

COMPILATION: dimensional analysis

Sept. 27, 2018

From: Justin Worboys

Especially for the Modeling chemistry curriculum I have battled finding a method of teaching dimensional analysis in a way that either resembles Modeling or resembles a POGIL. I have taught to diverse student sets, and I always just find that I need to dig deeper and deeper into the math principles and intuitive science principles every time.

I created this to help supplement the math skills:

[https://docs.google.com/document/d/1h\\_HjG58HA26ZBqiv6ukBz4P\\_-fnzhE3fxgLF2kCNMao/edit](https://docs.google.com/document/d/1h_HjG58HA26ZBqiv6ukBz4P_-fnzhE3fxgLF2kCNMao/edit)

But now I am finding out how weak their understanding is when comparing gram/meter/liter to kilogram/kilometer/milliliter (1000 of the small thing fit in the big thing idea).

I feel like I keep just going into a rabbit hole of concepts that they need framing before it makes sense.

Does anyone have curriculum resources or websites that really do a good job getting someone to understand dimensional analysis? I would love to have a way that ties into proportional reasoning.

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Sept. 27, 2018

From: Nicholas Park, long-time Modeling Workshop leader in Texas

See this: "For Every" Speak: A Cognitive Approach to Teaching Dimensional Analysis, by Gary Abud, Jr., MA, Grosse Pointe North High School.

<https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbXhYnVkc2NpfGd4OjQ2ZDViYzlwZDY2YmUyMTU>

[Jane's note: Gary Abud is a Modeling Workshop leader in chemistry, in Michigan.]

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Oct. 3, 2018

From: Nathan Harada, a Modeling Workshop leader in Chicago

Hi Justin, I also suggest using the "for every" speak as a way to make sense out of the conversion factors.

In addition, my daughters started using Singapore math in their math classes using bar models to visually represent different math relationships. I think this would also work well in doing conversions. There are a couple of teachers who have written about using bar models in their physics/chemistry classes. Here is one that I like:

<http://mrbenney.wordpress.com/2018/03/22/using-maths-pedagogy-to-inform-my-science-teaching/>

The bar models help students visualize equivalence (like your meter stick diagram in your notes) and then make it easier to determine whether to multiply or divide.

The other thing that I have changed in my teaching of conversions is to allow students to show separate steps for their conversions rather than one long conversion equation. It is less efficient, but I think it is more effective for students. They'll develop their own strategies for efficiency as they develop mastery.

Oct. 4, 2018

From: Justin Worboys

Thanks for the few responses. I've made significant updates to the last document I was working on.  
[docs.google.com/document/d/1xiN5q\\_rINMSNmZ4Jnq0h5f-CkEn--N7q5FYy\\_RgZfbg/edit](https://docs.google.com/document/d/1xiN5q_rINMSNmZ4Jnq0h5f-CkEn--N7q5FYy_RgZfbg/edit)

I'd like to respond to a couple of the responses towards the group though:

\*-focusing on the "for every" language\*

I use this quite a bit since reading Arons. I also find the "Out of every (denominator amount), take/move/rise/fall/etc (numerator amount)" language to be even more appropriate.

\*-focusing on bar models\*

I already try to do a picture model method similar to this. I actually do that at the start of the worksheet I put together. I added a visual answer that I use for that problem. Many of the changes I made try to focus on doing more visual/bar model diagrams throughout.

\*\*I had a hard time trying to figure out how to visually represent multiplying by a fraction.\*

I see that people think that it is best to move away from dimensional analysis/factor label method. I think students will likely encounter it in college and I want to expose them.

More importantly for me (yes students need to know the physical meaning behind the mathematical symbolism), I have continuously/at many schools needed to show students how to handle unit analysis -- like the area under a velocity time, they struggle to realize that you can "cancel" the seconds. When we look at slope of velocity over time, they don't realize that meters every second every second is the same at meters/seconds squared. Plus many struggle synthesizing the multiplicative identity property with the multiplicative associative property, which become even more important when they move toward doing the heavy mathematics portions.

Anyway, thanks for the tips. I'd like to have a summer math worksheet or a course "pre-math" resource that would try to supplement kids' math skills before entering into my courses.