Teaching Modeling
Needle Found in a Haystack

Amanda Beecher
School of Theoretical and Applied Sciences
Ramapo College of New Jersey
Mahwah, NJ

Kayla Blyman
Mathematics
Saint Martin's University
Lacey, WA
k.blyman@comap.com

In our increasingly technologically-advanced and data-driven world, the demand for adept problem solvers has never been higher. Applied mathematics and data science programs are growing, and employers are expecting college graduates to possess a certain baseline of problem-solving skills.

We believe in the power of modeling education to equip our students for their futures. More specifically, our goal as educators is to help our students develop a modeling mindset [Arney et al. 2020]. This shared goal fuels our mutual passion to constantly improve the landscape of mathematical and interdisciplinary modeling. One of the greatest resources that any educator has in these pursuits is their colleagues. To that end, we have spent countless hours discussing existing resources for teaching modeling, both with each other and with educators at all levels. Often, these conversations come around to a collective dreaming about resources that we really wished existed.

Sometimes we are pleasantly surprised to learn that we were wrong about a resource's non-existence when we stumble across it—or at least across something "close enough." These moments when we find a new-to-us resource—such as a UMAP Module or a COMAP contest problem—that meets the needs of our classroom are always exciting. Such discoveries often take a bit of digging to find a gem that meets the specific needs of a class. Therefore, we find ourselves searching for them well beyond the months when we are teaching these classes, always prepping for the next time when we will need them.

The UMAP Journal 44 (2) (2023) 103–105.

In searching for resources, we look for ones in which students can learn about the process, the topic, and maybe even some mathematics. We tend to use COMAP resources to showcase individual aspects of the modeling process, or work repetitively on the same problem to showcase the full process altogether. It is time-consuming to weave together the modeling process from examples; and doing so rarely features authentic problems that are truly interesting, important, and accessible to our students. Moreover, do these individual topics create a cohesive course?

We often hear of others with the same struggle. When discussing these struggles with Eric Marland of Appalachian State University, he suggested that we read *How to Model It: Problem Solving for the Computer Age* [Starfield et al. 1990]. This is the book that we dreamed must surely exist! Eric expresses the value of the book in a review in this issue of *The UMAP Journal* [Marland 2023]. You should read this book! It would have saved us many hours of trying to view problems through the lens of the modeling process, because the authors do it so fluidly in their book.

It is with great pleasure that we also share with you in this issue two of the book's authors' further reflections—30+ years later—on modeling and teaching modeling [Smith and Starfield 2023]. They share the wisdom that they have gained by cumulatively spending the better part of a century thinking about teaching modeling and working to make positive changes in their own applied mathematics classrooms. They begin with reflections about their 1990 book with Andrew L. Bleloch. However, their reflections go beyond the book to guide you how to teach modeling effectively. Their advice helps students think through problems in a structured way that makes the scary part of different right answers a little more manageable, yet continually encourages creative problem solving. The freedom that some mathematics students fear is precisely the value of modeling showcased in the the book and in this subsequent article. Starfield, Smith, and Bleloch show students the real power of the mathematics that they are using and hopefully encourages them to learn more.

We hope you get as much out of the book and the contemporary reflections as we have!

References

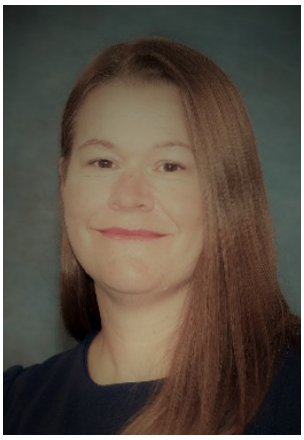
Arney, Chris, Amanda Beecher, and Jessica Libertini. 2020. What is math modeling? It's a noun! It's a verb! It's … a mindset??? *Consortium* No. 120: 1–2.

Marland, Eric. Review of Starfield et al. [1990]. *The UMAP Journal* 44 (2): 182–184.

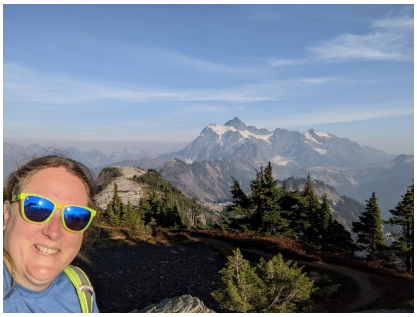
Smith, Karl A., and Anthony M. Starfield. 2023. *How to Model It: Problem Solving for the Computer Age*—still going strong at 30+ years. *The UMAP Journal* 44 (2): 107–116.

Starfield, Anthony M., Karl A. Smith, and Andrew L. Bleloch. 1990. *How To Model It: Problem Solving for the Computer Age*. 1994. Reprint. Edina, MN: Burgess International Group. 2020. Reprint. Buford, GA: LAD Custom Publishing. https://ladbookstore.com/products/how-to-model-it-problem-solving-for-the-computer-age-print.

About the Authors



Amanda Beecher is Associate Professor of Mathematics at Ramapo College of New Jersey. She is founding department head of the Data Science undergraduate program and Program Director of the M.S. in Applied Mathematics program at Ramapo College. She earned her Ph.D. from the University at Albany, SUNY. Before arriving at Ramapo, she had a three-year postdoc at the US Military Academy, where her interests in applied mathematics were fostered. Her research interests include combinatorics, graph theory, commutative algebra, modern applied mathematics including data analysis, and mathematical modeling. Her educational endeavors include bringing interdisciplinary modeling opportunities to colleagues and students.



Kayla Blyman is Assistant Professor of Mathematics at Saint Martin's University in Lacey, WA. She holds a Ph.D. in STEM Education and an M.A. in Mathematics, both from the University of Kentucky. She has taught at the US Military Academy, Berea College, Midway College (now Midway University), and the University of Kentucky. Kayla wears multiple hats with COMAP: director of the Middle Mathematical Contest in Modeling (MidMCM); co-director, problem director and author, final judge, judges' commentary author, triage judging coordinator, and triage judge for the Interdisciplinary Contest in Modeling (ICM®); and associate editor for the Teaching Modeling department of *The UMAP Journal*. Kayla's research is focused on the development and implementation of new and creative ways to teach and assess undergraduate mathematics with a goal of better developing creative problem solvers for our future. As an avid explorer—both professionally and personally—Kayla loves spending time in the great outdoors, partaking in the arts, traveling to new places, and trying new food.