THE LEGACY OF R.L. MOORE Newsletter

No. 5 January 2012

Transforming Lives Through Inquiry-Based Learning

A mathematics class can be a life changing experience for a student. It happens, for example, when students feel that their ability to master a challenging subject with minimal guidance and to solve problems creatively on their own has been expanded beyond what they thought possible before.

This notion goes beyond just meeting a test standard. It addresses one of the real goals of education: to enable graduates to deal with the problems of tomorrow which are unknown to us today.

The recent large-scale assessment of outcomes of IBL courses at four major universities provides data that support the value of IBL methods from a number of different viewpoints. This captures part of the transformative experience. See the University of Colorado study

www.colorado.edu/eer/research/steminquiry.html

Several of the presenters at the 14th Annual Legacy of R.L. Moore Conference in June 2011 had by chance each picked as their theme the transformative experience of IBL.

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INSIDE

University of Michigan Center for Inquiry Based Learning logo.

POGIL: Process Oriented Guided Inquiry Learning

pogil.org

Culture of Discovery: Berry College

IBL is alive and well at Berry College. This small liberal arts college in northwest Georgia boasts faculty from a variety of disciplines who focus their classes on the interaction between students and concepts. Departments represented in the *Active Learning @ Berry* group include mathematics (Jill Cochran, Paul Kapitza, Eric McDowell, Ron Taylor, Zahava Wilstein), physics (Chuck Lane, Dan Robb, Todd Timberlake), chemistry (Andy Bressette, Kevin Hoke, Ken Martin), psychology (Kristen Diliberto) and philosophy (Michael Papazian).

Chemistry faculty are involved with the POGIL project. In this approach, students work in teams to formulate correct conclusions

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The ability to learn on one's own was given by Ted Mahavier of Lamar University as the key to whether students succeed or fail on entering the work force or continuing in higher education. A Moore Method or IBL type of course offers an environment "in which a student may produce within him or herself a transformational experience by doing something he or she did not believe possible."

After describing how Moore typically ran his own "Moore Method" classes, Ted gave details of a Modified Moore Method approach as "a small step" beyond the test/lecture method.

Stan Yoshinobu, of Cal Poly in San Luis Obispo and director of the Academy of Inquiry-Based Learning, focused on why we need transformative change in our classrooms. He pointed out that it does not require rebuilding our entire infrastructure. Instead it depends on teaching practices centered on student engagement.

Stan Yoshinobu, Legacy Conference 2011

*The **national Academy** of Inquiry-Based Learning, offers a place on-line for exchange of ideas, support, developing new materials, and leads to IBL workshops.*

www.InquiryBasedLearning.org

The banquet speaker, Michael Starbird, made transformation his main theme.

Almost half his talk consisted of engaging stories about his teacher, the renowned topologist RH Bing, and the broad lessons one could learn from his colorful mentor.

For example, Bing maintained that the time for real work on a problem is after you solve it. Can the insight used for it be used to solve another problem, move the topic further, or be applied to a different topic?

Bing's life was altered by the experience of having been found by RL Moore.

Mike made the point that we are in the business of taking people whose futures are not formed and somehow influencing them to become more than they could imagine they could be.

Can we intentionally structure the teaching of effective thinking and creativity?

Specific skills we can convey with this kind of teaching include:

- *Deep understanding*: Thinking for yourself.
- *Make mistakes*: Has anything creative been done except on a pile of mistaken attempts? The embarrassment of making mistakes in class has been taught by our systematic telling them that every mistake is bad.
- *Raise questions*: Questions are not just what you do if you are confused, or preparing for an exam, they are part of everyday life.
- *Consider the flow of ideas*: Everything comes from previous mathematical ideas and continues on.

"I hope," Mike asserted of his students, "that I'm making them better artists, better writers, better politicians, more thoughtful citizens."

{For videos of conference talks and relevant literature see LegacyRLMoore.org, especially J. Green, *Life as an Activity: Eight Things I Learned from Dr. Moore's Classes*.}

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based on an investigation of data and information followed by leading questions. The Moore method is also used in some upper level courses.

Berry physicists have also adapted the Moore method for use in their upper level physics classes such as modern physics, classical mechanics and thermodynamics. In lower level classes they use a mixture of group work and computer simulations to recreate/reenact important developments in physics and astronomy rather than just have students memorize facts, formulas and theories.

Math faculty at Berry use a variety of techniques, from a traditional Moore method in courses such as real analysis, topology, geometry and introduction to proof, to POGIL style courses in the calculus sequence and linear algebra.

Outside of the sciences, Dr. Diliberto uses a version of the POGIL method in some of her psychology courses and Dr. Papazian has used the Moore method in his symbolic logic classes.

Kevin Hoke (standing) and Michael Papazian, Berry College professors of chemistry and philosophy respectively, members of the Berry panel session, Legacy Conference 2009.

Interest among students in continuing their education at the graduate level has been on the rise and recent graduates have pointed to their experience in Berry's active learning environment as a reason they feel well prepared to succeed in graduate school.

Berry's IBL program started with a group of six faculty who received a start-up grant from the EAF to create a culture of discovery among the sciences. In addition to growth of this group, three of its members have won school-wide teaching awards and two have written textbooks that are geared at providing an active approach to learning.

Berry was founded in 1902 by Martha Berry as a school for enterprising rural boys. Situated on 26,000 acres of land it currently has an enrollment of approximately 1850 undergraduate students and boasts one of the nation's most successful on-campus work experience programs with more than 90 percent of undergraduates working on campus prior to graduation.

—Ron Taylor

Featured Publication

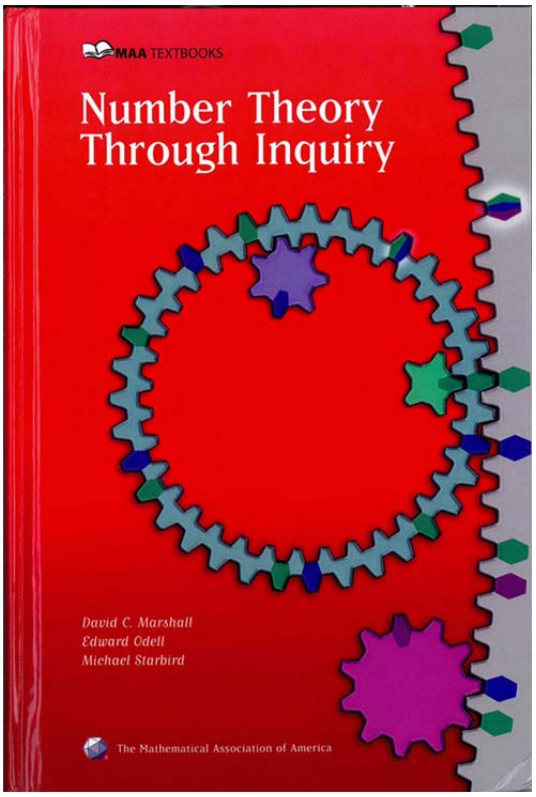
Number Theory Through Inquiry

With cover art suggesting the meaning and proof of the Chinese Remainder Theorem, this textbook is "a carefully arranged sequence of challenges that lead students to discover ideas about numbers and to discover methods of proof on their own."

It is designed to be used as part of a guided discovery or Modified Moore Method type of learning and is appropriate for a proof transitions course, for an independent study experience, or for a course designed as an introduction to abstract mathematics.

Historical illustrations underline the fact that mathematics is constantly in development and is open to new discoveries, even by beginners.

In addition to the classical topics of number theory, a chapter on public key cryptography is included.



David C. Marshall, Edward Odell & Michael Starbird,

Mathematical Association of America, 2007

maa.org

Calendar Note:
15th Annual Legacy of R.L. Moore Conference, Austin, TX, 14–16 June 2012.
See Forthcoming Events, LegacyRLMoore.org

A Gift to the Future

The Foundation is grateful for recent contributions from individuals. Such gifts help to shape our response to the urgent need to improve student performance in science, technology, engineering, and mathematics. Guided inquiry, as part of the total learning environment, has been shown to offer improvement of students' creativity and problem solving abilities. Your support will help us increase the impact of our existing programs and extend efforts to new initiatives.

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