Developing “Function Sense” through the art of conjecturing

Teachers Development Group
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Funds of knowledge in our room today

Think about a time where refuting, questioning, or extending conventional wisdom (in other words, departing from commonly held beliefs) positively impacted the situation at hand. It can be personal or someone else's story.

Elon Musk

“I think generally people’s thinking process is too bound by convention or analogy to prior experiences. It’s rare that people try to think of something on a first principles basis. They’ll say, “We’ll do that because it’s always been done that way.” Or they’ll not do it because “Well, nobody’s ever done that, so it must not be good.” But that’s just a ridiculous way to think. You have to build up the reasoning from the ground up—“from the first principles” is the phrase that’s used in physics. You look at the fundamentals and construct your reasoning from that, and then you see if you have a conclusion that works or doesn’t work, and it may or may not be different from what people have done in the past.”

The Right to Conjecture

Intellectual progress in mathematics and scientific domains depends on our being able to make and freely explore conjectures - **claims and problems we pose for ourselves**

This requires an environment where students have:

- The right to question
- The right to both use and refute “established” knowledge as appropriate
- The right to reason from first principles rather than abstractions that may feel removed from personal experiences

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Why the focus on the universal Right to Conjecture?

- The making and growing of mathematics has been reserved for certain groups
- Education Reform efforts have focused on “problem-solving” as a way to engage our historically marginalized students
- Problem-posing and the creation of mathematics are often left out of the narrative in our public schools

How will we spend our time together?

- How do we position our *teachers* as intellectual beings who pose and explore their own mathematical conjectures through rich professional learning experiences?
- What content within our K-12 curriculum can be used as a vehicle?
- What types of software environments support this work?

Are there more lines or points in the 2D space?

URLs

- Math Mind Habits - https://www.geogebra.org/m/dBZAMxSV
- Desmos Calculator - https://www.desmos.com/calculator

Can another parameter space help us?

- Plot a line in the m-b plane
- Make a list/table of at least 5 points on this line
- Each of these points is a line in the x-y plane. Use the Desmos calculator to plot these lines
- What do you notice? Does it help prove/disprove your conjecture?

What effect does varying ‘b’ have on the graph of a quadratic function?

Exploring our conjecture

- https://www.geogebra.org/m/tDJ6xZEn
- For fixed values of ‘a’ and ‘c’, what do you notice as you vary ‘b’?
- Can you find an expression for the curve traced out by the vertex of the parabola?

Function Sense

A high level of fluency, ease and comfort with functions and their manipulations and transformations in a variety of situations

How did the activities, specifically the act of making and exploring conjectures, support the development of Function Sense?

What other routines, practices and strategies do you currently employ to build Function Sense?

Five Elements of Motivating and Engaging Mathematics Instruction

- Climate of Understanding
- Climate of Curiosity and Relevance
- Climate of Challenge and Support for Challenge
- Climate of Active Learning and Agency
- A Welcoming and Warm Classroom Community

Which of your behaviors and actions connected to each of the 5 Elements?

Reflecting and Looking Ahead

- To what extent is conjecturing a part of students' experience in mathematics classrooms?
- To what extent is conjecturing a part of teachers' experience in professional learning opportunities?
- What are some thoughts and questions you are left with in terms of next steps for your school community or district?

Please keep in touch

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