Purdue Mission to Mars: Recruiting High School Students to a Polytechnic College

Dr. Matthew Turner, Purdue University (Statewide Technology)

Dr. Matthew Turner is an Assistant Professor of ECET at Purdue University New Albany where he teaches courses in power systems and controls. Prior to joining the faculty at Purdue, Professor Turner worked as a researcher at the Conn Center for Renewable Energy Research in the area of power and energy systems, with a focus on smart grid implementation and computer modeling. Dr. Turner’s current research concentrates on demand response technologies and the application of novel teaching and learning methods to power engineering education.

Rustin Webster, Purdue University, New Albany

Dr. Rustin Webster is a visiting assistant professor at Purdue University. He teaches within the Purdue Polytechnic Institute and the department of engineering technology. He specializes in mechanical engineering and computer graphics technology. Prior to joining Purdue, Dr. Webster worked in the Department of Defense field for over 7 years as an engineer, project manager, and research. His specialization was in mechanical design, research and development, and business development. He studied at Murray State University and the University of Alabama at Birmingham where his research was on immersive virtual learning environments for educational training purposes. Furthermore, Dr. Webster has received various professional certifications from the American Society of Mechanical Engineers, SolidWorks Corporation, the Project Management Institute, and NACE International.

Ms. Danielle Reynolds
Mr. Timothy Cooley, Purdue University New Albany
Prof. Andrew McCart, Purdue Polytechnic

Continuing Lecturer of Organizational Leadership.

Prof. Joseph F Dues Jr., Purdue Polytechnic New Albany
Purdue Mission to Mars: Recruiting High School Students into a Polytechnic College
Matthew Turner, Joe Dues, Tim Cooley, Rustin Webster, Richard Kopp, Andrew McCart, and Dani Reynolds

Abstract
This paper presents the development and implementation of an integrative half-day recruiting event targeting high school students that combines elements of four degree programs: Organizational Leadership, Electrical Engineering Technology, Mechanical Engineering Technology, and Computer Graphics Technology. During the workshop, students engage in active learning: Purdue New Albany is transformed into an aerospace design think tank and high school students are transformed into Polytechnic interns. The interns are then presented with a challenge: A new form of bacteria has possibly been identified on Mars and soil samples must be collected for analysis. However, the next shuttle launch is in 3 hours and the robotic equipment has to be ready! Student teams work with faculty mentors to design, test, and retest robots that can navigate the surface of Mars and collect a soil sample for analysis. Through this integrative experience, students work in teams to learn and apply new skills in leadership, engineering technology, and computer graphics. The impact of the recruitment event is assessed via pre and post surveys of students’ attitudes towards the degree options based on Likert style assessments.

Introduction
As one of the Purdue Moves initiatives, the Purdue College of Technology is transforming into Purdue Polytechnic: academic programs that incorporate innovative learning environments utilizing theory-based applied learning, integration of humanities with technical studies, a learn-by-doing atmosphere, and new options for majors and for earning a degree. Such a transformation is designed to produce graduates with deep technical knowledge, applied skills, and problem solving and critical thinking abilities who are also trained in communication and leadership. Purdue Polytechnic New Albany, one of the eight statewide locations of Purdue Polytechnic, served as a pilot location for Purdue Polytechnic, and has been instrumental in conceiving, testing, and refining the new and innovative learning pedagogies that are to be utilized within the college. As part of this transformation, the New Albany location also explored new methods for attracting new students to the academic programs, resulting in Purdue Mission to Mars (PMTM), a learn-by-doing approach to high school recruiting.

Many other colleges and universities have implemented recruiting via classroom visits to K-12 schools, professional development programs for teachers, engineering contests for students, and on-campus visits. Such programs can be designed to increase engineering enrollment, diversify engineering, educate future generations, teach the teachers, or to improve the quality of the undergraduate engineering experience [1]. Such programs are increasingly important to recruitment efforts, as many as 50% of students have made the decision on a college major by their junior year of high school [2]. Examples of outreach programs include the K-12 Engineering Education Programs (KEEP) Seminar Series for high school juniors and seniors, which invited high school students to observe research presentations by scientists and engineers to better understand the possibilities for career paths in Science, Technology, Engineering, and Mathematics (STEM)[3]. Alternative approaches can be seen in such programs as ‘LearnING-An applied engineering program’, which seeks to raise interest in engineering education through problem based learning [3], and robotics summer camps designed to attract high school girls into computing fields[5]. Such project based approaches can be semester-long or as short as a 1-2 minute learning experience [6], and have been shown to successfully attract students to STEM fields, with particular success in recruiting female and minority populations [7]-[8]. Additionally, some evidence exists that visits to higher-education instructions are effective in guiding students towards STEM educational choices [9].
PMTM builds on this previous body of work by creating an out-of-school experience that is not only project based, but specifically designed to inspire and attract the student participants. This novel approach to recruitment combines elements of four degree programs: Organizational Leadership, Electrical Engineering Technology, Mechanical Engineering Technology, and Computer Graphics Technology. During the workshop, students engaged in active learning designed to inspire their imaginations: Purdue New Albany was transformed into an aerospace design think tank and high school students were transformed into Polytechnic interns. Upon arrival at Purdue, the Polytechnic interns participated in a “New Employee Orientation” that utilizes team building, leadership, and innovation activities, resulting in the formation of design teams. The interns were then presented with a challenge: A new form of bacteria has possibly been identified on Mars and soil samples must be collected for analysis, however, the next shuttle launch is in 3 hours and the robotic equipment has to be ready! For three hours, the intern teams worked with faculty mentors to design, test, and retest robots that can navigate the surface of Mars and collect a soil sample for analysis. Once the soil sample was collected, the students worked with Computer Graphics Technology faculty to create a video log of the build event and media for a news and media campaign.

Through this integrative experience, students worked in teams to learn and apply new skills in leadership, engineering technology, and computer graphics. Purdue Mission to Mars launched for the first time on November 13th, 2015. The impact of the recruitment event was assessed via pre and post surveys of students’ and parents’ attitudes towards the degree options based on Likert style assessments.

PMTM Program Development and Rationale
PMTM was created to offer students a dynamic and hands-on engineering design experience that inspires them to choose STEM majors. Therefore, great effort was put into the creation of an authentic mission experience that included appropriate technical content that informed participants of the program offerings at Purdue Polytechnic. As such, the critical components of the event requiring development prior to the event included a) an event script and supporting media, b) a physical 3-D Martian surface, c) a robotic rover based on LEGO Mind Storm robots, d) custom sensors and hardware to extend the capabilities of the rover, and e) instructional documents for student preparation of their “news releases”.

a) Script and Multimedia
To engage students in PMTM, they were asked to role play as if they were design engineers in an aerospace think tank. To make the experience as authentic as possible, a fictional mars rover campaign was created and the engineering facilities were arranged to appear as a NASA-like environment. Three classrooms were converted into engineering design labs, and a conference room was converted into Mission Control. A multimedia theme was also created for all documents and presentations, giving the event a cohesive atmosphere. Figure 1 shows the overall program schedule that was followed.
b) Martian Surface
A physical Martian surface was fabricated for the robotic rovers to navigate, modeled off of NASA satellite imagery of Mars (Figure 2). The structure was fabricated using 4’ x 8’ x 2” pink foam insulation panels, assembled to create an eight by twelve foot sculpted landscape. Individual terrain features made from additional layers of sculpted foam up to ten inches tall and five feet in diameter were added so simulate the crater rim features on the left side of Elysium Mons and Orcus Patera, stray boulders, and eroded dust plains. Twelve inch tall stiffening borders made from thin plywood were added for robot containment and to link the panels during final assembly. Finally, two coats of latex paint were applied. Foam sawdust and food coloring were added to enhance texturing, shading and small-scale shaping of detail features and special sections. To facilitate the “soil test” blue aquarium gravel was placed on the surface.

To locate the bacteria of interest, the teams were offered four navigational options: touch sensors to monitor and follow geographic contours, rotation counts to measure geographic distances, ultrasonic object detection to monitor position, or a luminescent “bio-trail”. The features of Mars were tailored to enhance these options through strategic contouring, limited use of obstacles, and inclusion of an embedded electroluminescent light cord to simulate the “bio-trail”.

c) Robots & Sensors
For the robotic rover, the LEGO Mindstorms NXT Kit #9797, Resource Set #9695, system (Figure 3) was used. It is built around a programmable controller called the Intelligent Brick. It has four input ports for connecting sensors and three output ports for controlling motors. The kits includes two touch sensors, an ultrasonic sensor, a light sensor and a sound level sensor. The motors are high torque, low speed motors with built-in encoders for accurate sensing of motor rotation. Three motors are available in each kit. In addition to the smart components, the NXT kits include lots of building components (beams, connectors, wheels, gears, tracks and more) to build the structure of the Mars rover and any necessary accessories.

Each team was supplied with a pre-built Purdue Extra Terrestrial Explorer (P.E.T.E) chassis to give them a common starting point to begin working on a design. The chassis consisted of the NXT controller brick, two drive motors connected to the main wheels, a freely pivoting wheel in the back to allow the rover to turn, and associated building components to connect it all together. An example of the initial chassis is shown in Figure 4. The chassis was intentionally designed to be relatively ineffective in navigating the surface of Mars in order to force the students to work on improving it. It was tall and prone to tipping over and did not track a straight line efficiently, making it difficult to navigate using an open loop control program.

**d) Programming and Hardware Interfacing**

Mindstorms NXT uses a visual programming environment where the programmer connects graphical elements (icons) that represent commands in the programming workspace (Figure 5). Each icon contains the appropriate parameters for the particular command. By arranging the icons in a logical way, custom programs can be written. An coding tutorial session was created that introduced the students to the NXT development environment by programming the P.E.T.E. to wait for an external button press, drive in a straight line for 6 feet, turn 45 degrees right, and to the drive straight again.
Additionally, custom hardware was developed for the P.E.T.E. rover in order to demonstrate basic engineering concepts related to the MET and ECET programs. Two scoop designs were modeled in SolidWorks and 3D printed. These scoops facilitated collection of the bacteria, and appropriate linkage assemblies printed for attachment to the robot’s rotary actuators. Having two designs allowed the student groups to evaluate each scoop design for effectiveness of collecting the aquarium rock “soil samples”. Additionally, a custom light sensor was developed using a Cadmium Sulfide photoresistor circuit. This custom sensor was tuned to the spectral frequency of the light used in the “bio-trail”. Although more sensitive than the Lego NXT light sensor, using this custom sensor required more sophisticated algorithm design, offering students an additional design challenge. The custom designed scoops and sensor are depicted in Figure 6.

![Figure 5. NXT Graphical Based Programming Environment](image5)

![Figure 6. 3D-Printed Scoops and Custom Light Sensor](image6)

e) **Video Production**

On each team, a Mission Recorder was assigned to record video as the teams built and tested their rover designs. Additionally, at the end of the event, the Mission Recorder was responsible for producing a news report documenting the event. It was assumed students had no previous experience with video production so several step-by-step instructional documents were developed to import and edit raw video in a way that was immediately deliverable. Each team then produced its own “news release” documenting their efforts to recover the mysterious bacteria.

**Recruiting**
Recruiting for this event entailed: travelling to local high schools to deliver event material to each guidance department, additional printed material mailed to regional high schools, online and newspaper advertising, attendance at local college fairs, and postings through social media. Turnout for the event was anticipated to yield approximately 40 interested high school juniors and seniors with every reasonable effort made to accommodate everyone wishing to attend. As project planning and construction progressed it became apparent that the event should be capped at 45 participants to effectively accommodate the range and sequence of activities planned without excessive strain on resources.

Locally, PMTM was the first of its kind and created such a buzz of excitement and interest that minimal recruiting was necessary. Word of mouth from guidance departments at local and regional high schools helped push registration to 98 participants. This provided three unanticipated benefits; it allowed the event to become exclusive and more attractive to future registrants, it gave the event a built-in audience for subsequent rollouts, and it minimized faculty/staff workloads and expenditures for the next two or three recruiting events since minimal enhancement would be necessary to maintain interest in the short term.

Event Summary
PMTM began in a large conference room (Mission Control) with faculty and staff at Purdue Polytechnic New Albany in character, performing their assigned roles: director of PMTM, head of recruitment, director of engineering, lab engineers, media relations specialists, etc.

The recruiting event began with Organizational Leadership training on successful team interaction since the students were expected to perform in project management and problem-solving groups all day. Few of the students had previously worked together and the initial half hour leadership training was designed to establish rapport, break the ice, and allow the students an opportunity to settle into a new setting before they had to perform.

The team-building exercise asked each student team to plan a hypothetical company picnic. The students were encouraged to open up by contributing to the easy question: "what do we need to plan a picnic?" Answers, recorded on the whiteboard, included "a time, date, location, menu, invitation list, activities, etc." The leadership professor then asked them to put the picnic list on hold for a brief moment. The professor then posed a harder question: "what are some qualities that make for a bad team member?" Student answers, prompted by the professor, included "not engaged, on their phone, late, absent, sleeping, negative, silent, looking out the window, etc." These answers caused some laughter and the students seemed to relax further. The professor then requested that they now try to plan their picnic, led by their pre-assigned team leader, but to be more committed to one of the negative qualities on the board than they were to the actual planning of the picnic. Naturally, very little planning was accomplished and they were stopped after about two minutes. A few groups were asked to share their experiences.

Next, the students were asked to list the qualities of a contributing team member. Prompted by the professor, the list, again recorded on the whiteboard, included "engaged, encouraging, contributing worthwhile thoughts, present, trusting, etc." This time, the students were asked to plan the picnic, but they were asked to first be more committed to one of the positive ways of being. After a few minutes, the students were interrupted and they reported back on this experience. Their feedback was that they had a much more enjoyable, easy, efficient, and effective experience by embodying the positive qualities.

Before the Organizational Leadership training was over, the professor asked them to keep the positive qualities in mind during their team exercises throughout the day. The professor also encouraged students to consider taking these positive qualities to their everyday lives; using real examples. Being committed
to bringing positive qualities can help any role in life; from an engineer on a development team, leading a volunteer group in the community, being a spouse in a marriage, or one of a group of friends planning a fun outing.

Next, based on the students’ previously indicated interest in degree programs, interns were assigned a team and a specific role in that team. Participation was limited to 45 students, 9 teams of 5 members each. Roles included Project Manager, Design Engineer, Computer Engineer, Mission Recorder, and Test Engineer. An introduction to the team’s activities was then presented, culminating in an announcement that an urgent task (bacteria retrieval) suddenly needed their immediate attention.

From there teams were shown to the laboratory space where pre-built robots, hardware and sensors, programming computers, and testing facilities awaited. Nearby the Martian surface was positioned so all students could measure, strategize, plan and test their ideas. Each team was given an overhead picture with the three possible routes, depending on their chosen method of navigation.

First the students were introduced to the LEGO Mindstorms hardware. After the basic hardware had been introduced, the participants were given a quick lesson on LEGO. Students were first taught how to turn a motor on and off with different options: unlimited rotation, a specified number of degrees, a specified number of rotations or a particular length of time. Next students were shown how Move icons can be used to coordinate multiple motors to get P.E.T.E. to travel in a straight line. Students were directed to experiment with power levels and duration controls to understand how P.E.T.E. moved. I.E. they measured the distance P.E.T.E traveled when it was programmed to move 1 rotation of the wheels and then compared that to the distance P.E.T.E traveled for 4 rotations of the wheels. Turning the rover was then explained. P.E.T.E. can spin in place by turning the motors in opposite directions. It can turn sharply by stopping one motor while the other continues to rotate or it can curve gradually by running one motor at a slower speed than the other. Students then experimented with the various methods of turning and learned to program P.E.T.E to follow a path with multiple straight segments linked with various turns. Lastly, the students were given some instruction on using sensors and conditions in their program. This included using the Wait command and While loops with a touch sensor to add feedback control to their program. Students were given some instruction to get them started, but the major focus of the exercise was for them to learn in a hands-on and self-directed way.

The Mars simulator (Figure 7) was designed so that there were three main routes that the rover could potentially take. The first route was on the flat plains around the outside of the crater and utilized waypoints. This route became known as the GPS option that relied on open loop programing to simple direct the rover past a series of defined locations. This route was the longest and thus probably the slowest if speed became a consideration. The second route was along the rim of the crater and utilizes a touch sensor to detect the raised side of the crater. This route was shorter and required closed loop programming that is less susceptible to variations in the surface of Mars. The last route was the shortest but required detecting luminescent bacteria, as simulated by an electroluminescent wire, embedded in the landscape surface. The design, fabrication, programming for the third route was more difficult that the first two options but allowed for the development of a custom made light sensor for this event.
All of the teams tried the GPS route initially and universally failed to reach the sample area. The chassis tipped easily if it encountered an obstacle or the edge of the crater rim. Imperfections in the surface of Mars created a slight diversion of the rover that would result in veering off of the planned course. Due to the length of the route and the turns required, very slight deviations in the initial placement of the rover created large errors in location at the end of the route. Despite these challenges, some teams persisted in trying to navigate to the goal using the waypoints. The few teams that did make it to the goal got there more out of luck than any programming skill. Some groups discovered that switching out the wheels for tank tracks greatly improved the positional reliability of the rover. The tracks have much greater contact area with Mars surface which increased the friction between the tracks and the ground. This in turn increased the likelihood that the rover stays on the intended path and was less likely to be redirected due to the holes and bumps in the surface of Mars. Just before lunch, the mentors started working with the teams to encourage them to try closed loop control with a touch sensor. Once the teams grasped the concept, the programming was much shorter than the GPS method. It’s basically a program that slowly curves right until it hits the rim, turns left until the sensor is no longer pressed and then loops. The difficult part of this method was the mechanical design of the structure needed to hold the touch sensor. A few groups got it partially working, but had trouble holding the touch sensor so that it was activated consistently. Some groups resorted to a brute force approach that involved driving over and through the obstacles on the surface of Mars. Without feedback control however, it was very difficult to stay on course. Other groups gave up on the GPS navigation and resorted to Bluetooth control of the rover. Of course, the rover was supposed to be autonomous, but driving the rover manually was a lot of fun!

Over the three plus hours the teams made decisions, programmed and constructed their robots, and tested their ideas. Technical assistance was provided by current MET and EET students as well as faculty to expedite solutions and overcome short term difficulties. On a more strategic level faculty’s participation was viewed as coach / mentor, to produce and foster a working environment centered on collaboration, trust, active learning, and enjoyment. The next generation of students will come from a heavy digital and informational world. From the beginning PMTM and faculty involvement was designed to provide simplified elements of each. The robots required digital programming while tasks could not be completed unless constant communication amongst all participants occurred. Students were trusted to be courageous, creative, and innovative in their robot design, coding, problem solving, etc.

GoPros and smartphones were in constant use by everyone, providing a large pool of video material the interns could use to create their final “news release”. Current CGT students assisted the interns with the
Data Analysis

Prior to participating in PMTM, students were asked to complete a survey that contained Likert-style questions assessing both familiarity and interest in the academic program offerings at Purdue Polytechnic and qualitative questions regarding students’ interest in STEM programs in general. After participating in PMTM, a second survey was distributed to students containing the same Likert-style questions and they were asked to rate their enjoyment of the PMTM program, if they would recommend friends to attend Purdue Polytechnic, and an open response question on changes they would like to see made to PMTM. Comparison of the pre and post surveys allowed gain scores to be calculated addressing the following research questions: did participation in PMTM increase students perception of their own understanding of the majors in Purdue Polytechnic, did participation in PMTM increase student interest in degree offering in Purdue Polytechnic, and did participation in PMTM increase student interest in attending Purdue Polytechnic at New Albany? This section presents the quantitative analysis of this survey data, as well as a mixed method qualitative assessment based on observations by the faculty involved in delivering the PMTM event and open ended feedback from the student participants. Figure 7 presents the Likert-style assessment questions used in both surveys, Figure 8 presents the pre-survey open ended response questions, and Figure 9 presents the post-survey open ended response questions.

| 1. | I understand what the field of Computer Graphics Technology (CGT) is. | Yes, completely | Yes, somewhat | Maybe | No, not really | No, not at all |
| 2. | I understand what the field of Electrical Engineering Technology (EET) is. | | | | | |
| 3. | I understand what the field of Mechanical Engineering Technology (MET) is. | | | | | |
| 4. | I understand what the field of Organizational Leadership (OL) is. | | | | | |
| 5. | I understand what Purdue Polytechnic is. | | | | | |
| 6. | I am interested in studying CGT as my college major. | | | | | |
| 7. | I am interested in studying EET as my college major. | | | | | |
| 8. | I am interested in studying MET as my college major. | | | | | |
| 9. | I am interested in studying OL as my college major. | | | | | |
| 10. | I am interested in attending Purdue Polytechnic in New Albany for college. | | | | | |

**Figure 7. Purdue Mission to Mars Assessment of Student Familiarity and Interest in Degree Offerings**

| 11. | If you are already interested in a college major, what is that major? | | | | | |
| 12. | If you are already interested in attending a specific college, what is that college? | | | | | |
| 13. | Of the majors offered at Purdue Polytechnic, which would you be most likely to choose as your college major (circle one)? | Computer Graphics Technology | Electrical Engineering Technology | Mechanical Engineering Technology | Organizational Leadership |

**Figure 8. Purdue Mission to Mars Pre-Event Survey Questions**

| 11. | Did you enjoy Purdue: Mission to Mars? | | | | | |
| 12. | Would you recommend that friends interested in a STEM major consider Purdue Polytechnic New Albany? | | | | | |
| 13. | What would you change about your experience at Purdue: Mission to Mars? | | | | | |

**Figure 9. Purdue Mission to Mars Post-Event Survey Questions**
a) Familiarity with Academic Programs
The first four Likert-style questions of the surveys related to recognition of majors: do students identify as having a qualitative understanding of the topics and applications covered within the subject. The fifth question asked students to assess their understanding of the College, Purdue Polytechnic. Survey responses were numerically coded according to the following scale: “Yes, completely” =+2, “Yes, somewhat” =+1, “Maybe” =0, “No, not really” =-1, and “No, not at all” =-2. Table 1 presents summarized data for the student responses to these questions (n=40) in two forms: average score of all respondents and total number of respondents answering in the affirmative (> =1). The change in reported data between pre and post surveys is also presented. Pre survey data reveals relatively little initial self-identification of understanding of the CGT and OL majors (50% and 35% respectively), while the engineering technology majors score higher on this scale (EET=72.5% and MET=77.5%). Post survey data shows a gain in self-reported understanding of the majors in all cases, with significant gains in both OL and CGT, while smaller gains were seen for EET and MET, although both of these programs obtained post survey affirmative understanding counts of >92.5%. Overall, this survey data supports PMTM as an effective method at improving student understanding of the subject and applications covered in the degree programs offered. When asked about Purdue Polytechnic, initial survey results were surprisingly high, with an average response of 0.8 and an affirmative response count of 27. These initial results indicate the possibility of a content validity error in this question. Item 5 of the survey was intended to measure student understanding of the concept of a polytechnic engineering and technology program. Given the relative scarcity of such programs regionally and nationally, these high scores indicate that students may have indicated affirmative to the statement “I understand that Purdue Polytechnic is the school in which these programs are offered”, which was not the intent. However, the relatively strong post score for this question (1.65 average) may indicate that the PMTM program itself clarified this question or students.

Table 1. Assessment Results for Understanding of Majors

<table>
<thead>
<tr>
<th></th>
<th>Pre (Average/N=1)</th>
<th>Post (Average/N=1)</th>
<th>Delta (Average/N=1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I understand what the field of Computer Graphics Technology (CGT) is.</td>
<td>0.3</td>
<td>1.2</td>
</tr>
<tr>
<td>2.</td>
<td>I understand what the field of Electrical Engineering Technology (EET) is.</td>
<td>0.65</td>
<td>1.325</td>
</tr>
<tr>
<td>3.</td>
<td>I understand what the field of Mechanical Engineering Technology (MET) is.</td>
<td>1.025</td>
<td>1.6</td>
</tr>
<tr>
<td>4.</td>
<td>I understand what the field of Organizational Leadership (OL) is.</td>
<td>0.225</td>
<td>1.225</td>
</tr>
<tr>
<td>5.</td>
<td>I understand what Purdue Polytechnic is.</td>
<td>0.8</td>
<td>1.65</td>
</tr>
</tbody>
</table>

b) Interest in Academic Programs
The second set of four Likert-style questions of the surveys related to interest in majors: do students identify as wanting to study a particular subject. The fifth question asked the students to assess their interest in attending Purdue Polytechnic. Survey responses were numerically coded as described previously and Table 2 presents the summarized data. In reporting this data, students were not required to indicate interest in only a single major, and many indicated interest in two or more. When asked to identify a single major of interest on the pre survey, students reported MET (25), EET (10), CGT (5), and OL (0). Interestingly, this roughly aligns with the relative program sizes at Purdue Polytechnic New Albany. The data shows that overall, EET gained the largest number of students, 9, and increase of 75%. Although net gains for OL and CGT were smaller, their percentage changes were larger, at 175% and 89% respectively. Perhaps most importantly, 34 of the 40 responding students indicated that they were interested in attending Purdue Polytechnic New Albany after completing the PMTP program, an increase of 62% as compared to the pre survey data.
c) Mixed Method Qualitative Analysis

When asked to rank their enjoyment of PMTM, the average score reported was 1.95, with 38 respondents choosing a score of 2. When asked if they would recommend Purdue Polytechnic New Albany to a friend, the average score reported was 1.975, with 39 respondents choosing a score of 2. When asked what they would change, the following categories of feedback were received: make no changes to the program (23), make the program longer in duration (7), more focus on CGT (1), more involved mission scenario (1), more emphasis on computer programming instruction (1). Combined, these rankings indicate an extremely favorable response from participants.

Faculty observations further support the success of the event at exciting student interest in STEM. Previously, Purdue NA has recruited high school students by having them participate in short demonstrations put on individually by each department. The focus of these events was explaining the curriculum of each degree and the careers they prepare students for. The faculty responsible for PMTM have been involved in similar higher education recruiting events for a combined total of more than 40 years. In their observation, distinct advantages of PMTM include increased engagement with material, increased interest in STEM careers, and demonstrated enthusiasm for group work.

Future Work

Due to the enthusiasm expressed for PMTM by high school STEM faculty and administration, Purdue New Albany will be offering two additional PMTM recruiting events during the Spring 2016 academic term. The efficacy of these events will be assessed during the Fall 2016 academic term in two ways: statistical analysis of enrollment data and qualitative assessment of enrolled student body population. Additionally, a very high level of enthusiasm and involvement was demonstrated by female students during the PMTM event, an outcome that was not predicted during the design of the program. Purdue Polytechnic New Albany hosts a female-focused recruiting event: Girls Only STEM (Go-STEM) each semester. Currently, a new assessment survey is being developed to help identify the relative efficacy of co-ed vs. single-gendered recruiting events on female student enrollment in engineering technology programs. In the future, girls only PMTM events will be held, allowing direct comparison between the events.

Conclusions

This paper presented the development and offering of an innovative multidisciplinary STEM recruitment event based on the building, programming, and testing of an autonomous robot meant to navigate a simulated Mars surface. Assessment results indicate that by engaging students in project and team-based learning in the context of real-world applications, interest in STEM majors can be increased in high school students.

References


