

## **ETOP 2019 Conference Report**

University of South Florida

I participated the 2019 SPIE Education and Training in Optics and Photonics (ETOP) conference in Quebec City, Quebec, Canada from May 21 – May 24, 2019. I learned a lot of things from the conference, and below are some of the highlights that I feel would impact my teaching the most in the future.

### **1. Enhancing students' engagement and learning outcomes through peer instruction**

group of students. The workshop also highlighted the use of embodied and virtual simulation demos that can let the students to interact more with specific physical concepts or physical model and by playing with it to receive customized feedback. I plan to look into how to use the available technologies in classrooms to incorporate these ideas into my Calculus-based General Physics I (PHY 2048) and Problem Solving for Calculus-based General Physics I (PHZ 2102) in Fall 2019 and my PHY 4424/5937 (Optics/Optics for Scientists) for Spring 2020.

## 2. Curriculum development and improvement for “Optics”-related upper-level STEM courses.

In the session of “curriculum development and improvement”, I learned a lot of new thoughts of experimental demonstrations from the talk “Undergraduate course on biomedical optics at a liberal arts college” given by Prof. Michael E. Durst from Middlebury College USA and from the talk “quantum harmonic oscillator fluorescence” given by Prof. Daniel Boye from Davidson College, USA. They provided a lot of hands-on demonstration ideas that can visualize the concepts of optical imaging, optical spectroscopy, which are extremely helpful to convey the knowledge to students who have limited exposures to Optics before taking the class. I plan to take some of the ideas into my PHY, such as the demonstration of structured illumination for super-resolution imaging, and the fluorescence of natural minerals, into my PHY 4424/5937 (Optics/Optics for Scientists) for Spring 2020.

In the same session, Prof. Bahaa Saleh (Director of CREOL, UCF) presented his new course in the talk “Teaching Optics from a linear Vector Space Perspective”. This is a graduate level course for first-year graduates at CREOL before they take Quantum Mechanics. Prof. Saleh emphasized the mathematical commonality in polarization optics, matrix optics, Fourier Optics, and quantum mechanics in terms of linear algebra. By unifying the mathematical tool, he shows that students could feel much more comfortable to learn different physics without struggling the maths which is often formulated with different symbols and terminologies for different physics. I feel Dr. Saleh’s approach to be extremely enlightening as it is common to see the students struggling in learning physical concepts due to the lack of adequate math skills. I have

In the workshop of “Problem-Based Learning: Engaging Students in STEM”, the host presented their efforts in promoting problem based learning to enhance students’ critical thinking & problem-solving , teamworking, written and oral communication and employability skills. The site “[www.pblorjects.org](http://www.pblorjects.org)” provides a lot of demonstrated ideas that closely connects STEM learning, everyday life and industrial needs. The workshop also shows how to perform assessment for such problem-solving-based learning, and how to create our own problem-solving learning challenges. Moreover, the workshop also showed us how to explore opportunities to interact with industrial partners in developing real-world challenges that are also suitable for undergraduate students. This idea connects with the philosophy of “Applied Physics” program of the Physics department at USF, and I plan to find more connections with local optics/photonics/laser companies in the metropolitan area of Tampa to develop more research experience for both undergraduate and graduate students. With all the information provided from the workshop, I plan to improve the designing and assessment of my existing course project in PHY 4424/5937 (Optics/Optics for Scientists) for Spring 2020.

#### **4. Outreach activities for broader impact**

I have learned numerous ideas for outreach activities that can be incorporated into various outreach programs, including the EngineeringExpo and various outreach programs with local schools through Physics.

For example, the three sponsoring professional society, IEEE, SPIE and OSA gives out holographic goggles that can demonstrate diffraction and color separation from white light sources. The McMaster University also presented a paper-based microscopy that can be easily mass-produced and distributed to K-12 students as well as general public. I have also talked with students and teachers from various universities about the exciting outreach activities that are carried to promote STEM education to K-12 students. I plan to interact more with the student chapter of OSA at USF and the Society of Physics Students (SPS) at USF to implement these ideas and explore new demonstration ideas in the coming calendar year of 2019-2020.

In summary, I really appreciate the support from USF STEER grant and the department of Physics to support me to attend SPIE ETOP 2019 conference. I have truly enjoyed the conference, learned greatly from the well-designed workshops, presentation sessions and social events. The conference has provided me with exposures to a large amount of effective teaching pedagogies and curriculum development. It has fueled me with inspirations for improving my future teaching in both lower and upper level STEM courses. I wish to have opportunities to attend more such conferences or other activities to boost my STEM teaching and research in the near future.