Studio Optics: Upper-division Implementation of Studio Format - A First Look

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OVERVIEW

During the Spring of 2006, the KSU physics department converted its first upper-division Optics course into a Studio format. During the first implementation of this course we conducted two kinds of evaluations to assess the impact of the new format on student learning and attitudes.

First, a conceptual test based on questions developed by Mazur [1] was administered as a pretest, mid-test, and posttest.

Second, an online survey containing Likert-scale and free-response questions assessed the students' perspectives about the course.

CONCEPTUAL-BASED TEST

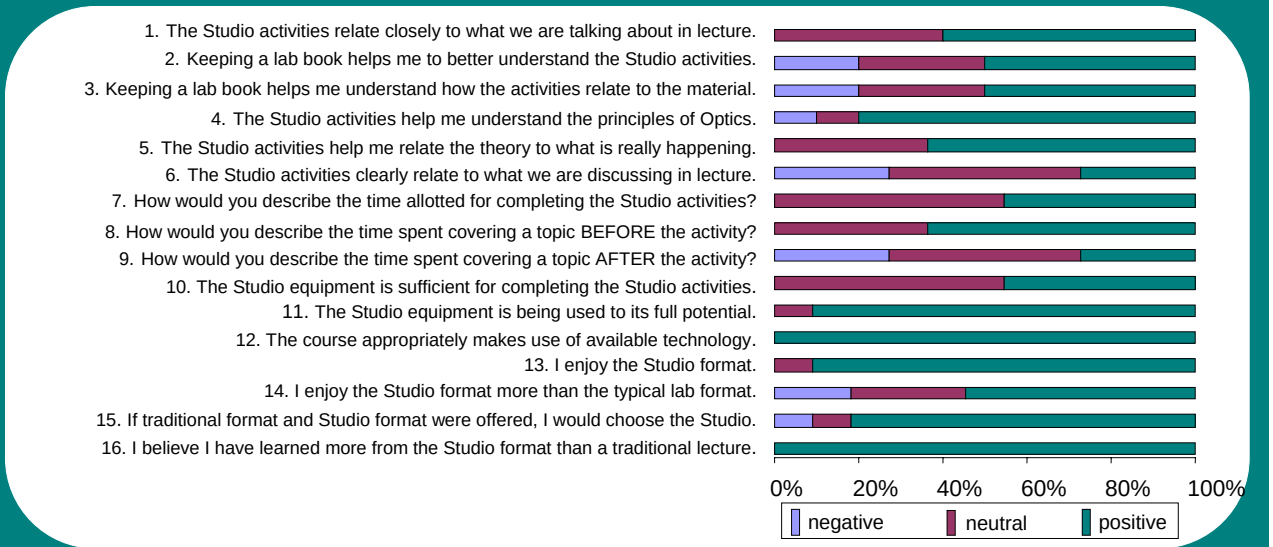
The data for the conceptual evaluation appears in the table below. A couple key features to notice are:

• Only topics that had been covered in lecture by the midway point were included on the mid-test.

• Only two sets of data can be considered statistically significant (highlighted in blue). However, the course has a strict limit of 20 students, so the given data represents all of the students who took all three tests.

• Regrettably, many of the average gains are negative. This would indicate that students actually answered more questions incorrectly post-instruction.

	Pretest to Midtest				Pretest to Posttest			
	Average Gain	Average Hake Gain	Effect Size	P(T<t)	Average Gain	Average Hake Gain	Effect Size	P(T<t)
Question 1	---	---	---	---	.27	.17	-.37	.16
Question 2	-.13	0	.16	.65	-.40	-.14	-.55	.16
Question 3	-.40	-.26	.72	.06	.20	.14	.33	.48
Question 4	-.27	-.08	.29	.24	1.07	.41	1.13	.01
Question 5	.27	.14	.35	.48	.73	.29	.88	.19
Question 6	---	---	---	---	.27	.16	.34	.52
Question 7	---	---	---	---	-.80	.29	.88	.09
Question 8	---	---	---	---	-.20	0	.26	.60
Question 9	---	---	---	---	.47	.11	.53	.25
Question 10	---	---	---	---	.53	.32	.76	.07
Question 11	.93	.47	1.15	.03	.47	.29	.63	.22
Question 12	.73	.57	.75	.12	.67	.49	.70	.06



Below are some of the free-responses from the survey, chosen because of their accurate representation of the responses as a whole.

"Usually the lab and lecture go together fairly well, only sometimes they have seemed unrelated."

"I really enjoy the optics studio activities. They are effective at demonstrating the material covered in the lecture, and usually fun and exciting."

"It would be better to spend more time after the activities to relate what we did to the book material. This way, the concept is presented at the beginning of class, we do something physically to visualize it, and then the concept is repeated to tie up any loose ends."

"Perhaps dedicating a little bit more time to follow up would be nice, as sometimes, even with the hands on activities, I don't really understand the concept or material."

"I like being able to do the activity directly after learning it, whereas in a lecture/lab combination, there may be a day or two in between to forget."

"I feel it has large potential, but at the current time, has problems with being 'thrown in' to the lectures."

"I like the idea of incorporating the lab and lectures, but they need to flow more together and have more guidance and goals associated with each lab."

"The best part of studio format is that a whole concept can be explored in one class."

LIKERT-SCALE and FREE-RESPONSE SURVEY

The student responses to the Likert-scale questions, as well as the questions themselves, are seen above. In general, student perspectives are quite positive. The greatest amount of neutral and negative responses come from issues such as allotment of time and use of technology. In terms of enjoyment and usefulness of learning the material, the Studio format was well received.

CONCLUSION

While the results of the conceptual evaluation are slightly disappointing, the results of the online survey of student perspectives are quite positive. The majority of students indicated that they responded well to the new format, despite the expected difficulties of implementing a new course design.

This course is the first in a two-year sequence, and is therefore only taught every fourth semester. The Studio format is planned for use during the next cycle, and we expect much greater success now that the Studio format and the activities themselves will be more familiar to the professor teaching the course.

[1] Mazur, E. *Peer Instruction: A User's Manual*. Prentice-Hall: Upper Saddle River, NJ. 1997.