Course Analysis: SK2303 Optical Physics 2024

Overview

The 2024 iteration of SK2303 Optical Physics sought to provide students with a comprehensive understanding of optical phenomena through a balance of theoretical instruction, hands-on laboratory experiments, and computational simulations. Inspired by educational frameworks such as **constructive alignment** and **experiential learning**, the course aimed to ensure that all teaching activities and assessments were aligned with the intended learning outcomes (TLOs).

While the course successfully engaged students and delivered strong academic results, feedback highlighted some areas for improvement, particularly regarding the effectiveness of problem-solving sessions led by teaching assistants (TAs). This analysis reflects on these issues while celebrating the course's strengths and proposing enhancements for future iterations.

Student Performance

A total of 36 students participated in the course. Their performance was assessed through:

1. **Exam**: Letter-graded (A-E) based on theoretical knowledge and problem-solving ability.
2. **Lab Work**: Pass/fail based on practical competence and completion of experiments.
3. **Simulation**: Pass/fail based on computational proficiency in applying theoretical concepts.

Grade Distribution:

- **Exam Grades**:
  - A: 36%
  - B: 28%
  - C: 19%
  - D: 11%
  - E: 6%
- **Lab and Simulation**:
  - Nearly all students successfully passed these components, reflecting strong engagement and practical understanding.

Teaching Methodology and Learning Theory

The course design was influenced by several key pedagogical principles:

1. **Constructive Alignment**

    • The TLOs, teaching activities, and assessments were carefully aligned. For instance, the theoretical instruction on diffraction and polarization was directly reinforced through labs and simulations that required students to apply these concepts.

2. **Experiential Learning**

    • Labs and simulations allowed students to actively experiment, observe, and reflect on optical phenomena. This hands-on approach was crucial for bridging theoretical knowledge and real-world applications.

3. **Active Learning**:

    • Problem-solving sessions aimed to engage students actively, fostering critical thinking and collaboration.

Feedback from Students

Strengths:

1. **Integration of Theory and Practice**:

    • Students appreciated the seamless connection between lectures, labs, and simulations.

    • Labs such as the Michelson interferometer and polarization experiments were particularly well-received, as they helped contextualize abstract concepts.

2. **Clear and Comprehensive Assessments**:

    • The exam structure was praised for its clarity and fairness, with questions appropriately aligned with the course material.

Challenges:

1. **Teaching Assistant Preparation**:

    • A common concern was that TAs were not consistently well-prepared for problem-solving sessions, leading to inefficiencies and student frustration. Some students felt that these sessions lacked structure and did not adequately address their questions.

2. **Grading Range**:

    • Several students noted that the current grading scale made it challenging to differentiate between top-tier performances (e.g., A vs. B).

Analysis of Labs and Simulations

1. **Laboratory Component**:

   • Labs were designed to foster active experimentation and reflection. The **Michelson interferometer lab** enabled students to observe interference patterns and measure wavelengths with high precision, while the **polarization lab** allowed them to apply Malus' Law and explore practical applications like imaging.

   • Feedback highlighted the labs as one of the course's strongest components, with students finding them engaging and highly relevant.

2. **Simulation Component**:

   • Simulations provided a dynamic way to visualize optical phenomena, bridging the gap between theoretical equations and tangible outcomes. For example, computational modeling of diffraction patterns helped students understand the role of slit width and wavelength.

3. **Constructive Alignment**:

   • Both labs and simulations were tightly aligned with TLOs, ensuring that students could directly apply theoretical knowledge in practical settings.

Proposed Changes to Address Challenges

1. **Improved TA Preparation**:

   - **Action Plan**:
     - Conduct mandatory TA training sessions before each problem-solving session to ensure they are well-prepared to address student questions.
     - Provide TAs with a detailed guide for each session, including sample problems and solutions.
   - **Expected Outcome**:
     - Improved efficiency and effectiveness of problem-solving sessions, leading to increased student satisfaction and learning outcomes.

2. **Revised Grading Scale**:

   - **Proposed Revision**: This will be discussed with the course examiner and program director.
     - A: 4.8–6.0
     - B: 3.8–4.7
     - C: 3.0–3.7
     - D: 2.6–2.9
     - E: 2.0–2.5

• **Rationale**: This revised scale provides a broader range for high-performing students, allowing finer distinctions between A and B grades.

3. **Enhanced Problem-Solving Sessions**:

   • Introduce collaborative learning techniques, such as peer-assisted problem-solving, to supplement TA-led sessions.

   • Use student feedback after each session to refine the structure and focus on commonly misunderstood topics.

Reflections on Course Design

The course successfully balanced theoretical instruction and hands-on learning, achieving strong outcomes in both. However, addressing the highlighted challenges, particularly in TA preparation and grading scale revisions, will further enhance the course's effectiveness.

Incorporating student feedback into the course design reflects a commitment to continuous improvement and ensures the course remains responsive to student needs. By aligning with learning theories such as constructive alignment and experiential learning, SK2303 Optical Physics can continue to provide a world-class educational experience.

Recommendations for Future Iterations

1. **Strengthen TA Training**:

   • Create a structured TA training program with a focus on problem-solving strategies and student engagement techniques.

2. **Expand Grading Criteria**:

   • Implement the revised grading scale to better reflect nuanced performance levels.

3. **Introduce Pre-Lab Quizzes**:

   • Test students' understanding of lab objectives and procedures before they begin, ensuring better preparedness.

4. **Integrate Modern Technology**:

   • Expand on the augmented reality (AR) tools used in the course, for additional virtual optical experiments, enhancing accessibility and engagement.

5. **Encourage Reflective Practice**:

   • Incorporate reflective journals for students to document their learning experiences and challenges throughout the course.

Conclusion

SK2303 Optical Physics continues to deliver a robust and engaging learning experience. By addressing student feedback and aligning teaching methods with evidence-based learning theories, the course can further strengthen its impact on student learning and satisfaction.