For data collection, a question was posed to all students at the end of session. It was preceded by a text describing the application of an IR laser for acne treatment. During the academic year 2012-13, students were asked to relate what was described in that text to what they had learnt throughout the session. The analysis of the 67 students' answers collected to that question revealed that many students explained the effects of the laser in vague terms, often repeating information included in the text, and so without providing evidence on their conceptions of absorption of IR light.
In a consecutive version of the instructional material, two more specific questions were added after the text. From the analysis of 168 students' answers to these questions, we found that less than 15% of students explicitly explained absorption in terms of energy associated to IR light. Rather than focusing on explaining the processes involved in absorption, most students' answers focused on describing the effects at a macroscopic level or at a microscopic level.
Students' answers to questions posed during the instruction (after carrying out a real experiment and after using a computer simulation) and at the end of the instruction have been collected during the academic year 2013-14. The results of the ongoing analysis of these data and implications for further developments of the instructional design will be discussed in the presentation during the conference.
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Session 6.2: Physics Teaching and Learning at University Level
Friday 11, 14:15-16:15 Room 8 (Aula 8)

Laboratory activities and the perception of the students

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The perception that students have towards laboratory activities has been analyzed on the basis of the results of a questionnaire that was distributed to a sample of 99 students from high school and about 270 university students from the Physics Bachelor degree course at the University of Torino.
The objective of laboratory activities is not only the demonstration of concepts, laws and procedures: very important are also the attainment of a greater maturity and autonomy of thought and an increased capacity of cooperation and of using various types of instruments by the students. Nevertheless, the students (and on occasion also some members of the teaching staff) often give greater importance to the subjects more closely related to didactic on-face activities.

In this context, it has been considered interesting to analyze the perception that students of different ages and school levels, from the last years of high school up to the third year of university, have towards laboratory activities.
After a preliminary phase of study on the expectations and on the perceptions of the students relative to the laboratory activities, it was decided to conduct a more detailed analysis of the evolution of the student opinions. The objective was that of following the temporal evolution of the approach to the laboratory, starting from the students of the IV and V years of high school and going on to students in the III year of the degree course in Physics at the University of Torino, where 6 obligatory laboratories are in operation, 2 for each year of the course.
The questions can be grouped together into some main streams:
• The usefulness of the laboratory to attain a greater comprehension of Physics;
• The interest in and the complementary nature of laboratory activities and classroom lessons;
• Implementation in the capacity to use other instruments, whether of an informatics type or others;
• The usefulness and ease of use of the informatics instrumentation.
The questionnaire also included two open questions on "What I like" and "What I do not like" in the laboratory activities.
An analysis was then conducted for each question, on the basis of a chi-square test, considering a null hypothesis, which followed a simple uniform statistical distribution. Therefore, the non-acceptance of the null hypothesis shows the presence of a diversified response, which points out, according to the context, a change in opinion over the years, or a more positive opinion (or more negative) that that foreseen for a pure proportional distribution for all of the years, or for some of the years of the course.
The analysis work carried out on the responses to the questionnaire has pointed out some considerations, which had already been shared by the teaching staff, and offered some food for thought, which could inspire future didactic programing.
Overall, it is possible to state that the analysis of the responses has made it possible to point out some critical points on which to work, over the next few years, in order to maintain the educational aspect of the laboratory courses and, at the same time, to broaden the educational capacity and the positive acceptance of the students.

An investigation of contextual gender bias of FCI questions

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At the University of Manchester we have been using the Force Concept Inventory (FCI)(1) for the past six years to evaluate first year physics students' conceptual understanding of Newtonian mechanics. We have collected data on about 1400 students, approximately 20% of whom are female. Analysis of the data reveals a consistent significant difference in the mean scores obtained by male and female students, both pre- and post- instruction, with the males outperforming the females by 10-20%. A similar gender gap has also been observed elsewhere in the UK(2), and the USA(3-6).
When we analyse the answers to individual questions we find that male students perform better than females on nearly all of the questions on the FCI. This is consistent with other data in the literature(6,7). However when we compare our data with similar data obtained in the US we were surprised to find that the gender gap is particularly wide for some of the same questions, especially questions 14 and 23. Such a gender gap might arise due to a male context of some of the FCI questions, and McCullough(8) has created a version of the FCI which uses a more female context for each of the thirty questions. An early study using this version (9) on a group of non-physics students showed no change in the overall scores for males and females. In a more recent study (10) on students in a calculus based physics course, McCullough concludes that changing the context of