

Engaging in Inquiry-Based Learning



It seems inconsistent to have a conference that is devoted to supporting teachers in using IBL methods that is itself conducted as a series of lectures. The program organizers of the 2014 Legacy Conference, held in June in Denver, addressed this issue by requiring presenters to include some form of interaction with their audience as a component of their presentation.

This worked well, for example, in a session devoted to IBL experiments in the Math Circle at Arizona State University, Tempe. For a part of the session participants engaged as if they were members of a math circle. This is in general, by the way, how the “math circles” movement has trained faculty organizers across the country in how to guide a group of highly motivated high schoolers as they work on challenging mathematics problems.

Of course, introducing inquiry or guided discovery learning methods into the classroom does not mean that the instructor never delivers lectures; it is just that the latter are seen as a

Please see *Engaging*, p. 2.



Would You Like to Suggest a Name for the New IBL Charitable Entity?

Preliminary work is underway to investigate the feasibility of a new public, non-profit organization which would build on the work of the private, Educational Advancement Foundation, in order to strengthen and expand IBL on a national basis. Some ideas thus far:

- American Math Lab;
- American Institute for Mathematics Education;
- Institute for Advancement of Mathematics Education.

We welcome your ideas at the email address below.



Scenes from the Denver conference, June 2014.

INSIDE

- 3 News Items
- 4 Evidence of Effective Teaching

Engaging continued from p. 1

contribution to the goal of greater student involvement.

Melvyn Jeter provided probably the most unusual interactive component: his former student, Karl Pierburg (see photo) who discussed how the topology course he took at Illinois Wesleyan University provided him with skills that have led to his success in professional football.

Michael Starbird's banquet talk centered on his experience producing a massive open online course (MOOC). He mentioned how as a child the family dinner-table discussion could be filled with addressing thought provoking questions—undoubtedly an influence in he and his brother becoming mathematicians. “When should a student begin to think deeply and creatively in solving problems?” he asked.

The next day, Ken Gross, founder of the Vermont Mathematics Initiative, offered an answer:

A student should begin to think deeply and creatively in solving problems as early in life as possible and no later than the start of kindergarten.

The kindergarten teacher and all subsequent teachers should be knowledgeable in mathematics, love mathematics, be able to teach mathematics in an inquiry-based mode, and appreciate that the purpose of mathematics is to solve problems.

Another fundamental issue for the mathematical community was addressed in the opening presentation by Julian Fleron and his colleague Philip Hotchkiss at Westfield State University in Massachusetts. They gave concrete examples of how IBL offers powerful learning opportunities for those that have been disengaged by the typical approach.

The Legacy Conference was sponsored by EAF and the Mathematical Association of America.



Karl Pierburg, Senior Director for Football Systems, Atlanta Falcons.

Videos of all presentations are available on YouTube at AcademyIBL or through the links in the conference program with abstracts at

LegacyRLMoore.org/2014

An excellent account of the Denver conference appeared in the August/September issue of MAA FOCUS, the newsmagazine of the Mathematical Association of America. Written by Katherine Merrow, it is available at

www.maa.org.



Kenneth I. Gross, Professor of Mathematics at the University of Vermont and Director of the Vermont Mathematics Initiative

News Items

California State University, Dominguez Hills established the new Center for Innovation in STEM Education with the support of a \$1 million endowment from the Annenberg Foundation. The interim assistant director, Matt Jones, has taken part in Legacy conferences and conducted workshops with Stan Yoshinobu and the Academy of Inquiry Based Learning.

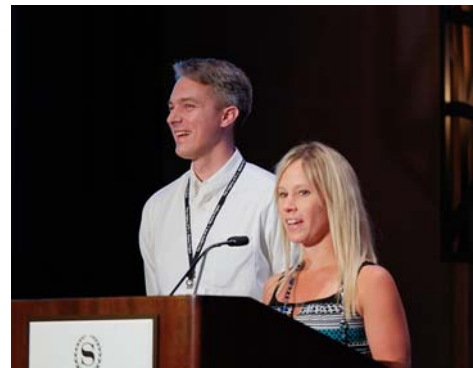
Overlapping with the Legacy conference in Denver in June was a meeting at the University of Texas at Austin of the national group Transforming Post-Secondary Education in Mathematics (TPSE). Work groups made recommendations on curriculum reform, opening pathways, the teaching culture in departments, and enhancing graduate training. An appended list of existing transformation efforts includes several supported by EAF:

- Academy of Inquiry-Based Learning;
- Journal of Inquiry-Based Learning in Mathematics;
- Center for Inquiry at the University of Michigan.

See the full report at www.tpsemath.org

A brief report, “Benefits for Women and Men of Inquiry-Based Learning in College Mathematics: A Multi-Institution Study” appeared in the *Journal for Research In Mathematics Education* for July, 2014 (Vol. 45, p. 406-418). It “suggests the real-world promise of broad uptake of student-centered teaching methods that improve learning outcomes and, ultimately, student retention in college mathematics.” The study, by Sandra L. Laursen, Marja-Liisa Hassi, Marina Kogan, and Timothy J. Weston, is based on results obtained in the major study, *Evaluation of the IBL*

Mathematics Project: Student and Instructor Outcomes of Inquiry-Based Learning in College Mathematics, the 2011 report to EAF and the IBL Mathematics Centers.



T.J. Hitchman and Angie Hodge, co-chairs of the Denver program committee.



Michael Starbird, banquet speaker at the 2014 Denver conference, discussing IBL and distance education.

The next Legacy Conference will be 25-27 June, 2015, in Austin.

Media

Active learning increases student performance in science, engineering, and mathematics

From the abstract:

To test the hypothesis that lecturing maximizes learning and course performance, we metaanalyzed 225 studies that reported data on examination scores or failure rates when comparing student performance in undergraduate science, technology, engineering, and mathematics (STEM) courses under traditional lecturing versus active learning. The effect sizes indicate that on average, student performance on examinations and concept inventories increased by 0.47 SDs under active learning (n = 158 studies), and that the odds ratio for failing was 1.95 under traditional lecturing (n = 67 studies). ... This is the largest and most comprehensive metaanalysis of undergraduate STEM education published to date. The results raise questions

*This meta-analysis makes a powerful case that any college or university that is teaching its STEM courses by traditional lectures is providing an inferior education to its students.**

S. Freeman, S.L. Eddy, M. McDonough, M.K. Smith, N. Okoroafor, H. Jordt, and M.P. Wenderoth, *Proceedings of the National Academy of Sciences*, 111, 23 (10 June 2014), 8410-8415.

about the continued use of traditional lecturing as a control in research studies, and support active learning as the preferred, empirically validated teaching practice in regular classrooms.

[Newsletter readers may note that this analysis was too early to include the University of Colorado studies that can be found at: www.colorado.edu/eer/research/steminquiry.html

The latter includes the main *Evaluation of the IBL Mathematics Project* (2011 report to EAF and the IBL Mathematics Centers) and publications based on it.]

*Carl E. Wieman, "Large-scale comparison of science teaching methods sends clear message," *Proceedings of the National Academy of Sciences*, 111, 23 (10 June 2014), 8319-8320.

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, improves students' creativity and problem solving abilities. Your support will help us increase the impact of our existing programs and extend efforts to new initiatives.

You can send a tax deductible contribution to The Educational Advancement Foundation at:

327 Congress Avenue, Suite 500, Austin, Texas 78701-3656.

Or, you can call us about planned or legacy giving and commemorative gifts through our development office at (512) 469-1700.