

A Discrete Introduction to Mathematical Modeling: Lessons Learned from Introducing (Bio)Mathematical Modeling through Difference Equations

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For many students, the beauty of mathematics lies in its utility and applicability to the real world. Mathematical modeling provides a framework to use mathematical expressions or algorithms to reproduce and deepen our understanding of observed patterns, and to make educated, quantifiable predictions for hypothetical scenarios. There are many biological systems whose dynamics can be modeled by discrete difference equations. This form of modeling requires only some knowledge of basic algebra to understand model construction and some fundamental forms of model analysis, and can therefore provide an excellent early introduction to mathematical modeling. For the past decade I have been introducing undergraduate students to mathematical modeling through discrete difference equation models applied to biological systems. Over the years, I have collected a variety of examples and applications. Here I will share some of the examples along with lessons learned through the development and continued refinement of an introductory level modeling course that appeals to students in a variety of majors and with a variety of mathematical backgrounds.