

## **PUGET SOUND CONSORTIUM FOR MANUFACTURING EXCELLENCE Student Field Trip Survey <sup>1</sup>**

*Shelley L. Balanko, Ph.D. and Laura J. Collins, Ph.D.*

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### **BACKGROUND**

The Puget Sound Consortium for Manufacturing Excellence (CME) is establishing a regional consortium to develop and implement programs and services providing Puget Sound industry workers with the tools and techniques required for world-class manufacturing. The CME works with local educational partners to promote manufacturing career opportunities to students. Toward this end, the CME is developing recruitment and retention strategies to encourage a diverse workforce. Of particular interest is the recruitment and retention of people from diverse ethnic backgrounds who are underrepresented in manufacturing careers. Consequently, the CME, in conjunction with the Mathematics, Engineering, and Science Achievement (MESA) program and Renton Technical College, sponsored a field trip to Renton Technical College for middle school and high school students of diverse ethnic backgrounds. The Office of Educational Assessment (OEA) was contracted by the CME to conduct a student survey of the field trip. Information obtained from the survey will be used to plan and improve future field trips.

Thirty-four students from the African American Academy ( $n = 23$ ) and Ranier Beach High School ( $n = 11$ ) attended a one-day field trip to Renton Technical College. Students selected, or were randomly assigned to, two of four workshops to attend during the field trip. Each workshop lasted 70 minutes and was instructed by Renton Technical College faculty. The workshop topics included machine technology, surveying, electronics, and drafting.

In the machine technology workshop, the instructors discussed the importance of machine technology and what machinists do. Students were introduced to computer assisted drafting (CAD) and computer assisted machining (CAM). Using the computer software, students drew a block containing their name. Computer Numerical Control (CNC) machine tools were then demonstrated. Students had the opportunity to use these machine tools to make souvenir name medallions that were based on their block designs. Students also saw how machine tools can be used to make chess pieces from raw materials.

During the survey workshop students were given a brief overview of surveying and a list of general questions about surveying was distributed. It was explained that surveyors make maps using their knowledge of mathematics and surveying equipment. Students were led outside to the campus courtyard for a demonstration of the surveying equipment (e.g., total station, retro-reflector, Global Positioning System), and they were invited to experiment with the equipment. After the demonstration students returned to the classroom for a brief overview. The measurements taken outside were downloaded to a classroom computer and a map of the courtyard was projected onto a screen. The instructors concluded by commenting that surveying is a lucrative career.

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The electronics workshop included a brief lecture on the history of electricity, a description of voltage, resistance, and current, and the presentation of mathematical formulas for calculating these concepts. Several handouts that contained information about electricity were distributed. A discussion of existing career opportunities in electronics was also included. The lecture was followed by time in the electronics lab in which Renton college students demonstrated the measurement of voltage, current, and resistance. Students had the opportunity to interact one-on-one with the college students to discuss the lab activities and the electronics program.

In the drafting workshop, students were stationed at computers with computer assisted drafting software, and they were paired with a Renton college student. Students were instructed in drafting a house complete with doors, windows, and a roof. The products of this exercise were printed for students to take home. Students also had the opportunity to ask the Renton college students questions about their own projects and the drafting program.

## METHODS

Ten minutes at the end of the field trip were reserved for students to complete an end-of-field-trip survey (see Appendix). The surveys were administered and collected by the CME field trip chaperones. Students were informed that the survey was voluntary and anonymous. The survey included open- and closed-ended questions. The questions inquired about demographic characteristics (e.g., grade, ethnicity), which workshops were attended, students' interest in the workshop area, and students' intent to pursue a career in that area. Other questions asked about students' liking of the field trip, their desire to attend another similar field trip, what they learned from the field trip, what were the two best things about the field trip, and what would make the field trip better.

Responses to the survey were coded and the quantitative data was analyzed with the Statistical Package for the Social Sciences (SPSS) version 10.0. Frequencies and means were calculated for each closed-ended question. The open-ended responses were analyzed inductively and substantive categories were developed for each question.

## RESULTS

Fourteen boys (41%) and 20 (59%) girls responded. Students identified themselves as Black/African American ( $n = 29$ , 85%), White/Caucasian American ( $n = 4$ , 12%), "other" ( $n = 4$ , 12%), Native American/Alaskan ( $n = 2$ , 6%), and Pacific Islander ( $n = 1$ , 3%). Notably, seven students (21%) reported bi- or multi-ethnic identities. The majority of students were in the eighth grade ( $n = 16$ , 47%), with the remainder in the tenth ( $n = 11$ , 32%), seventh ( $n = 5$ , 15%), and sixth ( $n = 2$ , 6%) grades.

Students indicated which workshops they attended, their degree of interest in each workshop area on a scale of 1 to 4 (1 = very uninterested, 2 = uninterested, 3 = interested, 4 = very interested), and rated their future interest in a career in that area on a scale of 1 to 4 (1 = definitely not, 2 = probably not, 3 = probably, 4 = definitely yes). Table 1 presents the frequencies, means, and standard deviations for each question and workshop. Students who attended the electronics workshop ( $n = 21$ , 62%) reported an average interest in electronics of 2.95,  $SD = .86$ . On average, their interest in a future career in electronics was 2.71,  $SD = .64$ . Students who went to the drafting workshop ( $n = 17$ , 50%) reported an

average interest in drafting of 3.31,  $SD = 1.08$ , and their average interest in a career in drafting was 3.24,  $SD = .56$ . Students who attended the machine technology workshop ( $n = 16$ , 47%) reported an average interest in machining of 2.93,  $SD = .96$ . Their average interest in a future career in machining was 2.88,  $SD = .72$ . Students who went to the surveying workshop ( $n = 14$ , 41%) reported an average interest in surveying of 2.43,  $SD = 1.02$ , and their average interest in a future career in surveying was 2.14,  $SD = .77$ . Students reported the greatest interest in the field of drafting, and the greatest future interest in a drafting career.

**Table 1. Response frequencies, means, and standard deviations for each question and workshop.**

<b>How interested are you in this area?</b>						
<b>Workshop</b>	<b>Very Uninterested 1</b>	<b>Uninterested 2</b>	<b>Interested 3</b>	<b>Very Interested 4</b>	<b>Mean</b>	<b>Standard Deviation</b>
Electronics ( $n = 21$ )	1 (5%)	5 (24%)	9 (43%)	6 (26%)	2.95	.86
Drafting ( $n = 16$ )	2 (13%)	1 (6%)	3 (19%)	10 (63%)	3.31	1.08
Machining ( $n = 15$ )	2 (13%)	1 (7%)	8 (53%)	4 (27%)	2.93	.96
Surveying ( $n = 14$ )	3 (21%)	4 (29%)	5 (36%)	2 (14%)	2.43	1.02
<b>Do you think you'd be interested in a career in this area in the future?</b>						
<b>Workshop</b>	<b>Definitely Not 1</b>	<b>Probably Not 2</b>	<b>Probably 3</b>	<b>Definitely Yes 4</b>	<b>Mean</b>	<b>Standard Deviation</b>
Electronics ( $n = 21$ )	1 (5%)	5 (24%)	14 (67%)	1 (5%)	2.71	.64
Drafting ( $n = 17$ )	0	1 (6%)	11 (65%)	5 (29%)	3.24	.56
Machining ( $n = 16$ )	1 (6%)	2 (13%)	11 (69%)	2 (13%)	2.88	.72
Surveying ( $n = 14$ )	3 (21%)	6 (43%)	5 (36%)	0	2.14	.77

Also using 4-point scales, students reported how much they liked the field trip (1 = I really didn't like it!, 2 = I didn't like it, 3 = I liked it, 4 = I really liked it), and how much they would want to attend future field trips about manufacturing technology (1 = definitely not, 2 = probably not, 3 = probably, 4 = definitely yes). Table 2 presents the frequencies, means, and standard deviations for these global questions. Overall, the students liked the field trip ( $M = 3.38$ ,  $SD = .60$ ) and they indicated that they would want to attend future manufacturing technology field trips ( $M = 3.56$ ,  $SD = .56$ ).

**Table 2. Response frequencies, means, and standard deviations for global questions.**

<b>Overall, how much did you like the field trip? (<math>n = 34</math>)</b>					
<b>I really didn't like it 1</b>	<b>I didn't like it 2</b>	<b>I liked it 3</b>	<b>I really liked it 4</b>	<b>Mean</b>	<b>Standard Deviation</b>
0	2 (6%)	17 (50%)	15 (44%)	3.38	.60
<b>If you could go on another field trip about manufacturing technology, would you want to? (<math>n = 34</math>)</b>					
<b>Definitely Not 1</b>	<b>Probably Not 2</b>	<b>Probably 3</b>	<b>Definitely Yes 4</b>	<b>Mean</b>	<b>Standard Deviation</b>
0	1 (3%)	13 (38%)	20 (59%)	3.56	.56

The themes that emerged from the responses to the open-ended questions are reported below along with the original question. Responses may not sum to 34 due to the open-ended nature of the questions and the possibility for more than one response per student.

***Tell us about one thing that you learned from the field trip.***

- Specific information about electronics (13) e.g., how to solder, history of names of energy, how to read ohms on a register
- Specific information about drafting (8) e.g., how to design a house, drafting is a long process
- Specific information about surveying (6) e.g., surveyors make a lot of money, how to survey
- Specific information about machining (5) e.g., how to graft a square with my name on it, how machines work, can make chess pieces that are metal
- Career information/information for planning for the future (4)
- Computing knowledge/skills (2)

***What were the two best things about the field trip?***

- Learning about drafting/design/building/making a house/furniture (12)
- Hands-on work/learning in a fun way/being out of school learning something/learning about things of interest (8)
- Food/lunch (8)
- Nice people/help from college students/meeting college students (7)
- Learning about surveying/GPS/detailed mapping/how far we are from space (5)
- Learning about electronics/circuits/voltages/resistance/soldering (5)
- Learning about machine technology/the machines/making chess pieces/castles (4)
- Hanging out/being with friends/bus ride (3)
- Getting stuff/having souvenirs to take home (2)

- Programs/classes (2)
- Other (4) e.g., the technology, working alone, learning about the Running Start program, others showing me their job

***Suggest two things to make the field trip better.***

- More hands-on/less talking/more interesting or exciting activities (13)
- Nothing/it was fine/good/the best (7)
- Better/more food (5)
- More time/longer classes/more workshops (5)
- More people/more people attending (3)
- More interaction with college students (2)
- Shorter time period/class sessions (2)
- Better transportation (2)
- Other (6) e.g., make space needles, free software, other techniques/classes, have something to take home, written background information on each area, everyone should attend all workshops

## **CONCLUSIONS AND RECOMMENDATIONS**

Students from the African American Academy and Ranier Beach High School liked the field trip to Renton Technical College. The students gained knowledge about each of the manufacturing technology areas that they were exposed to during the workshops. In addition to content area knowledge, students gained knowledge about computing, as well as general information about manufacturing careers and planning for the future. Drafting received the highest average ratings for students' current interests as well as their future interest in a career. An overwhelming majority of students indicated that they would like to attend future field trips about manufacturing technology.

When planning future field trips, it is recommended that planners consider what students thought was best about the event. In particular, students enjoyed learning about things of interest to them (e.g., drafting), hands-on learning, and having the opportunity to interact with, and learn from, college students. Students' suggestions for improvement could also be incorporated into future field trip plans. The most frequent suggestions included more hands-on learning activities, more/better food, and more time in the workshop sessions.

## APPENDIX

Consortium for Manufacturing Excellence (CME) and Mathematics Engineering Science  
Achievement (MESA) Student Field Trip Survey

We would like to ask you questions about the CME/MESA field trip to **Renton Technical College** so we can make future field trips better. You don't have to fill out the survey or answer all the questions. Responses to the survey will be summarized by the UW Office of Educational Assessment and returned to the CME field trip planners. Please don't tell us your name. Circle one response for each question, unless asked to circle all that apply.

1. What grade are you in?    **6<sup>TH</sup>**    **7<sup>TH</sup>**    **8<sup>TH</sup>**    **9<sup>TH</sup>**    **10<sup>TH</sup>**    **11<sup>TH</sup>**    **12<sup>TH</sup>**

2. Please describe yourself: (Circle all that apply.)

**BLACK/AFRICAN AMERICAN**                      **PACIFIC ISLANDER**                      **LATINA/O AMERICAN**  
**WHITE/CAUCASIAN AMERICAN**           **ASIAN AMERICAN**                      **NATIVE AMERICAN/ALASKAN**  
**OTHER** \_\_\_\_\_ **(SPECIFY)**

3. Your Gender:    **MALE**                                      **FEMALE**

4. Circle the workshop you attended first:    **MACHINING**    **SURVEYING**    **ELECTRONICS**    **DRAFTING**

How interested are you in this area?

**VERY UNINTERESTED**            **UNINTERESTED**            **INTERESTED**            **VERY INTERESTED**

Do you think you'd be interested in a career in this area in the future?

**DEFINITELY NOT**            **PROBABLY NOT**            **PROBABLY**            **DEFINITELY YES**

5. Circle the workshop you attended second:    **MACHINING**    **SURVEYING**    **ELECTRONICS**    **DRAFTING**

How interested are you in this area?

**VERY UNINTERESTED**            **UNINTERESTED**            **INTERESTED**            **VERY INTERESTED**

Do you think you'd be interested in a career in this area in the future?

**DEFINITELY NOT**            **PROBABLY NOT**            **PROBABLY**            **DEFINITELY YES**

6. Overall, how much did you like the field trip?

**I REALLY DIDN'T LIKE IT!**            **I DIDN'T LIKE IT.**            **I LIKED IT.**            **I REALLY LIKED IT!**

7. If you could go on another field trip about manufacturing technology, would you want to?

**DEFINITELY NOT**            **PROBABLY NOT**            **PROBABLY**            **DEFINITELY YES**

8. Tell us about one thing that you learned from the field trip.

9. What were the two **best** things about the field trip?

10. Suggest two things to make the field trip better.