PFL
PREPARING FUTURE LEADERS
GUIDE TO THRIVE

Fun with Photons: An Interactive Learning Collaboration

Felix Kaess[1], Andrew Klump[1], Qiang Guo[1], Seunghyun Yoo[2], Jonathan Baker[1], Preston C. Bowes[1], Zlatko Sitar[1]

[1] Department of Materials Science and Engineering, North Carolina State University, Raleigh, NC 27695-7919, USA

[2] Department of Forest Biomaterials, North Carolina State University, Raleigh, NC 27695-8001, USA

Exploris

Motivation

PhD candidates at NC State:

- Disconnect between academic research and real world problems
- Often experience problems when explaining their research to non-scientific audience
- Stuck in the ivory tower – depletion of perspective and creativity
- Lack of opportunity to express their love of science outside of graduate school

Middle school kids:

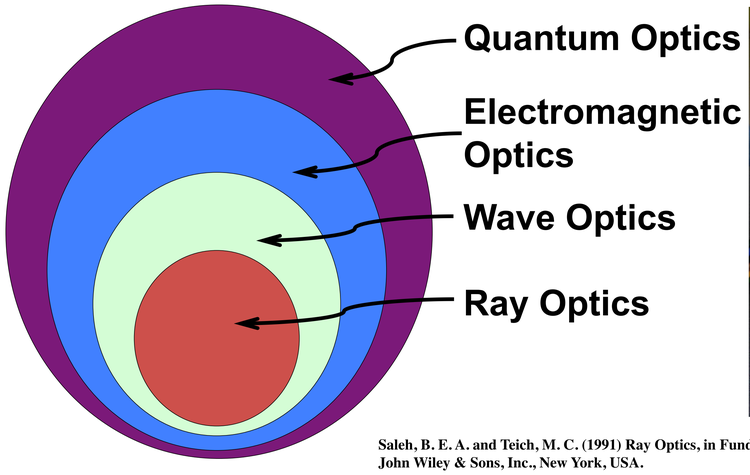
- Passionate learners and experimenters
- Want to experience the world around them, Want to have fun
- Very little exposure to science and technology at school – disparity with high technology exposure outside of school (internet, smartphones & tablets, Youtube)
- Open to new perspectives and projects

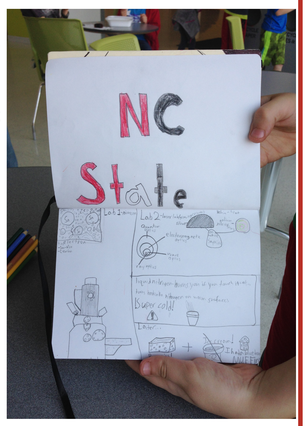
Project Description & Outcomes

- **Graduate students from the lecture "MSE704: Interaction of Photons with Solids" partnered with The Exploris School in Raleigh to create a mutual learning experience with a selected group of middle school students.**
- **The graduate students became teachers in the 5 week long "Exploration" project and successfully transformed the rather abstract lecture materials into tangible scientific experiments and taught the 5th graders about the four different fields of photonics.**
- **This process of translating theoretical insights into practical demonstrations for a non-scientific audience helped the PhD candidates to reflect on their own research and role as scientists in society**
- **As a result of this project, both sides learned a lot about science, education, and communication from each other. Furthermore, all participants got excited to keep studying the fascinating field of light and deepen their understanding of science when they grow up / finish graduate school.**

This work was a part of the author's professional development project for the PTP program (Preparing the Professoriate).

The Teaching Material – What is light?





Saleh, B. E. A. and Teich, M. C. (1991) Ray Optics, in Fundamentals of Photonics, John Wiley & Sons, Inc., New York, USA.

Outcome

"Although I went in with the expectation that I would be teaching the students, I believe I learned so much from them. " – A. Klump

"During my preparations, I gained some interesting new perspectives on antennas and Maxwell's equations, as I tried to imagine how I could understand them if I had no prior knowledge on the subjects. " – J. Baker

"I believe that we seeded the scientific mind to them which will blossom in the future. In conclusion, this project was helpful not only to the middle school children, but also to me by letting me think simpler about the complex phenomena." – S. Yoo

"Creating a lesson plan for the kids and the kids' responses during the activity made me realize how difficult it is to filter out all of the jargon we use every day as scientists." – P. Bowes

"They immediately realized that they could rub the paper on the wall with the pencil and it worked. They were so proud of themselves. " – Q. Guo

"This was the best exploration EVER!" – Jack, Exploris

"Wooaaaah!!" – Kids upon seeing their first laser interference pattern