

2023-24 Program Review

Program Name: Physics
Program Contact: David Locke
Academic Year: 2023-24
Status: In Progress
Updated on: 27 Sept 2023

INTRODUCTION: WHAT IS PROGRAM REVIEW FOR?

The goal of program review is to assess how well our programs are doing. Program review asks us to:

- Reflect on the state of student learning or support in our disciplines and programs, by discussing:
 - efforts to achieve equity across student populations and modes of delivery;
 - results of assessment activities aimed at improving or researching student learning;
 - new challenges or changes to the program.
- Identify resources that we need to change and improve.

Though program review is tied to accreditation, ultimately, we want program review to be meaningful for us. This means we want to use program review to highlight and celebrate what is working, identify what isn't and to figure out what we can do about it. Program review also provides an opportunity to assess how those things work in practice, and work to improve our practices to be able to serve our students even better. It also serves to create cross-campus understanding and dialogue and make more informed decisions in our teaching and programs. Program review is also an opportunity to advocate for change and for resources by showing need and equity issues that we need additional support to be able to address.

1. Description of Program (200-400 words)

- Provide a brief description of the program and how it supports the following:
 - [CSM Mission and Values Statements](#)
 - [CSM Statement of Solidarity](#)
 - [CSM's Strategic Priorities](#)
 - [SMCCCD's Strategic Goals](#)
 - [CSM Forward 2028 - Education Master Plan](#)
- Identify any factors, including federal, state, or local initiatives, that have impacted the program and the students served

The Physics Program at College of San Mateo supports students in STEM fields by providing a 2-semester and a 3-semester lower division physics sequence applicable to both AS, AS-T and BS degrees at UCs, CSUs and many private universities. The program also supports students obtaining non-STEM field degrees by offering options for completing natural science general education requirements.

Currently, the program's primary course offerings (The PHYS 250/26/270 sequence and the PHYS 210/220 sequence) are offered in two modalities:

1. In-person classes taught during the day.

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2. Fully online synchronous or partially synchronous evening courses.

In addition to these offerings, the department offers several asynchronous online courses (PHYS 100, 211, and 221) that either supplement the above courses or provide general education targeted at non-STEM majors. The department's goal in offering our course courses in multiple modalities is to make our classes accessible to the widest possible range of students, in accordance with CSM's institutional priority 3.

The physics department aims to ensure equity, social justice, and completion for groups traditionally underrepresented in the physical sciences and engineering. To achieve these goals, the department continues to develop its instructional approaches informed by pedagogical research on teaching methods that foster equity and inclusion. These methods include active learning¹ and group work, such as data tasks², designed to foster students' senses of belonging and identification as scientists. Department faculty are actively participating in initiatives such as the Science Faculty Institute for Teaching and Learning (SFIT) to further develop their skills in this area. These efforts correspond directly to CSM's institutional priority 1.

Further support for fostering equity, social justice, and completion, has been provided outside the classroom through faculty participation in supplemental programs such as Academic Excellence workshops and Physics Jam, which help students review math concepts and prepare for or get extra help in physics courses. Faculty have also assisted students in the program by holding office hours in the Integrated Science Center. Department partnerships with MESA and METaS have been an integral part of striving for equity for our students, both inside and outside the classroom.

Though, as the data discussed below will show, there has been improvement in equitable outcomes for some underrepresented groups in physics classes, we still have room for growth. An immediate challenge that disproportionately affects disadvantaged populations is the additional costs of laboratory kits and other electronic equipment for needed for our online classes. Funding and logistical support for lending these kits to students free of charge would help alleviate these issues. Bigger picture challenges include finding ways to continue to improve success rates for students from underrepresented groups in our classes, and also finding ways to recruit more students from these groups to attend department classes to begin with.

The Drone Mapping Club, advised by a departmental faculty, works with partners at SFSU to involve CSM students academic research. This partnership with a 4-year institution is in line with CSM's institutional priority 2, and, through its public visibility and providing the opportunity for students to immediately conduct hands-on academic research, helps to recruit students from underrepresented groups into the physical sciences.

References

1. Freeman, Scott et al. "Active learning increases student performance in science, engineering, and mathematics." *Proceedings of the National Academy of Sciences of the United States of America* vol. 111,23 (2014): 8410-5. doi:10.1073/pnas.1319030111
2. Bustos-Works, C. et al. "Moving Toward Inclusivity in Chemistry by Developing Data-Based Instructional Tasks Aimed at Increasing Students' Self-Perception as Capable

Learners Who Belong in STEM.” Journal of Chemical Education vol. 99,1 (2022): 177-184. doi: 10.1021/acs.jchemed.1c00366

2. Results of Previous Program Review (200-500 words)

- a) Describe the results of your previous Program Review’s action plan and identified equity gaps.
- Previous Goals
 - Results Achieved
 - Changes Implemented
 - Plans still in progress
 - Any notable or surprising results and outcomes

Plan Goal: Reduce racial equity gap in success rates. Improve overall success rates.

Three action steps were planned for this goal:

Action 1: The department’s primary strategy for addressing equity gaps and improving success has been to provide more supplemental instruction to students through the tutoring available at the ISC and learning center and SI leaders. In addition, the department, funded by the Metas grant, has offered the “Physics Jam” preparatory workshop to students free of charge prior to each semester for interested students over the past two years. The department plans to continue these as funding allows and plans to begin offering our companion courses 880MC and 880MD as supplemental courses.

Action 2: Further action steps in our plans were to implement “Honors” Physics Jams throughout the course of the semester. These Physics Jams will occur every Friday, and will focus on providing additional challenge and context for the core physics courses. The model for these advanced Physics Jams is the Treisman model for supplemental honors sections, which improved success rates in calculus classes among African-American students.

Action 3: Alex Wong will, if accepted, participate in the Open for Antiracism in California Community Colleges (OFAR) program in 2021-2022. As part of this program, he will “create an individual action plan for the spring term, to integrate OER and open pedagogy as a way to make teaching and learning explicitly antiracist”. This action plan will be applied to PHYS 260.

Prof. Wong will also disseminate the techniques used in the OFAR program to colleagues in the physics department, primarily through their participation in the Science Faculty Institute for Teaching and Learning (SFIT), which will begin in Fall 2022.

Results achieved: Although the Metas grant has ended, funding for the “Physics Jam” has continued with MESA funding. The department has shifted from offering the 880 companion courses developed and the “Honors” Physics Jams to offering weekly Friday Academic Excellence Workshops (AEWs) each semester. Ideally, if funding allowed, we would develop separate Academic Excellence Workshops for each course. The workshops offer a relaxed environment for support and community building as students practice the skills they are learning in their Physics classes.

This altered plan is ongoing. And, with the shift to the AEWs, we need to consider the best way to collect data to analyze the benefit the AEWs may be providing.

Alex Wong was not accepted to the OFAR program. However, in coordination with Paul Hankamp in the Biology department. Prof. Wong has cofacilitated the SFIT program in Fall 2022 and now in Fall 2023. The SFIT program aims to help STEM faculty develop their pedagogical approaches to better foster equity in STEM classes by supporting evidence-based pedagogical projects and building community between colleagues. Prof. Wong is currently a participant, as well as cofacilitator, in this program.

Plan Goal: Improve available resources for remote students to reduce equity gaps.

Action: Acquire equipment for students to borrow, free of charge, in remote classes. These include:

Lab kits

Tablets (for participating in whiteboarding activities and otherwise communicating electronically).

Results achieved: Wacom tablets are now available for students to check out from the library. These can be quite essential in Physics classes, since drawings and sketches are an important live activity in online synchronous classes. The tablets allow for full participation for students who may not otherwise be able to participate as fully as other students.

The department is further pursuing providing lab kits available for check out from the library for students in online classes.

- b) Explain any curriculum or programmatic changes since last program review
- To specific courses, or to any discipline as a whole
 - Includes degree, certificate, or course sequences, program delivery or structure, etc.

Compared to Fall 2021 when all but one hybrid section in Physics was taught fully remotely, we are now offering a balance of in-person and remote learning options for students.

Students can complete the Physics 250-260-270 sequence in-person or fully remotely. Physics 250 has remote sections every Fall and Spring semester. Physics 260 is

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offered with a remote section every Fall semester and Physics 270 is offered with a remote section every Spring semester.

Students can also complete the Physics 210-220 sequence in-person or fully remotely. Physics 210 is offered with an online section every Fall semester. Physics 220 is offered only in Spring (in-person) and in Summer (fully remotely).

For students transferring to UC, the Physics 210-211-220-221 sequence is offered with Physics 211 and 221 being offered only as remote courses.

- c) Discipline-level and SLO (Student Learning Outcomes) assessment/Student Services and SAO (Service Area Outcomes) assessment: Describe learning or area assessment plans implemented since last Program Review, including any activities undertaken to address equity or delivery mode gaps. Your summary should explain:

- SLO/SAO
 - What did the assessment focus on?
 - Was it discipline/program/service-specific or interdisciplinary/a collaboration between programs or services?
 - Why was it prioritized (e.g., equity issue, key disciplinary issue, etc.)?
- Assessment results
 - What was the activity or intervention?
 - What were the outcomes?
- Program improvements implemented
 - What did you learn from it?
- What changed?

We are currently developing common assessment questions with accompanying rubrics for Physics 250 and Physics 260 to be asked on an exam in all sections. Assessment of the SLOs would be done by applying a common rubric to the assessment question. We will assess Physics 260 this semester and Physics 250 in the Spring 2024 semester.

3. Current Program Review (200-400 words)

Please use the statistics below, which are college-wide, as a reference. Please refer to the Program Review website for individual program data.

College Stats 2022-23	Ethnicity	First Gen	Age	Gender	Total
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<p>Headcount (unduplicated)</p>	<p>Latinx 32% White 26% Asian 20% Filipino 7% Multiracial 7% Black 3% Pacific Islander 2% Unknown 3% Native American 0%</p>	<p>45% of our students are the first in their family to go to college.</p>	<p>66% 24 yrs. and under 18% Ages 25-34 17% over 35 yrs.</p>	<p>49% Female 48% Male 3% Non-disclosed or non-binary</p>	<p>13,180 students</p>
<p>Enrollments (duplicated)</p>	<p>Latinx 35% White 26% Asian 16% Filipino 6% Multiracial 8% Black 3% Pacific Islander 3% Unknown 3% Native American 0%</p>	<p>47% of enrollments were by students who are the first in their family to go to college.</p>	<p>76% 24 yrs. and under 13% Ages 25-34 11% over 35 yrs.</p>	<p>48% Female 50% Male 2% Non-disclosed or non-binary</p>	<p>37,014 enrollments</p>

- a) **Student population equity:** Discuss any gaps in student success, persistence, satisfaction, utilization or enrollment across student populations (statistics provided for ethnicity, first-generation, age, gender and total enrollment), or student population served.
- Findings: What has changed from the previous program review?
 - Analysis: What factors do you feel contribute to these gaps?
 - Resources: If you were granted a resource request, please note what that was and the impact it had.
 - Plans to address opportunity gaps: What has your program done to address these gaps? Include information on:
 - interventions implemented
 - any successes in closing gaps
 - ongoing challenges

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Findings	Analysis	Resources	Plans to Address Opportunity Gaps												
<p>1. Hispanic, Filipino and 1st generation student success rates have improved from pre-pandemic numbers, but for Hispanic and Filipino students they are still below the departmental average.</p>	<p>The table below shows 18-19 and 22-23 success rates for Hispanic, Filipino, and 1st generation students. (We consider these years because the 20-21 and 21-22 data was heavily impacted by Covid-era policies).</p> <table border="1" data-bbox="399 516 833 632"> <thead> <tr> <th></th> <th>Hisp.</th> <th>Fil</th> <th>1st Gen</th> </tr> </thead> <tbody> <tr> <td>18-19</td> <td>55%</td> <td>42%</td> <td>50%</td> </tr> <tr> <td>22-23</td> <td>66%</td> <td>50%</td> <td>69%</td> </tr> </tbody> </table> <p>Overall departmental success rates barely changed (69% and 70% for 18-19 and 22-23, respectively), so this data represents a reduction of equity gaps. 1st generation students now have success rates only slightly lower than non-1st generation students (69% versus 73%). However, Hispanic and Filipino students continue to have lower success rates than the departmental average.</p> <p>Students from smaller demographic groups were not included in the above analysis due to small sample size.</p>		Hisp.	Fil	1 st Gen	18-19	55%	42%	50%	22-23	66%	50%	69%		<p>Departmental faculty will continue to participate in equity-focused professional development such as the SFIT program, which we expect will continue to improve equity in our classes. The Department will continue to collaborate with the Title V and MESA grants to provide support for underrepresented groups in physics such as continued academic excellence workshops, tutoring, embedded tutors, etc. Get funds, potentially from MESA, Title V, or other sources to hire embedded tutors to provide coaching to students.</p>
	Hisp.	Fil	1 st Gen												
18-19	55%	42%	50%												
22-23	66%	50%	69%												
<p>2. Success rates for students with disabilities continue to lag behind departmental averages.</p>	<p>Students with disabilities had a 61% success rate in 22-23, as compared to a 71% success rate for students without disabilities. This 10-point gap is similar to the gap in the pre-covid 18-19 school year.</p>		<p>Departmental faculty will continue to participate in equity-focused professional development such as the SFIT program, which we expect will continue to improve equity in our classes. Departmental faculty will work actively with the Disabilities Resource Center to identify potential causes of this equity gap and methods for addressing them.</p>												
<p>3. Enrollment of Hispanic students in physics classes has increased significantly compared to pre-covid numbers, but is still low compared to the college-wide</p>	<p>The table below shows 18-19 and 22-23 enrollment percentages for Hispanic students and females. (We consider these years because the 20-21 and 21-22 data was heavily impacted by Covid-era policies).</p> <table border="1" data-bbox="399 1839 721 1875"> <thead> <tr> <th></th> <th>Hisp.</th> <th>Females</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Hisp.	Females					<p>The department will continue to work with the Title V and MESA grants to provide programming that may attract students from underrepresented groups. Outreach from Departmental activities like the Drone Mapping Club and Family Science Day can also help draw more students from underrepresented groups into</p>						
	Hisp.	Females													

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population. Females continue to be underrepresented in physics classes.	18-19	13%	31%		physics classes. The department will request funds for reassign time to develop a new, project-based, curriculum for PHYS 100 that might attract students who otherwise would not consider a physics class or continue on in physics.
	22-23	25%	33%		
	Substantial progress has been made in enrollment rates for Hispanic students, although they still fall short of CSM as a whole (35%).				
	Students from smaller demographic groups were not included in the above analysis due to small sample size.				

b) **Modes of Delivery equity:** Discuss any gaps in student success, persistence, satisfaction, utilization or enrollment, and student population served across different delivery modes. Please comment on in person services/instruction vs hybrid services options/instruction vs completely online services/instruction.

- Changes since last Program Review: What has changed, in terms of gaps, since last program review?
- Analysis of gaps: What factors do you feel contribute to these gaps?
- Plans to address opportunity gaps: What has your program done to address these equity gaps? Include information on:
 - interventions implemented
 - any successes in closing gaps
 - ongoing challenges

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Changes since last Program Review	Analysis of Gaps	Plans to Address Opportunity Gaps
1. n/a: Last program review lacked data.	From Spring 2021 to Spring 2023, overall success rates in online classes lagged behind those in in-person classes, 70% to 79%.	Faculty will continue professional development aimed at improving online pedagogy such as QOTL2 and the SFIT program. The department will request funding and logistical support for free lab kit loans to low-income students.
2. n/a: Last program review lacked data.	Asian students have especially large success rate drops in online classes, with success rates 14% and 16% lower in online (as compared to in-person) classes for domestic and international Asian students respectively.	Faculty will continue professional development aimed at improving online pedagogy such as QOTL2 and the SFIT program. For international students, the department will request funding for captioning of videos and other support for students whose first language is not English.
3.		

(c) **Challenges and Opportunities:** Describe any **other** particular challenges, opportunities, or other factors that impact the success of your program (e.g., natural or health disasters, assessing whether a degree program is meeting its learning outcomes, developing new degree programs or courses, adapting to a changing student population, keeping a flagging program alive, starting a learning community, resources, etc.).

The department's enrollment has increased from an average of 338 enrollments in the 20-21 and 21-22 academic years to 420 enrollments in the 22-23 academic year. Nevertheless, the department's enrollment has not fully rebounded to pre-pandemic levels, with enrollments still substantially below the 594 enrollments recorded in the 18-19 academic year. However, given that many of the department's classes require substantial pre-requisites, and are offered in two and three semester sequences, the continued low enrollment numbers may be largely attributable to the delayed effects of dramatic enrollment drops in the covid-impacted 20-21 and 21-22 academic years. Large incoming cohorts of both in-person and online PHYS 250 and PHYS 210 classes make us optimistic that enrollment will continue to rebound.

Last year, one of the department's full-time members retired, and was not replaced. The lower enrollment numbers and the availability of a full-time astronomy faculty to teach some of our classes have enabled us to manage with two full-time faculty, but if enrollment continues to rebound, an additional full-time faculty position will be required in the future.

The department is increasingly concerned about the validity of online course grades, as secure tests are difficult to administer online, particularly with the rapid improvement of artificial intelligence. Given that higher levels of physics and engineering courses very frequently require testing, the department does not feel that eliminating testing is an option that would ensure proper preparation of our graduates for transfer. The department would like to encourage the College to provide secure facilities in which online students can take tests, and would further encourage the College to work with other institutions to provide similar facilities at other locations for students learning from a distance. We would also like the College to work to implement a class modality that has online instruction but requires in-person tests.

4. Planning

a) **Discipline-level and SLO (Student Learning Outcomes) assessment/Student Services and SAO (Service Area Outcomes) assessment for 2023-2025:** Describe learning or area assessment plans for this Program Review cycle, **including any activities planned to address equity or delivery mode gaps.** Your summary should explain:

- SLO/SAO
 - What will your assessment focus on?
 - Is it discipline/program/service-specific or will it be interdisciplinary/a collaboration between programs or services?
 - Why is it prioritized (e.g., equity issue, key disciplinary issue, etc.)?
- Assessment plan
 - What is the planned activity or intervention?
 - Describe next steps and the timeline for your SLO/SAO assessment
- Resources for SLO/SAO assessment
 - What resources will you need to assess changes (i.e., PRIE support in the form of specific data, surveys, etc.)?

We are currently developing common assessment questions with accompanying rubrics for Physics 250 and Physics 260 to be asked on an exam in all sections. Assessment of the SLOs would be done by applying a common rubric to the assessment question. We will assess Physics 260 this semester and Physics 250 in the Spring 2024 semester. These assessments will inform our discipline level learning outcomes.

One resource that would help the validity of our assessment across modes of delivery is the ability to offer distance education courses as “ONLINE WITH IN-PERSON PROCTORED ASSESSMENT: (OPA)” as defined by the Academic Senate for Community Colleges in the Spring 2019 Resolution Number: 09.06 found here: <https://www.asccc.org/resolutions/support->

[new-distance-education-definitions](#). Without this option, it may prove difficult to assess SLOs in a way that can identify gaps related to mode of delivery.

SLOs/SAOs	Assessment Plan	Resources for SLO/SAO assessment
1. Physics 260 Circuit Analysis and Ampere’s Law SLOs	Develop and select common assessment questions with accompanying rubrics to be asked on an exam in all sections. Assessment of the SLOs would be done by applying a common rubric to the assessment question. Assessment done in Fall 2023 with follow up discussion in Spring 2024.	Ability to offer distance education courses as “ONLINE WITH IN-PERSON PROCTORED ASSESSMENT: (OPA)” as defined by the Academic Senate for Community Colleges in the Spring 2019 Resolution Number: 09.06 found here: https://www.asccc.org/resolutions/support-new-distance-education-definitions
2. Physics 250 Newton’s Laws of Motion and Conservation Laws SLOs	Develop and select common assessment questions with accompanying rubrics to be asked on an exam in all sections. Assessment of the SLOs would be done by applying a common rubric to the assessment question. Assessment done in Spring 2024 with follow up discussion in Fall 2024.	Ability to offer distance education courses as “ONLINE WITH IN-PERSON PROCTORED ASSESSMENT: (OPA)” as defined by the Academic Senate for Community Colleges in the Spring 2019 Resolution Number: 09.06 found here: https://www.asccc.org/resolutions/support-new-distance-education-definitions
3.		

b) Program goals

Based on your current review of your program’s equity gaps, learning assessments and challenges and opportunities, identify specific goals and plans. Please note that whereas SLOs/SAOs involve assessing and measuring a specific skill or knowledge students will be able to do/understand upon successful completion of a course, program, service, and/or degree/certificate, program goals reflect overall aspects of your program or service you hope to improve.

Please note that closing equity gaps is a College-wide priority. If there are significant equity gaps in student success, persistence, satisfaction, utilization or enrollment, and student population served in your program, these should be addressed in at least one of your goals (see 3a and 3b).

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For each goal, you should include:

- A brief description of the issue being addressed (equity gap, etc.)
- What actions you plan to take
- What measurable outcomes you hope to achieve
- A timeline
- Who is responsible
- What support do you anticipate needing in order to achieve your goals and plans, including:
 - Professional development activities
 - Institutional support
 - Collaborations
 - Training
 - Resources

Goal	Actions	Measurable Outcomes	Timeline	Responsible Party	Support Needed
1. Regrow enrollment to pre-pandemic levels in all classes.	Continue to support students with access to in-person and remote courses offerings and support (tutoring, AEWs). Coordinate with other STEM fields to avoid scheduling conflicts. Lobby to remove Wednesday Flex Day from fall semester.	Enrollment numbers reaching or exceeding pre-pandemic levels on a per course basis.	1-2 years	David Locke and Alex Wong	<p>As we approach and/or reach pre-pandemic enrollment levels, we will need to replace our full-time faculty member who retired in Dec 2022.</p> <p>Removing the Fall Wednesday mid-semester Flex Day which causes scheduling conflicts for STEM students.</p> <p>Release time for faculty to design a new, project-based PHYS 100 curriculum with the aim of creating a more relevant, engaging class that could attract underrepresented groups.</p>
2. Reduce equity gaps in success in Physics courses while increasing success for	Continue to partner with MESA to provide students with access to in-person and remote learning support, including tutoring and	Reduced equity gaps and higher success rates.	Review data annually.	David Locke	<p>Release time for faculty to design a new, project-based PHYS 100 curriculum with the aim of creating a more relevant, engaging class that could attract underrepresented groups.</p>

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all students.	AEWs. Also, through the MESA partnership, continue to support the Speaker Series, student internships, and STEM clubs. Develop project-based curriculum for Physics 100 to deliver a course that may lead more students to explore STEM.				
3. Continue to offer quality online courses and close mode of delivery achievement gaps.	Continued professional development and training for faculty teaching online. Continue to offer hardware support to students (tablets, lab kits). Continue to use software that is beneficial to student learning and explore additional software.	Reduced success rate gaps between online and in-person courses.	Review data annually.	Alex Wong	Annual license renewals of Classkick and Vernier Video Analysis Ability to offer distance education courses as “ONLINE WITH IN-PERSON PROCTORED ASSESSMENT: (OPA)” as defined by the Academic Senate for Community Colleges in the Spring 2019 Resolution Number: 09.06 found here: https://www.asccc.org/resolutions/support-new-distance-education-definitions

5. CE Only

- a) Review the program's available labor market data, as applicable, and explain how the program meets a documented labor market demand. Here are two relevant links:

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- [State of California Employment Development Department, Labor Market Information Division](#) (the official source for California Labor Market Information):
 - [Employment data](#) (by Program Top Code) from the State Chancellor's Office
- b) Summarize student outcomes in terms of degrees and certificates. Identify areas of accomplishments and areas of concern.
- c) Review and update the program's Advisory Committee information. Provide the date of most recent advisory committee meeting and outcomes of the meeting (updates, changes, new members, etc.).
- d) What strategies have you discussed in your recent Advisory Committee's meetings to meet the needs and challenges of getting people retrained and back to work?