Self-evaluation in a Geometrical Optics laboratory with a large number of students

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Abstract: After each laboratory session, students must answer individually three random multiple choice questions. The corresponding software has been developed by us. This self-evaluation test motivates students before and during sessions performance, and provides objective information to the teacher. The estimated students' mean satisfaction with this system is 8.1/10.

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Specific software for self-evaluation in the geometrical optics laboratory (first course for the optics and optometry diploma) has been developed. Later it has been used by 141 undergraduate students during a total of 8 sessions. After each session, and using a personal password, students must answer individually a three four-option questionnaire, randomly selected from a database with 124 questions. There was a response time limit of 45 s per question, and the answers were processed in the computer. The goal of this self-evaluation test is to motivate students' learning before and during laboratory sessions, and also to provide objective information to the teacher, who is usually responsible for a laboratory with 24 students per session. Our proposed self-evaluation software could be easily implemented in other undergraduate optics laboratories.

Figure 1 shows the mean percentage (and standard deviation) of correct answers by our students, corresponding to each one of the 8 laboratory sessions. An overall average of 78.2% correct answers was found, with similar results for all sessions: 1. Visualization of ray trajectories through simple Optical Systems, and measurement of the refractive index of a plane-parallel plate; 2. Verification of paraxial equations for a converging lens; 3. Measurement of focal lengths of converging and diverging lenses; 4. Determination of the cardinal points of an optical system formed by two lenses; 5. Dispersive prisms: measurement of refractive indices at different wavelengths; 6. Measurement of radius of curvature for concave and convex mirrors; 7. Compound microscope: measurement of magnification of the objectives, and refractive indices of plane-parallel plates; 8. Effect of aperture and field stops, and visualization of geometrical and chromatic aberrations.

Figure 2 shows the mean results and standard deviation of a survey where the next 8 questions were posed to the students: 1 The use of the computer program is: very difficult (0); very easy (10); 2. The proposed questions are related to the laboratory handbook and to the experimental work that you have done: not at all (0); very closely (10); 3. The proposed questions are: very difficult (0); very easy (10); 4. The time available for answering each question is: very short (0); very long (10); 5. With this system the performance of the laboratory sessions improves: not al all (0); very considerably (10); 6. This self-evaluation system is: very stressful (0); not stressful at all (10); 7. Do you think this system should be used in other undergraduate laboratories to improve learning?: never(0); always (10); 8. Please mark globally this self-evaluation procedure to improve laboratory teaching in geometrical optics: very bad (0); very good (10). We are particularly encouraged by the high mean score obtained for this last question: 8.1/10.

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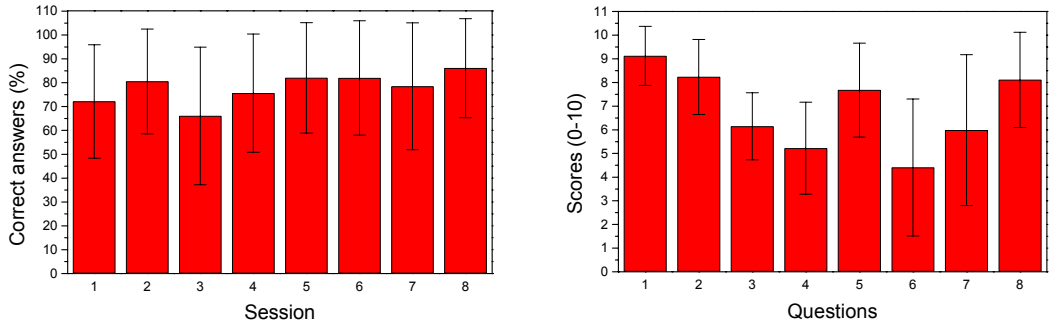

Fig 1. Percentage of correct answers (left), and results of a survey (see text) passed to the students (right).