

JBAC Math dialogue

GS Physics Courses Discussion

Participants: Dusty Rittenbach – RCC; Doug Gardner – RCC; Nikki Armstrong – SWOCC; Lucas Lembrick – CGCC; Barry Allen – PCC; Matt Beekman – Oregon Tech; Donna Lewelling and Doug Nelson

Doug asked group to keep in mind: How much of the traditional notation math topics/courses are we talking about? Should we doing some reform/applied work?

Entry Level Pre-requisites/Corequisites:

PCC: Its almost a philosophical distinction. What algebra addresses is the equality... This equals this. $A=B=C$ so $A=C$. Arabs invented algebra – but how did they do it? Because they went into India and learned the concept of zero. They need the basic concept of this. In physics they must be able to solve word problems. Students who come from other countries are well-prepared although the topics are often “crammed”. Many students come to the physics programs from other countries and have different background, etc. Students need to have good study habits – do their homework.

OIT – also sees the students coming from varied background/origins. Algebra skills are not at the level you might expect.

Students also take time off – which poses a challenge.

Students who take 254 have had more time to refine basic algebra skills.

Is a MTH 95 student prepared? Physics is very based on applied math. When you first learn you learn in a specific context.

How physics interfaces – use kinematics; the concept of acceleration, etc.

RCC: its more homogenous population – 80% Rural white male; 15% rural white female. A good portion of them have been taking their math classes at RCC or coming from HS well-prepared.

While critical thinking is a challenge, there are challenges with manipulating the symbols, don't be sloppy, slow down.

When teaching 95 and 105 are we teaching what we need for GS Physics? Nikki's response: Calculus based physics is a different discussion. Students struggle with the framework within the different contexts – solve this linear equations vs. find the maximum acceleration of XX... They don't see the process is really the same. In other words using F for Force versus X.

When Nikki is teaching 95 or 111 – if you take away a lot of physical manipulation then you get to what applies universally. We need to get back to the overall relationship of things.

Need to move away from using “X” and use symbols that stand for something.

The language used to teach concepts is at the heart of things.

Pedagogy that is less about symbolic manipulation is at the heart of things.

Career change is a big deal for students – a lot of students want to become engineers.

Where are permutations and combinations taught (only taught in one part of basic physics)? Sometimes in a finite math course (MTH 245 – some in MTH 211 – sometimes MTH 105).

Students have trouble with modeling in physics and determining which piece of information to include or not.

General problem-solving and critical thinking skills are necessary for physics. Having a framework or strategy to solve a problem...

What does it mean to have students get better problem solving skills? At what level? Does it matter?

Training someone to be comfortable with not knowing how to do something. Setting up a way to talk about things and assessing things – it's okay to be unsure, I want you to think about things – think about how you are doing rather than focusing so much on the right answer.

Any sort of real problem is an approximation to the truth.

It's okay to experiment. Build up a culture of trust in the class to be wrong. Let's explore their thinking. Having a focus on the process to arrive at the answer.

The difference between an exercise and a problem. Teaching students how to solve a problem.

Encouraging students to solve problems a few different ways – when they get the answer wrong – have the student identify why.

With outlines, course syllabi, etc. instructors are required to get thru a specific amount of stuff – there is no room to allow for student to be uncomfortable. How do cut things out that you don't need or that are duplicative (math 95 and 111 have a significant amount of overlap).

What role has technology in “speeding up” students – where they don't want to struggle they want the answer now?

There is definitely a correlation with this. It is a big culture shift – students who don't know how to solve the problems at home – “they didn't teach us this” ... they don't understand that this part of the journey. Maybe “being comfortable with being uncomfortable” should be on the syllabi.

There is more than one type of applied mathematics.

Skills that are needed for physics:

Figuring out vector components – signs and cosigns... Doing problems with units.

Use of units – have it be as part of the “ride” to the solution.

Vectors in Trig in basic algebra (MTH 112).

Vectors are more important than Trig identities.

Compare and contrast a vector, components of vector and magnitude of vector.

Teaching students how to solve the problem without numbers... Learning how to manipulate symbols.

What process should you use in a situation – is the answer reasonable? Why or why not?

Some schools have 251 as a prereq for 211... HMMM?

Trig and basic algebra are the skills to solve.

Subscribing is likely a good skill for them to have.

Nurturing a sense of bravery – it's okay to be uncomfortable... Just try something.

In math we don't give a lot of room for choice – in physics there are a lot of opportunities for choice.

Does success in your discipline seem to require algebra/calculus projectory?

For the 200 level yes.

However, for general physics – could they be successful in an applied math setting. RCC does have good alignment because Dusty and Doug worked together to design the applied math course.

Students who take statistics math (standard deviation or even conceptually) could be successful in physics. In principle it could be helpful.

TAKE AWAYS:

Applied math is important. There isn't much that they need to know when they come into physics in terms of math... It is the application. They don't need to know a lot of math just the math they need to know very well.