Adaptation of teaching and assessment to students' ambition levels

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Project idea

The project aimed at testing and evaluating different methods to adapt and align the teaching activities and examination methods to students' abilities and ambition levels as well as communicate the course goals and required levels for passing and higher grades to the students in a clear and efficient fashion.

Through this, we aim to improve the students' ability and ambition to take responsibility for their studies as well as facilitate them to efficiently plan their time and study activities.

The study included two courses: Signals and Systems, 5cp, taught to ca 90 Engineering Physics (F) students and ca 45 Electrical Engineering (E/EI) students in year three; and the theoretical part of Embedded Signal Processing Systems, 5 of 10cp, taught to ca 50 Informationtechnology (IT) students in year three. Note that the courses are very similar and the same course material was used. F students were taught by Mikael Sternad, who acted as a reference group, and both E/EI and IT students were taught by Steffi Knorn (applicant).

Implementation

Teaching activities

Classic teaching is usually conducted via lectures or problem-solving sessions, which suffers from two main disadvantages. First, all students (or at least large groups of them) are taught simultaneously, i.e., in the same time, manner and room etc. This means that the teacher can at best try to adapt his/her teaching to the majority of the students. Further, students tend to take a passive role during these teaching activities, which leads to little or no interaction with the teacher and little time or possibility to reflect on the material.

Hence, a radically different teaching approach was implemented in all three courses: Students were divided into small groups of up to 8 students of their choice, i.e., students were asked to join a group freely. Then, each student group got one hour of scheduled time with the head teacher of the course, which could be used according to the students' choice. Options included mini lectures or explanations of some material, solving examples, answering questions or giving feedback on students' work.

Students were also given an extensive portfolio of course material, which is summarized in the following subsection.

Course material

In order to allow students to prepare for the group sessions, extensive course material was made available at the beginning of the course. This included
- A course compendium written for the course, including dedicated exercises;
- Worked out solutions for all exercises of the course compendium;
- Conceptual questions with solutions for each course week's material;

- Video recordings of lectures covering most of the material in the course compendium;
- A summary for each course week including a list of recommended reading material, video lectures and exercises to be solved;
- An explanation of each course goal, including a break down into which subparts are required for passing the course or receiving higher grades and related, relevant material such as parts in the compendium, video lectures and exercises.

Written examination

The written exam was structured into one question per course goal. Further, for each course goal, i.e., each question, contained one part "for passing" and a second part "for higher grades". In order to pass the exam, students needed to demonstrate sufficient understanding and knowledge of each of the parts "for passing". No points or other summative metrics were used here. Solutions for questions "for higher grades" were instead graded by points, where each part "for higher grades" allowed to receive the same amount of points. Then, students, that had passed the exam, received grade 4 when receiving at least 33% of the points and grade 5 when receiving at least 66% of the points.

It is important to mention here, that all subgoals for the course goals were analyzed using Bloom's revised taxonomy. It was ensured that all parts in the basic category, i.e. required for passing the corresponding course goal, referred to lower levels of Bloom's revised taxonomy while parts assigned to be required for higher grades were ensured to correspond to higher levels of Bloom's revised taxonomy.

Further, previous exams, that already followed the same structure as indicated above, were analyzed in terms of which level of Bloom's taxonomy each part corresponded to. Of course, the exams during this study were designed choosing questions according to the list of subgoals needed for passing and higher grades.

Results

Students' perceptions and opinions

Most students quickly got used to the new organization of the course in terms of knowing which sessions to attend and which group to join. However, it quickly became apparent that students were hardly able to adapt their study routine to the new structure. Instead of using the group sessions to get feedback on their work and ask questions, most students hardly prepared for the sessions, despite being encouraged to do so, specially at the beginning of the course. Rather, students often fell back into their usual passive role. The majority used their group session time to request mini lectures and explanations on the board. Further, students often did not have any preferences on which material they wanted to be covered and rather asked for a classical overview of the main topics or whatever the teacher perceived as most important.

Only a small group of students changed their study routine as intended by the teachers. They prepared for the sessions by reading and watching videos as well as solving some exercise questions. These students quickly became leaders of their groups during the group sessions and other students followed their propositions on how to use the time. These students got a lot out of the course and occasionally reflected about how much they learned

and how efficient they perceived the sessions. Further, it seemed that other students, from the first category, who were in a group with at least one student, that prepared, also benefitted from this.

Some students also opted out from attending the sessions. This had to be expected and is a well observed behavior during traditional courses with usually not all students attending lectures.

In the course evaluation, one can see that some or even many E/EI students reflected positively about the changed course structure and acknowledged that teachers did a lot to help them learn and understand. However, the overall rating for the course dropped for E/EI students from Median: 4.5 Mean: 4.3 to Median: 4 Mean: 3.7. The criticism received most often was indeed the request to at least have some lectures in the course in order to give guidance and overview.

Examination results

In contrast to some students' discontent with the course, the overall exam results for E/EI showed indeed a little improvement. Compared to the exam in January 2018, where only 36.8% passed, 45.8% of the E/EI students passed the exam in January 2019. The improvement for IT students was extremely drastic: While 43.2% passed in January 2017 and 41.1% in January 2018, 77.8% of the IT students passed the exam in January 2019.[1]

Conclusions

Asking the students whether they think the new teaching form is better, many will complain about the required work and intensive workload as well as the lack of traditional lectures. Specially during the course, it is likely that students are not able to yet understand the benefits of the new method such as a higher passing rate. Hence, the most important question that arises from this study might be: Shall we teach so that students feel comfortable or so that we maximize their learning? In order to understand better where the best compromise lies, more work is needed. Some interesting questions to investigate in the future might be:

- Can students' content be improved by adding some lectures (as requested) without compromising the positive effects of the group teaching mode (such as increased passing grade)?
- Are students in some programs more or less prone to benefit from the small group teaching?
- Will students retain their knowledge achieved through the small group teaching longer?
- Do students improve their metacognitive skills by being forced to be more self-steered and self-organized when using small group teaching?
- Would students respond more positively when being taught with this method in first year, i.e., before being overly used to classical lectures?
- Would students' opinions on this teaching method change when being more used to it, e.g. by being taught in this form also in a subsequent course?

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[1] Note that this increase can have other reasons than only the changed teaching methods: Students reported to be scared due to terrible passing statistics from earlier years and hence reported to have studied a lot. Further, the course was given for the last time so that only two re-exams will be offered after January 2019. Hence, the motivation of passing the exam at the first try was likely much increased.