

This paper describes a novel way to structure the content of an introductory physics course. Rather than introducing one topic at a time, the instructor introduces four major concepts (lenses) of mechanics – momentum, energy, forces and kinematics – to the students during the first week. Throughout the term problems are introduced and analyzed by these four lenses. Students are explicitly asked to identify the applicable concept before the solution to any problem and are graded for doing so.

The author provides a careful description of how students have responded to this curriculum via CLASS scores, student evaluations, student resistance to identifying concepts unless their grade depends on it, and student self reflection of learning. Traditionally papers that present new pedagogies present evidence of student learning. This paper does not. I would of course very much like to see these results; however, I do appreciate the author(s) explaining that their measures of learning vary more by term than from traditional to revised pedagogy. This provides some evidence of the level of learning from this pedagogy, leaving me with the assumption that learning gains are on the order of 20% similar to those in traditional instruction. If this is not the case, then I strongly suggest that the author provide some data about learning gains.

I found this paper to be very clearly written and well organized. I enjoyed reading about the course and came away feeling like I was provided a clear picture. The author did a nice job of describing the difficulties while transitioning to this pedagogy, which I believe is the strongest part of the paper. The learning curve for the instructor, the dip in student evaluations and later recovery, and the need for explicit grading are consistent with the struggles I have heard from faculty adopting any new pedagogy.

I did not, however, come away thinking that I would want to try this approach and suspect that many other readers will feel the same. I think this is due to a combination of the honest description of the struggle to adopt a new curriculum, the lack of appropriate resources (textbook, etc...), and that there currently isn't strong evidence of improved learning. The CLASS scores are encouraging, however, there is no comparison to students attitudes during "serial" instruction. So it's possible that this instructor would have seen these sorts of gains with their previous "serial" curriculum.

Specific suggestions

In the 10 Week outline, I recommend listing the four lenses on Week 1. Specifically "Week 1: (Introductions, Philosophy, and the Four Lenses: momentum, energy, forces and kinematics)" The reason I suggest this is that on the first read through, a person may not remember these from the first paragraph and it's an easy addition to this 10 Week outline. Also, a reader who is surfing, may go to this list before reading the manuscript from the beginning.

In the Thinking like Experts section I am left with a few questions:

1. I would like to see a little more quantitative data and maybe a bit more description if there is space. For example, "The results indicate a modest positive average shift, 7%(5%) favorable, and a significant shift, 22%(4%) favorable, in applied conceptual understanding (Fig.1). " Alternatively a table with some of this data could be added. I like the figure but the reader should be provided with Standard error values so that they can see for themselves the relative significance of the results.

2. I see that this data came from a potential body of 96 students. Are the 96 students from the last two terms that you taught? I'm only guessing since each class is 48 students. Please explain which courses these students are from and how this corresponds with changes to the course and other student data reported. Are these students the ones who provided an average of 3 on faculty evaluations or are they a different group.

3. I see that 63 of this 96 responded pre and post. Are they equally distributed between the sections surveyed? Do you have other data to support that these are representative of the class as a whole or could there be some selection effect causing these to be the more positive or more involved students in the course?

4. I think it would be valuable to provide readers with an example of a statement from the Applied Conceptual Understanding category (one that had particularly large improvement) or maybe a brief summary of the types of statements so that readers have a better sense of what this gain indicates. Specifically I wonder if you saw big gains on the plugging numbers into a formula statement or the physics consists of disconnected topics statement. From the manuscript, one would hope that these statements show marked expert-like movement.

5. Do you have CLASS data from before transitioning to a "parallel" pedagogy?