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

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Potential competing interests: No potential competing interests to declare.

I find the idea of starting a Calculus course by teaching differential equations intriguing. My experience is that some students may gain deeper understanding of derivatives and integrals by considering the examples such as the velocity and acceleration of a car, or gravitational forces. For students who might be using differential equations frequently, it could be beneficial with a short course focusing on this goal.

However, I have four concerns: 1. the way the article is written requires major improvements, 2. the manuscript requires further references, 3. the suggested schedule, 4. I would like to see results from implementing and testing the proposed schedule.

Concern 1:

- Several sentences should not be stated in a universal manner. As an example, I recommend replacing ‘Laws of physics governing how things change are written as differential equations’ by e.g., ‘Laws of physics governing how things change can be written as differential equations’. Just a few lines below, physical laws of motion are stated without derivatives.

- In the introduction, there should be a sentence or two about the students: major, assumed preexisting competence, the course goal. Some statements in the manuscript might only be true for a specified group of students. Without proof, I am not convinced that the laws governing planetary motion are taught in every high school. Another example: at my university, students learn a bit about differential equations in the first weeks – and students of engineering or STEM usually have seen differential equations at Norwegian high schools.

- I recommend clarifying which Calculus class in which study program is considered in the article and I would make section 2 about comparing the traditional way of teaching this class with the new way.

- The article contains several sentences that either require a reference or need to be stated as personal opinions. If it is not possible to find references undermining statements such as ‘The problems with the way calculus is currently taught are #1 – it is unmotivated because interesting problems are unsolvable, #2 – it is abstract and too rigorous, and #3 – it takes two years’, this should be a stated as personal opinion. I am not familiar with this topic, but does everybody agree that the NSF reform from 1985 – 2000 came to naught? Is the primary goal of Calculus always to learn about differential equations? (Calculus is also been taught to students of Computer Science).

- There are some inaccuracies in describing mathematical concepts. As an example, ‘by setting Δt to 0’ should be replace

by e.g., ‘by letting Δt go to 0’. What is meant by ‘as h gets smaller the line gets straighter’?

Concern 2: A literature review is missing, and Wikipedia is used as reference.

Concern 3: I would recommend making central results clearly visible. As an example, the result for the derivative of the logarithm deserves in my opinion a sentence of its own. Furthermore, we expect our students to be able to solve a broader variety of differential equations. It is unclear to me, how students learn about this.