Guest Editorial

It’s Self-Evident!

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I was watching the new Ken Burns film on Benjamin Franklin [Burns and Duncan 2022]. They were talking about how Thomas Jefferson sent a draft of the Declaration of Independence to Franklin to read over.

To quote Walter Isaacson, the famed historian, “Using heavy backslashes, he [Franklin] crossed out the last three words of Jefferson’s phrase, ‘We hold these truths to be sacred and undeniable’ and changed it to read: ‘We hold these truths to be self-evident’” [Isaacson 2003].

For many years, I have been using mathematical modeling to motivate and teach mathematics, quite often differential equations. I did no formal educational studies. I did not survey my students or go to a curriculum committee. I was not motivated by the “story problems” offered so inadequately by the starred problems in textbooks. I read no formal studies about statistical analyses of “with and without modeling” in a mathematics course.

So what about the value of mathematical modeling?

*It is a self-evident truth!*

Modeling excited students. It interested and engaged them. They got hooked on an intriguing situation or problem, often one that was not even in their major area of interest, that is, the discipline that sent them over to the Mathematics Dept. to take the differential equations course. They learned to apply the mathematics that they were studying and how to transfer that mathematics to their cognate disciplines. They wanted to know the mathematics that could address this modeling situation—what snookered them and drew them in was the modeling opportunity that I was offering them in class before we learned the appropriate mathematics. Thus, they were receptive to bringing them this new mathematics and
methods; indeed, they were craving it at times. And they loved how it addressed their situation in studying another discipline, often eloquently so.

A further self-evident fact was that we as teachers were intrigued by the amazing number of diverse areas in which modeling with mathematics, especially the mathematics of change that we call differential equations, played a key role; intrigued enough

- to write something up for our students to consider in class,
- to use some of that special/precious time that we had together in our class hours and in our syllabus(!), and
- to risk taking them on the wandering journey of discovery rather than the linear, direct path of lecture and technique.

And the reason that we talk about modeling at conferences, write about it in articles, share examples with colleagues in SIMIODE, CODEE, COMAP, and The UMAP Journal, other journals, etc.—and bubble over with joy when we think about it and share with colleagues what just happened in our classroom—is because it is a self-evident truth.

Thank you, the audience of this Journal, so much for helping me realize again just how self-evident it is that if you use a realistic situation—a modeling opportunity, if you will—to introduce students to mathematics, and through which they will learn (of necessity, just to address this one modeling situation) new mathematics, then you are doing them a great service and you are more likely to have them hold on to and embrace mathematics in their lives. And they will return to campus years later and tell you just that. They will not tell you about

- the proof of the fundamental theorem of calculus,
- separation of variables, or
- existence and uniqueness of solutions to differential equations.

No. They will recount instead

- the struggle to determine one term in a differential equation model,
- the work and methods to estimate a parameter and give it import, and
- the complete satisfaction to see the crucial role of the mathematics in helping them understand an intriguing situation that you brought to class, often in an area completely alien to them.

And they will thank you profusely for doing so.

To them the role of learning mathematics in context and applying mathematics is self-evident in motivating them to want to learn more mathematics and its rich beauty and usefulness.
So while I truly believe that using modeling to motivate and teach differential equations is a “self-evident” approach, it sure is refreshing to sit in the choirs of readers of The UMAP Journal and hear your voices, share your excitement, and feel that strong evidentiary vibe!

Thank you so much for your participation in our broader conversation through your readership, and more importantly, for your work with your students in this self-evident venture. I am blessed by association with collegial self-evidenters. A rhetorical question: Where were they all when I was taking my undergraduate mathematics courses in 1960?

References


About the Author

Brian Winkel is Professor Emeritus of Mathematical Sciences at the US Military Academy at West Point. He founded and is the editor emeritus of the journals Cryptologia and PRIMUS: Problems, Resources, and Issues in Mathematics Undergraduate Studies. He is also the founder of SIMIODE, an online community for teachers and learners of differential equations, with a repository of refereed modeling scenarios, curated online texts and quality teaching materials, and project areas and spaces for active collaboration.