

Inquiry-based Learning in Mathematics: What is it?

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What is IBL?

From the Academy of Inquiry Based Learning (AIBL):

Inquiry Based Learning, or IBL for short, is a broad range of empirically validated teaching methods which emphasize (a) deeply engaging students and (b) providing students with opportunities to authentically learn by collaborating with their peers.

From *Discovering the Art of Mathematics*:

Inquiry-Based Learning (IBL) is an approach to teaching and learning in which the classroom environment is characterized by the student being the active participant while the teacher's role is decentralized. This pedagogy builds on guided discovery, a descendant of the ancient Socratic approach to teaching.

What is IBL?

Traditional lecture: knowledge is transferred from instructor to student

IBL: content and techniques are discovered by the students through guidance that is structured by the instructor

What is IBL?

Typical IBL structure:

A set of course notes is given to students at the start of the semester (or month or week).

These notes consist of a list of definitions, examples, and *problems to solve, questions to answer, and/or theorems to prove*.

Students work on this list in order outside of class either alone or in groups without the use of outside help.

Class periods are primarily spent with students presenting (in order) their solutions/proofs.

History

R.L. Moore (1882 - 1974) was disillusioned with math courses as a graduate student at Univ. of Chicago.

In 1920, he began a long career (forced retirement in 1969) at the University of Texas, where he made use of his “Moore method” of teaching.

Even though he was racist, sexist, polarizing....

How does it work?

Day one: be up front with students.... Hand out the first set of problems, send them on their way with clear expectations on what will happen on the next meeting.

Presentations:

A certain number of points per attempt (regardless of quality).

Multiple presenters may be at the board at a time.

Presenters take turns explaining their solution/proof.

Award a point or two for quality questions or suggestions.

Encourage supportive questions from the audience, not criticism.

Written work:

Up to 6 points for a correct solution/proof turned in before it's presented.

2 points if turned in after presented (redos, late work permitted).

LOTS of grading, make sure to NEVER get behind.

How does it work?

Maintenance:

Frequent pep talks are necessary.

Underachievers require special attention...

Plagiarism is always an issue.

Supplementary lists of problems are often a good idea....

Is it better?

Short answer: YES.

There is no shortage of literature providing evidence that IBL (or more general active learning) improves students success, retention of knowledge, and student engagement. Some of my favorites:

Springer, L., Stanne, M.E., and Donovan, S., Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis, *Review of Educational Research*, **69** no. 1 (1999).

Freeman, S., et.al, Active learning increases student performance in science, engineering, and mathematics, *Proc. Nat. Acad. of Sciences*, **111** no. 23 (2014).

Laursen, S., et.al., Evaluation of the IBL mathematics project: Student and instructor outcomes of inquiry-based learning in college mathematics, Univ. Colorado, (2011).

My history

(Had a few masters-level math class taught using IBL in San Marcos.)

Started attending workshops at UT-Austin in 2004.

Received a grant to write my own notes for a 2006 linear algebra course (using Mathematica). Huge failure.

Two years later, used Carol Schumacher's *Chapter Zero* for MATH 3300. Huge success (to me).

In Spring 2009 I used David Clark's notes for Euclidean geometry.

In 2010 I wrote small sets of notes for Calculus II and III.

In 2011 I used my own notes for an entire Calculus I course. I've used them ever since. (samples included as a handout)

How can I try it?

Look for course materials at jiblm.org and artofmathematics.org

Summer workshops sponsored by the Academy of Inquiry Based Learning

The STEM Center at SHSU sponsors summer workshops

The SHSU QEP in 2019 will sponsor several different campus-wide faculty development opportunities to promote and encourage active learning

Is it better?

My opinions....

Thank you....

Thank you for listening participating.

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