

The Inquiry Oriented Classroom - A Reflection

Justin Dunmyre, FSU

How I got involved

- First contact with Inquiry Based Learning: Project NExT, a professional development program for early career mathematicians
- Second contact: attended a summer workshop on Inquiry Based Learning, taught one course in this style
- Applied and was accepted to be a TIMES fellow to beta-test these inquiry oriented materials as part of a NSF funded research project out of NCSU.

Inquiry Spectrum in Mathematics

- T.J. Hitchman's 4 Criteria:

1. Who has the responsibility for developing and presenting new ideas?
2. Who has the responsibility for critiquing the work presented?
3. Who has the final say on the validity of a particular argument?
4. Who is responsible for asking questions and setting the agenda for further investigation?

- Goal: answer these questions with “the students”

Some flavors of Inquiry

- Moore Method
- Modified Moore Method / Inquiry Based Learning
- Inquiry Oriented Learning

What is Inquiry Oriented Learning?

- Worksheets (“task sheets”)
 - Nonstandard problems
 - Multiple initial interpretations
 - Multiple ways to arrive at a solution
 - Solutions allow further inquiry

What is Inquiry Oriented Learning?

- Active learning environment:
 - Private Think Time
 - Small Group Work
 - Whole Class Discussion

Why I practice Inquiry Oriented Learning

Ten years from now, what do I want my students to remember from my course?

What does it mean to “do mathematics?”

Soft skills

Why I practice Inquiry Oriented Learning - the data

- According to a landmark meta-study published in PNAS, students in traditional lecture courses are 1.5 times more likely to fail than students in courses with active learning
- Further research indicates that active learning “does no harm” and, moreover, helps narrow the gap for women and minorities in mathematics

Four focal instructional practices

- Eliciting student thinking
- Building on student thinking
- Developing a shared understanding
- Introducing language and notation

My role as curator

- I use the board as a record of the discussion they are having.
- I try not to make obvious judgements about the validity of one claim or another
- Instead, I ask guiding questions of the class (or highlight excellent questions that came up in group discussion (or fake it!)) to nudge students along my mathematical agenda

Video Clip - Group A

- After doing a recap of last class, I set them on a new task.
- While they read the new task and start to work, I give them some private think time by erasing the board and getting set up for the next discussion
- I'm always keeping my ears peeled for interesting discussion, and I make a beeline for one group in particular (we'll call them group A).
- It takes all of my discipline not to jump up and down with excitement, but I had to hover to see if the conversation got prematurely cut-off.

Video Clip - Group A pt 2

- After about 7 minutes of group work, I bring the class together for discussion.
- Students volunteer descriptions of their solution, and I put my interpretation on the board.
- Once we're all on the same page, we're ready for the interesting discussion that group A was having.
- Students are eager to discuss the problem, and I can't get a word in

Video Clip - Back and Forth

- About 5 minutes after I took Group A's debate to the whole classroom, I get the feeling that students are near a consensus- the distance between fingers should increase.
- Another student explains his thinking on the problem, and another student provides a rebuttal, which Matt answers by talking about asymptotes. These are three students from three different groups!
- When the students start talking about piecewise functions, this is no longer part of my agenda. I seek to divert the conversation by calling on Ray, who I hoped would ask a question from earlier. He did not.
- Asymptote is not the terminology that we use in the discipline when we talk about phase lines, it is language that the students came up with. So, I reroute the conversation by taking the time to introduce formal language and notation.

If we have time... Owl
discussion 6:10

How did the students feel?

- Students were always surprised when class was over. A few asked if there was any way to make it longer so that we didn't have our discussions cut off!
- Some students that struggled in previous classes with me, showed great improvement in this class

Why Inquiry?

- Based on data: improved pass rate over lecture
- Important note: lecture is defined as “continuous exposition with minimal unplanned questions from the audience”
- Based on data: better for minorities, women, while “doing no harm”
- The students act like mathematicians!

Inquiries?