# Promoting active learning in physics courses for the agro-food degrees

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**Abstract**. Teaching/learning physics in the bio area require a revision of contents, approaches, methods. In the last years at the University of Udine, an experimentation was carried out in the physics course for the agro-food degrees. The main choices will be discussed, highlighting the basic role of active learning proposals and continuous assessment.

## 1 Introduction. The problem.

Research in physics education has highlighted the importance of promoting active learning also at university level [1-3]. Several groups have been studying how to "reinvent" physics for courses for students of the bio and natural sciences sectors [4-6]. One of the main knot is to involve students in addressing issues that they feel distant and little related to the respective field of study [7-8]. This involves further problems in the case of those courses of study in which the role of technological applications is strong, such as those for future agricultural, food production, environment and nature technicians. In these thematic areas, physical concepts are applied at different levels, almost always in an uncritical and dogmatic way. On the other hand, knowledge in physics courses is often constructed away from application contexts, assuming that the students then create the link between concepts and applications.

For an effective approach to physics it is necessary to carry out a profound process of reviewing the issues addressed, the angles of attack used, the contexts in which to address the different issues with the aim of making physics an effective and useful work-tool and not a set of knowledge that remains confused, vague or inactive.

In the last three years at the University of Udine, educational innovation projects were tested in the basic Physics courses that involved cohorts of 400-500 students per year of four degree courses: Agronomy; Oenology; Science of nature and environment, Science and technology of food. Approaches followed and outcomes in specific areas have been presented in previous works [9-12].

This paper discuss the strategic choices made, aiming to improve the level of involvement of students both on the web and in the presence, the implementation of a continuous assessment process, the improvement of formative success, the students preparation in the perspective of their specific studies area. The main elements will be discussed, highlighting on the basis of the results achieved the founding role for the students learning and formation of the experimental activities, the self-assessment questionnaires on the web, the continuous evaluation process.

## 2 Research design, instruments and methods

Designing the courses, the focus was on raising the quality, rather than adopting simplifying approaches, which are ineffective both in terms of understanding the concepts and the ability to apply them [4, 13]. It was decided to analyze problematic contexts typical of the study courses involved in order to draw new angles of attack on the different topics dealt with [11]. Classroom activities were proposed with clickers, paper questionnaires, demonstration experiments, interactive lecture demonstrations [1,3], to achieve an active involvement of the students, with a high level commitment [4, 2, 13]. We aimed to build a functional undestanding

[13] of the physical concepts that gave them the tools to: appropriate of the methodologies with which physics builds its laws and validates them experimentally, reach an understanding of the physical concepts that allow students to face the main conceptual knots often on which are connected the main learning problems, know how to use physical concepts to interpret qualitatively but consistently phenomena of daily life and of their respective fields of study, know how to apply concepts and physical laws to the resolution of simple both qualitative and quantitative problem solving [14-15].

The approach to physics looks at contents and contexts taken from the specific area of study of the students in increasingly invasive and punctual way. In addition to this, the problem was posed of implementing active learning while teaching to a considerable numbers of students (200-300 students per course). Experimental laboratory activities, demonstration experiments from the desk with real-time graphs, interactive lessons with clickers, network support with web forums and questionnaires on the web are differentiated tools to promote active and effective learning of students and able to limit the serious problem of students dispersion.

## 3 Conclusion

The results collected both on the basis of the self-assessment tests, the intermediate and final written exam tests show significant learning level of students of the main concepts dealt with, the competence in the use of physical concepts in the analysis of daily phenomena and specific to their respective fields of study. The competence in quantitative problem solving, was only partial, particularly insecure when inverse problems were proposed. The analysis of the interventions in the web forum highlights the importance of defining precise tasks so that the online activity translates into effective formative path.

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