University of Washington
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Program Evaluation Division

PUGET SOUND CONSORTIUM FOR MANUFACTURING EXCELLENCE
Student Field Trip to Edmonds Community College and Dillon Works Survey [1]

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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 sponsored a field trip to Edmonds Community College and Dillon Works, a small manufacturing company, for middle 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.

Fifteen students from the African American Academy attended a one-day field trip to Edmonds Community College and Dillon Works. At Edmonds Community College, the students participated in two activities in the Material Science Laboratory. The first activity was called, "What's This?" and was led by Dr. Dave Kim, a CME staff member. In this activity, the four classifications of solid materials (e.g., metals, polymers, ceramics, and composites) were explained. Once the properties of each type of solid were described, students were invited to select an object from a table displaying approximately 25 objects. Each student was called upon to classify his or her selected object as either a metal, polymer, ceramic, or composite. Once the student had classified the object, a brief explanation of why the object belonged to the appropriate category followed. Students were given miniature notebooks for their participation in this exercise.

The second activity was called, "Glue-Goo" and it was led by Dr. Tom Stoebe from the University of Washington and his graduate student assistant. In this activity, students worked in teams to create four glue substances. Students made two red putties that consisted of: 1) red polymer mixture (50% glue/50% water) and borax solution, or 2) red polymer mixture (50% glue/50% water), borax solution, and 1 tsp of vegetable oil. Students also made two green putties that consisted of: 1) green polymer mixture (75% glue/25% water) and borax solution, or 2) green polymer mixture (75% glue/25% water), borax solution, and 1 tsp of vegetable oil. The students formed the putties into balls and then examined them to judge and record the substances' texture, consistency, fluidity, and elasticity. Once the students' observations had been recorded, they discussed reasons for variations in the putties' physical properties. Plastic bags were provided so students could take their glue-goo putty home.

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The activities in the Material Science Lab were followed by a brief lunch that included pizza, sodas, and cookies. After the lunch break, a teacher from the African American Academy led the group through a reflective exercise in which the students reported what they had learned from the field trip activities and their thoughts on this learning.

In the afternoon, the students were taken on a tour of the Dillon Works custom manufacturing facility by its Director of Marketing and Sales, Mr. Brian Leonard. Dillon Works designs and fabricates "almost anything." They utilize metal, foam, plastic, fiberglass, wood, fabric or any combination of the above in their creations. Dillon Works makes a wide variety of products (e.g., costumes, sets, props, furniture, decorations, etc.) for a range of spaces such as casinos, retail stores, and trade show booths. Students were led on a tour of the lobby and conference room; design area; molding/sculpting, wood, and metal shops; and the fabrication, soft goods, and painting areas. Students were able to observe the production of several pieces, and were exposed to diverse employees including several women, a typically underrepresented group in manufacturing environments. At the end of the tour, Mr. Leonard led the students through a production exercise. The students were split into three teams and given the task of identifying the steps for producing 1500 Christmas ornaments at a low cost. The teams brainstormed their production strategies, and a team spokesperson communicated the plans to the larger group. Mr. Leonard then conveyed Dillon Works' strategy for making this product for an actual client. The CME staff concluded the field trip by linking the morning activities in the Material Science Laboratory with the process that Dillon Works employees undertake when experimenting with ways to manufacture innovative products. Students were given Dillon Works brochures and a miniature Taco Time cactus antenna topper as souvenirs.

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 an OEA evaluator. 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), how interesting the field trip activities were, what students learned from the field trip activities, students' interest in a career in manufacturing technology, how much students liked 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

Ten girls (67%) and five (33%) boys responded to the survey. Students identified themselves as Black/African American ($\underline{n}$ = 11, 73%) and four students (27%) reported bi- or multi-ethnic identities. The majority of students were in the eighth grade ($\underline{n}$ = 10, 67%), with the remainder in the seventh ($\underline{n}$ = 3, 20%), and sixth ($\underline{n}$ = 1, 7%) grades. One student (7%) did not report his or her grade.

Students indicated how interesting each field trip activity was on a scale of 1 to 4 (1 = very uninteresting, 2 = uninteresting, 3 = interesting, 4 = very interesting). Table 1 presents the frequencies, means, and standard deviations for each activity rating. On average, students rated all of the activities as interesting, but the time at Dillon Works was considered most interesting, M = 3.87, SD = .35.

Table 1. Response frequencies, means, and standard deviations for each activity rating.

How interesting was: (n=15)						
Activity	**Very Uninteresting 1**	**Uninteresting 2**	**Interesting 3**	**Very Interesting 4**	**Mean**	**Standard Deviation**
What's this?	0	1 (7%)	9 (60%)	5 (33%)	3.27	.59
Glue-Goo	0	0	7 (47%)	8 (53%)	3.53	.52
Time at Dillon Works	0	0	2 (13%)	13 (87%)	3.87	.35

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 interested they would be in a career in manufacturing technology in the future (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 = 3.73, SD = .46) and they indicated that they would probably be interested in a career in manufacturing technology in the future (M = 3.00, SD = .65).

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

Overall, how much did you like the field trip? (n =15)					
I really didn't like it 1	**I didn't like it 2**	**I liked it 3**	**I really liked it 4**	**Mean**	**Standard Deviation**
0	0	4 (27%)	11 (73%)	3.73	.46
Do you think you'd be interested in a career in manufacturing technology in the future? (n = 15)					
Definitely Not 1	**Probably Not 2**	**Probably 3**	**Definitely Yes 4**	**Mean**	**Standard Deviation**
0	3 (20%)	9 (60%)	3 (20%)	3.00	.65

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 15 due to the open-ended nature of the questions and the possibility for more than one response per student.

Tell us one thing that you learned from the "What's This?" activity.

- The four classifications of solids (metals, ceramics, polymers, composites)/how to categorize materials (7)
- It is hard to classify objects (e.g., what you think is one thing could be classified as the others) (3)
- What things are made of/where things come from (2)
- Scientific name for plastics is polymers (1)
- When two things are one it is called a composite (1)

Tell us one thing that you learned from the "Glue-Goo" activity.

- Glue-goo has different properties with different substances added (water or oil) (7)
- How to make silly putty/glue-goo/how to make things (2)
- Glue-goo can turn into a ball (2)
- Can make rubber from rubber and sulfur (1)
- The way manufacturers come up with the right materials (1)

Tell us one thing that you learned from the time at Dillon Works.

- How Dillon Works makes (e.g., design, mold, vacuum mold, paint, build) things (e.g., bell ornament, heavy things) (9)
- What Dillon Works makes (e.g., jelly beans, money, almost anything) (3)
- Who Dillon Works makes things for (e.g., Sony, TV commercials) (2)
- Who makes Dillon Works products (1)
- Your senses may deceive you when it comes to artificial objects (1)

What were the two best things about the field trip?

- Dillon Works (e.g., tour, models, touching stuff) (8)
- Glue-goo (5)
- Pizza/food (2)
- Learning that combining two things could give you a very different thing (1)
- Learned something new at both places (1)
- Souvenirs (1)

Suggest two things to make the field trip better.

- Everything was great/nothing/liked it (4)
- More hands-on experiences (3)
- Other (e.g., less walking, more stuff to take home, less exposure to harsh smells, more food, if we could make something at Dillon Works) (5)

CONCLUSIONS AND RECOMMENDATIONS

Students from the African American Academy liked the field trip to Edmonds Community College and Dillon Works. The students reported that the activities were interesting, and they learned a variety of things from each activity. The majority of students also indicated that they would be interested in a career in manufacturing technology in the future.

When planning future field trips, it is recommended that planners consider what students thought was best about the event as well as their suggestions for improvement. In particular, students liked their time at Dillon Works and the Glue-Goo activity, and the most frequent suggestion for improvement was the request for more hands-on learning activities.

APPENDIX

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

We would like to ask you questions about the CME/MESA field trip to **Edmonds Community College and Dillon Works** 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 <u>one</u> response for each question, unless asked to circle all that apply.

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

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. How interesting was the "What's this?" activity?

   VERY UNINTERESTING **UNINTERESTING** **INTERESTING** **VERY INTERESTING**

5. Tell us one thing that you learned from the "What's this?" activity.

6. How interesting was the "Glue-Goo" activity?

   VERY UNINTERESTING **UNINTERESTING** **INTERESTING** **VERY INTERESTING**

7. Tell us one thing that you learned from the "Glue-Goo" activity.

8. How interesting was the time spent at Dillon Works?

   VERY UNINTERESTING **UNINTERESTING** **INTERESTING** **VERY INTERESTING**

9. Tell us one thing that you learned at Dillon Works.

10. 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!**

11. Do you think you'd be interested in a career in manufacturing technology in the future?

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

12. What were the two best things about the field trip?

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

THANK YOU!