

Panel 2: Students' prior knowledge (in mathematics)

A student's prior knowledge of mathematics in particular is a critically important prerequisite for studying engineering sciences. A student's ultimate academic success is decided by whether or not they begin their engineering studies with enough previous knowledge of mathematics. Despite this, incoming students increasingly appear to arrive at university with insufficient prior knowledge of math. In this panel, we will discuss the following questions:

- I Are students entering university with less knowledge of mathematics than before or are the expectations greater than before?
- II How much mathematical skill must an engineer have?
- III How can students be motivated to take on supplementary courses?
- IV Which courses teach mathematics most effectively and when should such courses be offered?

Input 1: Professor Dr Duncan Lawson, Coventry University, UK

Input 2: Professor Dr Herold Dehling, Ruhr University Bochum

Chair: Professor Dr Burkhard Alpers, Aalen University of Applied Sciences

Results and statements

ad I

There is broad consensus that students enter university with less knowledge of mathematics than before. Identified reasons are as follows:

- shortened math curricula at high school result in insufficient amount of time for training and therefore in a missing fluency of basic mathematics, especially secondary level 1 mathematics (grade 7-10).
- Excessive use of calculators leads to a lack of basic arithmetic skills.
- Nowadays students may enter university not only via the Abitur but by means of some alternative ways. Usually, these students' mathematical background is sub Abitur level.

ad II

There is consensus that it depends a lot on the particular field of engineering to what extent what kind of mathematics is required. This shall be identified in cooperation with the respective engineering departments.

ad III

The conclusion of the related discussion is to focus on self-motivated students. Such a self-motivation may be generated by making the students aware of their (possibly) insufficient mathematical capabilities. This can be done by initial tests. Another successful approach offers support in the 2nd semester after failure in a regular exam.

It shall be noticed that supplementary classes parallel to regular courses may overstrain a weak student. A stretching of courses by introducing a "Semester 0" may provide a remedy to this problem.

ad IV

Mathematical courses shall be adapted to the study course which they are part of. Suggestions to obtain this are as follows:

- Embedding examples and exercise in an engineering background. This may be coupled with dedicated math lectures for each field of engineering.
- Inviting speakers from engineering departments to show the application of mathematical concepts in the field of engineering

Conclusion (lessons learned, final statement)

Students' prior knowledge of mathematics is often insufficient for several reasons (s. a. ad I).

This makes counter measures indeed necessary. The presented approaches from Coventry and Bochum show some first success.