

# DIVERSIFICATION, A CHALLENGE TO RENEW THE WORK SESSION PHYSICS

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## ABSTRACT

Implementation of the Bologna agreement between EU members causes big changes in the higher education in Flanders, Belgium. As a result the subject physics is reduced in the revised curriculum for engineering sciences. To maximise the benefit given the limited time, we work out a new approach for the work sessions physics.

Our experience shows that the students have great difficulties writing solid reports. Therefore we emphasize the importance of the written report in the first bachelor year. However as a test, we introduced peer assessment for learning purposes: we let the students perform an experiment with the aid of a report written by one of their colleagues. Additionally the students are asked to review the original report. The results bear out neither obvious positive or negative influence on the student's lab skills. Therefore several refinements are suggested.

In the second bachelor year, in addition to a reduction of the number of experiments, we diversify our goals. The students have to study 4 experiments profoundly. Assessment relies on a written report, an oral presentation, a practical test and a written test. Moreover, the students are asked to formulate some test questions themselves.

The presentations and reports are evaluated by the teacher-expert. For a small test group we also use formative peer assessment. The score given by the teacher and the averaged ranking given by the fellow students correlates rather well. Therefore the peer assessment can be extended to evaluate the presentations. The assessment of the own presentation on the other hand gives no correlation with the expert's score.

Comparing the scores to those of previous year, shows no main differences. The appreciation of the students although, as appeared from a small inquiry, is much higher.

## SUMMARY

The higher education in Flanders undergoes big changes due to the Bologna agreement between the EU members. As a result the subject physics is reduced in the revised curriculum for engineering sciences. To maximise the benefit given the limited time, we found it necessary to adapt the approach in the work session physics.

In the first bachelor year we focus on the basic skills to achieve during the work sessions, i.e. we emphasize on the importance of the written report, as our experience shows that the students have great difficulties writing solid reports. This is trained using 9 experiments where the students have to write a report in small groups during the 3 hour of the work session. Afterwards the teacher gives feedback. To enhance the critical mind, the students are also asked to make a formative peer assessment of one of the reports of their colleagues. This is conceived as a co- and self assessment. The students are allowed to train an experiment with the aid of a report written by one of their colleagues. In addition they have to review the report using an evaluation form as a guideline. They are asked to give a score based on a few criteria for a good, written report. To evaluate the content the students perform the measurements themselves and make the necessary calculations and graphs. Thus, the peer assessment is intended as an assessment for learning, a self assessment for their own reports.

In the second year we diversify our approach. Besides the traditional performing of experiments and training the skill of making good written reports, which is mainly trained in the first bachelor year, we introduce more freedom, oral presentations and peer assessment. The number of experiments is reduced; only 4 experiments have to be studied profoundly. At the end of the semester this is tested in a written and a practical test. The students are allowed to train the live experiment weekly in small groups. In addition the students themselves are asked to formulate a few model questions as could be used for the written test. As such they are obliged to reflect about their work. For only two out of the four experiments they present the results: of one by means of a written scientific report and for another we expect them to give a ten minute oral presentation explaining to their fellow students the main goal, principle and results of the experiment. Each presentation is followed by a discussion which is a great opportunity to develop the interpersonal skills. As such not only the teacher but the students as well have to take their responsibility in giving appropriate feedback and the students are obliged to learn from each other. The students are allowed a large degree of freedom to plan their work themselves, they are left with the responsibility of 2 additional experiments that will be tested only at the end of the semester.

The score for the different parts of the work session are compared during the different years looking if the changes have an influence on the scoring pattern. So far the scores indicate no big changes during the years but the appreciation of the students, as appeared from a small inquiry, is much higher. They prefer the new approach above the method of merely writing reports of all the experiments. Although we can conclude that the students prepare the experiment of the presentation more profoundly. To actualise their presentation, the students search the internet for relevant applets and small films or look for appropriate applications of the presented theory. This is also reflected in the score in the written test. The score on the question concerning the presentation is 10% higher than the score on the other questions.

A new approach and implementation challenges asks also new assessment forms. Peer assessment is introduced in the first bachelor year. Major conclusions regarding the effect cannot be drawn from it at this moment. Obviously although, the students are not used to interpret measurements and must train in doing so. In combination with an enhanced and more systematic feedback of the expert, using an assessment form, we believe this can be a useful tool for the future to reduce repeatedly and cumulative errors.

In the second year the students are asked to assess oral presentations. The presentations are evaluated by the teacher-expert who is also responsible for the final score but the students are also asked to perform a formative peer assessment. Independent of the given score by the expert, they give a ranking score between 1 and 4 at the different presentations. There are a few conditions making it impossible to give all their colleagues 4. They are also asked to evaluate their own presentation. The averaged score from the class group is compared with the score of the expert. We can conclude that there is a clear linear correlation between both scores (correlation coefficient  $R^2 = 0.67$ ). This assumes that there is, within the given set-up, a strong parallelism in marking criterions although they are not specified by the expert. This allows us to use the peer assessment as a summative assessment and to evolve to co-assessment of both peer and expert. The self assessment of the presentation (average of the 3 or 4 members of the group) shows no correlation with the score of the expert ( $R^2 = 0.14$ ) nor with the score of the peer group ( $R^2 = 0.15$ ). Therefore we conclude that the self assessment is not objective.

The new approach addresses more skills than before, therefore also asks for new forms of assessment. In diversifying the assessment not only the disciplinary knowledge but also other skills are included in the final result.