

## **PSME ADDITIONAL LOTTERY FUNDS REQUEST 2014 – 2015**

The PSME Division would like to request lottery dollars to help defray several categories of Division expenses:

Chemistry Laboratory Chemical Supplies	\$ 32,000
Mathematics, Chemistry and Physics Software Licenses:	\$ 30,000
Physics and Chemistry Laboratory Equipment Repair	\$ 9,500
Quiz and Exam Printing and Copying:	\$ 50,000
Total:	\$121,500

### **Chemistry Laboratory Chemical Supplies**

Chemical supplies necessary for the continuation of all chemistry classes are not eligible for Measure C funding nor (because they are “perishable”) have they ever been eligible for materials fees funding, even in the past when material funds could be collected for other general purposes. As a result, chemicals for classroom chemical experiments have traditionally been funded by lottery allocations. Each year an initial allocation was disbursed to cover the cost of the chemicals, but this initial amount has always been insufficient to cover the total yearly costs, and additional funds requests were solicited and approved each year. The Division would like to formalize this continuing supplement as a request to increase our current chemistry lottery allocation by \$32,000, which is the approximate average of the additional supplements over the past few years. Incorporating this “supplement” into a single allocation will eliminate the annual secondary request and allow for better planning and representation of true expenses.

### **Software Licensing**

The PSME Division relies to a large and growing extent on the use of teaching software. The math department uses statistics software in each of their more than 30 statistics sections each quarter (the use of software and technology is specified in the curriculum and required for compliance with transfer agreements), and all math classes from beginning developmental level through differential equations use software to enhance classroom instruction, encourage and monitor student homework, and provide opportunities for student practice. The other science departments utilize software to a similar degree for visualization, practice, modeling, laboratory data acquisition, and homework. For example, in geology classroom software is used to demonstrate and create geological map making, in meteorology it

is used to visualize weather patterns, in physics and chemistry to capture and analyze laboratory data, in engineering to model electrical circuits and mechanical systems, etc. In the past three years software use in the sciences has increased to new levels as textbook publishers move to electronic modes of instruction. Although students are required to purchase software in many of these disciplines, the Division still needs to have software (and computers) available for those students who do not have access to the necessary equipment, for use in the classroom environment, and for cases in which software is too costly for direct student purchase.

A major problem concerning software acquisition is that most software products are available on a license basis only rather than as a one-time purchase. This has been a recent trend that continues to accelerate. Many software products are now only offered on a yearly license fee basis rather than through outright purchase. **Since Measure C funding will not cover such licensing acquisitions, we are unable to purchase much needed software using Measure C funds.** Although whenever possible we purchase software products on a one-time, “forever” basis, we still have many software needs that cannot be acquired in that fashion. For this reason, we are requesting a lottery supplement to cover the cost of key software that is available through licensed purchase only.

Our critical licensed software needs are:

ChemDraw	\$ 8,000
MatLab	\$12,000
Mathmatica	\$ 4,500
MiniTab Statistics	\$ 3,000
Labview	\$ 3,000
Total	\$30,000

#### **Equipment Repair and Maintenance for Aging Physics and Chemistry Laboratory and Demonstration Equipment**

Although Measure C funding can be used to purchase new laboratory equipment, it cannot be applied to maintenance and repair of equipment. Additional lottery funding would allow us to repair worn and damaged (but still useful) equipment that would otherwise have to be totally replaced by Measure C or other funds. The request would allow us to refurbish mechanics and electrical laboratory and demonstration apparatus in the physics department and PH and spectrophotometer equipment in the chemistry department in lieu of replacing such equipment at a cost of 20 to 30 times the repair cost. The request includes \$6,500 for physics equipment repair and \$3,000 for chemistry repair. The majority of the equipment to be repaired has served for well over 15 years and would have a 15 or more year additional lifespan if repaired.

**Quiz and Exam Copying Costs:** In the years immediately preceding the termination of material fee collection, the PSME Division was spending approximately \$120,000 per year on copying and printing costs for classroom use.

When it became apparent that the material fees would no longer be collected, the Division made a major effort to reduce the printing burden to the minimal sustainable level. Faculty were asked to either distribute all class documents electronically or when appropriate to provide printed copies for direct purchase by students through the bookstore and reprographics department. Individual accounts were initiated for all Division copying machines and maximum copies per session limits were programmed into the copiers. ***Copying and printing was limited to quizzes and exams only***, and then only in cases where it was impossible to present questions in an electronic form. Individual accounts were monitored closely by the dean to ensure no large violations occurred. Even moderate violations received reminders about limits to printing. Division Assistants also constantly monitored copy machines to ensure compliance with Division policy.

In addition the Division web site was used to provide a repository of syllabi and other course documents that in the past had been distributed in paper form, department and individual faculty web pages were encouraged and supported, and training in the use of course management software for the distribution of documents was provided. A Division meeting was held to solicit additional ideas for reducing printing and copying costs.

The Division responded very well, and in the 2013 – 14 year, total copying and printing costs for classroom use were approximately halved from their previous level to about \$62,000 for the year (including summer).

The current level of division funded copying and printing has been reduced to nearly its essential minimum level. Given that the PSME Division serves approximately 33,000 total enrollments per year, the current classroom copying and printing costs represent \$1.88 per student enrollment. This does not include other additional necessary division and department printing and copying costs (for usual office copying, curriculum development, student forms, evaluations, etc.) which are paid from Division B Budget funds. This level of funding is essential for quiz and exam printing. A sample survey of mathematics faculty found that the average math class required (per student enrollment over 11 weeks) 7 pages of copying for quizzes, 12 pages of mid-term exam copying (usually 3 “mid-terms”), and 6 pages of final exam copying. Thus, a typical mathematics class requires 26 pages of copying solely for quizzes and exams, well over the approximate 15 pages funded by our request for \$50,000 lottery supplement. Mathematics has by far the largest enrollment in the division; however physics and chemistry have a similar high demand for quiz and exam printing. It is only by lower needs in the other departments that we can sustain quiz and exam copying for the division as a whole.

It is impossible for the Division to realistically lower the printing and copying costs much further. The nature of mathematics and science exams requires the presentation of diagrams, images, and graphs. Students need to be able to label, sketch, and demonstrate other hand drawn graphics directly on the exam sheets graphics. Good STEM assessment practices require students to show mastery in word problems and to practice proper mathematical writing, with its emphasis on the organization and demonstration of the steps in a solution process rather than just a presentation of the solution itself. As a consequence mathematics and science tests tend

to require many pages (for the questions, graphs, tables, diagrams and all the solution steps). Unlike writing and other exams where prompts, graphs, and tables can be displayed electronically and students can write solutions in a separate blue book, a math or science exam with typically 20 – 30 questions/parts questions containing necessary drawings and graphs cannot be electronically displayed and answered on a separate sheet. There is no way to coordinate the synchronization of a display of 20 or 30 questions for all students (who require differing time and ordering to answer their questions), and students need to be able to complete tables, graphs, and diagrams directly on the question. In addition, cheating considerations limit the availability of using student supplied paper or allowing display of exam questions on individual student devices . The PSME Division has met and discussed various techniques for reducing paper and copying of quiz and exams. We have done searches for procedures for further reducing exam and quiz copying, but we have reached the point of minimum usage consistent with reasonable pedagogical methodologies.

We are requesting \$50,000 of lottery funding to help defray the costs of providing absolutely necessary tests and quizzes. According to State funding guidelines, lottery funds are eligible for instructional materials, which "may be printed or nonprinted, and may include textbooks, technology-based materials, other educational materials, and *tests*." Funding our minimum quiz and exam requirements is absolutely essential to our Division's educational mission.

**What will the money be used for?** (i.e., software, videos, etc.) Please see attached for allowable items.

**1. Chemistry: Chemicals for chemistry laboratory experiments (Chem 10, Chem 30A, 30B, Chem 50, Chem 1A, 1B, 1C, Chem 12A, 12B, 12C):**

Each year for the past 8 years the chemistry department has requested and received additional lottery funds to cover the expense of purchasing chemical supplies necessary for each of the chemistry lab sections. Similar funding was also granted in previous years (before I became dean). We would like to incorporate this additional funding as part of our normal ongoing allocation so that the request process does not have to be repeated each year. Chemical expenses are not eligible for Measure C or materials fee funding.

**2. 5 year software licenses for mathematics, chemistry, meteorology, physics, and engineering courses:** Several of the software packages can be shared by multiple departments and multiple courses using dynamically metered licensing; i.e. licenses which are not tied to particular computers (departments/courses) but instead allow a maximum number of simultaneous users from any on-campus computer. These items are not eligible for purchase through Measure C funding since that funding prohibits the purchase of multi-year software licenses. The requested software is not available on a one-time, outright purchase (non-licensed) basis.

The requested software includes:

**Statistics Software:** for use in Math 10 sections

**Graphing Software:** for use in all math classes, as well as in physics, and engineering classes

**Data Acquisition, Analysis, and Modeling Software:** for use in physics, chemistry, meteorology, and engineering classes to allow students to collect and analyze data from laboratory experiments and to create mathematical models that help explain processes and predict future events. For example, motion data captured in physics experiments can be analyzed and modeled to demonstrate basic laws of motion and weather data captured by our campus weather station can be analyzed and modeled to demonstrate weather prediction techniques.

**3. Equipment repair and maintenance for aging physics and chemistry laboratory and demonstration equipment:** Although Measure C funding can be used to purchase new laboratory equipment, it cannot be applied to maintenance and repair of equipment. Additional lottery funding would allow us to repair worn and damaged (but still useful) equipment that would otherwise have to be totally replaced by Measure C or other funds. Both chemistry and physics have not had any source of funding for the past 7 years that can pay for the necessary repair and maintenance of equipment that has been in use between 10 and 25 years and that could continue to be useful for all laboratory classes in those disciplines. A relatively small lottery allocation could save many tens of thousands of dollars in unnecessary purchases of new replacement equipment. For example, replacement of air tracks used in experiments in multiple physics classes would cost approximately \$60,000, while repairs for similar (still useful ) existing equipment could be done for a few thousand dollars. Likewise, new IR (infra-red) Spectrometer analysis apparatuses used in multiple chemistry laboratory classes would cost more than 40,000 dollars, but repairing the existing apparatus can be accomplished for under \$2,000.

**4. Quiz and Exam Copying Costs:** The loss of alternative funding for funding the copying of quizzes and exams has led the Division to reduce all copying to its very minimum levels. Division policy is

to support only absolutely essential copying, and multiple mechanisms for enforcing that policy have been put in place. Despite the draconian (successful) efforts described elsewhere in this document, the Division is still unable to maintain the very base level of funding necessary to copy quizzes and exams essential to our educational mission. The requested supplementary lottery funding would allow us to carry out a minimum level of assessment needed for effective teaching and learning.

***How many students will benefit from this purchase?***

**1. Chemicals for chemistry laboratory experiments:**

The chemicals are necessary for all laboratory experiments in Chem 10, Chem 30A, 30B, Chem 50, Chem 1A, 1B, 1C, Chem 12A, 12B, and 12C; i.e. all sections of chemistry. Enrollments in these courses are approximately **2,800 per year**. The chemicals are used in every class for 10 weeks per quarter. The requested funding is equivalent to approximately \$10.71 per student for a quarter class.

- 2. 5 year software licenses for mathematics, chemistry, meteorology, physics, and engineering courses:** The statistics software would be used very heavily in Math 10, for which we have over 32 sections each academic quarter and 13 additional sections in the summer. The total enrollment for Math 10 alone is thus more than **4,000 students per year**. The other mathematics and graphing software could be used in any mathematics course (including statics courses), or up to **24,000 students per year**. The data acquisition, analysis, and modeling software could be used in all chemistry, physics, and engineering, and meteorology classes which have a combined enrollment of approximately **6,000 students per year**. The above numbers represent the potential pool of users; however, given that we cannot afford licensing for every student in all these classes, the usage would be limited to selected courses. A conservative estimate of the overall numbers of students served by selected use of the combined software would be **10,000 students per year**.

- 3. Equipment repair and maintenance for aging physics and chemistry laboratory and demonstration equipment:** Total enrollment for physics and chemistry laboratory classes using equipment that needs maintenance and repair is approximately **5000 per year**. Each of those students would potentially benefit from this expenditure.

- 4. Quiz and Exam Copying Costs:** The requested funds would benefit all students enrolled in PSME classes or about **30,000 students per year**.

***How does this enhance your Equity Goals?***

All the requests will benefit all students enrolled in PSME classes, and hence benefit targeted student populations. One of our Division goals is to encourage and enhance STEM opportunities for underrepresented students, and each of the requested items is key for our Division to provide a meaningful and engaging learning experience that will attract students to STEM disciplines and provide tools (such as graphing and modeling software) important

for their success. Providing college funded software also allows students who might otherwise not have access to similar software an equitable access to critical learning tools.

***How does this enhance your Student Learning Outcomes?***

Two of the overarching student learning outcomes common to all Physical Science, Mathematics, and Engineering courses are that students demonstrate an understanding of

- 1) how observation, measurement and experiment of our physical environment can be recorded and analyzed to build a mathematical model of our universe, and
- 2) how these models allow for prediction and understanding of physical events and an appreciation of the role that such models play in each individual's life.

Each of the items for which funding is requested very directly contributes to these processes by enhancing the collection and analysis of physical data and building, visualizing, and appreciating the resulting mathematical models. Funds for copying quizzes and exams are also essential for assessing the effectiveness of attaining our student learning outcomes.

***Was this noted on your Program Review?***

All requested items were noted in our past program review.