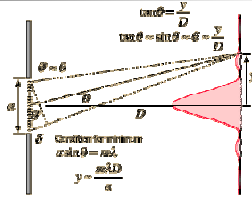


How Upper-division Physics Students Respond to a Studio Laboratory Activity



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Studio Optics

KSU upper-division Optics redesigned as a Studio

- Meets:
 - 3 sessions per week
 - Two 2-hour sessions, One 1-hour session
- Write-ups contain minimal instruction.
 - "Messing about" emphasized rather than systematic laboratory procedure.
- Lecture interspersed with experiments in each session.
- Students: Upper Undergraduate and Graduate



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Research Questions

- How clear is the Studio experiment write-up for the students?
- How do students proceed through the Studio experiment?
- How do students reason as they work through the Studio experiment?



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Research Plan

- Teaching Interview: 2 sessions
- Each session ~ 50 minutes
- 1st session topic:
 - Single Slit Diffraction
- 2nd session topics:
 - Circular Diffraction
 - Poissons' Spot



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Research Participants

- 12 Students Interviewed
 - 5 REU Students (Research Experience for Undergrads)
 - 3 K-State Physics Undergraduate Students
 - 4 K-State Physics Graduate Students
- Level of Education: Mixed
 - All have taken 1 yr Calculus-based Physics
 - 4 have taken an Optics course



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Teaching Interview Strategy (slide 1 of 2)



- Students worked through experiment.
- Minimal comments from observers.
- Students asked to explain their experiment "notebook."



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Teaching Interview Strategy (slide 2 of 2)

- Students cued to make all observations pertinent to experimental goal.
 - “What about the spacing between your bright spots? Is it changing, or not?”
 - “What about the intensity of your bright spots?”
- Students required to defend their own explanation of observations.
 - “Could you show me what you mean by ‘those two waves add together’? Could you draw me a picture?”



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Results

Students appear to :

- Understand the experiment write-up.
 - Some questions about use of equipment. (12 of 12)
- Be unfamiliar with “messing around.”
 - Use traditional experimental procedure. (9 of 12)
- Have difficulties with the physics.
 - Rely on equations to find quantities to measure. (11 of 12)
 - Gaps in understanding wave mechanics. (9 of 12)
 - Do not recognize incorrect result. (5 of 12)

No trends based on students' background.



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Conclusions

- How clear is the Studio experiment write-up for the students?
 - None had difficulties with write-up, all needed clarification regarding use of equipment.
- How do students proceed through the Studio experiment?
 - Use traditional experimental procedures rather than “messing about.”
- How do students reason as they work through the Studio experiment?
 - Rely on equations to look for quantities that they need.



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What we Learned

Students' expectations regarding a science laboratory appear to constrain exploration activities in this Studio optics experiment.

We may need to work on opening students' minds to a different way of thinking about laboratories to facilitate Studio optics.



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Thank You!

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