

The pros and cons of a self-paced introductory optics laboratory during the pandemic

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Abstract: Teaching laboratory courses, under pandemic restrictions, required new methodologies. In an introductory optics lab, a self-paced approach was implemented. Students completed experiments independently on flexible weekly schedule. Pros and cons of the method are presented. © 2021 The Author(s)

1. Introduction

The corona virus pandemic led professors and students down a path of new territory for teaching and learning. At the start of the pandemic as universities were shutting down, professors were scrambling in an effort to transition classes to virtual environments, posting notes, videos and other resources for students to learn remotely. Zooming became commonplace for many lectures, meetings and office hours. As the pandemic progressed, in-person learning resumed, but with many restrictions such as masking, social distancing and limited classroom capacities. For laboratory courses, the return to in-person learning, was a welcome relief. However, social distancing made working in groups or with a partner, a standard before the pandemic, an unrealistic option. Limited classroom capacities created even further complications for small laboratories. Finding a balance between performing labs in person and accommodating COVID protocols was a challenge. For the author of this paper, the solution for a small optics laboratory, with COVID restrictions of half capacity and 6 feet social distancing, was a self-paced approach. In this approach, students performed the lab independently under a flexible weekly schedule. The method was a success with many pros and some cons as discussed in the paper. Section 2 presents the basics procedure for the lab under normal conditions while section 3 presents the self-paced approach. In sections 4 and 5 the pros and cons are presented followed by a summary in section 6.

2. Introductory optics laboratory under normal conditions

The introductory optics laboratory compliments the introductory optics course. Students take the two simultaneously. The experiments performed coincide with the material covered in the course. The students complete a lab each week based on material covered in the class. Student collect the data in the lab and then have a week to write a formal lab report. Under normal conditions, students work in pairs with the instructor in the laboratory offering assistance as needed. The instructor offers a brief overview of the experiment and the data collection before students begin. In addition, the instructor provides the students with a write-up which contains a brief overview of optics theory for the experiment and information on how to collect the data. The room that hosts this optics lab has four narrow tables with one experimental setup on each table. Under normal conditions, students work in pairs or groups of three performing the experiment, in close contact with each other. The students collect data and then complete the analysis and write-up on their own, before turning the lab in the following week. This method has been used since the lab was introduced many years ago.

3. Self-paced optics laboratory under COVID restrictions

When the pandemic hit, close contact with lots of students in one room was forbidden. The instructor's institution issued capacity limits based on the size of the room. The capacity for the optics lab with social distancing left room for three students. The semester enrollment for the lab was twelve students. There were a few options proposed to teach the lab in person with COVID protocols. The first was to offer four section to accommodate all students. The scheduling logistics for this was nearly impossible for the instructor and the students. In addition it would push the professor over the recommended contact hours for the semester. The second was to offer one lab section but decreasing the length of time needed to collect data. Thus all students could cycle through collecting data in one lab period. This would limit the data collection time to less than an hour for each of the four groups. With this method, the instructor felt students would rush through the data focusing on finishing not learning. After much thought, the instructor decided to try a self-paced approach. This method gave the students flexibility throughout the day and the week to collect the data. The only requirement was that students had to collect the data independently in the lab without going over the room capacity limit, before the week ended. The labs were due on Wednesday of the

following week, no matter what day the student performed the lab. The instructor was available for questions in person when on campus but also offered to answer questions via zoom or email as needed. The instructor was not in the lab when the students were performing it.

4. Pros of the self-paced approach

The students responded very well to the self-paced approach. As expected some students performed the lab early in the week leaving lots of time for analysis and writing while others waited until the end of the week to collect data and finished the report on the weekend. Over all the students completed the labs successfully without the pre-COVID benefits of instructor overviews, lab partners and the instructor available to answer questions immediately. For the last lab submission, students were asked to comment on the self-paced approach. A few of the comments are presented below.

“In terms of the self-paced nature of the class, I found it was much easier and faster to get the labs done as I could choose when to work on them and when it worked best in my schedule”

“I enjoyed doing the self-paced lab gave me much more free time.”

“Overall, I feel that these self-paced labs were a positive change and provided us students with the ability to do the labs at our own pace and would recommend that the self-paced data collection be continued.”

“Overall I think this semester went very well considering the Covid restraints. I think the system of collecting the data on our own time was both a blessing and a curse. It was nice to be able to collect the data on my own time since I am usually busy in the afternoons on Wednesday’s and did not want to have a lab all afternoon. However, it was a curse in some ways too because it required me to manage my time which is a skill that I have not developed enough yet to be perfectly honest. I think the labs themselves were straightforward enough for the data to be collected on our own time and I encountered little trouble when trying to conduct the labs without other people in the lab to help me.”

“As for the self-paced lab times, I was a huge fan. It was helpful because that was less time wasted on just forming up and more time allotted to get work done. There were also instances where I was already in Mallory Hall for a class or a meeting and decided to go straight to the lab to get it done earlier.”

In summary, the students seemed to value the flexibility and were able to complete the labs without the instructor or a lab partner. It did require students prioritizing time for the lab but as stated by one student perhaps working on their time management was a good thing. In addition, this approach forced the students to think while they were performing the lab since they were doing it independently. It also eliminated easy access to the professor so students had to try to the lab on their own. From the instructor’s standpoint, it was useful for the student to struggle a little on their own in the lab before asking for help. As result the questioned raised by the students were thoughtful and resulted in productive learning.

5. Cons of the self-paced approach

Since labs were performed independently, the professor had to spend extra time editing the lab write-ups to make sure procedures were clear and easy to follow. For some experiments additional figures and pictures were added so students had a visual to refer to. In a few cases, the instructor did more of the preliminary alignment than would have been performed using the standard approach. In addition to the extra time spent editing labs, the instructor missed the weekly interactions with the students. Time with students in lab offers a unique teaching perspective that cannot be mimicked in the classroom. Teaching moments are often unveiled in questions asked by students in the lab and thus being able to show what happens experimentally solidifies the concept. Furthermore, students often learn from each other, so doing the labs independently eliminated the students sharing knowledge with each other.

6. Summary

In conclusion, the self-paced approach was a successful method for students in an introductory optics laboratory. From the student perspective, having the flexibility to choose when to perform the lab was highly valued. From the instructor standpoint, it made the students accountable for their time management and emphasized thinking and learning while doing the experiment. Although there were some cons, the pros make the professor tempted to try this method or a blend of the self-paced approach with the standard approach in the future.