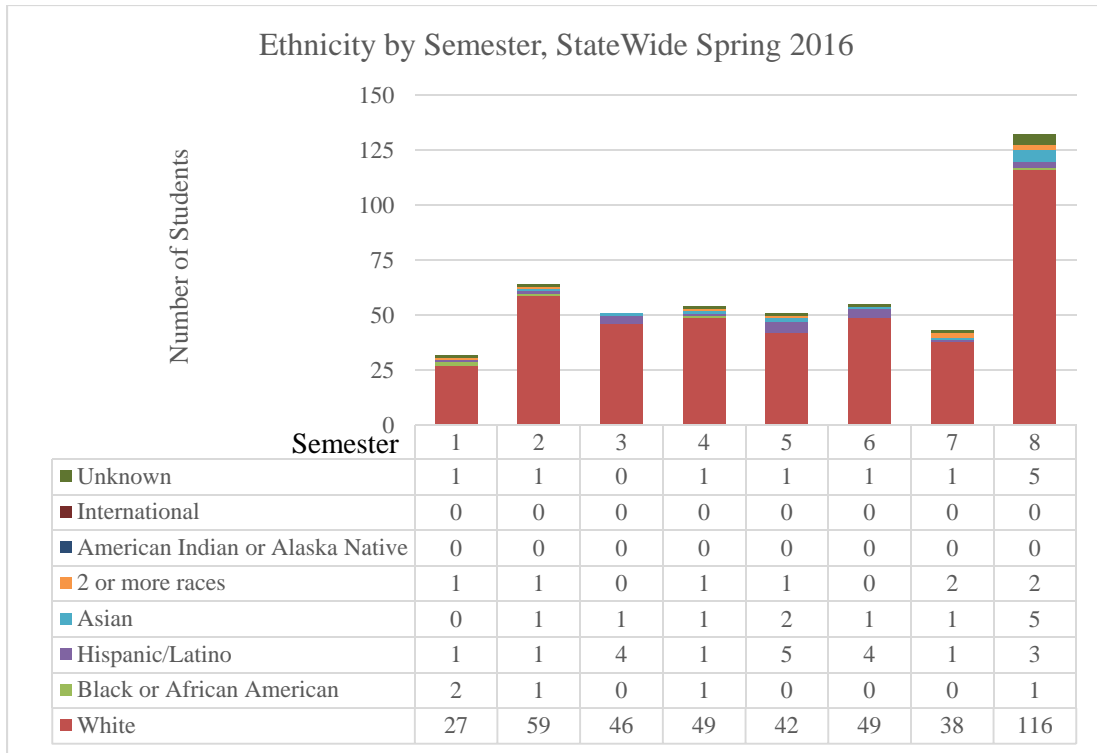


**Figure 4: Student Ethnicity by Semester, Statewide Locations, Spring 2013**



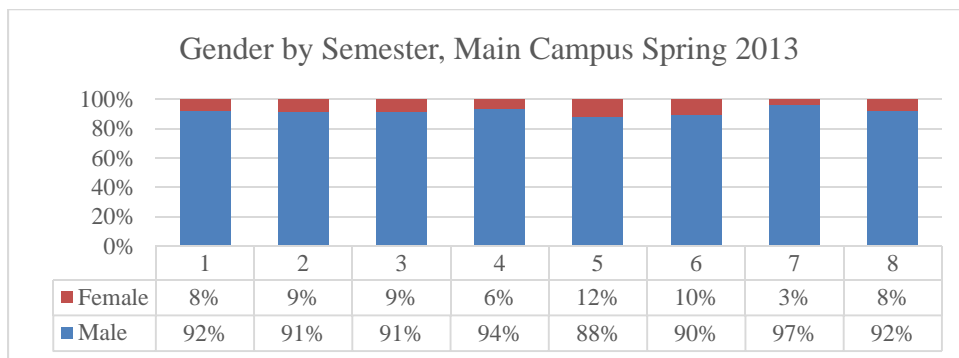
**Figure 5: Student Ethnicity by Semester, Statewide Locations, Fall 2013**



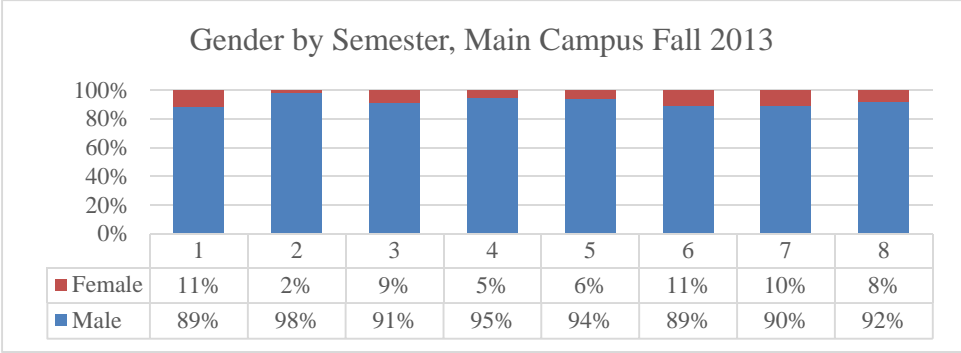


**Figure 6: Student Ethnicity by Semester, Statewide Locations, Spring 2016**

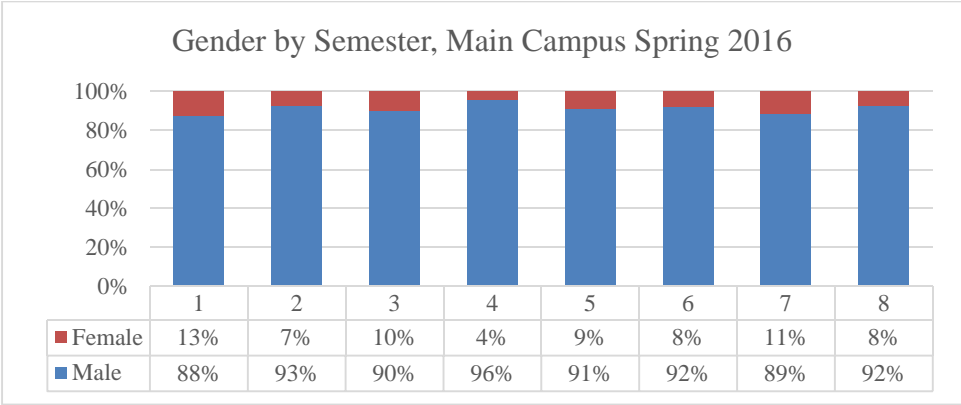
Figure 7 through Figure 12 show the student distribution by gender. The overall average percentage of female students at the Main campus was 8%, 8%, and 9% for the spring 2013, fall 2013, and spring 2016 semesters. The Statewide Locations showed a similar but lower percentage of female students for the same semesters, 7%, 8%, and 7%.



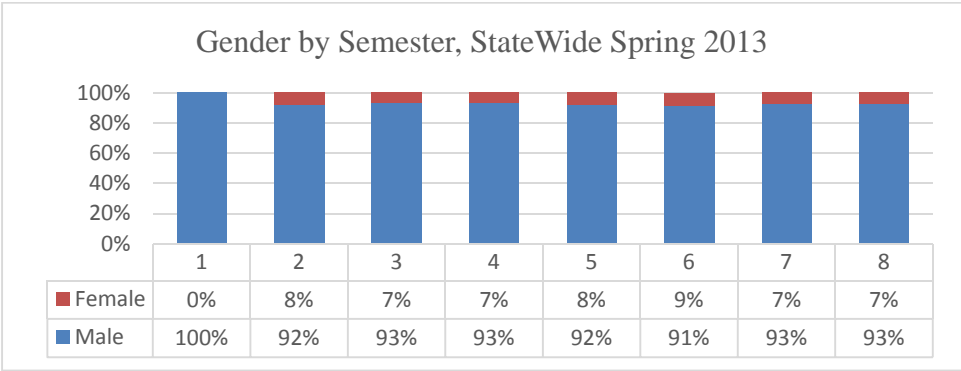
**Figure 7: Student Gender by Semester, Main campus, Spring 2013**



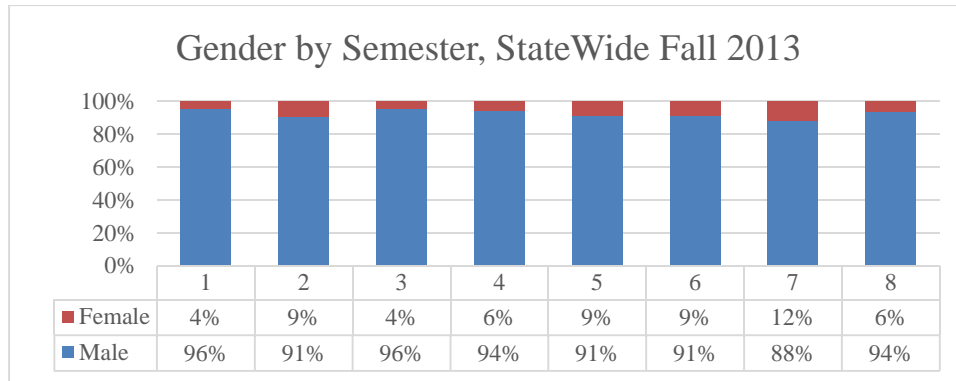
**Figure 8: Student Gender by Semester, Main campus, Fall 2013**



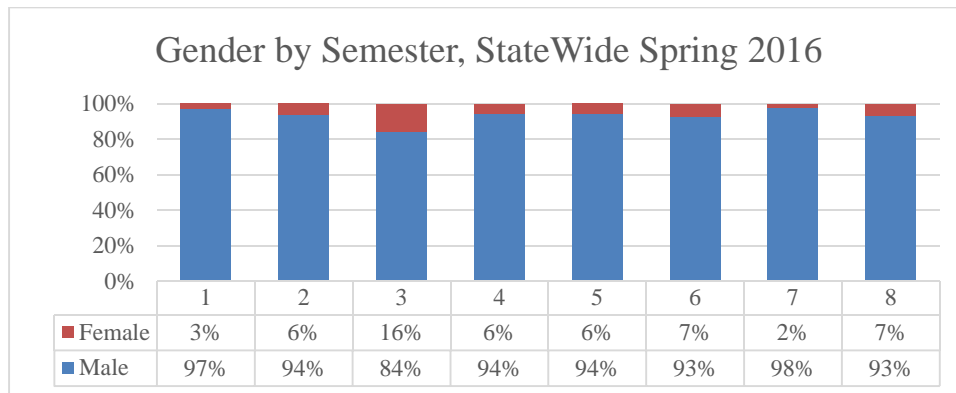
**Figure 9: Student Gender by Semester, Main campus, Spring 2016**



**Figure 10: Student Gender by Semester, Statewide Locations, Spring 2013**



**Figure 11: Student Gender by Semester, Statewide Locations, Fall 2013**

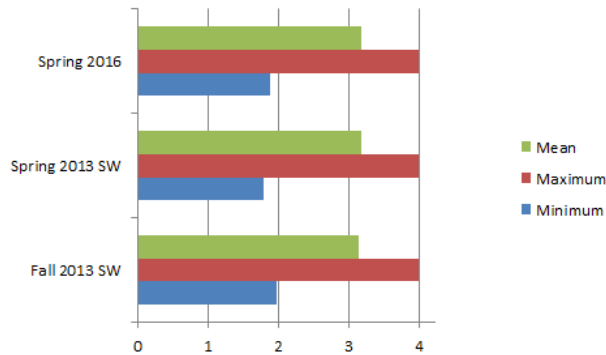


**Figure 12: Student Gender by Semester, Statewide Locations, Spring 2016**

To further answer the last question data from the three semesters examined was reviewed using unique student identifiers and comparing them through the semesters they were in school. When compared to data provided for a study done previously<sup>19</sup> the researchers found that engineering technology students persisted at the same rates as those found previously in the engineering study.

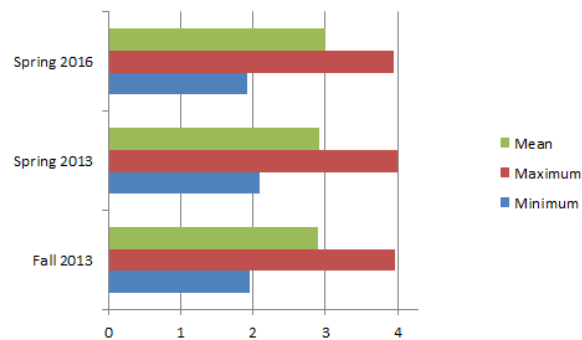
In each of the semesters examined, further review of semester 8 data showed that every semester had one student that had a cumulative GPA less than the required for graduation. Based on the way the data is recorded, the researchers were unable to see if these individuals were able to raise their GPA and graduate or if they did not complete the program. Race and gender data was reviewed for these individuals and it was noted that all of these students were white male, the same as the majority of students in the engineering technology program.

This prompted a comparison of Cumulative GPA data from the three semesters which revealed that statewide students did better overall than the Main Campus students. This data provides additional information illustrating the differences in these students, Figures 13 and 14 show the differences in the student population.



**Figure 13: Cumulative GPA Semester, Statewide Locations**

Comparing Figure 14 to Figure 13, each semester at the statewide locations, at least one student has a maximum cumulative GPA of 4.0, whereas this is not always the case at the main campus where two of the three semesters had maximum GPA's less than a 4.0. In two of the three semesters examined the main campus minimum cumulative GPA was less than the minimum at the statewide locations. Overall, the mean cumulative GPA's are higher at the statewide locations than on the main campus.



**Figure 14: Cumulative GPA Semester, Main Campus Location**

## Discussion

The demographic data from the main campus indicates that the engineering technology student population is primarily male, with white students being the predominant race. However, data from the statewide campuses indicate that the gender divide is even greater with the population being almost all male, and almost all white. These comparisons provide a clear delineation between the two student populations. Thus answering the first of the research questions and providing the engineering technology community clarity regarding their student population.

When evaluating the data for the three semesters used to examine students at the main campus and statewide facilities, it was found that engineering technology students persist in the program similarly to engineering students<sup>19</sup>. The earlier study of engineering students found that students leaving the program cannot be predicted by gender or race. Therefore, the data in both cases, engineering and engineering technology, indicated that students leave regardless of these factors.

The comparison of cumulative GPA's indicated that students at the statewide campuses perform slightly better than those at the main campus. Although slight differences are shown in Tables 13 and 14, the distribution and mean are very close. These programs share curriculum, faculty from both meet regularly and they work together for a common goal. The results of this comparison suggest that a similar outcome suggests well-grounded curriculum and collaboration by faculty to achieve similar goals.

While this may be the case for this particular program, programs of a similar nature or even slightly different can use this type of comparison to evaluate their own situation. These results provide the administrators of this program easy access to evidence of the student body composition. Faculty working together or apart may find this information helpful in understanding students that transfer in or out of their programs, as well as understanding the need and possibility of further diversification of the student body.

## **Conclusion**

While this is a relatively small sample for a demographic study, for the purposes of furthering faculty and administrative understanding of the study body this study was undertaken. The authors have heard various things about the demographics of the two student bodies, this work provides evidence regarding the actual composition of these two distinct groups of students. The data that was examined in this study was spaced in a way that the student body in 2013 and 2016 potentially were the same group. Changes to that group were more evident with the smaller numbers of students.

The demographics of the two student populations within engineering technology show that in the case of the university studied, most students in both populations are white males. When compared to other STEM populations, this is unique. Most engineering programs have more females and minority students, as do those in science and mathematics. While there is a significant number of international students that are not white, the predominant race is white.

The retention and degree completion rates are difficult to ascertain, however they appear to have the same characteristics as those found in the engineering population<sup>19</sup>. Providing evidence that students in the engineering technology population for this university, which limits the findings significantly, are not affected by race or gender when leaving the program.

Through this work and the review of data, further study has been identified. The data is rich with opportunity to further our understanding regarding persistence and retention of students, clearly

it is not race or gender that dictate whether a student stays in or leaves a program. Studying the difference of engineering technology students as compared to other STEM students will further enhance the engineering technology body of knowledge and develop our understanding of appropriate recruitment and pedagogical techniques.

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