STEM Learning:
The Power and Promise of Developing a Conjecturing Modality

@DoctorMatHney (Twitter)

Gabriel Matney
November 18, 2017
Conjecture

Consider statements made in this Keynote conjectures for you to evaluate. They are said so they can be thought about, tested, and modified.

Let’s start with the idea that conjecturing is a fundamental human phenomenon.
Pre-Schoolers and Rectangular Prisms
“Making conjectures throughout life”
Quick Blocks

“Making conjectures throughout life”
Put the snap-cubes together like the picture you just saw.

If you are not sure, make a conjecture about what you think is correct.
How can we subtract?

“Making conjectures throughout life”

\[
\begin{align*}
82 - 36 &= 46 \\
80 - 30 &= 50 \\
2 - 6 &= -4 \\
50 + -4 &= 46
\end{align*}
\]
Quick Practice Conjecturing
Who is the Keynote Speaker guy?

Prior Knowledge: You know he is a middle aged associate professor of mathematics education at Bowling Green State University.

Conjecture about what kinds of things he may have done in his life up to this point?

“I wonder if you...”
• Pulled weeds for the elderly from age 8-18
• A janitor for JaniKing Franchise #49
• Ran a computer lab
• Once thought the earth must be falling down through space and conjectured that it would soon hit the bottom of something
• Hauled Hay in the form of rectangular prisms every season
• Wrecked a tractor into the side of a railroad bridge
• Cooked (Expo) for Red Lobster
• Started a school in the inner-city
• Enjoys skydiving and bungee jumping in many countries
• Taught mathematics to people from age 2 through 63
• President of Math Club, Physics Club and a Fraternity
There is wisdom to being in “conjecture” mode

Rather than assuming we know and acting upon assumed knowledge we could operate from an open modality through continually testing our conjectures.

Let’s enjoy making some other conjectures together.
Visualizing Pattern
Spaces for Students to Conjecture

• Students’ conjectured – Can we make a robot that cleans toilets? (because they did not like cleaning toilets)
Spaces for Students to Conjecture

- Student’s conjectured: How can robotics be used to make oil drilling more feasible and safer?

- Research received 1st place in the nation.
Spaces for Students to Conjecture

- Student’s conjectured: How can robotics be used by those who lost their limbs to help them regain mobility?

- Research received 3rd place in the nation.
Spaces for Students to Conjecture

- Student’s conjectured: How did people know how to find things before GPS?
Spaces for Students to Conjecture

- Student’s conjectured: How is mathematics used in aviation?

*Upper Surface Curved*  
*Lower Surface Flat*

---

**Thrust to Weight Ratio**

\[
\text{ratio} = \frac{F}{W} = \frac{\text{Thrust}}{\text{Weight}} = \frac{ma}{mg} = \frac{a}{g}
\]

- \(a\) = acceleration
- \(g\) = gravitational acceleration

High \(F/W\) = High Acceleration = High Climb Rate
\(F/W > 1.0\) can accelerate vertically.
Spaces for Students to Conjecture

- Student’s conjectured: Why are geodesic domes being designed for Mars and why do we not use them more on earth?
Spaces for Students to Conjecture

• Student’s conjectured: Based on a discussion about music at the school dance “What would the general formula be for any number of different venues for bands if a change in music genre made a new venue?”

\[
\begin{align*}
C_{(n,r)} &= \frac{n!}{r! (n-r)!} \\
P_{(n,r)} &= \frac{n!}{(n-r)!}
\end{align*}
\]

$n = \text{set size: the total number of items in the sample}$
$r = \text{subset size: the number of items to be selected from the sample}$
Spaces for Students to Conjecture

• Student’s conjectured: What would it take to start a community Center to help people get good jobs?
The connections that students make through testing their *authentic conjectures* allows their learning to *become greater than any set of static knowledge to be learned*. Perhaps more importantly, it develops a *sustainable conjecturing modality* inside their very being. This will allow them to have a life of “perpetual and thoughtful wonder”.
So long as you desire adventure,
  never cease to conjecture
Let it spring forth from you,
  as a resonate emergence whose time is due
For when you openly conjecture,
  there will flourish adventure
Conjecturing Broadens and Deepens Connections more than Assumptions.
Conjecturing Broadens and Deepens Connections more than Assumptions.
Assumptions are not Conjectures?

• The students that did all these things often have a lot of assumptions made about them by others. Here are the facts that led to other assumptions people would make about my students:

  • Impoverished (98% free and reduced lunch)
  • At-risk (inner-city had a 26% likelihood of graduation)
  • Held back by Violence (50% of the state’s violent crime within 3 mile radius of the school)
  • Unintelligent (average grade level equivalency in 9th grade was 4th grade)
Questions?

Thoughts?

Conjectures?
Gabriel Matney
Associate Professor of Mathematics Education

gmatney@bgsu.edu
@DoctorMatHney (Twitter)