DESIGNING AN ASYNCHRONOUS INTRODUCTORY PHYSICS COURSE: INTERACTION, LABS, AND ACADEMIC INTEGRITY IN ONLINE EDUCATION

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Online courses are often criticized for limited engagement and perceived lower instructional quality compared to in-person offerings, yet student demand continues to grow. We describe the design and implementation of a first-semester introductory Physics course developed for a fully asynchronous, intensive 6-week summer term at a large research-intensive public university.

The course was structured to promote meaningful interactions among students, instructors, and course content. Student–content interactions were supported through instructor videos, slides, an e-book, an online laboratory platform, and an online homework system. Student–instructor interactions included weekly discussion board posts on the learning management system (LMS) and group office hours. In addition, synchronous office hours held twice per week, along with consistent instructor feedback on assignments, emails, and LMS messages, further strengthened student–instructor engagement.

Principles of Universal Design for Learning were integrated to support accessibility and inclusivity. A central challenge – the laboratory component – was addressed by implementing authentic, hands-on experimental activities adapted for remote learning. Students purchased laboratory kits from a vendor that provided all the necessary equipment to complete the course's ten laboratories and carried out the activities through the vendor's online platform. They submitted photos of their laboratory setups, completed data tables, and responses to questions within the platform. Instructors were able to access and grade students' laboratory submissions directly there.

We ran the course for the first time this past summer. Demand for the online section exceeded our expectations, with the course filling (20 students) on the first day of summer registration and requiring us to open a second section, which nearly filled as well. By comparison, the in-person summer section had about one-quarter as many students. Student performance was on par with that of the in-person section. However, the online section had a higher drop rate, especially during the first two weeks. In addition, students often struggled even more to manage their time in an asynchronous online course, so clear communication through frequent course announcements was critically important. Strong course organization and structure were equally important in addressing this.

We also outline strategies used to promote academic integrity in the online environment. All quizzes and exams were completed using a live proctoring service, where students scheduled individual exam time slots. Numerical problems included randomized values for certain variables, and problem pools were used to generate different quiz versions. Students were required to upload images of their handwritten work for all questions, including multiple-choice items. Because lab activities were hands-on, students collected real data, which helped deter data sharing.