

Challenges & Attendance in Introductory Physics Courses in an Online Environment

Nitara Fernando

Pat Clancy, Miranda Schmidt, Cayleigh Robertson, Daniel Dobrowolski, Greg Van Gastel
McMaster University

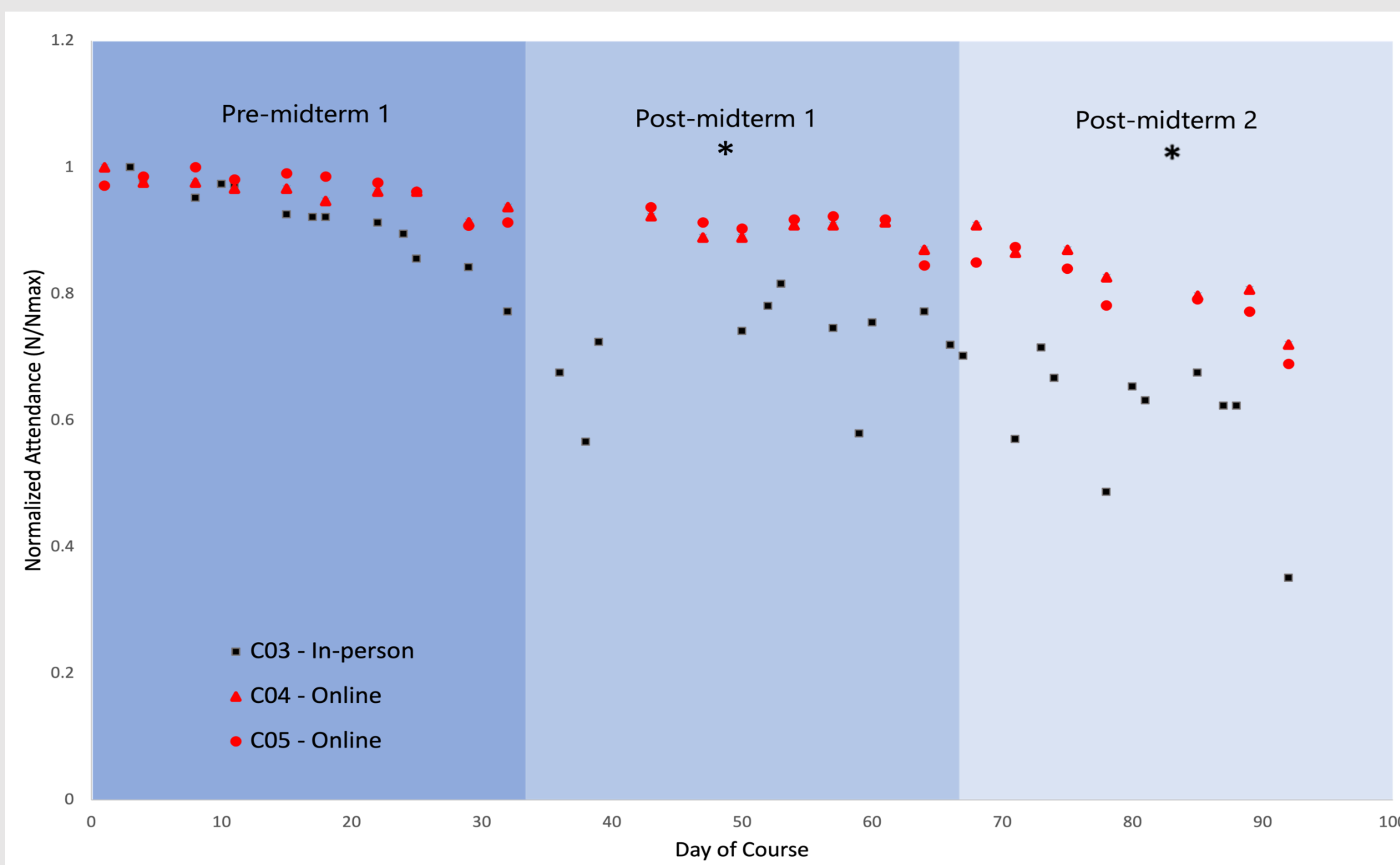
Introduction

- Improving introductory physics courses relies on identifying topics and aspects that students find challenging.
- For instance, problem solving is a challenging aspect of physics. Differences in the way faculty and intro students approach novel problems shows a difference in problem solving methods employed between both groups. Teaching students to approach problems systematically can improve the way they approach problems (Singh, 2002).
- Additionally, the recent switch to online teaching methods changed how many courses were delivered. Lecture attendance has been shown to be an important indicator of student performance in physics classes (Moore, 2003).
- Examining the online lecture attendance in comparison to in-person lectures shows aspects of an online model that are beneficial to carry forward once on-campus classes return.

Methods

- A survey was distributed to students in three streams of introductory physics: life sciences, engineering, and physical sciences.
- Results from the open-ended question "what do you find most challenging about physics?" were sorted.
- Lecture attendance comparing introductory physics for engineers during the online semester (2021 winter) and in-person semester (2019 fall) were plotted and compared using an ANOVA test.

Attendance: Online vs In-person



* Denotes statistical significance

- Attendance was measured by iclicker participation
- 75% of questions must be answered for a student to be marked present
- In-person class met 3x per week
- Online classes met 2x per week with additional pre-recorded video content

Figure 1. Attendance of 2 online (red) and 1 in-person (black) introductory physics classes for engineers, as measured by iclicker participation throughout the semester.

	Online (C04)	Online (C05)	In-person (C03)
Pre-M1	0.963	0.973	0.929
Post-M1	0.905	0.908	0.711
Post-M2	0.827	0.8	0.639

Table 1. Average attendance for online and in-person classes.

Challenges in Introductory Physics

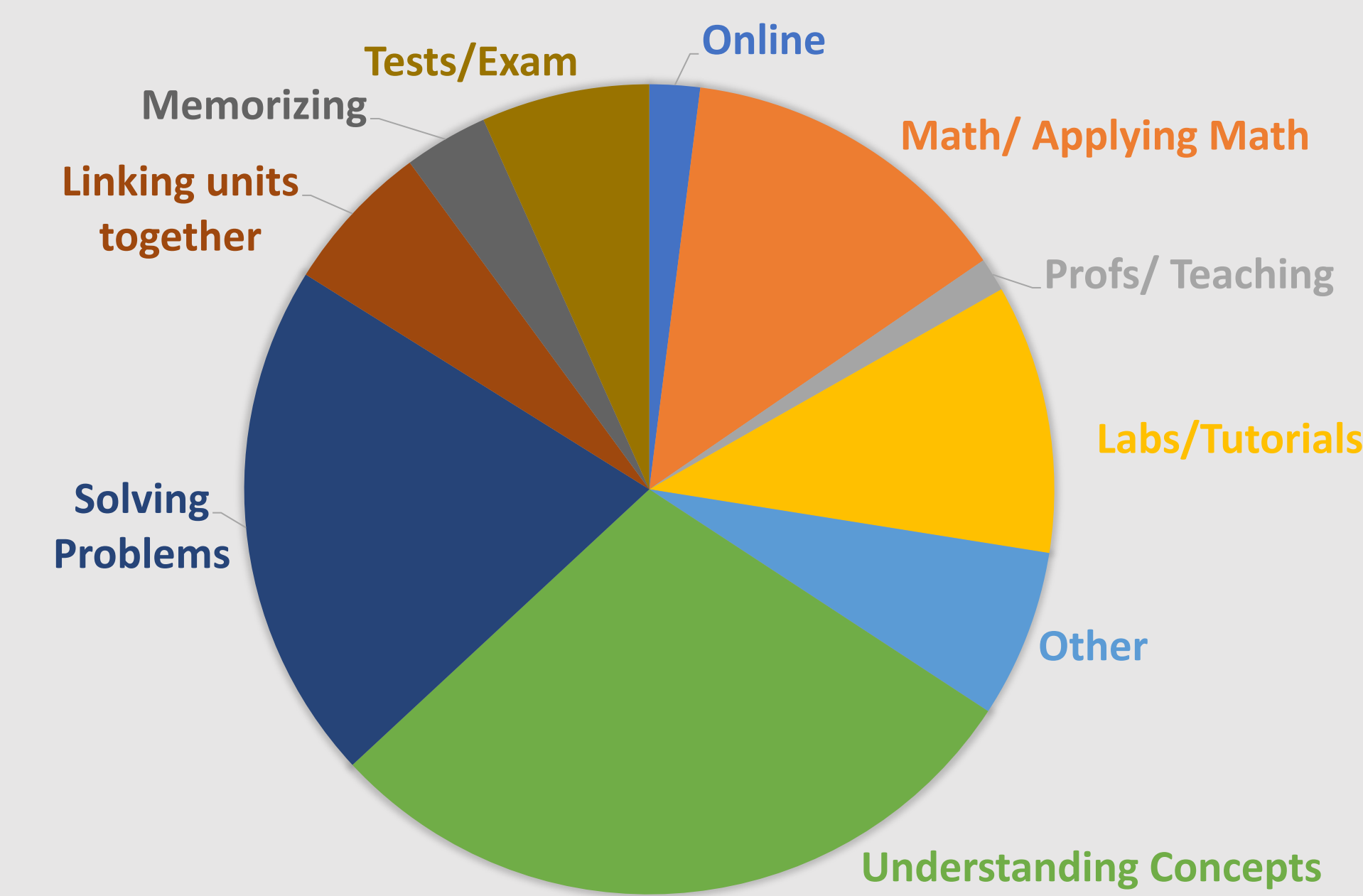


Figure 2. Aspects of physics that students found challenging in the life sciences, physical sciences, and engineering (150 responses) in Fall 2020. General understanding (29%), problem solving (21%), and math (13%) are the most challenging aspects. The shift to online classes (2%) was not a notable challenge amongst most students.

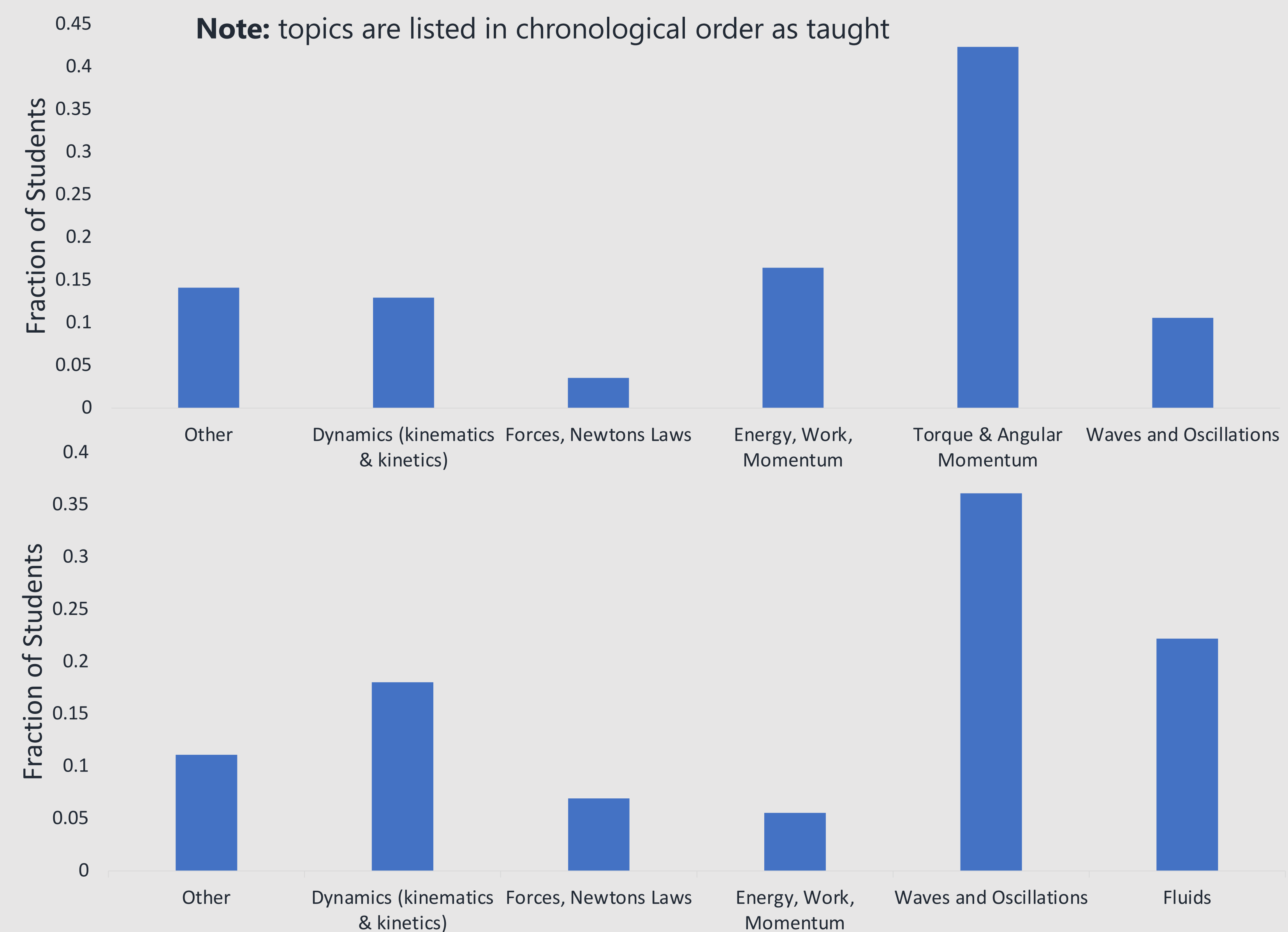


Figure 3. Challenging topics in intro-mechanics for engineers. Torque and angular momentum seem to be the most challenging topics for students.

Figure 4. Challenging topics in intro-mechanics for life sciences. Newly introduced topics (waves and fluids) seem to be the most challenging for students. These topics were also taught at the end of the course.

Conclusions

- Following a similar blended learning approach with 2 live lectures per week, as done with the online offerings, may improve class attendance.
- The continuation of more online courses or providing lecture recordings should be considered to improve attendance.
- There should be a focus on teaching students skills for problem solving and ensuring full understanding of difficult concepts.
- The order in which topics are taught may affect learning and more emphasis should be put on newly introduced topics

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References:

- Singh, C. (2002). When physical intuition fails. *American Journal of Physics*, 70(11), 1103–1109. <https://doi.org/10.1119/1.1512659>
 Moore, R. (2003). Attendance and Performance: How Important Is It for Students To Attend Class? *Journal of College of Science Teaching*, 32 (6). https://www.researchgate.net/publication/234649117_Attendance_and_Performance_How_Important_Is_It_for_Students_To_Attend_Class