ENHANCING STUDENTS’ KNOWLEDGE USING INTERACTIVE LECTURES AND VIDEO ANALYSIS

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Motivation

- Physics are often considered to be difficult subject. Students at the technical universities in Slovakia are less interested in studying Physics and Mathematics because they consider them difficult to learn and to understand.
- If we want to prepare graduates who are able to work independently with a high degree of creativity, then apart from devoted scientists, well-educated teachers, study materials of high quality, we should keep in mind that university teachers of physics and mathematics must take into account the specific needs and requirements of each faculty and prepare specific study materials supporting the specialization of these faculties.
- As a result, most of the students enrolling to technical universities have only theoretical knowledge about physical phenomena, several preconceptions and misconceptions.
- We try to prepare our students for teamwork and collaboration with scientists and engineers, so they are able to work in interdisciplinary fields at the interface between physics and technical departments. Therefore, we decided to support freshmen by interactive lectures using video and video analysis and find out whether interactive lectures are more effective in increasing students prior knowledge level of physics than traditional lectures.
METODOLOGY OF TEACHING PHYSICS AND EVALUATING

• At the beginning of the second semester of academic year 2018/19, the Force Concept Inventory (FCI) was administered to students at the Faculty of Electrical Engineering and Information Technology (FEEIT) University of Žilina (UNIZA) to find out their prior knowledge level of physics.
• The pre-test was carried out at the beginning of the second semester during the first week, post-test was carried out at the end of semester (the 13th week, after the semester course ‘Physics’) and it was attended by 64 students who participated in the pre- and post-test.
• The students were assigned to two groups – the experimental (was attended by 44 students) and the control group (was attended by 20 students). Only those students who participated actively in the lectures took part in the experimental group. Students who did not attend lectures took part in control group.
• The lectures were conducted in an interactive way aimed at clarity - using real-life videos related to the topic. All videos were analysed with the help of the program Tracker (using VAS method). Students from both groups attended compulsory computational physics seminars.
• The subject ‘Physics’ consists of 3 - 2 - 1 (lectures - exercises - labs) lessons per week, presence study. The semester consists of 13 weeks. The only difference between experimental and control group was that students from experimental group actively attended 13 interactive lectures while students from control group did not attend lectures.
ANALYSIS OF RESULTS

• Pre-test:

These results indicate that there is no statistical difference in the mean pre-test FCI score of the experimental and the control group at the beginning of semester.
ANALYSIS OF RESULTS

• Post-test:

But results in figure indicate that there is statistical difference in the mean post-test FCI score of the experimental and the control group at the end of semester.
DISCUSSION

• As the authors of FCI test claim it is necessary to point out that 60% of FCI test, for empirical reasons, is minimal threshold so that a student could continue in understanding Newtonian mechanics effectively. Below this threshold, a student’s grasp of Newtonian concepts is insufficient for effective problem solving. Otherwise a student is not able to overcome difficulties which caused him/her misconception and thus s/he learns physics by heart.

• 80 – 85% FCI score represents the mastery level when a student thinks in terms of intentions and Newtonian physics. As the authors state such an outcome does not depend on what teacher, in what country and what kind of school s/he teaches.

• The results of pre-test (Fig. 1) reveal that only 14% of students in the experimental and 9% in control group reached the level of 60% or higher from FCI score.

• In post-test (Fig. 2) the results reveal that 44% of students in the experimental and only 18% in control group reached the level of 60% or higher from FCI score. 16% of students in experimental group reached the mastery level from FCI score in post-test.
CONCLUSIONS

• Our results confirmed that there is statistical difference in the mean of post-test FCI score at the end of semester of the experimental group – only those students who actively participated in the lectures from Physics in comparison with the control group – students who did not attended lectures.

• Watching real physics concept videos and their subsequent video analysis had a positive impact on the growth of knowledge and improving of conception of Newtonian mechanics at the end of the semester.
REFERENCES