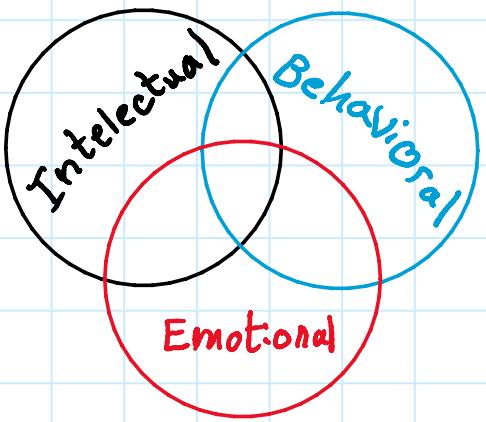


► Instructional Goals



Human Psyche Domains

Intellectual domain:

Knowledge & understanding concepts

Behavioral domain:

practices & actions with which
we apply or develop knowledge

Emotional domain:

how we feel about our
knowledge and actions

Example Learning Goals: College Algebra

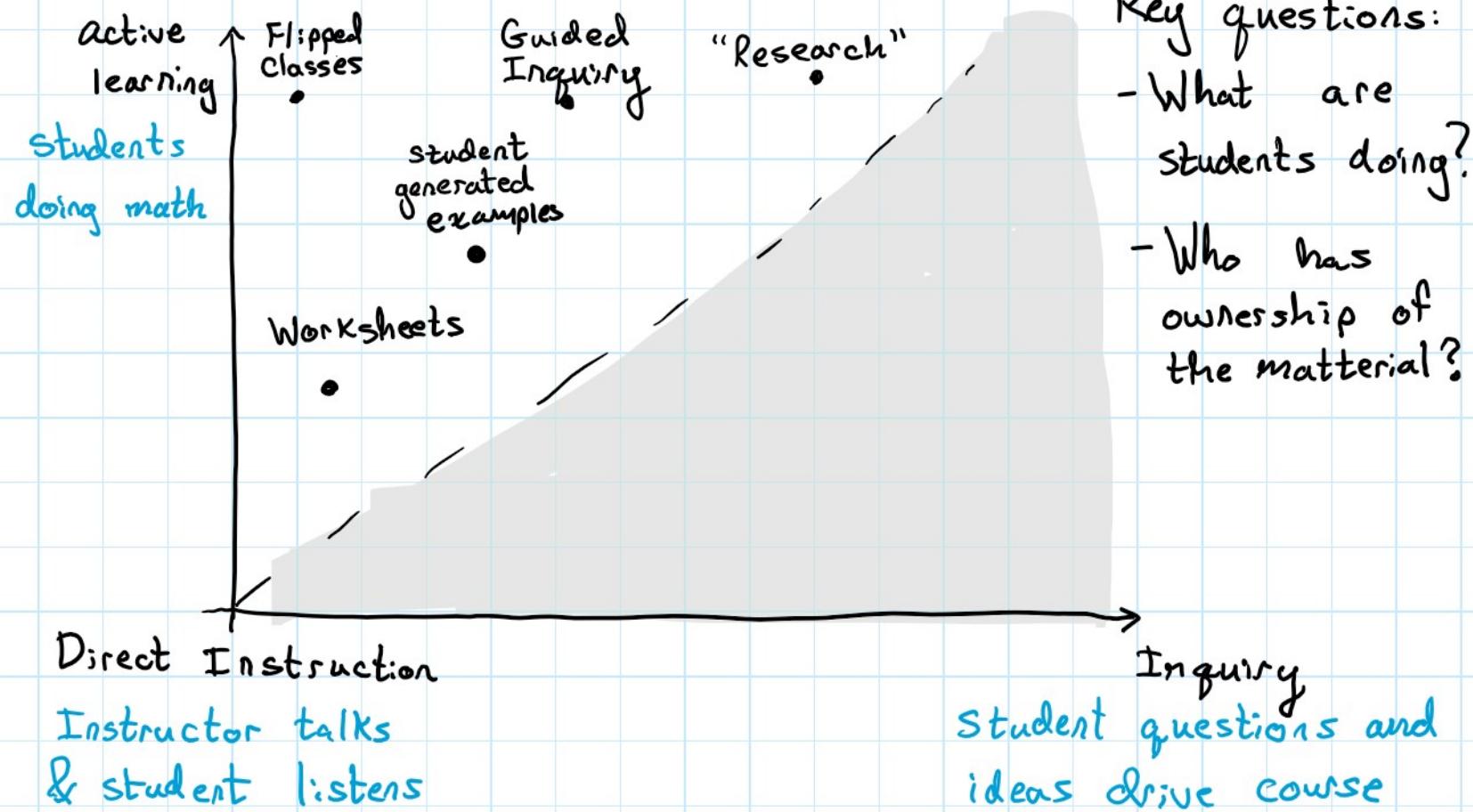
Students will have opportunities to engage in the following
Mathematical practices.

- persist and work through perceived failure
- develop a personal framework of problem solving techniques
- collaborate productively with a team
- create, interpret and revise real-world models

(Source MAA Instructional Practices Guide)

(Source MAA Instructional Practices Guide)

► What is Inquiry Based Learning?



Activity Examine Your Own Practice

Stage 1:

- list your classroom practices
- plot your practices on the direct instruction/
Active / Inquiry learning axis.

Stage 2:

- form groups of ~four
- share plots
- choose one technique and write it big
on a piece of paper
- have group member physically plot it in
the room by standing with the sign.

► Evidence that it works

Freeman et.al "Active learning increases student performance
2014 in science, engineering and mathematics"

- meta analysis of 225 studies
- average exam score improved by ~6%
- students in lecture courses were 1.5 times more likely to fail

Lawsen et.al "Benefits for women and men of inquiry-based learning in college mathematics"

- IBL boosted lower achieving students and didn't harm high achievers; it shrank the gap.
- learning gains correlated with amount of student centered class time.

► IBL in practice

Instructor Role

- Choose activities
- provide scaffolding i.e. break into smaller steps
- create a safe and welcoming space
- guide discussion
- provide emphasis
- facilitate synthesis

Activity

Sample Course Materials

Stage 1:

- form groups of about four
- Count off 1-4, one number per group
- Read Sample with your groups number
- Discuss the sample
 - active vs. inquiry-based?
 - What might students struggle with? Scaffolding?
 - Good follow up questions

Stage 2:

- form new groups with one person for each sample
- Share

Techniques for success

- Start small
- Don't reinvent the wheel
- Start early in the course
- Be flexible & conservative about estimating time
- focus on process and reasoning rather than answers
- Emphasize student-student interactions
- Debrief at the end of the lesson
- Share your materials & experiences

Resources

Academy of Inquiry Based Learning <http://www.inquirybasedlearning.org/>
Journal of Inquiry-Based Learning <http://jiblm.org//index.php>
The Art of mathematics <http://www.artofmathematics.org/>

Calculus

Boulder/Omaha Active Learning
Alliance <http://math.colorado.edu/activecalc1/index.html>
Good Questions Project <http://pi.math.cornell.edu/~GoodQuestions/>
Stewart Calculus Instructor's Guide has a lot of worksheets

Linear Algebra

Inquiry Oriented Linear Algebra <http://iola.math.vt.edu/index.php>

Differential Equations

Inquiry Oriented Differential Equations <https://iode.wordpress.ncsu.edu/>