Review of: "Essential Calculus, a Revolutionary Approach to Teaching Calculus"

Ionuţ Gabriel Farcaş[1]

1 University of Texas at Austin

Potential competing interests: No potential competing interests to declare.

I like the idea behind the presented paper, to teach calculus in a more effective way, especially for students studying engineering or domain sciences, such as physics or chemistry. I assume that the author targets mostly this category of students rather than students in mathematics.

My opinion, however, is that the article is not yet mature enough to be implemented in a specific curriculum nor offers rigorous arguments for why the proposed ten week implementation is more effective than existing strategies. Moreover, while I agree that especially majors such as engineering or physics might benefit from a more application-oriented teaching of calculus, a ten week class may not be enough to cover the proposed topics as thoroughly as they should be.

A few comments and suggestions for improvement are the following. I personally learned a great deal of single-variable calculus and even the basics of solving ordinary differential equations in high school. I am aware that not all educational systems are the same, but you should clearly specify what are the target students/majors and educational systems for your proposed paradigm. Presumably, you refer to the US system. Moreover, some aspects of your paper can create ambiguity, especially for prospective students who have little or no prior calculus knowledge. For example, you are talking mostly about single-variable calculus and ordinary differential equations, but you do not mention this explicitly. Moreover, you state several times that the primary purpose of calculus is to solve differential equations. That is not really true, or at least it should be formulated more carefully. Perhaps you want to rephrase it to something like ``The main application of calculus is to formulate governing equations of physical or engineering systems usually stemming from first principles." Most equations relevant to the physical world, with realistic geometries (and initial/boundary conditions) cannot be solved analytically, which is why the field of computational science emerged over the past few decades (calculus is an essential part of the curriculum in computational science as well.). This is connected to ``The reason is that differential equations are typically very difficult to solve, and what's worse, most are unsolvable."  You also say that ``in physics the differential equations are first order and second order". Most equations are first or second order, that is true, due to the fact that many models stem from perhaps the most important and interpretable equation (for science and engineering) from the past 300+ years, F = m*a, but there are also higher-order equations in physics.