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Facilitating Higher-Order Learning in an Introductory Physics Course

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What is most important for non-physics specialists to learn from an introductory physics course? How can course design and assessment support learning transferable skills, especially in large "lecture"classes? We will discuss preliminary results from a collaborative research-practice self-study partnership focusing on Sealfon's implementation of learner-centered approaches in a 200-student first-semester algebra-based physics course with labs. The course design followed the two intentionalities of the Investigative Science Learning Environment (ISLE) approach (Brookes, Etkina, and Planinsic 2020): (1) We want students to learn physics by thinking like physicists; by engaging in knowledge-generating activities that mimic the actual practices of physics and using the reasoning tools that physicists use when constructing and applying knowledge. (2) The way in which students learn physics should enhance their well-being (via empowering versus authoritative teaching practices). In the lecture hall, students worked in pairs or small groups on knowledge-generating activities on their white boards (laminated sheets of paper). Sealfon regularly pulled a group's whiteboard, displayed it to the class using a document camera, and discussed the activity with the class. In labs, students worked in small groups to design and conduct experiments to observe phenomena, propose explanations for patterns, and test ideas (hypotheses). Students completed reading and homework using the interactive Perusall platform with brief feedback provided by their teaching assistants. Nontraditional assessment elements included two-stage tests with an optional collaborative portion and an option to revise and resubmit problem-solving solutions on tests with oral quizzes given by teaching assistants.

Keyword-1

active learning

Keyword-2

introductory physics

Keyword-3

self-study

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