2012 Award for an Exemplary Program or Achievement in a Mathematics Department

The Award for an Exemplary Program or Achievement in a Mathematics Department was established by the AMS Council in 2004 and was given for the first time in 2006. The purpose is to recognize a department that has distinguished itself by undertaking an unusual or particularly effective program of value to the mathematics community internally or in relation to the rest of society. Departments of mathematical sciences in North America that offer at least a bachelor's degree in mathematical sciences are eligible. Through the generous support of an anonymous donor, the award carries a cash prize of US$5,000.

The award is presented by the AMS Council acting on the recommendation of a selection committee. For the 2012 award, the members of the selection committee were: Carlos Castillo-Chavez, Annalisa Crannell, Phil Kutzko (chair), Suzanne M. Lenhart, and Francis E. Su.

The previous recipients of the award are Harvey Mudd College (2006), the University of California, Los Angeles (2007), the University of Iowa (2008), the University of Nebraska, Lincoln (2009), North Carolina State University (2010), and the Math Center at the University of Arizona (2011).

The recipient of the 2012 Award for an Exemplary Program or Achievement in a Mathematics Department is the Department of Mathematics at Bryn Mawr College. What follows is the selection committee’s citation.

Citation

The American Mathematical Society is pleased to recognize the Department of Mathematics at Bryn Mawr College with the 2011 Award for an Exemplary Program or Achievement by a Mathematics Department. The math department at Bryn Mawr has a long history of encouraging women to pursue careers in mathematics and, more generally, of providing women with an environment in which they may thrive in this pursuit. Indeed, it was Bryn Mawr that Emmy Noether chose as her new home when she was forced to leave her position in Germany in 1933, a choice that is emblematic of the role that the department played in those difficult days. In the 1970s the department made the decision to encourage all students to take as much mathematics as they can, regardless of their ability or career path, while at the same time providing the students with the support they need to be successful. During the 1990s roughly 5 percent of Bryn Mawr graduates majored in math; during the period 2001–2010 the rate rose to almost 9 percent. To put this in perspective, this percentage is 11 times the national average for the percentage of women graduating with an undergraduate degree in mathematics and places Bryn Mawr second among all colleges and universities in the U.S. Although the department has substantially increased Bryn Mawr’s percentage of math majors, it has maintained its tradition for sending its students on to doctoral programs. The department ranks 10th nationally in the percentage of female graduates going on to earn the Ph.D. in mathematics and, in the past three years, has produced four of the few female winners of the NSF Graduate Fellowship in mathematics. Bryn Mawr is known nationally as a college with a tradition of inclusiveness and the math department exemplifies this. Over the last five years almost 10 percent of the department’s graduates are from African American or Hispanic backgrounds.

As is typical with Exemplary Program awardees, these achievements came about as a result of careful planning and great dedication. The department has worked to create a vertically integrated mathematical community. For example, students in the department’s small Ph.D. program play a supporting role in advanced undergraduate courses. As a result, fully 4 percent of the Bryn Mawr student body took real analysis last semester. Community is also encouraged by a variety of activities which range from colloquia and math clubs to more unusual activities such as the Math Shakespeare Reading Group and the weekly Distressing Math Collective at which, “...upper class students and graduate students give presentations and lead discussions on distressingly weird math problems.” In addition to building community, the department has carefully considered the role...
of its curriculum, continually assessing its performance and making adjustments as warranted. For example, the differential equations course has been revised to include a dynamical systems approach focusing on mathematical models of environmental issues.

Given the passion with which the Bryn Mawr math faculty has built this exemplary program, it will come as no surprise that they are leaders nationally. Rhonda Hughes, working with Sylvia Bozeman, Professor of Mathematics at Spelman College, founded the highly successful and award-winning EDGE program, a program that supports women and minorities as they make the transition from undergraduate to graduate school. Other faculty have taught in the EDGE program or at the IAS Women and Mathematics Program. In sum, this small faculty, consisting of eight permanent members, has played a national role well out of proportion to its size.

The purpose of the Award for an Exemplary Program or Achievement by a Mathematics Department is to recognize a department that has distinguished itself by undertaking an unusual or particularly effective program of value to the mathematics community, internally or in relation to the rest of society. The department at Bryn Mawr, by playing such a prominent and effective role, both at Bryn Mawr and nationally, in the effort to increase the number of women and students from underrepresented backgrounds who major in math certainly meets these criteria. Further, the department at Bryn Mawr provides a model that may be implemented at other departments with similar demographics and missions. It is for these reasons that the department is so deserving of this award.

A little more than fifty years ago, I entered a classroom at the Illinois Institute of Technology (IIT), where I was a freshman, and had an experience that changed my life. The professor, Pasquale Porcelli, was teaching calculus using an inquiry-based approach I learned later was called the Moore Method. In the class we were being asked to develop rigorously the basic concepts of calculus, together with the theorems, along a carefully crafted path developed by him. Moreover, we had to present and defend our ideas to the rest of the class.

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Over the remainder of my studies at IIT, about half of my mathematics classes were taught in this manner and the other half by the traditional lecture method. Upon graduation I followed Porcelli to Louisiana State University (LSU), where I obtained my doctorate under his direction. Again, about half of my studies at LSU followed the Moore Method approach and half by way of lectures. What were the benefits of the inquiry-based approach to learning and why do I say it changed my life?

While I had been interested in mathematics before, these Moore Method courses prompted me to decide not only to major in mathematics as an undergraduate but also to pursue a doctorate. Further, I found that I understood the basics in most areas and how to approach questions so well that I had a head start in learning new mathematics as well as in doing research. But that was not all. A mastery of clear, critical thinking carried over to
other parts of my life, including my administrative
career. Knowing how to approach problems and
defend the value and correctness of my insights
and analyses were invaluable in my roles as de-
partment chair, dean, provost, and executive vice
president, and in a leadership position in the wider
mathematics community.

But why am I relating to you this “ancient his-
tory” concerning my life and career? After all, it is
not surprising that a mathematically talented stu-
dent such as I was might thrive in the atmosphere
of a Moore Method classroom. Let me tell you why.

Several years ago, because of this background,
I joined a project to develop and promote ap-
proaches to mathematics instruction closely re-
lated to the Moore Method—methods which are
called inquiry-based learning or IBL. While related
in spirit to the Moore Method, IBL is broader and
can be characterized as a student-centered ap-
proach that focuses on solving, communicating,
and discussing meaningful mathematics problems
in a purposeful sequence and, further, to construct
and understand mathematical concepts. (And con-
structing a purposeful sequence is critical.)

After several years of effort, the IBL project
decided that an impartial, objective evaluation and
assessment was needed to determine the effects of
IBL at the four universities where the project was
focused. The data collected have been tabulated
and analyzed, and the results are now available.¹
They did not surprise or disappoint. First and
foremost, there were positive benefits for almost
all students. However, two findings were particu-
larly welcome and we believe important.

Women students reported a more positive ex-
perience and much greater learning gains in the
IBL courses as compared to lecture courses. In
particular, whereas the gains in IBL courses were
largely independent of gender, that was not the
case in lecture courses. Moreover, the same was
true for students whose previous performance in
mathematics was below average. These students
reported a more positive experience and developed
a better understanding of mathematics. Finally,
we did not see the increasingly negative attitude
toward mathematics that was formed by students
in the lecture courses!

What lessons can be drawn from these data? I
am not suggesting that the data support that all
mathematics be taught using an IBL approach.
However, having some IBL courses, particularly
early in their studies, seems to provide a more pos-
itive experience for women students and improves
their attitude toward mathematics. It also seems
to help below-average-achieving students catch up
or, at least, perform at a level which would enable
them to go on in mathematics-related disciplines.

¹ http://www.colorado.edu/eer/research/
steminquiry.html.

Now I am not certain my experience at IIT and
LSU can be used to evaluate an IBL approach for
current students. That is why the evaluation/as-
sessment study is so important. We all seek to
use our own experience as a guide to understand
what we see in today’s classrooms. Sometimes this
works and sometimes it doesn’t.

Given the great penchant of today’s students
to communicate their thoughts with each other in
“real time”, it is not clear to me how that fits with
the lecture method. And I doubt that their intense
desire to interact with all information sources, as
their blogs and constant use of ubiquitous social
media make clear, supports the lecture approach
either. In particular, it seems to me that an IBL ap-
proach would resonate more strongly with today’s
students.

In evaluating and assessing the various ap-
proaches to mathematics instruction, we must
be careful that we agree on the goals we have for
them. Learning mathematics is certainly most im-
portant. But developing a positive attitude toward
mathematics and acquiring the ability to learn
and use mathematics are key in a student’s future
studies and career.

In conclusion, I believe the assessment study
strongly supports the notion that to achieve these
goals for today’s students, experiencing an IBL
approach in several mathematics courses is supe-
rior to a program based only on lectures.