Online-based surveys in the Lectures on Mechanics II

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Lectures on Mechanics II
- Module Mechanic II: Mechanics of Materials, 6 ECTS
- Fundamental concepts and laws of statics such as stresses, strains, Hook’s linear law.
- The students apply the mathematical/mechanical analysis and modeling. The students apply the fundamental methods of elastostatics to simply engineering problems. The students estimate the validity and limitations of the introduced methods.
- 90 min. per week
- 891 inscribed students (summer term 2019)
- Grading: written exam + midterm

Status Quo
- Comprehensive introduction into elastostatics
- Presentation of the theory with interactively filling out of empty boxes in the script.
- Students do not dare to ask questions during the lecture because they think that they expose themselves to their fellow students.

Objectives
1. Improve the interaction between the lecturer and the students.
2. Activate and increase the learning rate in understanding fundamental concepts of the theory during and between the weekly lectures.
3. Introduce an indicator for the lecturer and for the students, how well basic concepts of the theory was understood and presented.
4. Quantify the students’ attitude in learning physical related topics.

Methods
- Didactic concept: Introduce multiple choice questions, using CONCEPTests and parts of CONCEPT inventories [4, 5, 2] in elastostatics during the lecture. Presented by an open access, browser based software called PINGO [3].
- Evaluation: Conduct surveys to quantify the students’ attitude in learning physical related topics with CLASS [1] and to quantify the impact of multiple choice questions.

Conclusion/Results
- No limitation concerning the IT infrastructure was observed during the whole course of the lecture.
- Ad 1 from objectives: Lectures were more relaxed and were not so overdriven by theory.
- Ad 2 from objectives: Students had a lively subject-related discourse with each other while they memorized and repeated basic concepts in theory.
- Ad 3 from objectives: PINGO is a smart and easy going system to conduct multiple choice questions.
- Ad 4 from objectives: No improvement in learning attitude patterns within the two conducted surveys (Figure 3).
- Increase in acceptance to perform multiple choice questions (Figure 4).
- Continue the online-based surveys in the Lectures on Mechanics II and update and redesign multiple choice questions according to Figure 2.

Acknowledgement
We thank the group of Christian Kautz, especially Julie Direnga, for discussion, providing their CLASS and for sharing the infrastructure publicly.

References

Evaluation: Survey concerning CLASS and impact of didactic concept
- 2 exactly the same surveys with 36 questions according CLASS [1] at the beginning (Pre) and around the mid term (Post) of the semester. Answer options ++, +, o, −, −−, i.e. full agreement to complete rejection of the statement.
- 271 and 121 valid received questionnaires for Pre and Post.
- For each lecture unit a subset of this pool of questions were conducted using an open access, browser based software called PINGO [3].

Figure 2: Percentage of correct answers separated by chapters according the lecture script.

Figure 3: Comparative statistical analysis (mean and standard deviation) of the two conducted surveys with optimal learning attitude patterns. The higher the values to the right, the more acceptance.

Figure 4: Histogram of answers to quantify the impact of multiple choice questions (Figure 4) quantified by answers of question number 16, 22 and 33.

Figure 1: Number of generated multiple choice questions (in sum 66) separated by chapters according the lecture script.

Didactic concept: multiple choice questions in elastostatics
- Designed a pool of new multiple choice questions for the field of elastostatics [4, 5, 2].
- For each lecture unit a subset of this pool of questions were conducted using an open access, browser based software called PINGO [3].

Figure 1: Number of generated multiple choice questions (in sum 66) separated by chapters according the lecture script.

Figure 2: Percentage of correct answers separated by chapters according the lecture script.

Figure 3: Comparative statistical analysis (mean and standard deviation) of the two conducted surveys with optimal learning attitude patterns. The higher the values to the right, the more acceptance.

Figure 4: Histogram of answers to quantify the impact of multiple choice questions (Figure 4) quantified by answers of question number 16, 22 and 33.