PUGET SOUND CONSORTIUM FOR MANUFACTURING EXCELLENCE

2003-2004 Evaluation Report

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March 2004

BACKGROUND

The Puget Sound Consortium for Manufacturing Excellence (PSCME) is a dynamic education-industry partnership working towards building the connection between manufacturing technology education, student career goals, and private sector demand. In its third and final year, the PSCME is working to solidify its legacy in manufacturing technology education by ensuring the sustainability of the programs and processes developed during the funding period.

The PSCME has worked with its partners to modularize manufacturing technology curriculum based on existing industry skill standards. Modularized instruction provides for customization of instruction for students, potentially leading to degree obtainment. PSCME partner institutions and industry now have the ability to integrate PSCME modules into their programs. Professional development activities focused on the implementation and delivery of the modularized curriculum system are offered to instructors. The PSCME also assists high schools, tech prep programs, colleges and universities in promoting manufacturing career opportunities to their students.

The PSCME has three program objectives:

Objective 1: Deploy a manufacturing technology curriculum that will ensure that graduates of manufacturing programs can meet national skill standards.

Objective 2: Promote professional development of high school instructors, college faculty and manufacturing trainers by providing high quality instruction on the use and application of PSCME instructional products.

Objective 3: Present a plan for curriculum articulation and interaction between high schools, community and technical colleges, four-year colleges and universities, and industry.

PROGRESS IN THE THIRD YEAR

Progress on Objectives 1 and 2: Curriculum and Professional Development

Because curriculum and professional development are so closely aligned, activities relating to both objectives are reported in this section. The PSCME has worked with industry partners, secondary schools and post-secondary institutions to attain its goals. As well, the PSCME has partnered with the Manufacturing Technology Advisory Group (MTAG) in the revision and implementation of core curriculum modules. The following sections report outcomes for curriculum and professional development activities.

High School Students' Summer Workshop.

Six high school students from the area participated in a summer workshop that piloted three modules, Career Exploration, Shop Skills, and Manufacturing Engineering Field Trip. One instructor, with the assistance of a technical aide, facilitated all of the modules at Shoreline Community College utilizing the Manufacturing/Machining

Lab, classrooms, and Computer Lab. The students also were able to attend a Manufacturing Engineering Field Trip to a small factory, ACCRA Manufacturing, Inc., in Bothell, WA. ACCRA Manufacturing, Inc. is a world class supplier of precision machined details and assemblies.

At the end of each module the students and the instructor completed surveys (see Appendix) that assessed their perceptions of the module. However, the instructor did not complete a survey for Career Exploration. Almost all students completed a survey for each module (Career Exploration N=5, Shop Skills N=6, Manufacturing Engineering Field Trip N=6). All students are in the 12th grade in the fall of 2003. There were five (83%) male students, and one (17%) female student. The participants were from diverse backgrounds: Asian American (n=3, 50%), White/Caucasian American (n=1, 17%), and other (Ukrainian, Vietnamese) (n=2, 33%).

Overall, students were not very challenged by the modules, but they reported that the module exercises were effective in helping them learn the material. Moreover, students indicated that it was easy to stay focused on the modules. Table 1 presents mean responses, with standard deviations, for three quantitative survey items. Responses were on four-point scales with larger values indicating more positive attributes (e.g., 1=very unchallenging, 2=unchallenging, 3=challenging, 4=very challenging). The Shop Skills module was rated as most challenging, with the most effective exercises, and it was most easy to stay focused on this module.

Table 1. High School Student Survey Results for Items 5, 6, and 7

Question	Career Exploration (N=5) Mean, SD	Shop Skills (N=6) Mean, SD	Manufacturing Engineering Field Trip (N=6) Mean, SD
How challenging was the module? (very unchallenging – very challenging)	2.60, .55	3.00, .00	2.00, .00
How effective were the module exercises in helping you learn the material? (very ineffective – very effective)	3.20, .45	3.83, .41	3.17, .40
How easy was it to stay focused on the module? (very difficult – very easy)	3.00, .00	3.17, .75	3.00, .71

Students also reported that the module objectives were clear and that they felt objectives were met by the end of the module. Table 2 presents the mean responses, with standard deviations, for two quantitative survey items. Responses were either, yes=1, or no=2. Smaller values are more positive, indicating the modules' objectives were clear and met. Students unanimously agreed that the Shop Skills module and Manufacturing Engineering Field Trip module had clear objectives that were met by the end of the module.

Table 2. High School Student Survey Results for Items 8 and 9

Question	Career Exploration (N=5) Mean, SD	Shop Skills (N=6) Mean, SD	Manufacturing Engineering Field Trip (N=6) Mean, SD
Were the objectives clear?	2.00, .00	1.00, .00	1.00, .00
At the end of the module, did you feel that you met the objectives?	1.20, .45	1.00, .00	1.00, .00

Students were asked three open-ended questions. Responses to these questions were analyzed for emergent themes. The themes and frequency of occurrence are presented for each question in Table 3. The responses may not sum to the number of participants because of non-response and/or multiple responses.

Table 3. High School Student Survey Results for Items 10, 11, and 12

Question	Career Exploration (N=5)	Shop Skills (N=6)	Manufacturing Engineering Field Trip (N=6)
What did you like best about the module?	• Future planning/career information (3) • Other (2): campus tour, H-7 timeline	• Using/seeing/understanding machines/technology (6)	• Future planning/career information (1) • Using/seeing/understanding machines/technology (3) • Visiting a factory (4)
What was the most important thing that you learned?	• Career information/variety/what's right for me/future planning (3) • Specifics about engineering/programming: work environment/pressure (2)	• How machines work/how to use machines (4) • Importance of safety (2) • Other (1): the Bridgeport	• Career information/variety/what's right for me/future planning (2) • Specifics about engineering/programming: work environment/pressure (2) • Manufacturing process/is a process (2) • How machines work/how to use machines (1) • Other (1): teamwork
What would you suggest to make the module better?	• Clearer/more specific instructions/explanation/ louder speakers (2) • More career information/job title lists/college offerings (3) • Good/no suggestions (1) • Other (1): more interaction	• Clearer/more specific instructions/explanations/ louder speakers (1) • More fun/useful projects/choice of projects/do a project at the factory (3) • Good/no suggestions (2) • Other (1): more time with each tool	• Clearer/more specific instructions/explanations/ louder speakers (2) • More fun/useful projects/choice of projects/do a project at the factory (1) • Good/no suggestions (1) • Other (3): need chairs, show more details on site, more actual machining

Summer Workshop Instructor Survey.

One instructor taught the three modules that were pilot tested, but only completed a survey for two modules, Shop Skills and Manufacturing Engineering Field Trip. It is not informative to report the instructor's responses in aggregate, given that only two modules were rated. PSCME module curriculum developers are encouraged to review the instructor's surveys in order to make module specific improvements. However, for both modules, this instructor's ratings ranged between "average" and "very good." The instructor reported the need to create additional materials for both modules, identified student gains, made suggestions for additions and deletions to the modules, identified challenges to using the modules, and made additional comments.

Educator Intern Workshop.

Twenty-seven instructors from a variety of disciplines and a variety of schools attended an Educator Intern Workshop facilitated by The Boeing Company. The educator interns teach in a variety of disciplines: English, Spanish, math, science, business, social studies, special education, computers/technology, leadership, career planning, media studies, construction, and automotive and small engine repairs. Each educator intern was assigned 1 or 2 modules to review using an MTAG Curriculum Evaluation Form. Educator interns reviewed the modules independently, or in a group of 2-3 people. At the conclusion of this process, educator interns completed a survey (see Appendix) assessing their perceptions of the curriculum modules that they had reviewed. Twenty-three educator intern surveys were completed. Two surveys were excluded from the analysis because one respondent indicated his/her ratings were based on perceptions of the module as if it had been revised, and the other survey was excluded because the respondent did not indicate which module was reviewed.

Of the original nineteen modules, nine were reviewed by the educator interns: Module 2) Interpersonal Effectiveness, Module 3) Safety in Manufacturing, Module 4) Hazardous Materials, Module 6) Career Exploration, Module 9) Total Quality Management (TQM), Module 11) Computer Applications, Module 13) Applied Mathematics, Module 14) Precision Measurement, and Module 18) Job Readiness. Respondents indicated their perceptions of each module on several criteria using a five-point scale (1=poor, 2=fair, 3=average, 4=good, 5=very good). Table 4 presents the rating criteria and the mean ratings with standard deviations for each module.

The most favorable ratings were allocated to module 3) Safety in Manufacturing, 9) Total Quality Management, and 14) Precision Measurement. The educator interns rated modules 6) Career Exploration and 11) Computer Applications least favorably. It is important to note that only one person rated module 9 and 14, and thus, the ratings represent one opinion.

Table 4. Educator Intern Survey Responses

Criteria (1=poor, 2=fair, 3=average, 4=good, 5=very good)	**Module Number* Mean (SD)**								
	2 n=2	**3 n=3**	**4 n=4**	**6 n=3**	**9 n=1**	**11 n=2**	**13 n=3**	**14 n=1**	**18 n=2**
Quality of learning activities in the module	4.00 (0)	4.00 (0)	3.75 (1.50)	2.00 (1.00)	5.00	1.00 (0)	3.00 (1.00)	3.00	3.50 (.71)
Module's ability to maintain students' interest	4.00 (0)	3.00 (1.00)	3.75 (1.50)	1.33 (.58)	4.00	1.00 (0)	2.00 (1.00)	5.00	3.50 (.71)
Accuracy of module content	4.00 (0)	4.33 (1.15)	3.50 (1.91)	1.67 (.58)	4.00	2.00 (1.41)	4.00 (0)	4.00	3.50 (.71)
Sequence of module activities builds conceptual understanding	3.00 (0)	4.00 (0)	2.75 (.96)	1.00 (0)	4.00	2.00 (1.41)	3.00 (0)	4.00	3.00 (0)
Module provides opportunities for students to apply new knowledge	3.00 (0)	3.67 (.58)	3.50 (1.29)	2.00 (1.00)	5.00	1.00 (0)	2.33 (.58)	3.00	3.50 (.71)
Module content's ability to address MTAG standards	4.00 (0)	4.33 (.58)	3.75 (1.50)	2.33 (.58)	4.00	1.50 (.71)	2.33 (.58)	5.00	4.00 (0)
Alignment of module objectives with module assessments	3.50 (.71)	3.67 (.58)	3.50 (1.29)	2.33 (.58)	3.00	1.00 (0)	3.33 (1.15)	4.00	3.50 (71)
Module's transferability to college-level instruction	2.50 (.71)	3.67 (1.15)	2.33 (1.52)	2.00 (1.73)	4.00	1.50 (.71)	2.00 (0)	4.00	3.00 (0)
Relevance to all students based on their own cultural/social experience	3.00 (0)	4.00 (1.00)	3.00 (1.83)	2.67 (1.15)	3.00	1.00 (0)	3.33 (.58)	4.00	5.00 (0)
Readiness of module for instruction	3.00 (1.41)	3.67 (.58)	3.00 (1.83)	1.33 (.58)	5.00	1.00 (0)	2.33 (.58)	4.00	2.50 (.71)
Clarity of module instructions for teachers	2.50 (.71)	4.33 (.58)	3.25 (1.50)	1.33 (.58)	4.00	1.00 (0)	3.33 (.58)	4.00	3.00 (0)
Flexibility of module for instructor modifications	3.50 (.71)	4.00 (1.00)	3.50 (1.29)	2.33 (.58)	3.00	1.00 (0)	3.33 (.58)	4.00	4.00 (0)
Module's usefulness as a teaching resource	4.00 (0)	4.00 (0)	3.25 (1.71)	2.00 (0)	5.00	1.00 (0)	2.67 (.58)	4.00	3.50 (.71)

*Module 2: Interpersonal Effectiveness, Module 3: Safety in Manufacturing, Module 4: Hazardous Materials, Module 6: Career Exploration, Module 9: Total Quality Management (TQM), Module11: Computer Applications, Module 13: Applied Mathematics, Module 14: Precision Measurement, and Module 18: Job Readiness.

Respondents could provide additional comments about the modules they reviewed. Comments were provided for modules 4, 6, 9, 11, 13, and 18 and they are summarized below.

Module 4: Hazardous Materials

- Good, needs sequencing work (2)
- Important topic, module needs strengthening (1)
- Rewrite, include higher levels of thinking and greater relevance (1)

Module 6: Career Exploration

- Base module on assessment tests (1)
- speakers need one hour each (1)
- should be exploratory not definitive (1)
- encourage students to leave comfort zones (1)

show students (hands-on) they have the ability for vocational fields (1)

Module 9: Total Quality Management

- Module's effectiveness depends on instructor's ability to lead discussions (1)

Module 11: Computer Applications

- Very poor: requires complete revision: too much material, too much lecturing, no resources (1)
- Break into 4/5 modules (1)
- Bring in more activities (1)
- Make suggested changes (1)

Module 13: Applied Mathematics

- Math problems were not applied (2)
- Could address more competencies (1)
- Grammatical/spelling errors (1)
- Few connections to core competencies (1)
- Handouts lacking/missing (1)

Module 18: Job Readiness

- Refine for post-secondary level and emphasize setting themselves apart from other applicants (1)

PSCME curriculum developers should consider making the modules more challenging for students, and implement specific suggestions for improvement made by the pilot instructor and the educator interns.

Assessment Rubric for Student Learning.

A National Visiting Committee (NVC) recommendation to the PSCME was to "Ensure that learning outcomes are measurable and student learning can be assessed." Toward this end, PSCME staff, the program evaluator, and other leaders have been involved in the development of a student assessment rubric. Two versions of the rubric have been developed and are being piloted by teachers. One rubric is scaled by competency and the other is scaled by activity. Interviews with teachers will take place this spring to gather perceptions on the usefulness of the rating scales and the preferred form. Briefly, the rubrics are presented below:

Total Quality Management Module – Ratings by Competency

1 =demonstrates poor understanding of core concepts	2 =demonstrates limited understanding of core concepts	3 =demonstrates good understanding of core concepts	4 = demonstrates excellent understanding of core concepts
• Cannot complete tasks • Makes frequent errors • Offers no suggestions	• can perform complete with supervision • makes occasional errors • offers suggestions	• can complete tasks without supervision • makes few errors • offers effective suggestions	• can teach tasks to others • makes no errors • offers creative & effective suggestions

Elicit Customer Needs (A)	1	2	3	4
Reason for Rating:				
Identify Group's Mission and Goals (D)	1	2	3	4
Reason for Rating:				
Explain Principles of Quality Improvement Programs (D)	1	2	3	4
Reason for Rating:				
Discuss Factors Affecting Customer Satisfaction (G)	1	2	3	4
Reason for Rating:				
State Roles of Designers, Engineers, and Technicians (I)	1	2	3	4
Reason for Rating:				
Class Participation	1	2	3	4
Reason for Rating:				
TOTAL SCORE				
Summary Comments:				

Total Quality Management Module – Ratings by Activity

1 =demonstrates poor understanding of core concepts	2 =demonstrates limited understanding of core concepts	3 =demonstrates good understanding of core concepts	4 = demonstrates excellent understanding of core concepts
• Cannot complete tasks • Makes frequent errors • Offers no suggestions	• can perform complete with supervision • makes occasional errors • offers suggestions	• can complete tasks without supervision • makes few errors • offers effective suggestions	• can teach tasks to others • makes no errors • offers creative & effective suggestions

Activity 1. Quality Criteria Group Reports (G)	1	2	3	4
Reason for Rating:				
Activity 2. Natural Toys Simulation: Writing Group Mission Statements (D, I)	1	2	3	4
Reason for Rating:				
Activity 3. Skill Check 2: Demonstrating Customer Focus (A, D)	1	2	3	4
Reason for Rating:				
Class Participation (A)	1	2	3	4
Reason for Rating:				
TOTAL SCORE				
Summary Comments:				

Manufacturing Curriculum Enhancement Program.

The National Science Foundation (NSF) authorized the funding of mini-grants to provide PSCME and MTAG community and technical colleges the opportunity to adopt the newly revised PSCME/MTAG manufacturing education modules into their education program. Funds available must be used for the enhancement of the college's manufacturing education programs. Eligible community and technical colleges had the opportunity to submit one request for up to $10,000. Specific program objectives can be focused on one, or combination, of the following areas:

- Curriculum review and revisions;
- Curriculum development needed to adapt the modules to the existing curriculum; and/or
- Development of programs for student recruitment and retention, especially for underrepresented populations

Proposals were submitted by: Lake Washington Technical College, Renton Technical College, Lower Columbia College, and the Museum of History and Industry. The PSCME program evaluator developed the following proposal evaluation criteria, and the PSCME review committee read and scored each proposal.

Proposal Evaluation Criteria

The following questions are designed to help identify the important elements for the proposals for the Manufacturing Curriculum Enhancement Program. Please circle your rating and explain your reason for your rating on each aspect.

1 represents the lowest and most negative impression on the scale,
3 represents an adequate impression, and
5 represents the highest and most positive impression

1. How well conceived and organized is the proposed activity?	1 2 3 4 5
Reason for rating:	
2. Will the proposed activity enhance the college's manufacturing education program?	1 2 3 4 5
Reason for rating:	
3. Are there sufficient resources within the college to carry out the proposal?	1 2 3 4 5
Reason for rating:	
4. How will the results be disseminated to others who would find them useful?	1 2 3 4 5
Reason for rating:	
5. How would the proposed activity broaden the participation of underrepresented students?	1 2 3 4 5
Reason for rating:	

Summary
With the above criteria in mind, please comment on any particular strengths of this proposal.
With the above criteria in mind, please comment on any particular weaknesses of this material.
After reviewing this material with only the above criteria in mind, _____ I recommend this proposal for funding. _____ I do not recommend this proposal for funding. Reviewer's Signature _____

Since the submission deadline, Lower Columbia College has decided not to participate. All other proposal ratings on each criteria and summary feedback were returned to the appropriate principle investigator. Each institution is currently taking steps to begin activities. PSCME will institute a second round of funding this spring with somewhat broader criteria.

Progress on Objective 3: Articulation

The PSCME has worked with industry partners, the MESA program, secondary schools and post-secondary institutions to attain its goals for articulation. The following sections report outcomes for articulation activities.

Student Field Trip to Edmonds Community College and Dillon Works.

The PSCME, 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. Fifteen students from the African American Academy attended the one-day field trip. 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 PSCME 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.

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 PSCME 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.

Students completed an end-of-field-trip survey at the end of the day (see Appendix). 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.

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 5 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, $\underline{M}$ = 3.87, $\underline{SD}$ = .35.

Table 5. 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
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 6 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 6. 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)

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.

SCORE Program Director Interviews.

The SCORE program is a one-day conference for junior and senior high school students of color. It is designed to be an opportunity for students of color to explore post-secondary educational opportunities, discuss relevant issues they may face as people of color, and it provides students with a network of community contacts for future reference. The program was marketed to recruit students not presently in leadership tracks and who are not already college bound. It is intended to be an opportunity for students to visit the Highline Community College campus, gain exposure to a variety of educational programs and careers, and gain information about "hot" jobs and the education necessary to obtain those jobs. Sixty-one students from four Highline Community College area high schools attended the program.

On February 6, 2003 and March 25, 2003 the director of the SCORE program at Highline Community College was interviewed. The interviews were conducted over the telephone and lasted approximately 15-20 minutes. The first interview occurred three weeks before the SCORE program had taken place, and the second interview was three weeks after the program occurred.

During the first interview, the following questions were asked: 1) What does the SCORE program entail?; 2) What is working?; 3) What have been some pitfalls?; 4) What recommendations would you have for someone developing a similar program? For the second interview, similar questions were asked: 5) What worked well?; 6) What did not work well?; 7) What recommendations do you have?

Responses were recorded in hand-written notes. The notes were analyzed inductively and substantive categories were developed. Rather than presenting the findings for each question, the results of the analysis are presented in four categories: 1) SCORE Program Description, 2) What Worked Well, 3) What Did Not Work Well, and 4) Director Recommendations.

1) SCORE Program Description

When implemented on February 28, 2003 the SCORE program began with a welcome speech. The welcome was followed by an energetic performance (e.g., step performance and slam poetry) intended to "hype-up" the students and put them at ease in the college environment. The high school students were then randomly assigned to small groups of 8-10 students led by current Highline Community College students. In the small groups, the Highline student leader facilitated a team building activity, led a discussion about the high school students' personal educational challenges and goals, and shared the story of their own path to college.

Once students became acquainted within the small groups, they attended two panel presentations. The first panel, Voices of Success, consisted of current Highline Community College students of color. These students were selected to represent a variety of paths to and through college to increase high school students' ability to connect their own experiences with those of a successful role model. The panelists varied in age and in their program of study. These students shared personal stories of their college paths; followed by a question and answer period. The second panel, Make it Happen, included two career counselors. The counselors provided students with detailed information about planning for the future (e.g., preparing for college, attending college, selecting a career).

Students were provided with a boxed-lunch. During the lunch break, the high school students and Highline students participated in an impromptu open-microphone session. Everyone was encouraged to demonstrate their talent (e.g., sing, dance, rap, tell a joke, etc.) to provide entertainment.

After the lunch break, the students individually selected two of seven workshops to attend. The seven workshops were: Applying to and Paying for College; From Two to Four: Differences Between Two- and Four-year Schools; College Athletics: The Myths, the Realities; Critical Moments; Marketing Yourself for Success; Technology Basics; Who am I? Understanding Racial Identity. The workshop sessions were followed by closing remarks, and then students departed for the bus back to their schools.

2) What Worked Well

With regard to planning the SCORE program, the director indicated that recruiting high school student participants was the greatest challenge. Personal contact with high school career counselors was the best strategy. The SCORE director met face-to-face with career counselors to inform them about the program and leave them with promotional brochures. She also offered to speak at assemblies, classes, student club meetings, and teacher meetings to promote the program. Another logistical element that worked well was the program's cost. There was no cost to the high schools or the individual students for participating. High school career counselors indicated that any cost, no matter how minimal, would have been prohibitive. Consequently, the SCORE program paid for the students' transportation and lunch.

Overall, the program exceeded the director's expectations. The high school students were very enthusiastic and attentive during the program. Randomly dividing students into small groups worked very well. Students were able to interact with students from other schools and learned about experiences other than their own and those of their friends. Interaction with the Highline Community College student leaders and the Voices of Success panelists was very beneficial. These interactions were very engaging for the students. It gave high school students the opportunity to relate their personal histories and experiences with those of successful college students which can make attending college seem like a more attainable goal.

The director reported that all seven workshops received high ratings on the program evaluation form. However, the most popular/most attended afternoon workshops were College Athletics: The Myths, the Realities and Who am I? Understanding Racial Identity.

Interestingly, the director commented that the highlight of the day was the impromptu open-microphone session. The entertainment kept the students active or attentive during the 45-minute lunch period. The director felt that a 45-minute lunch break without an activity would be too long, leaving the students idle, and potentially bored and restless.

3) What Did Not Work Well

As indicated above, recruitment of participants was the greatest challenge. Although planning for this event began in June 2002, participant recruitment could have been improved by occurring earlier. The promotional brochures were not ready until three weeks before the event, and thus, recruitment was late. The brochures were delayed because they contained the program schedule which had to be revised to coincide with the high school students' schedule. Consequently, program planning should have taken the participants' school schedule into account at the very beginning, and not after the day's events had been planned, scheduled, and printed on the brochures. The director was very pleased that 61 students attended, but the program could have accommodated 150 students and it was initially hoped that 100 students would participate. Being able to recruit earlier may have increased attendance.

The Make it Happen panel did not work as well as desired. This panel presentation included a lot of lecture material, and the students appeared bored. It may have worked better if the information was presented in a more interactive manner with a more motivational message.

Although the afternoon workshops were well attended, it appeared that students did not have enough information to make very informed workshop selections. It may have worked better to have more descriptive information provided for each workshop, and more active marketing of these sessions.

4) Director Recommendations

The director made several recommendations to improve the SCORE program and other similar programs based on general observations and reflections. First, given that this was the first year for the SCORE program, the director felt it was difficult to get schools interested and committed to participating because the program did not have an established reputation. Once high quality was assured at no cost, schools were very receptive to the program.

Second, the director suggested that high school principals be involved in student recruitment. Career counselors are the best resource for front-line contact with students. However, contacting both high school career counselors and their school principal increases the career counselor's accountability to follow through

with promised recruitment activities. Furthermore, recruitment efforts need to explicitly state that program activities pertain to the target minority populations while expressing that students from dominant groups are welcome. It should be noted, however, that dominant group students' information needs might not be met given the goals of the program.

A third recommendation pertains to logistical factors. More signs could have been posted on campus to direct the students' movement throughout the day. The director observed that high school students are accustomed to adults regulating their movement, and in the absence of these the controls, the students needed more signs indicating where they needed to be throughout the day. Students only required 5 minutes to move about campus to attend the next activity.

Finally, the high school students seemed very interested in the college cafeteria. Rather than providing a boxed-lunch, the director determined that future programs permit the students to order their lunch, as typical college students do, through the cafeteria. In addition to making the high school students' "college experience" more realistic, the director recommends this as a cost-savings strategy. For example, in the future, SCORE participants will be issued a $5.00 voucher for the cafeteria. The program is only charged for the number of vouchers remitted rather than for a pre-ordered number of boxed-lunches that are wasted if fewer than expected students arrive on the day of the program.

In summary, the director of the SCORE program at Highline Community College was very pleased with how well the program was attended and delivered. Successful program elements included: no participation fees, face-to-face contact with high school career counselors when recruiting participants, small group activities, interaction with Highline college students during the program, and the open-microphone lunch session. To improve this program, and other similar programs, recruitment activities should start earlier such as several months before the event, recruitment efforts should include school principals to improve accountability for recruitment follow-through, program scheduling needs to consider the restrictions of students' daily schedules, ample signage should be posted to better direct students' on-campus movement, information should be imparted by interactive methods as opposed to lecture formats, lunch breaks should be short (i.e., less than 45 minutes) or include an engaging activity, and lunch should be provided in a way that is more consistent with typical "college life."

Interestingly, some of these findings converge with those reported in PSCME student field trip outcomes. For instance, students that attended the field trips really enjoyed interacting with college students and engaging in interactive hands-on activities. Consequently, when planning future recruitment activities these factors should be given careful consideration as they seem to be important to students across contexts.

Interview with Washington State MESA Director.

In an effort to gather information that can guide PSCME planning, the MESA Director, Patricia MacGowan, was interviewed on September 16, 2003, concerning PSCME/MESA activities and suggestions for future collaboration. The following information is a summary of the interview:

Challenges for PSCME Leadership

From her experience, Patricia MacGowan noted two major challenges that PSCME Leadership will face as they go forward in the coming year. These challenges included:

- Curriculum and activities need to be based on and reinforce the concepts in the Essential Academic Learning Requirements (EALRs) of Washington State. These requirements are the basis for the state testing system, the Washington Assessment of Student Learning (WASL).

- High schools in Washington State have been reorganized according to the "Small Schools" concept. In this format, each large high school contains several smaller schools and/or academies, each with its own curriculum format and educational staff. The challenge for PSCME Leadership is to reach the teachers and students in all of the small schools/academies within each traditionally known high school.

Suggestions for PSCME Leadership

With these challenges noted, Patricia MacGowan provided many ideas for strategic activities that the PSCME could undertake. Suggestions included:

- *Discuss PSCME goals with MESA staff.* MESA staff need to understand the goals of the PSCME and why they are important. PSCME leadership can find a time to meet MESA staff and provide information. During this conversation, PSCME staff can also learn about MESA activities. Through this interaction, the programs can explore ways to collaborate and strengthen the use of resources.

- *A key strategy should be to "grow" Teacher Leaders.* MESA has cultivated a group of "champions" who they term Teacher Leaders. These teachers have been supported through MESA professional development activities. They become curriculum leads for MESA and use MESA curriculum materials in their own classrooms. Experienced Teacher Leaders also mentor other teachers as they begin to implement MESA curriculum in their own classrooms.

- *Host summer teacher institutes with stipends for teachers who participate.* The institute would introduce teachers to PSCME materials, gather feedback from teachers concerning how the materials could be used in the classroom, and then continue to support the teachers as they pilot the materials in the next academic year. Patricia MacGowan noted that it has become almost impossible to "pull teachers out of their classrooms" during the school year. Her suggestion would be to collaborate with MESA and include MESA Teacher Leaders as participants of the PSCME summer institutes. Patricia MacGowan noted that "many things are marketed to teachers" but what PSCME should do is help teachers select and use appropriate curriculum.

- *Develop strategies to impact student learning across grade levels.* Patricia MacGowan suggested development of an upper elementary strategy (grades 3-5), a middle level strategy (grades 6-8), an "early" high school strategy (grades 9-10), and an "upper" high school strategy (grades 11-12). Each strategy would include appropriate activities and emphasize particularly relevant concepts. For example, students in the early grades can be introduced to concepts through hands-on activities and field trips to interesting manufacturing sites. Middle school students can gain more in-depth understanding with activities that build on the upper elementary activities. Students in the early high school levels can learn about career options in manufacturing. Upper high school students need help with choosing postsecondary educational opportunities and applying for entrance to programs.

- *Create internships for high school students.* Patricia MacGowan noted that high school students are looking for internship opportunities, either in the summer or after school during the academic year. She stated that internships make a "huge impression" on students and can be a significant recruitment strategy.

- *Provide speakers for classrooms.* Teachers welcome the chance to invite knowledgeable, articulate speakers into their classrooms. Teachers may not understand manufacturing concepts or may not be knowledgeable about career opportunities. Dynamic speakers can provide this information in an inspiring, motivating style.

- *Plan field trips for students.* Patricia MacGowan noted that you "can't do too many field trips." Although it takes time and effort to plan field trips, there are considerable benefits. While on-site, students will meet diverse role models who can encourage them to explore careers in manufacturing.

The MESA program has successfully worked with teachers and schools for many years, and Patricia MacGowan provides excellent leadership. It will be beneficial to PSCME to not only build on MESA knowledge and activities, but also to plan collaborations that continue to enhance each program. PSCME Leadership should thoughtfully consider Patricia MacGowan's suggestions and work to strengthen ties between the programs.

PSCME Program Management and Dissemination Activities

NJCATE Convention Presentation.

The fourth annual conference on student recruitment and retention strategies for engineering technology, hosted by the New Jersey Center for Advanced Technological Education (NJATE), was held in Miami, Florida, on May 2-3, 2003. The PSCME program evaluators attended the convention and presented a session about the PSCME Focus Group Executive Summary. The presentation was well received and noted on the NJCATE website. The presentation included the following points:

The focus groups were conducted with: 1) women re-entering the workforce who were attending a YWCA employment program, 2) parents involved in the Mathematics, Engineering, Science Achievement (MESA) program, representing the general community, and 3) representatives from a variety of Puget Sound manufacturing industries. The groups varied in size (7-10), and participants were diverse with respect to age, race/ethnicity, and gender. The focus groups lasted 1-2 hours and addressed a variety of issues. The women's and parents' groups explored participants' perceptions of careers in manufacturing (e.g., stereotypes and areas of interest), barriers to pursuing these careers, and training opportunities. The industry representative group explored participants' expectations for the future of manufacturing and their attitudes, values, and ideas regarding the recruitment of women and diverse populations.

Participants in the women's and parents' groups reported that there is value in a career that goes beyond procuring money for survival. Careers, unlike jobs, can provide self-definition and personal fulfillment. When discussing manufacturing careers in particular, they were viewed both positively as a desirable career, and negatively as a "go nowhere" job. Both participant groups had little knowledge of, or experience with, the manufacturing industry, and consequently, many responses were based on negative stereotypes from North American culture as well as from exploitative labor practices in other countries. For instance, the manufacturing industry was associated with factories, hard labor, production, male-dominated workforces, regimented

schedules, job insecurity, low pay, little opportunity for advancement, and biases against women and people of diverse ethnic backgrounds. Participants expressed that their perceptions of manufacturing were dependent upon their exposure to the industry and their family employment history/values. More positively, management positions in manufacturing were regarded highly and were viewed as more financially and personally rewarding.

Participants identified many barriers to pursuing manufacturing careers such as a lack of knowledge about manufacturing industries and negative perceptions (e.g., stereotypes, frequent layoffs). Within the women's group, attention also focused on tangible barriers such as a lack of financial resources for training, childcare costs, transportation issues, and physical limitations (e.g., size, strength, age, disabilities). If a manufacturing career were to be pursued, both the women's group and the parents' group demonstrated a preference for upper-level positions and positions with many opportunities for advancement. A variety of manufacturing areas of interest were identified, with research and development common to both groups. Participants readily identified colleges, universities, and manufacturing companies as places to obtain training for manufacturing careers. On-the-job training and internships were considered very attractive training options. According to these participants, the cost and duration of training should be commensurate with income potential. Moreover, training facilities should be easily accessible (i.e., close to bus routes, provided online).

The industry representative focus group explored participants' thoughts on the future of manufacturing in Washington and qualities needed in future employees. First, there was some concern that lower level production may be at risk in this state, but technology skills required in assembly and manufacturing will be in demand. Consequently, the participants anticipate that manufacturing careers of the future will require individuals who are efficient, highly skilled, knowledgeable and experienced with computer technologies, and good communicators/team builders. Furthermore, future employees need to be flexible, life-long learners with competitive attitudes who are capable of big-picture thinking and problem solving. The industry representatives reported that there are many career paths available in manufacturing industries. Each path depends on an individual's desires and how each company encourages and develops its people. Presently, new employees are acquired from a variety of sources. Personnel are most frequently hired from college programs, the pool of temporary workers, former military personnel and from referrals by current employees. Participants felt there is no bias against women or people of diverse ethnic backgrounds in manufacturing industries. However, several other potential barriers to pursuing manufacturing careers were acknowledged including negative stereotypes, variable economic cycles, lack of public knowledge about the benefits of manufacturing careers, and poor marketing by the industry and educational institutions.

Based on the findings of the three focus groups, several recommendations were made. It was suggested that the manufacturing industry partner with educational institutions to provide financially feasible training opportunities such as internship programs. Marketing strategies need to be revised to dispel negative stereotypes and increase public knowledge of the benefits of manufacturing careers. Moreover, it was suggested that all recruitment and retention efforts should make a concerted effort to reach out to women and people of diverse ethnic backgrounds.

Collaboration on new NSF proposal.

PSCME leadership participated in the development of another NSF proposal submitted by Shoreline Community College. Program activities, outcomes, and evaluation methods are outlined in the chart below:

Program Activities	Program Outcomes	Evaluation Methods
Manufacturing Technology Articulation Council	Establish articulated degree structure with certificate-bearing learning module clusters	Yearly interviews with Council representatives concerning progress and outcomes
Statewide Conferences	Best practices and certification system disseminated	Survey of participants
Informational Resources	Information disseminated to a broader audience	Track website hits and material distribution, checking for increase in audience
Summer Seminars for Teacher Professional Development	Teacher use of best practices and module clusters	Survey of participants with follow-up interviews concerning implementation
Pilot Test Curriculum Modules	Student attainment of skills	Review student assessment results for curriculum modules
High School & College Career Counselor Activities	Increased awareness of career opportunities	Interviews with career counselors
MESA Program Collaboration	Increased student interest in educational and career opportunities	Survey of participants
Manufacturing Technology Summer Camps	Increased student interest in educational and career opportunities	Survey of participants
Public Service Announcements for Parents	Information disseminated to parents	Focus groups with parents of underrepresented students

National Visiting Committee.

At the end of the second year, PSCME once again hosted its National Visiting Committee. Presentations of yearly activities preceded discussions and suggestions for improvement. NVC members drafted a summary report of the visit and recommendations for PSCME leadership. As part of the PSCME year 3 evaluation plan, strategies that address these recommendations will be documented during year. NVC recommendations include:

Objective 1 – Manufacturing Technology Curriculum

1. Incorporate learning centered pedagogy that included troubleshooting, problem solving, and advanced levels of Blooms Taxonomy in both the MTAG and PSCME modules. (Increase challenge)
2. Continue to explore certification of high school students in manufacturing technology in conjunction with OSPI, MTAG, and industry. This certification would identify student skill levels and competencies in specific skill set areas.
3. Establish a continuous quality control method.
4. Incorporate learning strategies for underrepresented populations based on beta testing and evaluate the need for adjusting the curriculum for these groups.
5. Create a module introduction or "TREE Sequence" that informs users of prerequisite knowledge/skill. This would assist users to effectively use the module.
6. Specify the ultimate deliverables of the project and describe progress towards their development.

7. Identify how and what curriculum deliverables will be sustained upon completion of the grant cycle.
8. Ensure that learning outcomes are measurable and student learning can be assessed.

Objective 2 – Professional Development

1. Partner with MTAG to develop a sustainable professional development plan for teachers utilizing the new curriculum.
2. Determine a method for evaluating whether the professional development is making an impact on the teachers and/or in the schools.

Objective 3 – Articulation

1. Utilize industry and academic partners in articulation planning and development.
2. Finalize student internship module.
3. If certification of students in manufacturing technology is established in conjunction with OSPI, community colleges, MTAG, and industry, pursue articulation agreements with and between the colleges.
4. Evaluate effectiveness of year 3 articulation activities.

Management

1. Utilize input from NVC and Advisory Committee to focus and enhance program development.
2. Define Shoreline CC personnel and program contributions. Be sure this defines specifically how SCC met the required match for the grant.
3. Clearly define sustainability plan for the deliverables of this project.
4. Ensure by the end of the grant cycle the team has met all grant objectives.
5. Stabilize space, support and reporting functions with Shoreline CC administration.

PSCME Activities Planned for this Year

PSCME leadership is actively pursuing the implementation and integration of PSCME/MTAG modules in area schools. Professional development for teachers will be ongoing during the year, as will articulation activities to ensure sustainability of program accomplishments.

Teachers from Oak Harbor and Anacortes are piloting ten modules this spring. Those who are piloting curriculum modules will participate in follow up interviews to investigate curriculum integration and delivery. Student assessments will be reviewed for learning outcomes and achievement of students from underrepresented groups. A transcript for students who complete the modules will be developed to document student progress, outcomes, and certification.

Teacher training sessions will be held as part of PSCME professional development activities this spring. Teachers will participate in several module activities, and will discuss implementation of the curriculum at their schools. Participants will be surveyed concerning satisfaction, outcomes of the professional development activities, and plans for curriculum integration of PSCME/MTAG modules.

School counselors will be invited to an information session this spring. Presentations will include an overview of the PSCME/MTAG curriculum, manufacturing examples, focus group information on career choices and

industry needs, and specific information concerning the proposed career exploration module. PSCME leaders agree that counselors should be included in the final development stage of the Career Pathways module.

Partner colleges and institutions that were granted funding under the PSCME mini-proposals will report this spring on their efforts, with final reporting in June. Both Renton and Lake Washington Technical Colleges are pilot testing modules. Interviews with instructors at each college will be conducted concerning outcomes and program integration. Additionally, the Museum of History and Industry is enhancing at least three modules by providing virtual workplace tours using streaming video.

PSCME Strategic Plan Goals for this Year:

Manufacturing Technology Curriculum

1. Finalize PSCME modules for validated curriculum gaps.
2. Develop a "tree" model showing the relationship between modules.
3. Create curriculum in a user-friendly format that incorporates learning centered pedagogy, including problem solving and troubleshooting and increased challenges for students.
4. Incorporate learning strategies for underrepresented groups.
5. Develop a model for continuous feedback and quality control for modules.
6. Complete pilot testing of curriculum in conjunction with MTAG.
7. Develop model for certification program for students in manufacturing technology in conjunction with OSPI, identifying specific student skills and competencies needed.
8. Identify how and what curriculum deliverables will be sustained upon completion of the grant cycle.
9. Ensure that learning outcomes are measurable and student learning can be assessed.
10. Complete full evaluation of curriculum program successes.

Professional Development

1. Offer institutes for MTAG high school and community/technical college instructors.
2. Partner with MTAG to develop a sustainable professional development plan for teachers utilizing the new curriculum.
3. Determine a method for evaluating whether the professional development is making an impact on the teachers and/or in the schools.
4. Offer institutes for MTAG high school and community/technical college instructors.
5. Evaluate program success in teacher training and develop model for follow-on activities.

Articulation

1. Utilize industry and academic partners in articulation planning and development.
2. If certification of students in manufacturing technology is established in conjunction with OSPI, community colleges, MTAG, and industry, develop model articulation agreements with and between the colleges.
3. Develop career map/pathway for students and counselors.
4. Complete student internship module.
5. Evaluate success of program articulation among program customers and potential for future program sustainability.

Management

1. Seek second round of NSF funding for PSCME project.
2. Utilize input from NVC and Advisory Committee to focus and enhance program development.

3. Define Shoreline CC personnel and program contributions. Be sure this defines specifically how SCC met the required match for the grant.
4. Clearly define sustainability plan for the deliverables of this project.
5. Ensure by the end of the grant cycle the team has met all grant objectives (ultimate deliverables document).
6. Develop college grant program for dissemination.
7. Stabilize space, support and reporting functions with Shoreline CC administration.
8. Organize and offer instructor summer institute.
9. Host final NVC meeting.
10. Complete final report.

Conclusion

The PSCME core staff is composed of knowledgeable, innovative team members. Strategic planning in years two and three has helped to focus activities and has led to task completion. Recently, a change in leadership has been the impetus for new management strategies. Weekly updates from staff and monthly leadership meetings are new activities that will support timely program conclusion. The final year's challenge is to provide for sustainability of projects and to actively pursue dissemination activities.

Recommendation

It is recommended that PSCME core staff thoroughly review participants' comments from previous evaluation activities that are included in this report. Carefully considering the results of surveys and interviews will allow staff to make data-based decisions for program improvement in this final year.

Appendix

Puget Sound Consortium for Manufacturing Excellence (PSCME)
Module Curriculum Student Survey

We would like to ask you questions about the PSCME Module Curriculum so we can make it 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 PSCME Module Curriculum developers. 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? **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. The module you participated in was: **CAREER EXPLORATION**

5. How challenging was the module?

   VERY UNCHALLENGING **UNCHALLENGING** **CHALLENGING** **VERY CHALLENGING**

6. How effective were the module exercises in helping you learn the material?

   VERY INEFFECTIVE **INEFFECTIVE** **EFFECTIVE** **VERY EFFECTIVE**

7. How easy was it to stay focused on the module?

   VERY DIFFICULT **DIFFICULT** **EASY** **VERY EASY**

8. Were the objectives clear? **YES** **NO**

9. At the end of the module, did you feel that you met the objectives? **YES** **NO**

10. What did you like best about the module?

11. What was the most important thing that you learned?

12. What would you suggest to make the module better.

Puget Sound Consortium for Manufacturing Excellence (PSCME)
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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. The module you participated in was: **SHOP SKILLS**

5. How challenging was the module?

   VERY UNCHALLENGING **UNCHALLENGING** **CHALLENGING** **VERY CHALLENGING**

6. How effective were the module exercises in helping you learn the material?

   VERY INEFFECTIVE **INEFFECTIVE** **EFFECTIVE** **VERY EFFECTIVE**

7. How easy was it to stay focused on the module?

   VERY DIFFICULT **DIFFICULT** **EASY** **VERY EASY**

8. Were the objectives clear? **YES** **NO**

9. At the end of the module, did you feel that you met the objectives? **YES** **NO**

10. What did you like best about the module?

11. What was the most important thing that you learned?

12. What would you suggest to make the module better.

Puget Sound Consortium for Manufacturing Excellence (PSCME)
Module Curriculum Student Survey

We would like to ask you questions about the PSCME Module Curriculum so we can make it 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 PSCME Module Curriculum developers. 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? **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. The module you participated in was: **MANUFACTURING ENGINEERING FIELD TRIP**

5. How challenging was the module?

   VERY UNCHALLENGING **UNCHALLENGING** **CHALLENGING** **VERY CHALLENGING**

6. How effective were the module exercises in helping you learn the material?

   VERY INEFFECTIVE **INEFFECTIVE** **EFFECTIVE** **VERY EFFECTIVE**

7. How easy was it to stay focused on the module?

   VERY DIFFICULT **DIFFICULT** **EASY** **VERY EASY**

8. Were the objectives clear? **YES** **NO**

9. At the end of the module, did you feel that you met the objectives? **YES** **NO**

10. What did you like best about the module?

11. What was the most important thing that you learned?

12. What would you suggest to make the module better.

PUGET SOUND CONSORTIUM FOR MANUFACTURING EXCELLENCE (PSCME)

MODULE CURRICULUM TEACHER SURVEY

This questionnaire is intended to provide information for PSCME planning and continued refinement of the Module Curriculum. Responses to the survey will be summarized by the UW Office of Educational Assessment.

Question 1:
Which module did you teach: (Circle one.)

Career Exploration ***Manufacturing Engineering Field Trip*** ***Shop Skills***

Questions 2-14: Please indicate your perceptions the module on the following scale.

	Poor		Fair	Average	Good	Very Good
3.	*Quality of learning activities in the module:*	*1*	*2*	*3*	*4*	*5*
4.	*Module's ability to maintain students' interest:*	*1*	*2*	*3*	*4*	*5*
5.	*Accuracy of module content:*	*1*	*2*	*3*	*4*	*5*
6.	*Sequence of module activities builds conceptual understanding:*	*1*	*2*	*3*	*4*	*5*
7.	*Module provides opportunities for students to apply new knowledge:*	*1*	*2*	*3*	*4*	*5*
8.	*Module content's ability to address MTAG standards:*	*1*	*2*	*3*	*4*	*5*
9.	*Alignment of module objectives with student assessments:*	*1*	*2*	*3*	*4*	*5*
10.	*Module's transferability to college-level instruction:*	*1*	*2*	*3*	*4*	*5*
11.	*Relevance to all students based on their own cultural/social experience:*	*1*	*2*	*3*	*4*	*5*
12.	*Readiness of module for instruction:*	*1*	*2*	*3*	*4*	*5*
13.	*Clarity of module instructions for teachers:*	*1*	*2*	*3*	*4*	*5*
14.	*Flexibility of module for instructor modifications:*	*1*	*2*	*3*	*4*	*5*
15.	*Module's usefulness as a teaching resource:*	*1*	*2*	*3*	*4*	*5*

Please respond to the following questions. Your comments are greatly appreciated!

15. Was it necessary for you to create materials to use with the module? If so, why and what did you create?

16. From your perspective, what did your students gain from the module?

17. What could be added to the module (please specify which module)?

18. What could be deleted from the module (please specify which module)?

19. What were the challenges of using the module (please specify which module)?

Additional comments on module: (Please include any comments students made while working on module activities.)

PUGET SOUND CONSORTIUM FOR MANUFACTURING EXCELLENCE (PSCME) AND MANUFACTURING TECHNOLOGY ADVISORY GROUP

MODULE CURRICULUM EDUCATOR INTERNS SURVEY

This questionnaire is intended to provide information for PSCME planning and continued refinement of the Module Curriculum. Responses to the survey will be summarized by the UW Office of Educational Assessment.

Question 1: Which module did you review? (Circle one)

- *MTAG Orientation*
- *Interpersonal Effectiveness*
- *Safety in Manufacturing*
- *Hazardous Materials*
- *Introduction to Manufacturing*
- *Career Exploration*
- *Manufacturing Engineering Field Trip*
- *Quality and the Customer*
- *Total Quality Management (TQM)*
- *Statistical Process Control*
- *Computer Applications*
- *Technical Drawing Interpretation*
- *Applied Mathematics*
- *Precision Measurement*
- *Manufacturing Planning*
- *Labor in Industry*
- *Shop Skills*
- *Job Readiness*
- *Capstone Project*

Question 2: Please list the categories of subjects you teach (i.e., math, science, computers, English):

_____ _____

_____

Questions 3-15: Please indicate your perceptions the module on the following scale.

Poor Good		Fair	Average	Good	Very
16.	*Quality of learning activities in the module:*	*1*	*2*	*3*	*4*	*5*
17.	*Module's ability to maintain students' interest:*	*1*	*2*	*3*	*4*	*5*
18.	*Accuracy of module content:*	*1*	*2*	*3*	*4*	*5*
19.	*Sequence of module activities builds conceptual understanding:*	*1*	*2*	*3*	*4*	*5*
20.	*Module provides opportunities for students to apply new knowledge:*	*1*	*2*	*3*	*4*	*5*
21.	*Module content's ability to address MTAG standards:*	*1*	*2*	*3*	*4*	*5*
22.	*Alignment of module objectives with student assessments:*	*1*	*2*	*3*	*4*	*5*
23.	*Module's transferability to college-level instruction:*	*1*	*2*	*3*	*4*	*5*
24.	*Relevance to all students based on their own cultural/social experience:*	*1*	*2*	*3*	*4*	*5*
25.	*Readiness of module for instruction:*	*1*	*2*	*3*	*4*	*5*
26.	*Clarity of module instructions for teachers:*	*1*	*2*	*3*	*4*	*5*
27.	*Flexibility of module for instructor modifications:*	*1*	*2*	*3*	*4*	*5*
28.	*Module's usefulness as a teaching resource:*	*1*	*2*	*3*	*4*	*5*

Question 16: Additional comments?

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

We would like to ask you questions about the PSCME/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 PSCME 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.

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

5. 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)**

6. Your Gender: **MALE** **FEMALE**

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

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

7. 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.