**Executive Summary**

All courses offered in the physics program at MJC focus upon three primary objectives (1) the development of content and physical theory through the lecture portion of our courses (2) the development of measurement and data analysis in the laboratory portion of the courses and (3) the development of analytical reasoning and problems solving skills through the weekly discussion hour. This three-pronged approach has served our students well in preparing them to transfer to top California universities. The vast majority of our physics/engineering students transfer to a four year university upon leaving MJC.

In analyzing our data we notice that the PLO with lowest success rate involves solving problems and applying physical laws to make predictions about physical systems. We utilize the weekly discussion hour to assess these skills on a weekly basis and to model these skills for students. A reasonable solution would be to increase the amount of time devoted to the development of these skills, but at present we are limited to the weekly hour put in place by the current unit values/curriculum. We recorded two years of data using an online homework program made available through textbook vendors only to discover that it failed to improve the problem solving skills of our students as anticipated. We are currently in the process of creating unique homework sets with the aim of improving problem solving skills in a collaborative learning environment to take place during the discussion hour.

With regards to the laboratory portion of our curriculum the data suggests that no changes to our current approach are necessary. As 94% of assessed students are able to measure, collect data and analyze data to a high degree of proficiency we see no reason to institute major changes at this time. Students transferring into our courses from other institutions comment favorably on the level of integration between the lectures, labs and problem solving required in the course. To successfully offer eight different laboratory courses within our program requires a regular level of monetary support in order for materials to be maintained, repaired and replaced/updated as necessary.

With regards to improvements made, we have developed courses specifically to address the needs of our community of students as well as to match curriculum to take advantage of the new capabilities that the Science Community Center offers. The newly instituted laboratory program in Astronomy 151 takes advantage of the modern equipment purchased through Measure E funding, while the newly developed Physical Science 180 hybrid course is designed to better meet the needs of our students who desire to pursue a career in K-6 education.

**Faculty Included in the Preparation and Sharing of this Report:**

Tom Nomof

Kenneth Meidl

**Please provide a brief and cogent narrative in response to each of the following questions.**

1. Provide a quantitative analysis for each PLO your CLOs inform. Provide the total number of students who passed/total number of students assessed in each PLO column *and* the corresponding PLO passing rate as an aggregated percentage*.*

**AWARD (and corresponding PLO) Students Passed/Assessed TOTAL RATE**

A.S.-T. Degree: Physics

1. *Use the Scientific Method to collect and analyze data in forming conclusions and to verify 46/48 94%*

*physical principles through measurement and experimentation.*

1. *Solve problems and predict outcomes in nature using physical laws. 32/48 67%*
2. *State and apply physical concepts to explain phenomena encountered in our everyday world. 35/48 73%*

1. Reflect on, consider and analyze the data you have. ***What does your CLO data tell you about how your students are achieving PLOs?*** *Be detailed, descriptive and analytical* in this qualitative assessment of each PLO in relation to your CLO data. **Are your results satisfactory?**
2. *Use the Scientific Method to collect and analyze data in forming conclusions and to verify physical principles through measurement and experimentation.*

The vast majority of students (94%) were able to achieve this PLO. This PLO is assessed through the required laboratory work for physics courses. Students are allowed to work in groups, be collaborative, and aid each other. The collaborative and more relaxed nature of lab work, compared to examinations, greatly aids the student. Since most students taking courses in physics are studying to be engineers, medical professionals, and scientists this PLO is extremely well suited to be studied, as it closely mimics working conditions in these fields. The results are satisfactory.

1. *Solve problems and predict outcomes in nature using physical laws.*

Solving problems in physics is one of the more complex activities asked of students. It is the most complex activity according to Bloom’s taxonomy. Students must apply physical laws to situations and then work out numerically a prediction based upon the law. The student may not apply the correct law, may not apply the law correctly, or may not be skillful enough to correctly work out the mathematical prediction. Our data shows that 67% of the assessed students were able to pass this assessment. For the level of difficulty required of this task, this result is satisfactory.

1. *State and apply physical concepts to explain phenomena encountered in our everyday world.*

Explaining physical phenomena using physical laws is a primary function of the physical sciences. As a higher order learning task, the idea of “applying” is difficult; however; 73% of the students assessed were able to correctly pass this PLO.

We believe that using the weekly discussion hour to help students develop their understanding, to be able to ask pertinent questions and to be quizzed verbally and in-writing has paid dividends in student understanding and communication skills. Top universities place high value on the development of communication, application, and problem solving skills.

1. Your department and the college should be making improvements based on student learning outcomes assessment, and we need to continue to document and share the improvements and progress you have already made. Did you make any changes in your CLO or PLO statements or analysis during the last cycle or recently? Did you receive funding for resources requests that were aimed to improve assessment results? Did you make any improvements in the areas of teaching and instruction processes, your courses, or your program? *Please explain your accomplishments and provide details about your efforts.*

Our area did make changes to CLO’s in the past cycle to more closely reflect GELO’s, ILO’s, and POL’s. Accordingly, some courses do not have significant data to analyze.

We have not received funding to improve assessment results, as a $4,000-$5,000 yearly allocation for the lab program is typically adequate for MJC to offer a meaningful lab experience for the student.

We have made some significant changes to the program to help the student population at MJC. A Physical Science 180 hybrid course is currently being developed for general education purposes as well as for students pursuing careers in K-12 education, and the Astronomy 151 has been significantly improved. The Astronomy 160 course is also undergoing significant changes to improve student retention and success; however, these courses are not part of this analysis. Thanks to grant monies, we’ve revamped our laboratory program with considerable success to keep up with changing technologies. The changes to the laboratory curriculum allow us to better integrate the lecture/discussion content with the lab content.**Action Plan.** Based on the assessments and analysis you have provided, please consider what changes or improvements you would like to make, which might include updating your CLO statements, modifying course outlines, rethinking instruction efforts, using different assessment instruments, asking for additional resources to improve assessment results, etc. ***Based on the analysis, provide an action plan for improvement that draws on your assessment results and efforts.***

Our lowest and most troubling CLO results involved the ability of our students to solve problems applying physical principles. We have noticed a downward trend in recent years regarding this particular skill. It seems apparent that our students are entering our courses less prepared for success in meeting this CLO. We are currently in the process of making changes to the structure of our discussion hour to increase the frequency of student assessment in hopes that students will spend more time developing the necessary problem solving skills outside of the classroom. The data clearly shows that in switching assessment strategies from the traditional paper and pencil tests used to assess homework to the online homework programs provided by many publishers, students have bypassed the process of developing these problem solving skills.

As stated previously we are making major changes to our curriculum to meet the immediate needs of the community we serve. This involves revamping curriculum in established courses, e.g., Astronomy 161, to integrate new equipment and facilities such as the state of the art planetarium recently built. This also involves the creation of entirely new courses like Physical Science 180 which caters to a changing demographic and a need for more K-12 educators in the future. We have streamlined assessments and provided our students with more immediate feedback using the Blackboard learning management system. When funding has been made available we have modernized our laboratory programs. We have introduced a hybrid course in conceptual physics to better meet the needs of our working students.