

Evaluation Report for STEP II Project – Center
for Occupational Research and Development
(CORD)

Instructor Questionnaire Results
2004

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Background

An Overview of Evaluation Methodology and Analyses Used in this Report

Background

In 1997 the Center for Occupational Research and Development (CORD) initiated the development of a series of photonics curriculum modules. The materials were designed to address a critical shortage in trained photonics technicians and in photonics instructional materials. This work was funded through the National Science Foundation's Advanced Technological Education program under a project titled STEP I (STEP – Science and Technological Education in Photonics). CORD continued its initial work through STEP II, a follow-up project designed to further develop and improve the photonics modular learning materials. The two primary outcome objectives of the STEP II project are as follows: 1) Update and improve modular learning materials for the existing course, Fundamentals of Photonics and 2) Develop new modules that support the mathematics level and content required by the photonics core curriculum. The evaluation of these STEP II objectives involved three components: pre and post content assessment, instructor satisfaction with modules, and student satisfaction with modules. The present report focuses on **instructor** satisfaction and involved the distribution of questionnaires to all seven participating professors representing six different states. The evaluator met with the professors in January 2004 to discuss the details of questionnaire distribution. The following six modules were incorporated into participating classes:

- Module 1-1 Nature and Properties of Light
- Module 1-2 Optical Handling and Positioning
- Module 1-3 Light Sources and Laser Safety
- Module 1-4 Basic Geometrical Optics
- Module 1-5 Basic Physical Optics
- Module 1-6 Principles of Lasers.

Each professor incorporated one or more modules into their courses. After completing a module, instructors completed a questionnaire designed to assess satisfaction with various module components and to identify areas for improvement. The questionnaire was developed with input from CORD staff, the independent evaluator, and the participating professors. As of August 2004, 27 completed surveys were received. The below table shows the number of completed surveys received for each of the six modules.

| MODULE | | |
|--|-----------|---------------|
| | Frequency | Valid Percent |
| Module 1-1: Nature and Properties of Light | 6 | 22.2 |
| Module 1-2: Optical Handling and Positioning | 4 | 14.8 |
| Module 1-3: Light Sources and Laser Safety | 5 | 18.5 |
| Module 1-4: Basic Geometrical Optics | 4 | 14.8 |
| Module 1-5: Basic Physical Optics | 3 | 11.1 |
| Module 1-6: Principles of Lasers | 5 | 18.5 |
| Total | 27 | 100.0 |

Instructors completed more than one satisfaction survey if they participated in more than one module. However, within a module, instructors only completed one satisfaction questionnaire. A total of 27 classes were taught using the six course modules. The attached report includes an executive summary, detailed results for each question, and a list of all open-ended comments by module. Within the comments section, all comments were encoded verbatim. This was done to preserve the integrity and context of the raw data. **Please note that the data analyses in this report are limited to descriptive statistics. The inclusion of inferential statistics was not possible due to the small number of respondents.**

Executive Summary

*Highlights of Findings From Each Section of the Report.
Recommendations for Possible Courses of Action Based on Results
are also Provided.*

Executive Summary

Background

- 27 completed questionnaires were received
- 100% of respondents taught module content with examples
- 59% of respondents taught hands-on laboratories
- 55% taught end-of-module exercises
- For all but one of the modules, most respondents taught the modules in 5-9 hours. The one exception was Module 1-4 (Basic Geometrical Optics) where half of the respondents taught the module in 10-15 hours

Length of Modules

- 73% of respondents indicated that the number of concepts covered in the module was about right for the amount of time allotted
- 27% of respondents indicated that the number of concepts covered in the modules was too many for the amount of time allotted
- For each component of the modules (technical level, reading level, mathematics level, problem exercises, and hands-on laboratories), the majority of respondents rated the level of difficulty as equal compared to other texts

Hands-on Laboratories

- Half of the respondents conducted the laboratories as included in the modules while 25% conducted their own laboratories. The remaining 25% of respondents were split with half modifying the module laboratories and half choosing not to conduct laboratories

Difficulty of Module Components

- For each of the main components (technical level, reading level, mathematics level, problem exercises, and hands-on laboratories) 65% or more of the respondents rated the modules as having the same level of difficulty compared to other texts
- The hands-on laboratories and problem exercises received the highest difficulty ratings with 12% and 11% of respondents rating these components as more difficult compared to other texts, respectively
- For all five of the module components Module 1-5 received the highest difficulty rating compared to the other modules

Rating of Overall Quality of Modules

- 78% of respondents rated the organization of the modules as “Excellent” or “Good”
- More than 75% of the respondents rated each module component (basic concepts, figures, examples, etc.) as “Excellent” or “Good”
- The examples received the highest rating while hands-on laboratories received the lowest rating
- Module 1-5 (Basic Physical Optics) had the lowest score or was tied with the lowest score on 5 of the 6 components assessed

Mathematics Supplement and Assessment

- 86% of respondents rated the mathematics supplement as “Excellent” or “Good”
- 80% of respondents rated the mathematics student assessment as “Excellent” or “Good”

Comments

- Several suggestions were made in regard to the possible reduction of material covered within a module
- For modules 1-4, 1-5, and 1-6, specific suggestions were made for splitting up the material into smaller groupings
- Several comments were made in regard to the sequencing of material; That is, there were a few concerns related to specific concepts that may be too sophisticated to cover in an introductory course
- There were several module specific suggestions including corrections to formulas

Conclusion

The majority of respondents indicated that the STEP II module components were “Good” or “Excellent” and that they were comparable to other texts in terms of level of difficulty. Most respondents thought that the organization of the modules was “Good” or “Excellent.” One module that did appear to receive the most concern was Module 1-5 (Basic Physical Optics). Although only three respondents incorporated this module into their course, it consistently received the lowest quality ratings and the highest difficulty ratings.

Respondents offered a variety of detailed suggestions that should be used to strengthen the current versions of the modules. The detailed results in this report should be examined carefully to ensure effective strategies for module improvement are identified. The following recommendations are intended to serve as a guide for possible courses of action based on the results described in this report:

- *The hands-on laboratories and problem exercises received the lowest quality ratings. Improve these components by ensuring they are consistent with the text and figures and that they are of the same high quality.*
- *Half of the respondents modified the laboratories, included their own laboratories, or did not conduct laboratories. Improve integration of laboratories with module text.*
- *Increase instructor use of laboratories and problem exercises.*
- *Improve Module 1-5 (Basic Physical Optics) by conducting a comprehensive review of all components (e.g., text, laboratories, exercises, etc.). Consider reducing the amount of material covered in this module.*
- *Improve all modules by ensuring all formulas and figures are accurately depicted.*
- *For all modules, eliminate any unnecessary explanations.*
- *Develop a quality control plan to ensure that modules are evaluated regularly by instructors and outside professionals and ensure necessary adjustments are made in a timely fashion.*
- *Promote the effective use of the mathematics supplement and the mathematics assessment.*

Detailed Results

Includes Detailed Results and Analyses for Each Question

Detailed Results From Survey Questions

Parts of Module Taught. The first question assessed the degree to which the various module components were incorporated into class instruction. The table below shows the number of respondents who taught the different parts of the course modules.

1. Please indicate which of the following major parts of the course module you taught (mark all parts you were assigned or covered in class)

| | # |
|-------------------------------------|----|
| 1a. Content with examples | 27 |
| 1b. Hands-on laboratory | 16 |
| 1c. End-of-module problem exercises | 15 |

All participating instructors taught the module content and associated examples. Fifty-nine percent (59%) taught the hands-on laboratories and 55% taught the end-of-module problem exercises. Thus, instructors focused on the module content and examples. Among the 27 sections taught using the six course modules, 26% incorporated only one of the three major components, 33% incorporated two of the three major components, and 41% included all three components.

Question 2 assessed the amount of each module incorporated into a class. Ninety-six percent (96%) of respondents taught 75% to 100% of their modules. To determine whether there were any differences across modules a crosstabulation of Question 2 by module was performed. The results are shown in the table below.

module * 2. What percentage of the module did you complete? Crosstabulation

| | | 2. What percentage of the module did you complete? | | | |
|--------|--|--|-------------|--------|--------|
| | | 50% to 75% | 75% to 100% | Total | |
| module | Module 1-1: Nature and Properties of Light | Count | 1 | 5 | 6 |
| | | % within module | 16.7% | 83.3% | 100.0% |
| | | % of Total | 3.7% | 18.5% | 22.2% |
| | Module 1-2: Optical Handling and Positioning | Count | 0 | 4 | 4 |
| | | % within module | .0% | 100.0% | 100.0% |
| | | % of Total | .0% | 14.8% | 14.8% |
| | Module 1-3: Light Sources and Laser Safety | Count | 0 | 5 | 5 |
| | | % within module | .0% | 100.0% | 100.0% |
| | | % of Total | .0% | 18.5% | 18.5% |
| | Module 1-4: Basic Geometrical Optics | Count | 0 | 4 | 4 |
| | | % within module | .0% | 100.0% | 100.0% |
| | | % of Total | .0% | 14.8% | 14.8% |
| | Module 1-5: Basic Physical Optics | Count | 0 | 3 | 3 |
| | | % within module | .0% | 100.0% | 100.0% |
| | | % of Total | .0% | 11.1% | 11.1% |
| | Module 1-6: Principles of Lasers | Count | 0 | 5 | 5 |
| | | % within module | .0% | 100.0% | 100.0% |
| | | % of Total | .0% | 18.5% | 18.5% |
| Total | Count | 1 | 26 | 27 | |
| | % within module | 3.7% | 96.3% | 100.0% | |
| | % of Total | 3.7% | 96.3% | 100.0% | |

The above results show that for all courses sections that incorporated the modules, with the exception of one course that incorporated Module 1-1 (Nature and Properties of Light), 75% to 100% of the course module was completed.

Perceived Adequacy of the Amount of Material in Modules. Question 3 assessed the number of contact hours used to teach a given module. The results are shown below.

3. How many contact hours did you teach using this module?

| | Frequency | Valid Percent |
|-------------|-----------|---------------|
| Less than 5 | 2 | 7.4 |
| 5-9 | 15 | 55.6 |
| 10-15 | 7 | 25.9 |
| 16-20 | 3 | 11.1 |
| Total | 27 | 100.0 |

For the majority of courses incorporating modules, 5-9 contact hours were used to teach the module. To determine whether there were any differences across the six modules, a crosstabulation on Question 3 by module was performed. The results are shown below.

module * 3. How many contact hours did you teach using this module? Crosstabulation

| | | 3. How many contact hours did you teach using this module? | | | | Total | |
|--------------------------------------|--|--|-------|-------|-------|--------|--------|
| | | Less than 5 | 5-9 | 10-15 | 16-20 | | |
| module | Module 1-1: Nature and Properties of Light | Count | 1 | 3 | 1 | 1 | 6 |
| | | % within module | 16.7% | 50.0% | 16.7% | 16.7% | 100.0% |
| | | % of Total | 3.7% | 11.1% | 3.7% | 3.7% | 22.2% |
| | Module 1-2: Optical Handling and Positioning | Count | 1 | 2 | 1 | 0 | 4 |
| | | % within module | 25.0% | 50.0% | 25.0% | .0% | 100.0% |
| | | % of Total | 3.7% | 7.4% | 3.7% | .0% | 14.8% |
| | Module 1-3: Light Sources and Laser Safety | Count | 0 | 3 | 1 | 1 | 5 |
| | | % within module | .0% | 60.0% | 20.0% | 20.0% | 100.0% |
| | | % of Total | .0% | 11.1% | 3.7% | 3.7% | 18.5% |
| Module 1-4: Basic Geometrical Optics | Count | 0 | 2 | 2 | 0 | 4 | |
| | % within module | .0% | 50.0% | 50.0% | .0% | 100.0% | |
| | % of Total | .0% | 7.4% | 7.4% | .0% | 14.8% | |
| Module 1-5: Basic Physical Optics | Count | 0 | 2 | 1 | 0 | 3 | |
| | % within module | .0% | 66.7% | 33.3% | .0% | 100.0% | |
| | % of Total | .0% | 7.4% | 3.7% | .0% | 11.1% | |
| Module 1-6: Principles of Lasers | Count | 0 | 3 | 1 | 1 | 5 | |
| | % within module | .0% | 60.0% | 20.0% | 20.0% | 100.0% | |
| | % of Total | .0% | 11.1% | 3.7% | 3.7% | 18.5% | |
| Total | | Count | 2 | 15 | 7 | 3 | 27 |
| | | % within module | 7.4% | 55.6% | 25.9% | 11.1% | 100.0% |
| | | % of Total | 7.4% | 55.6% | 25.9% | 11.1% | 100.0% |

The pattern results were generally consistent across the six modules. For all modules, 50% or more of the classes used 5-9 contact hours to cover a module. Module 1-4 (Basic Geometrical Optics) appeared to require more contact hours given that 50% of the sections incorporating this module used 10-15 contact hours.

Question 4 assessed respondent satisfaction with the amount of material covered given the allotted time. The results are shown below.

4. Based on the typical technology courses you have taught, is the number of concepts covered in this module:

| | Frequency | Valid Percent |
|--|-----------|---------------|
| too many for the time you have allotted | 7 | 26.9 |
| about right for the time you have allotted | 19 | 73.1 |
| Total | 26 | 100.0 |
| No Response | 1 | |
| Total | 27 | |

Seventy-three percent (73%) of respondents thought that the number of concepts covered was about right for the time allotted. Twenty-seven percent (27%) thought that too many concepts were covered while none of the instructors believed that too few concepts were covered. To determine whether these findings were consistent across all six modules, a separate crosstabulation of Question 4 by module was performed. The results from this analysis are shown below.

module * 4. Based on the typical technology courses you have taught, is the number of concepts covered in this module: Crosstabulation

| | | | 4. based on the typical technology courses you have taught, is the number of concepts covered in this module: | | Total |
|--------|--|-----------------|---|--|--------|
| | | | too many for the time you have allotted | about right for the time you have allotted | |
| module | Module 1-1: Nature and Properties of Light | Count | 1 | 4 | 5 |
| | | % within module | 20.0% | 80.0% | 100.0% |
| | | % of Total | 3.8% | 15.4% | 19.2% |
| | Module 1-2: Optical Handling and Positioning | Count | 1 | 3 | 4 |
| | | % within module | 25.0% | 75.0% | 100.0% |
| | | % of Total | 3.8% | 11.5% | 15.4% |
| | Module 1-3: Light Sources and Laser Safety | Count | 0 | 5 | 5 |
| | | % within module | .0% | 100.0% | 100.0% |
| | | % of Total | .0% | 19.2% | 19.2% |
| | Module 1-4: Basic Geometrical Optics | Count | 2 | 2 | 4 |
| | | % within module | 50.0% | 50.0% | 100.0% |
| | | % of Total | 7.7% | 7.7% | 15.4% |
| | Module 1-5: Basic Physical Optics | Count | 1 | 2 | 3 |
| | | % within module | 33.3% | 66.7% | 100.0% |
| | | % of Total | 3.8% | 7.7% | 11.5% |
| | Module 1-6: Principles of Lasers | Count | 2 | 3 | 5 |
| | | % within module | 40.0% | 60.0% | 100.0% |
| | | % of Total | 7.7% | 11.5% | 19.2% |
| | Total | Count | 7 | 19 | 26 |
| | | % within module | 26.9% | 73.1% | 100.0% |
| | | % of Total | 26.9% | 73.1% | 100.0% |

More than 70% of the respondents thought the first three modules covered about the right amount of material in the time allotted. For Module 1-4 (Basic Geometrical Optics), 50% of respondents thought the amount of material covered was about right and 50% thought that too many concepts were covered. For Module 1-5 (Basic Physical Optics), 67% thought the amount of material covered was about right and 33% thought that too many concepts were covered. For Module 1-6 (Principles of Lasers), 60% of

students thought the amount of material covered was about right and 40% thought too many concepts were covered. In terms of amount of information covered, respondents had the greatest concerns with Modules 1-4 and 1-6 compared to other modules.

Hands-on Laboratories. Questions 5 and 6 assessed the method used to conduct the hands-on laboratories and the availability of the required equipment, respectively. The results are shown below.

5. How did you conduct the hands-on laboratories in this module?

| | Frequency | Valid Percent |
|--|-----------|---------------|
| Conducted laboratories as included in the module | 8 | 50.0 |
| Modified laboratories in the module | 2 | 12.5 |
| Conducted my own equivalent laboratories | 4 | 25.0 |
| Did not conduct laboratories | 2 | 12.5 |
| Total | 16 | 100.0 |
| No Response | 11 | |
| Total | 27 | |

Fifty percent (50%) of respondents conducted the laboratories as included in the module and 25% used their own equivalent laboratories. The remaining 25% of respondents were split with half modifying the laboratories and the other half choosing not to conduct laboratories. To determine whether these findings were consistent across all six modules, a separate crosstabulation of Question 5 by module was performed. The results from this analysis are shown below.

module * 5. How did you conduct the hands-on laboratories in this module? Crosstabulation

| | | 5. How did you conduct the hands-on laboratories in this module? | | | | Total | |
|--|--|--|-------------------------------------|--|------------------------------|--------|--------|
| | | Conducted laboratories as included in the module | Modified laboratories in the module | Conducted my own equivalent laboratories | Did not conduct laboratories | | |
| module | Module 1-1: Nature and Properties of Light | Count | 1 | 2 | 2 | 0 | 5 |
| | | % within module | 20.0% | 40.0% | 40.0% | .0% | 100.0% |
| | | % of Total | 6.3% | 12.5% | 12.5% | .0% | 31.3% |
| Module 1-2: Optical Handling and Positioning | Count | 0 | 0 | 1 | 1 | 2 | |
| | % within module | .0% | .0% | 50.0% | 50.0% | 100.0% | |
| | % of Total | .0% | .0% | 6.3% | 6.3% | 12.5% | |
| Module 1-3: Light Sources and Laser Safety | Count | 3 | 0 | 0 | 0 | 3 | |
| | % within module | 100.0% | .0% | .0% | .0% | 100.0% | |
| | % of Total | 18.8% | .0% | .0% | .0% | 18.8% | |
| Module 1-4: Basic Geometrical Optics | Count | 1 | 0 | 0 | 0 | 1 | |
| | % within module | 100.0% | .0% | .0% | .0% | 100.0% | |
| | % of Total | 6.3% | .0% | .0% | .0% | 6.3% | |
| Module 1-5: Basic Physical Optics | Count | 1 | 0 | 1 | 0 | 2 | |
| | % within module | 50.0% | .0% | 50.0% | .0% | 100.0% | |
| | % of Total | 6.3% | .0% | 6.3% | .0% | 12.5% | |
| Module 1-6: Principles of Lasers | Count | 2 | 0 | 0 | 1 | 3 | |
| | % within module | 66.7% | .0% | .0% | 33.3% | 100.0% | |
| | % of Total | 12.5% | .0% | .0% | 6.3% | 18.8% | |
| Total | Count | 8 | 2 | 4 | 2 | 16 | |
| | % within module | 50.0% | 12.5% | 25.0% | 12.5% | 100.0% | |
| | % of Total | 50.0% | 12.5% | 25.0% | 12.5% | 100.0% | |

The above results are difficult to interpret because of the small numbers included in each crosstabulation cell. This is due to the fact that 11 respondents did not answer Question 5. For the hands-on laboratories for Module 1-1 (Nature and Properties of Light) only one respondent conducted the laboratories as described in the module. Two of

the other four respondents modified the laboratories and two included their own laboratories. For the hands-on laboratories in Module 1-2 (Optical Handling and Positioning), none of the two respondents conducted the laboratories as described in the module. Rather, one included his/her own laboratories and other respondent did not conduct the laboratories. For the hands-on laboratories in Modules 1-3 (Light Sources and Laser Safety) and 1-4 (Basic Geometrical Optics), all four respondents conducted the laboratories as described in the modules. For Module 1-5 (Basic Physical Optics), one of the two respondents conducted the laboratories as described in the module while the other respondent included his/her own laboratories. For Module 1-6 (Principles of Lasers), two of the three respondents conducted the laboratories as described in the module while the other respondent did not conduct laboratories.

The results from Question 6, which addressed the availability of equipment required for the laboratories, are shown below.

6. Was the equipment required for the module's hands-on laboratories readily available at your site?

| | | Frequency | Valid Percent |
|-------------|-------|-----------|---------------|
| | Yes | 20 | 95.2 |
| | No | 1 | 4.8 |
| | Total | 21 | 100.0 |
| No Response | | 6 | |
| Total | | 27 | |

All but one respondent indicated that the equipment needed to conduct the laboratories was readily available. The one exception involved one of six respondents that incorporated Module 1-1 (Nature and Properties of Light).

Perceived Difficulty of Each Module Component. Questions 8-12 assessed perceived difficulty of module components compared to text materials respondents have used in their other courses. The results are shown below.

Please rate the difficulty of the STEP II course module compared to text material you have used in the past.

| | More Difficult | | Same Difficulty | | Less Difficult | | Total | |
|---|----------------|-------|-----------------|-------|----------------|-------|-------|--------|
| | # | % | # | % | # | % | # | % |
| 8. Technical level of the material | 2 | 7.4% | 20 | 74.1% | 5 | 18.5% | 27 | 100.0% |
| 9. The reading level of the material | 1 | 3.7% | 23 | 85.2% | 3 | 11.1% | 27 | 100.0% |
| 10. The mathematics level of the material | 2 | 7.7% | 17 | 65.4% | 7 | 26.9% | 26 | 100.0% |
| 11. The problem exercises | 3 | 11.1% | 20 | 74.1% | 4 | 14.8% | 27 | 100.0% |
| 12. The hands-on laboratories | 3 | 12.0% | 18 | 72.0% | 4 | 16.0% | 25 | 100.0% |

For each of the main module components, 65% or more of the respondents rated the modules as having the same difficulty as text materials used in other courses. When combined with the “less difficult” response, 88% to 96% of respondents rated each module as having the same or lower level of difficulty compared to other texts. For the mathematics level of the modules, more than a quarter of respondents believed it was less difficult when compared to the mathematics level of other texts. Nearly 20% of respondents thought the technical level of the modules was less difficult compared to other texts. The hands-on laboratories and problem exercises received the highest difficulty ratings with 12% and 11% of respondents rating these components as more

difficult compared to the laboratories and exercises used in other texts, respectively. The reading level received the lowest difficulty rating with only 4% of respondents rating this component as more difficult compared to the reading level of other texts. To determine if there were any differences across modules, a series of crosstabulations were performed. The results from each of the five crosstabulations are shown below.

module * 8. Technical level of the material Crosstabulation

| | | 8. Technical level of the material | | | Total | |
|--------|--|------------------------------------|-----------------|----------------|--------|--------|
| | | More Difficult | Same Difficulty | Less Difficult | | |
| module | Module 1-1: Nature and Properties of Light | Count | 1 | 3 | 2 | 6 |
| | | % within module | 16.7% | 50.0% | 33.3% | 100.0% |
| | | % of Total | 3.7% | 11.1% | 7.4% | 22.2% |
| | Module 1-2: Optical Handling and Positioning | Count | 0 | 4 | 0 | 4 |
| | | % within module | .0% | 100.0% | .0% | 100.0% |
| | | % of Total | .0% | 14.8% | .0% | 14.8% |
| | Module 1-3: Light Sources and Laser Safety | Count | 0 | 3 | 2 | 5 |
| | | % within module | .0% | 60.0% | 40.0% | 100.0% |
| | | % of Total | .0% | 11.1% | 7.4% | 18.5% |
| | Module 1-4: Basic Geometrical Optics | Count | 0 | 4 | 0 | 4 |
| | | % within module | .0% | 100.0% | .0% | 100.0% |
| | | % of Total | .0% | 14.8% | .0% | 14.8% |
| | Module 1-5: Basic Physical Optics | Count | 1 | 2 | 0 | 3 |
| | | % within module | 33.3% | 66.7% | .0% | 100.0% |
| | | % of Total | 3.7% | 7.4% | .0% | 11.1% |
| | Module 1-6: Principles of Lasers | Count | 0 | 4 | 1 | 5 |
| | | % within module | .0% | 80.0% | 20.0% | 100.0% |
| | | % of Total | .0% | 14.8% | 3.7% | 18.5% |
| Total | Count | 2 | 20 | 5 | 27 | |
| | % within module | 7.4% | 74.1% | 18.5% | 100.0% | |
| | % of Total | 7.4% | 74.1% | 18.5% | 100.0% | |

For all modules, between 50% and 100% of respondents rated the **technical** level as the same difficulty as other texts. When combined with the “less difficult” response, 67% to 100% of respondents rated the technical level of each module as the same level of difficulty or less difficult compared to other texts. Module 1-5 (Basic Physical Optics) received the highest difficulty rating with 1 of 3 (33%) respondents rating the technical level of this module as more difficult compared to other texts. Four of the modules (1-2 [Optical Handling and Positioning], 1-3 [Light Sources and Laser Safety], 1-4 [Basic Geometrical Optics], and 1-6 [Principles of Lasers]) received the lowest difficulty ratings with none of the respondents rating the technical level of these modules as more difficult compared to the technical level of other texts.

module * 9. the reading level of the material Crosstabulation

| | | 9. the reading level of the material | | | Total | |
|--------|--|--------------------------------------|-----------------|----------------|-------|--------|
| | | More Difficult | Same Difficulty | Less Difficult | | |
| module | Module 1-1: Nature and Properties of Light | Count | 0 | 5 | 1 | 6 |
| | | % within module | .0% | 83.3% | 16.7% | 100.0% |
| | | % of Total | .0% | 18.5% | 3.7% | 22.2% |
| | Module 1-2: Optical Handling and Positioning | Count | 0 | 4 | 0 | 4 |
| | | % within module | .0% | 100.0% | .0% | 100.0% |
| | | % of Total | .0% | 14.8% | .0% | 14.8% |
| | Module 1-3: Light Sources and Laser Safety | Count | 0 | 4 | 1 | 5 |
| | | % within module | .0% | 80.0% | 20.0% | 100.0% |
| | | % of Total | .0% | 14.8% | 3.7% | 18.5% |
| | Module 1-4: Basic Geometrical Optics | Count | 0 | 4 | 0 | 4 |
| | | % within module | .0% | 100.0% | .0% | 100.0% |
| | | % of Total | .0% | 14.8% | .0% | 14.8% |
| | Module 1-5: Basic Physical Optics | Count | 1 | 2 | 0 | 3 |
| | | % within module | 33.3% | 66.7% | .0% | 100.0% |
| | | % of Total | 3.7% | 7.4% | .0% | 11.1% |
| | Module 1-6: Principles of Lasers | Count | 0 | 4 | 1 | 5 |
| | | % within module | .0% | 80.0% | 20.0% | 100.0% |
| | | % of Total | .0% | 14.8% | 3.7% | 18.5% |
| | Total | Count | 1 | 23 | 3 | 27 |
| | | % within module | 3.7% | 85.2% | 11.1% | 100.0% |
| | | % of Total | 3.7% | 85.2% | 11.1% | 100.0% |

For all modules, between 67% and 100% of respondents rated the reading level as the same difficulty as other texts. Module 1-5 (Basic Physical Optics) received the highest difficulty rating with 1 of 3 (33%) respondents rating this module as more difficult compared to other texts. For all other modules, none of the respondents rated the reading level as more difficult compared to the reading level of other texts.

module * 10. The mathematics level of the material Crosstabulation

| | | 10. The mathematics level of the material | | | Total | |
|--------|--|---|-----------------|----------------|--------|--------|
| | | More Difficult | Same Difficulty | Less Difficult | | |
| module | Module 1-1: Nature and Properties of Light | Count | 0 | 4 | 2 | 6 |
| | | % within module | .0% | 66.7% | 33.3% | 100.0% |
| | | % of Total | .0% | 15.4% | 7.7% | 23.1% |
| | Module 1-2: Optical Handling and Positioning | Count | 0 | 3 | 0 | 3 |
| | | % within module | .0% | 100.0% | .0% | 100.0% |
| | | % of Total | .0% | 11.5% | .0% | 11.5% |
| | Module 1-3: Light Sources and Laser Safety | Count | 0 | 3 | 2 | 5 |
| | | % within module | .0% | 60.0% | 40.0% | 100.0% |
| | | % of Total | .0% | 11.5% | 7.7% | 19.2% |
| | Module 1-4: Basic Geometrical Optics | Count | 1 | 3 | 0 | 4 |
| | | % within module | 25.0% | 75.0% | .0% | 100.0% |
| | | % of Total | 3.8% | 11.5% | .0% | 15.4% |
| | Module 1-5: Basic Physical Optics | Count | 1 | 1 | 1 | 3 |
| | | % within module | 33.3% | 33.3% | 33.3% | 100.0% |
| | | % of Total | 3.8% | 3.8% | 3.8% | 11.5% |
| | Module 1-6: Principles of Lasers | Count | 0 | 3 | 2 | 5 |
| | | % within module | .0% | 60.0% | 40.0% | 100.0% |
| | | % of Total | .0% | 11.5% | 7.7% | 19.2% |
| Total | Count | 2 | 17 | 7 | 26 | |
| | % within module | 7.7% | 65.4% | 26.9% | 100.0% | |
| | % of Total | 7.7% | 65.4% | 26.9% | 100.0% | |

For all modules, between 33% and 100% of the respondents rated the **mathematics** as the same difficulty as other texts. When combined with the “less difficult” response, 67% to 100% of respondents rated the mathematics of each module as the same level of difficulty or less difficult compared to other texts. Module 1-5 (Basic Physical Optics) received the highest difficulty rating with 1 of 3 (33%) respondents rating the mathematics of this module as more difficult compared to other texts. Four of the modules (1-1 [Nature and Properties of Light], 1-2 [Optical Handling and Positioning], 1-3 [Light Sources and Laser Safety], and 1-6 [Principles of Lasers]) received the lowest difficulty ratings with none of the respondents rating the mathematics level of these modules as more difficult compared to the mathematics level of other texts.

module * 11. The problem exercises Crosstabulation

| | | | 11. The problem exercises | | | Total |
|--------|--|-----------------|---------------------------|-----------------|----------------|--------|
| | | | More Difficult | Same Difficulty | Less Difficult | |
| module | Module 1-1: Nature and Properties of Light | Count | 1 | 3 | 2 | 6 |
| | | % within module | 16.7% | 50.0% | 33.3% | 100.0% |
| | | % of Total | 3.7% | 11.1% | 7.4% | 22.2% |
| | Module 1-2: Optical Handling and Positioning | Count | 0 | 4 | 0 | 4 |
| | | % within module | .0% | 100.0% | .0% | 100.0% |
| | | % of Total | .0% | 14.8% | .0% | 14.8% |
| | Module 1-3: Light Sources and Laser Safety | Count | 0 | 4 | 1 | 5 |
| | | % within module | .0% | 80.0% | 20.0% | 100.0% |
| | | % of Total | .0% | 14.8% | 3.7% | 18.5% |
| | Module 1-4: Basic Geometrical Optics | Count | 1 | 3 | 0 | 4 |
| | | % within module | 25.0% | 75.0% | .0% | 100.0% |
| | | % of Total | 3.7% | 11.1% | .0% | 14.8% |
| | Module 1-5: Basic Physical Optics | Count | 1 | 2 | 0 | 3 |
| | | % within module | 33.3% | 66.7% | .0% | 100.0% |
| | | % of Total | 3.7% | 7.4% | .0% | 11.1% |
| | Module 1-6: Principles of Lasers | Count | 0 | 4 | 1 | 5 |
| | | % within module | .0% | 80.0% | 20.0% | 100.0% |
| | | % of Total | .0% | 14.8% | 3.7% | 18.5% |
| | Total | Count | 3 | 20 | 4 | 27 |
| | | % within module | 11.1% | 74.1% | 14.8% | 100.0% |
| | | % of Total | 11.1% | 74.1% | 14.8% | 100.0% |

For all modules, between 50% and 100% of respondents rated the **problem exercises** as the same difficulty as other texts. When combined with the “less difficult” response, 67% to 100% of respondents rated the problem exercises of each module as the same level of difficulty or less difficult compared to other texts. Module 1-5 (Basic Physical Optics) received the highest difficulty rating with 1 of 3 (33%) respondents rating the problem exercises of this module as more difficult compared to other texts. Three of the modules (1-2 [Optical Handling and Positioning], 1-3 [Light Sources and Laser Safety], and 1-6 [Principles of Lasers]) received the lowest difficulty ratings with none of the respondents rating the problem exercises of this module as more difficult compared to the problem exercises of other texts.

module * 12. The hands-on laboratories Crosstabulation

| | | 12. The hands-on laboratories | | | Total | |
|--------|--|-------------------------------|-----------------|----------------|-------|--------|
| | | More Difficult | Same Difficulty | Less Difficult | | |
| module | Module 1-1: Nature and Properties of Light | Count | 1 | 2 | 2 | 5 |
| | | % within module | 20.0% | 40.0% | 40.0% | 100.0% |
| | | % of Total | 4.0% | 8.0% | 8.0% | 20.0% |
| | Module 1-2: Optical Handling and Positioning | Count | 0 | 3 | 0 | 3 |
| | | % within module | .0% | 100.0% | .0% | 100.0% |
| | | % of Total | .0% | 12.0% | .0% | 12.0% |
| | Module 1-3: Light Sources and Laser Safety | Count | 0 | 4 | 1 | 5 |
| | | % within module | .0% | 80.0% | 20.0% | 100.0% |
| | | % of Total | .0% | 16.0% | 4.0% | 20.0% |
| | Module 1-4: Basic Geometrical Optics | Count | 1 | 3 | 0 | 4 |
| | | % within module | 25.0% | 75.0% | .0% | 100.0% |
| | | % of Total | 4.0% | 12.0% | .0% | 16.0% |
| | Module 1-5: Basic Physical Optics | Count | 1 | 2 | 0 | 3 |
| | | % within module | 33.3% | 66.7% | .0% | 100.0% |
| | | % of Total | 4.0% | 8.0% | .0% | 12.0% |
| | Module 1-6: Principles of Lasers | Count | 0 | 4 | 1 | 5 |
| | | % within module | .0% | 80.0% | 20.0% | 100.0% |
| | | % of Total | .0% | 16.0% | 4.0% | 20.0% |
| | Total | Count | 3 | 18 | 4 | 25 |
| | | % within module | 12.0% | 72.0% | 16.0% | 100.0% |
| | | % of Total | 12.0% | 72.0% | 16.0% | 100.0% |

For all modules, between 40% and 100% of respondents rated the **hands-on laboratories** as the same difficulty as hands-on laboratories in other texts. When combined with the “less difficult” response, 67% to 100% of respondents rated the hands-on laboratories of each module as the same level of difficulty or less difficult compared to other texts. Module 1-5 (Basic Physical Optics) received the highest difficulty rating with 1 of 3 (33%) respondents rating the hands-on laboratories of this module as more difficult compared to other texts. Three of the modules (1-2 [Optical Handling and Positioning], 1-3 [Light Sources and Laser Safety], and 1-6 [Principles of Lasers]) received the lowest difficulty ratings with none of the respondents rating the hands-on laboratories of this module as more difficult compared to the laboratories of other texts.

Perceived Quality of Each Module Component. Questions 13-18 assessed the perceived quality of each of the major module components. The two tables below show the results from this section. The first table shows the percentage of responses for each of five Likert items which ranged from “Excellent” to “Very Inadequate.” To facilitate interpretation, the second table shows the results in terms of average scores where a 5 represents “Excellent” and a 1 represents “Very Inadequate.”

Please rate the overall quality of each component of the STEP II course module in terms of impact on student learning.

| | Excellent | | Good | | Average | | Below Average | | Total | |
|---|-----------|-------|------|-------|---------|-------|---------------|-------|-------|--------|
| | # | % | # | % | # | % | # | % | # | % |
| 13. Basic concepts (text) | 11 | 40.7% | 12 | 44.4% | 4 | 14.8% | | | 27 | 100.0% |
| 14. Figures | 13 | 48.1% | 11 | 40.7% | 3 | 11.1% | | | 27 | 100.0% |
| 15. Examples | 10 | 37.0% | 15 | 55.6% | 2 | 7.4% | | | 27 | 100.0% |
| 16. Hands-on laboratory | 5 | 21.7% | 13 | 56.5% | 1 | 4.3% | 4 | 17.4% | 23 | 100.0% |
| 17. Problem exercises | 10 | 37.0% | 12 | 44.4% | 5 | 18.5% | | | 27 | 100.0% |
| 18. Internet-based demonstrations (Applets) | 4 | 25.0% | 10 | 62.5% | | | 2 | 12.5% | 16 | 100.0% |

Average Scores (5:Excellent - 1:Very Inadequate)

| | N | Minimum | Maximum | Mean | |
|---|----|---------|---------|-----------|------------|
| | | | | Statistic | Std. Error |
| 13. Basic concepts (text) | 27 | 3.00 | 5.00 | 4.2593 | .13705 |
| 14. Figures | 27 | 3.00 | 5.00 | 4.3704 | .13235 |
| 15. Examples | 27 | 3.00 | 5.00 | 4.2963 | .11712 |
| 16. Hands-on laboratory | 23 | 2.00 | 5.00 | 3.8261 | .20519 |
| 17. Problem exercises | 27 | 3.00 | 5.00 | 4.1852 | .14159 |
| 18. Internet-based demonstrations (Applets) | 16 | 2.00 | 5.00 | 4.0000 | .22361 |
| Valid N (listwise) | 16 | | | | |

Between 78% and 93% of respondents rated all components as “Excellent” or “Good.” The examples component received the highest satisfaction ratings (93%), while the problem exercises (81%) and hands-on laboratory (78%) received the lowest ratings, respectively. Although 88% of respondents rated the Internet-based demonstrations as “Excellent” or “Good”, interpretation of this result is complicated by the fact that 41% of respondents chose the “Not Applicable” option. To determine whether there were differences in satisfaction ratings across the six modules, average scores by component and by module were computed. The results are shown below.

Report

| module | | 13. Basic concepts (text) | 14. Figures | 15. Examples | 16. Hands-on laboratory | 17. Problem exercises | 18. Internet-based demonstrations (Applets) |
|--|--------------------|---------------------------|-------------|--------------|-------------------------|-----------------------|---|
| Module 1-1: Nature and Properties of Light | Mean | 4.1667 | 4.5000 | 4.3333 | 4.0000 | 4.1667 | 4.6667 |
| | N | 6 | 6 | 6 | 5 | 6 | 3 |
| | Std. Error of Mean | .30732 | .22361 | .21082 | .31623 | .30732 | .33333 |
| Module 1-2: Optical Handling and Positioning | Mean | 4.2500 | 4.5000 | 4.2500 | 4.0000 | 4.2500 | 4.0000 |
| | N | 4 | 4 | 4 | 2 | 4 | 2 |
| | Std. Error of Mean | .25000 | .28868 | .25000 | .00000 | .25000 | .00000 |
| Module 1-3: Light Sources and Laser Safety | Mean | 4.6000 | 4.4000 | 4.4000 | 4.4000 | 4.2000 | 3.6667 |
| | N | 5 | 5 | 5 | 5 | 5 | 3 |
| | Std. Error of Mean | .24495 | .40000 | .24495 | .24495 | .37417 | .88192 |
| Module 1-4: Basic Geometrical Optics | Mean | 4.2500 | 4.0000 | 4.2500 | 3.0000 | 4.2500 | 4.0000 |
| | N | 4 | 4 | 4 | 4 | 4 | 3 |
| | Std. Error of Mean | .25000 | .40825 | .25000 | .57735 | .25000 | .00000 |
| Module 1-5: Basic Physical Optics | Mean | 3.6667 | 4.3333 | 4.0000 | 3.0000 | 3.6667 | 4.0000 |
| | N | 3 | 3 | 3 | 2 | 3 | 1 |
| | Std. Error of Mean | .66667 | .33333 | .57735 | 1.00000 | .66667 | . |
| Module 1-6: Principles of Lasers | Mean | 4.4000 | 4.4000 | 4.4000 | 4.0000 | 4.4000 | 3.7500 |
| | N | 5 | 5 | 5 | 5 | 5 | 4 |
| | Std. Error of Mean | .40000 | .40000 | .40000 | .54772 | .40000 | .62915 |
| Total | Mean | 4.2593 | 4.3704 | 4.2963 | 3.8261 | 4.1852 | 4.0000 |
| | N | 27 | 27 | 27 | 23 | 27 | 16 |
| | Std. Error of Mean | .13705 | .13235 | .11712 | .20519 | .14159 | .22361 |

Because of the small sample size for each module, interpretation of the results is difficult. However, one trend that did appear was that Module 1-5 (Basic Physical Optics) had the lowest satisfaction score or was tied with the lowest score on 5 of the 6 components. In addition, the average scores for each component within this module were below the average for all modules.

Organization of Each Module. Question 7 assessed the perceived organization of the modules compared to other texts. The results are shown below.

7. How would you rate the organization of the module compared to other texts you have used?

| | Frequency | Valid Percent |
|---------------|-----------|---------------|
| Excellent | 10 | 43.5 |
| Good | 8 | 34.8 |
| Average | 3 | 13.0 |
| Below Average | 2 | 8.7 |
| Total | 23 | 100.0 |
| No Response | 4 | |
| Total | 27 | |

Seventy-eight percent (78%) of respondents rated the organization of the modules as “Excellent” or “Good” compared to other texts. To determine whether these results were consistent across all six modules, a separate crosstabulation of Question 7 by module was performed. The results from this analysis are shown below.

module * 7. How would you rate the organization of the module compared to other texts you have used?
Crosstabulation

| | | | 7. How would you rate the organization of the module compared to other texts you have used? | | | | Total |
|--------|--|-----------------|---|-------|---------|---------------|--------|
| | | | Excellent | Good | Average | Below Average | |
| module | Module 1-1: Nature and Properties of Light | Count | 2 | 3 | 0 | 1 | 6 |
| | | % within module | 33.3% | 50.0% | .0% | 16.7% | 100.0% |
| | | % of Total | 8.7% | 13.0% | .0% | 4.3% | 26.1% |
| | Module 1-2: Optical Handling and Positioning | Count | 1 | 3 | 0 | 0 | 4 |
| | | % within module | 25.0% | 75.0% | .0% | .0% | 100.0% |
| | | % of Total | 4.3% | 13.0% | .0% | .0% | 17.4% |
| | Module 1-3: Light Sources and Laser Safety | Count | 2 | 2 | 0 | 0 | 4 |
| | | % within module | 50.0% | 50.0% | .0% | .0% | 100.0% |
| | | % of Total | 8.7% | 8.7% | .0% | .0% | 17.4% |
| | Module 1-4: Basic Geometrical Optics | Count | 1 | 0 | 0 | 1 | 2 |
| | | % within module | 50.0% | .0% | .0% | 50.0% | 100.0% |
| | | % of Total | 4.3% | .0% | .0% | 4.3% | 8.7% |
| | Module 1-5: Basic Physical Optics | Count | 1 | 0 | 2 | 0 | 3 |
| | | % within module | 33.3% | .0% | 66.7% | .0% | 100.0% |
| | | % of Total | 4.3% | .0% | 8.7% | .0% | 13.0% |
| | Module 1-6: Principles of Lasers | Count | 3 | 0 | 1 | 0 | 4 |
| | | % within module | 75.0% | .0% | 25.0% | .0% | 100.0% |
| | | % of Total | 13.0% | .0% | 4.3% | .0% | 17.4% |
| Total | | Count | 10 | 8 | 3 | 2 | 23 |
| | | % within module | 43.5% | 34.8% | 13.0% | 8.7% | 100.0% |
| | | % of Total | 43.5% | 34.8% | 13.0% | 8.7% | 100.0% |

Modules 1-2 (Optical Handling and Positioning) and 1-3 (Light Sources and Laser Safety) received the highest satisfaction ratings with 100% of respondents rating the organization of these modules as “Excellent” or “Good.” Module 1-5 (Basic Physical Optics) received the lowest rating with 1 of 3 respondents (33%) rating the organization of this module as “Excellent” or “Good.”

Satisfaction with Mathematics for Photonics Education Supplement. Question 19 assessed satisfaction with the module mathematics supplement in terms of the degree to which it prepared students for the math skills needed for the course. The results from Question 19 are shown below.

19. Please rate the "Mathematics for Photonics Education" supplement for appropriateness in student preparation of necessary math skills for the course.

| | Frequency | Valid Percent |
|---------------|-----------|---------------|
| Excellent | 9 | 42.9 |
| Good | 9 | 42.9 |
| Average | 1 | 4.8 |
| Below Average | 2 | 9.5 |
| Total | 21 | 100.0 |
| No Response | 6 | |
| Total | 27 | |

Eighty-six percent (86%) of respondents rated the mathematics supplement as “Excellent” or “Good.” To determine whether there were differences in ratings across modules, a crosstabulation on Question 19 by module was performed. The results are shown below.

module * 19. Please rate the "Mathematics for Photonics Education" supplement for appropriateness in student preparation of necessary math skills for the course. Crosstabulation

| | | 19. Please rate the "Mathematics for Photonics Education" supplement for appropriateness in student preparation of necessary math skills for the course. | | | | | |
|--------|--|--|-------|---------|---------------|--------|--------|
| | | Excellent | Good | Average | Below Average | Total | |
| module | Module 1-1: Nature and Properties of Light | Count | 2 | 2 | 0 | 1 | 5 |
| | | % within module | 40.0% | 40.0% | .0% | 20.0% | 100.0% |
| | | % of Total | 9.5% | 9.5% | .0% | 4.8% | 23.8% |
| | Module 1-2: Optical Handling and Positioning | Count | 2 | 1 | 0 | 0 | 3 |
| | | % within module | 66.7% | 33.3% | .0% | .0% | 100.0% |
| | | % of Total | 9.5% | 4.8% | .0% | .0% | 14.3% |
| | Module 1-3: Light Sources and Laser Safety | Count | 1 | 2 | 0 | 0 | 3 |
| | | % within module | 33.3% | 66.7% | .0% | .0% | 100.0% |
| | | % of Total | 4.8% | 9.5% | .0% | .0% | 14.3% |
| | Module 1-4: Basic Geometrical Optics | Count | 1 | 2 | 0 | 1 | 4 |
| | | % within module | 25.0% | 50.0% | .0% | 25.0% | 100.0% |
| | | % of Total | 4.8% | 9.5% | .0% | 4.8% | 19.0% |
| | Module 1-5: Basic Physical Optics | Count | 1 | 0 | 1 | 0 | 2 |
| | | % within module | 50.0% | .0% | 50.0% | .0% | 100.0% |
| | | % of Total | 4.8% | .0% | 4.8% | .0% | 9.5% |
| | Module 1-6: Principles of Lasers | Count | 2 | 2 | 0 | 0 | 4 |
| | | % within module | 50.0% | 50.0% | .0% | .0% | 100.0% |
| | | % of Total | 9.5% | 9.5% | .0% | .0% | 19.0% |
| Total | Count | 9 | 9 | 1 | 2 | 21 | |
| | % within module | 42.9% | 42.9% | 4.8% | 9.5% | 100.0% | |
| | % of Total | 42.9% | 42.9% | 4.8% | 9.5% | 100.0% | |

One hundred percent (100%) of respondents to Modules 1-2 (Optical Handling and Positioning), 1-3 (Light Sources and Laser Safety), and 1-6 (Principles of Lasers) rated the mathematics supplement as “Excellent” or “Good.” Module 1-5 (Basic Physical Optics) respondents gave the supplement the lowest rating with 50% of respondents rating the mathematics supplement as “Excellent” or “Good.”

Satisfaction with Mathematics for Photonics Education Assessment. Question 20 assessed the perceived adequacy of the mathematics student assessment to identify the mathematics needed for the course. The results from Question 20 are shown below.

20. Please rate the adequacy of the "Mathematics for Photonics Education" student assessment to identify student weaknesses in the mathematics needed for the course.

| | Frequency | Valid Percent |
|-------------|-----------|---------------|
| Excellent | 8 | 40.0 |
| Good | 8 | 40.0 |
| Average | 4 | 20.0 |
| Total | 20 | 100.0 |
| No Response | 7 | |
| Total | 27 | |

Eighty percent (80%) of respondents rated the mathematics student assessment as “Excellent” or “Good.” To determine whether there were differences in ratings across modules, a crosstabulation of Question 20 by module was performed. The results are shown below.

module * 20. Please rate the adequacy of the "Mathematics for Photonics Education" student assessment to identify student weaknesses in the mathematics needed for the course. Crosstabulation

| | | 20. Please rate the adequacy of the "Mathematics for Photonics Education" student assessment to identify student weaknesses in the mathematics needed for the course. | | | | Total |
|--------|--|---|-------|---------|-------|--------|
| | | Excellent | Good | Average | | |
| module | Module 1-1: Nature and Properties of Light | Count | 2 | 2 | 1 | 5 |
| | | % within module | 40.0% | 40.0% | 20.0% | 100.0% |
| | | % of Total | 10.0% | 10.0% | 5.0% | 25.0% |
| | Module 1-2: Optical Handling and Positioning | Count | 1 | 1 | 1 | 3 |
| | | % within module | 33.3% | 33.3% | 33.3% | 100.0% |
| | | % of Total | 5.0% | 5.0% | 5.0% | 15.0% |
| | Module 1-3: Light Sources and Laser Safety | Count | 1 | 2 | 0 | 3 |
| | | % within module | 33.3% | 66.7% | .0% | 100.0% |
| | | % of Total | 5.0% | 10.0% | .0% | 15.0% |
| | Module 1-4: Basic Geometrical Optics | Count | 1 | 1 | 1 | 3 |
| | | % within module | 33.3% | 33.3% | 33.3% | 100.0% |
| | | % of Total | 5.0% | 5.0% | 5.0% | 15.0% |
| | Module 1-5: Basic Physical Optics | Count | 1 | 0 | 1 | 2 |
| | | % within module | 50.0% | .0% | 50.0% | 100.0% |
| | | % of Total | 5.0% | .0% | 5.0% | 10.0% |
| | Module 1-6: Principles of Lasers | Count | 2 | 2 | 0 | 4 |
| | | % within module | 50.0% | 50.0% | .0% | 100.0% |
| | | % of Total | 10.0% | 10.0% | .0% | 20.0% |
| Total | | Count | 8 | 8 | 4 | 20 |
| | | % within module | 40.0% | 40.0% | 20.0% | 100.0% |
| | | % of Total | 40.0% | 40.0% | 20.0% | 100.0% |

One hundred percent (100%) of respondents to Modules 1-3 (Light Sources and Laser Safety) and 1-6 (Principles of Lasers) rated the mathematics assessment as “Excellent” or “Good.” Module 1-5 (Basic Physical Optics) respondents gave the mathematics assessment the lowest rating with 50% of respondents rating the mathematics supplement as “Excellent” or “Good.”

Open-Ended Comments

Listing of all Comments Verbatim

Instructor Questionnaire for STEP II Project Comments

Module 1-1 (Nature and Properties of Light)

21. How can the Step II module be improved?

Should be more direct in order of topics presented; omit material on polarization, diffraction and interference; Make lab procedures more direct (succinct)-don't ramble; update scientific notation and metric prefixes to current levels (i.e. femto, atto, peta...)

I feel that it is too early to introduce interference and diffraction. Raman scattering is not necessary. Total internal reflection can be introduced here.

Interference seems to be in the particle section. Should relate to wave nature. In reflection refer to angles A&B; in refraction refer to angles as 1 & 2. To help stay consistent, maybe use same label, for incident angles and reflected or refracted. Less for student to retain.

I think that the module is very well-written and at the appropriate level for an introductory course. Don't change it. One area which could possibly be changed is the lab exercise. A prism spectrometer can perform the same measurement while providing much more interesting features than the current lab. Prism spectrometers can be purchased (www.surplussed.com) for \$125.

22. Please provide any additional comments about the Step II module.

Math supplement needs to stress metric system unit conversions; Info in Module 1-1 may be ok for a junior or sophomore with previous physics background; Module has too much material for entry-level student.

In lab we used a laser in place of flashlight in some areas. Others we used spectroscope with light source. We don't have flashlights.

We will be implementing the Photonics Mathematics supplement in the fall so I was unable to implement any of this.

Module 1-2 (Optical Handling and Positioning)

21. How can the Step II module be improved?

The module (1-2) has too much material for an overview module. Covering ideas like Brewster's angle and what happens at air to glass interface is a little heavy without more basic ideas. Brewster's angle requires some understanding of polarization to make the point clear.

22. Please provide any additional comments about the Step II module.

Overall, I think the students responded well to the material. However I felt “rushed” in presenting that module in 6 class hours.

Organization and content excellent. Easy to instruct. Avoid discussion on optical components.

Pg. 48 $E=p/a$. This was not covered before this; Typo page 55, 1st par, front and rear; Typo page 65, magnesium fluoride, page 85, problem 7, outside pressure 1×10^5 Pa

Module 1-3 (Light Sources and Laser Safety)

21. How can the Step II module be improved?

Laser safety aspects should be presented earlier in the course. For example, in module 1-1 prior to turning to laser for the associated lab.

Test needs more math. The test was too easy.

22. Please provide any additional comments about the Step II module.

Excellent discussion on light sources and laser safety.

Module 1-4 (Basic Geometrical Optics)

21. How can the Step II module be improved?

The module is too long. Should be 3 modules for the amount and depth needed. Labs need much improvement. Don't show half of what is in the text material. To do a good job of covering material more needed. I added other labs I have used before in past Geometrical optics.

Lab C-Should present an equation connecting spherometer measurement and radius with curvature; A first year student won't be able to derive it; Lab D-Maintaining parallelism of the two laser beams is very difficult for an entry level student.

22. Please provide any additional comments about the Step II module.

This module is out of balance with the rest of the book. It is as if everything about geometrical optics was thrown in without much thought about it.

Too much material (overkill) in the module for an introductory course; Inclusion of Cassagrain system is good; Includes only one fiber optics example; With rapidly expanding fiber technology, the book should devote additional material to the topic.

Module 1-5 (Basic Physical Optics)

21. How can the Step II module be improved?

Divide Module 1-5 into two. Wave optics and polarization need to be separated. Pg. 217. The equation is incorrect.

The content is appropriate for a survey course such as 'Fundamentals of Photonics,' where more in depth coverage will follow. Our program (in its current context) requires more in depth coverage, as we only have 1 semester of wave optics. I therefore beefed up the topics. In summary, it is well-written but not well-matched to our program.

22. Please provide any additional comments about the Step II module.

Math level is beyond the scope of a first year student; The amount of laboratory work is overwhelming to a beginner student.

Module 1-6 (Principles of Lasers)

21. How can the Step II module be improved?

May break into two modules. Module may be placed in order before geometric optics.

This module is the same as 1-4 in that it has way too much info and depth to have as just one chapter or module. This covers all of the "intro to laser" book in one module. It still has as much info to discuss but much has been left out. One lab to replace 10 or 11 is not going to get across the ideas needed.

22. Please provide any additional comments about the Step II module.

To sum up, too many details left out. This seems to be an idea passing around in schools now. Give the student only the high lights of each topic. Our entire education system is going to a black box concept. What's inside and how does it work will round them off. Then they can fit into more than one job. They are flexible.

Instructor Questionnaire

Module Title: _____

Institution: _____

Course No. and Section: _____

This questionnaire seeks your opinion of the course module listed at the top of this page. Your responses will be used to assess satisfaction with module content, organization, difficulty, and general effectiveness. The results from the questionnaire will be used to make improvements in the course module. *Please use a No. 2 pencil.*

1. Please indicate which of the following major parts of the course module you taught (*Mark all parts you assigned or covered in class*)

- 0 Content with examples
- 1 Hands-on laboratory
- 2 End-of-module problem exercises

2. What percentage of the module did you complete?

- 0 Less than 25%
- 1 25% to 49%
- 2 50% to 74%
- 3 75% to 100%

3. How many contact hours did you teach using this module?

- 0 Less than 5
- 1 5 - 9
- 2 10 - 15
- 3 16 - 20
- 4 20 or more

4. Based on the typical technology courses you have taught, is the number of concepts covered in this module

- 0 too many for the time you have allotted
- 1 about right for the time you have allotted
- 2 too few for the time you have allotted

5. How did you conduct the hands-on laboratories in this module?

- 0 Conducted laboratories as included in the module
- 1 Modified laboratories in the module
- 2 Conducted my own equivalent laboratories
- 3 Did not conduct laboratories

6. Was the equipment required for the module's hands-on laboratories readily available at your site?

- 0 Yes
- 1 No

7. How would you rate the organization of the module compared to other texts you have used?

- 0 Excellent
- 1 Good
- 2 Average
- 3 Below Average
- 4 Very Inadequate

Please rate the difficulty of the Step II course module compared to text material you have used in the past.

- 8. Technical level of the material
- 9. The reading level of the material
- 10. The mathematics level of the material
- 11. The problem exercises
- 12. The hands-on laboratories

More Difficult Same Difficulty Less Difficult

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Please rate the overall quality of each component of the Step II course module in terms of impact on student learning.

- 13. Basic concepts (text)
- 14. Figures
- 15. Examples
- 16. Hands-on laboratory
- 17. Problem exercises
- 18. Internet-based demonstrations (Applets)

Excellent Good Average Below Average Very Inadequate Not Applicable

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19. Please rate the "Mathematics for Photonics Education" supplement for appropriateness in student preparation of necessary math skills for the course.

- ① Excellent
- ② Good
- ③ Average
- ④ Below Average
- ⑤ Very Inadequate

20. Please rate the adequacy of the "Mathematics for Photonics Education" student assessment to identify student weaknesses in the mathematics needed for the course.

- ① Excellent
- ② Good
- ③ Average
- ④ Below Average
- ⑤ Very Inadequate

Comments

21. How can the Step II module be improved?

22. Please provide any additional comments about the Step II module.

Thank you for your participation in this project.