

## **Full Paper: Exploring Issues Faced by Students in STEM Fields: First Year Focus and First Generation Focus**

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# Full Paper: Exploring Issues Faced by Students in STEM Fields: First-Year Focus and First-Generation Focus

## Abstract

West Virginia University Institute of Technology (WVU Tech) is a small school that heavily recruits from the local area that consists of very small towns and rural areas (historically Montgomery, WV and currently Beckley, WV). WVU Tech University currently does not have a specific first-year engineering program and is looking for ways to incorporate these concepts into the existing student services, STEM student organizations on campus, or integrating material into existing courses (or designing new courses). The goal of this paper is to identify and investigate the specific issues unique to first-generation STEM students, in particular, first-generation students from very rural areas (population < 5,000). The authors collected anonymous data from a mixture of first-generation and non-first-generation undergraduate students enrolled at WVU Tech University during the Spring 2018 semester using a twenty-minute online survey (where students self-identify their first-generation status). The survey focused on high school background, areas that students feel they struggle with, issues they are having completing classwork (particularly in STEM courses), and perceived missing student services. Additionally, students were asked about their knowledge of college, their participation in the First-Generation Program and student organizations, and their perception of their support system, whether family, friends, or faculty and staff. Using the data collected, the authors will examine the emerging themes and make suggestions for possible actions for WVU Tech University to take within their STEM program and First-Generation Program to increase the number of STEM students completing their degrees, successfully recruiting more students into the STEM program, and increasing the number of first-generation students pursuing STEM majors. In an early examination of the data, the authors have found differences in the college experience of first-generation students who participate in the First-Generation Program and those who do not. The authors would like to incorporate some of the activities from the First-Generation Program into other programs to help other first-generation students.

## Introduction

West Virginia University Institute of Technology (WVU Tech) is a school with approximately 1600 students that heavily recruits from the local area (historically Montgomery, WV and currently Beckley, WV) [1]. Approximately 35% of the student population of WVU Tech are first-generation and 66% are either first-generation or low income. Of the students admitted in Fall 2017, only 19.38% had a general ACT score above 23 [1]. The goal of this research is to identify and investigate the specific issues and areas of struggle unique to first-generation STEM (Science, Technology, Engineering, and Mathematics) college students, particularly those for first-year students. It has been published ([2] and [3]) by the National Science Board that there is a sharp decline of students enrolling in STEM fields. Thus, it is important to recruit a wide variety of students from various backgrounds into the STEM fields particularly those from

minority groups, including first-generation students. A first-generation college student faces unique challenges and struggles with fitting in, adapting to a college schedule, and handling family responsibilities. etc. These students often belong to specialized programs (Promising Futures, TRIO, FIRST, Chance, Promise, etc.) aimed specifically at first-generation students and those who qualify for government financial aid. WVU Tech has a TRIO program that serves any student who is either first-generation, low-income, and/or with documented disabilities. TRIO provides a range of programs including: advising, tutoring, activities/trips, and student workshops.

### **Method of Data Collection**

The survey participants are first-generation and non-first-generation undergraduate students (both STEM and non-STEM majors) enrolled at WVU Tech during the Spring 2018 semester from all majors offered at WVU Tech. (The researchers sent participants an e-mail invitation to participate in the study with a copy of the cover letter as a recruitment script. Participants who chose to take the study clicked on the survey link and were taken to the online survey at Qualtrics. The survey was designed to take approximately twenty minutes to complete and was comprised of an assortment of quick answer questions (multiple choice, select all, true/false questions) and longer essay questions. The online surveys, via Qualtrics, guaranteed anonymity as no IP addresses were stored and no identifying information was asked for. Within the survey, students self-identified their status as first-generation (or not) and self-identified their year in college. The researchers are relying on student honesty with identification of being a first-generation or first-year student.

After the survey closed, the data was examined and analyzed. The survey ask students to identify problems they had in college and difficulties they had with courses (particularly in STEM courses). The authors used the data collected to derive themes among the following populations: (1) college students in general, (2) STEM college students, (3) first-generation students, (4) first-generation STEM students, and (5) first-year, first-generation students. Based on the emerging themes, the authors identified actions WVU Tech could take within their STEM programs, and their First-Generation Programs, to improve the experiences of this sub-population to increase the number of students who remain in STEM by improving the experiences of STEM students in general and the STEM first-generation students specifically. These actions include recruitment efforts, freshman orientation, pre-summer programs, and extra events. The survey and study was approved by the IRB board at WVU.

### **Questions from the Survey**

The survey was developed and created by the authors of the paper with feedback and suggestions of the staff of the WVU Tech TRIO program. The questions from the survey are highlighted throughout the results section. As mentioned previously, the survey was sent to a all undergraduate students enrolled at WVU Tech; the data was also analyzed for themes for other populations outside of first-generation students [4].

## Results

The survey was emailed to 1600 students total with 600 of these students being STEM majors. Of the 138 students who responded to the survey 83 reported that they were first-generation college students. Of those, 56% attended high school in a town with fewer than 5,000 people, and 31% in a town with a population of under 50,000. Fifty-eight percent of the respondents planned to major in a STEM field. Fifty first-year students responded and 26 of those reported being first-generation. A little over half of the students participate in the WVU Tech TRIO program (a program that specifically helps first-generation college students, students with documented disabilities, and those classified as low-income as reported on the Free Application for Federal Student Aid (FASFA)). Table 1 highlights the differences between the first-year, first-generation students and the first-year, non-first-generation student (both STEM and non-STEM majors). The recurring themes identified by the authors are summarized in Table 2.

First-year, first-generation students reported with more frequency (52% vs. 40%) the feeling that they lacked the educational background for college. Both populations of first-year students cited math as the top area missing in their background. However, the first-generation students express a slightly wider variety of missing experiences over their non-first-generation counterparts. The first-generation students cite both science and mentorship (6% and 9%) as missing background while the non-first-generation students do not mention them (0% and 0%). However, the non-first-generation students cite missing experiences at a higher percentage than the first-generation students. Both populations report missing computer and engineering skills, but computer was higher for the first-generation students and engineering was higher for non-first-generation students.

Forty-eight percent of the first-generation students reported feeling underprepared academically, while 40% of the general population felt they had a stronger than average academic background. Among first-generation students from towns with populations less than 5,000, 60% of students felt less prepared than most students compared to 14% of first-generation students from more populated areas. Many of the students from rural areas commented specifically on the lack of courses offered and the lack of rigor in their high school. A larger percentage of all first-year students (45% for both first-generation and non-first-generation) feel that their backgrounds caused them to have a different experience than most college students. When asked to explain why, key differences were seen in the two groups. First-generation students reported more feelings of being underprepared due to high school. The non-first-generation students cited more stories of feeling prepared. (Non-first-generation student's example statement: "I have a really strong background and that makes me easier the college experience" vs first-generation student example statement: "High school did not prepare me for college math.").

Table 1: First-Year First-Generation vs. First-Year Non-First-Generation Survey Summary

Question	First-Generation Student Data	Non-First-Generation Student Data
Gender	38% Male, 62% Female	63% Male, 37% Female
Population of Town for High School	50% 4,999 and under, 42% 5000-49,999, 8% 50,000 and above	42% 4,999 and under, 42% 5000-49,999, 16% 50,000 and above
Consider Changing Major	40% Yes, 60% No	30% Yes, 70% No
STEM Major	54% Yes, 46% No	63% Yes, 37% No
Member of Student Organizations and Helpfulness	58% Yes, 42% No, 100% feel it is helpful, 0% do not	55% Yes, 45% No, 80% feel it is helpful, 20% do not
Feeling Background Differed from Others	52% Yes, 48% No	40% Yes, 60% No
Top Areas of Missing Background	Math, General College/ University Knowledge, Computer, Missing Experiences, Engineering, Mentoring	Math, General College/ University Knowledge, Missing Experiences, Computer, Engineering
Grades Influencing Decision to Stay at WVU Tech	77% Yes, 22% No	84% Yes, 16% No
People Discouraging Staying in College	22% Yes, 78% No	16% Yes, 84% No
Top Three Campus Services Used	Advising, Tutoring, TRIO	Tutoring, Advising, WVU Tech Adventures

Table 2: Summary of Themes for First-Year, First-Generation Students

Topic	Results
Encouragement to Pursue College	Majority cited Family with others citing Friends and Teachers
Encouragement to Pursue Major	Family, Faculty/Teachers, Mentors, and Self
People Discouraging Staying in College	22% Yes, 78% No
Discouragement to Pursue College	Too Expense, Good Paying Jobs without a Degree, Not College Material, and Flawed Educational System
Discouragement to Pursue Major	Lack of Financial Gain, Inability to Accomplish Goals
Top Three Campus Services Used	Advising, Tutoring, TRIO
Missing Background Differences	Mentoring and Science
Method of Hearing about Events	Email, Facebook, and Posted Flyers

Both groups of students had family as a significant source of support and encouragement to pursue college. In answer to the same question, however, first-generation students report support from professors and student organizations as encouragement to stay in college, but this was not seen in the other group. Twenty-two percent of students in both populations reported being discouraged from pursuing college. Both groups reported discouragement related to college being expensive and not worth the monkey. However, first-generation students reported discouragement related to not being good enough for college, while the other group did not. (Example quote from first-generation student: "... and told me I wasn't good enough")

Students, overall, felt that on-campus student organizations helped bring liked minded people together. However, students were overall split on the importance of these organizations to their college careers (general population: 49% yes, 51% no and first-generation population: 52.5% yes, 47.5% no). The first-generation students seem to have slightly stronger feelings on the student organizations than the general student population. Thirty-Six percent of the general population and 22.5% of the first-generation population were members of STEM organizations and both groups felt these organizations were helpful. The general population wanted organizations to focus on social / fun activities. The first-generation student data showed a similar trend, but included an additional desire for more career development workshops and events. It should be noted that many of the first-generation students also report not using the formal career services workshops.

The first-generation students use university student services differently than the general population of students. First-generation students report using tutoring services at a higher rate (41% vs 33% respectively) but use the career services and resume review at less than half the rate of the other students, (14.5% and 12% vs. 29.5% and 29.5%) (The TRIO program has tutoring in addition to the general tutoring mentioned in the 41%). Interestingly, when looking only at first-generation students who are not members of the SSS program, their reported use of tutoring and career services is very close to that of the general population. The general students report visiting their academic advisors less frequently than the first-generation students. (TRIO program participants are required to meet with their SSS advisory weekly as first-year students). The general population of students and first-generation students not in the SSS program report wanting more faculty interaction and mentorship opportunities at a higher rate than the first-generation students in TRIO. The first-year students report hearing about these services primarily from email. However, first-generation students also state that Facebook and posted flyers are where they hear about services and events while non-first-generation students cite the website and professors as their source.

## **Conclusions**

The TRIO SSS program (which serves first-generation college students) at WVU Tech is an excellent program but the authors would like to see an increase in TRIO students who successfully major in STEM fields. The authors suggest additional programs to help students with math, computer, and science skills to help attract and retain first-generation students into

STEM majors. From the results and themes observed, the authors have made several interesting observations. First-generation SSS students visit advisors more frequently than other students and it is believed the difference is partly because the first-generation use advising for more than just class selection. The first-generation students who did not participate in TRIO are very similar to the general population students. The authors believe that mentorship and services available through TRIO make a difference in the experiences of the first-year, first-generation students and that perhaps similar services could be provided for the general population of students. The lack of career services advising by TRIO first-generation students is disturbing, although partially explained by some resume services provided within the TRIO program.

### **Future Work**

The authors wish to expand this study to other universities in order to determine if these themes are localized to WVU Tech and specific to this unique university environment or are recurring at multiple universities in a variety of sizes and locations. A large majority of our students, both first-generation and general population come from a rural background. The authors would also like to survey students deeper on the themes that emerged from the above data to gain a better understanding of the issues facing first-generation students. If proposed changes are implemented at WVU Tech, the authors will survey the students afterwards to see if improvements were made and if any new concerns have arisen.

### **References**

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