The “Vorkurs Mathematik” at the RWTH Aachen University

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What is “Vorkurs”?

The “Vorkurs Mathematik” is a

- preparatory course in mathematics for
- beginners in all fields of study.

Outline of this presentation:

- Why is it necessary?
- Aims
- How is it done?
- How about success?

The situation

In Germany, mathematics education in schools is diverse:

- 16 Bundesländer, each responsible for education
- different curriculae for mathematics teaching
- different number of years (12 vs. 13)
- different intensity of mathematics training
- different style of mathematics in schools and universities

In addition one encounters:

- natural differences between teachers
- individual differences between students

$\Longrightarrow$ wide range of different preparatory education

Aims of the Vorkurs

Help beginning students to bridge the gap between school and university:

- revise school mathematics
- try to achieve a common minimal level
- cushion the difference in style of mathematics
- help students to discover their deficiencies
- give opportunity to acclimate to the university and to being responsible for their own learning

Organisation and Schedule

The Vorkurs Mathematik

- takes place in the last few weeks before the first semester
- runs for 5 weeks
- is voluntary and free of charge
- is for beginning students of all subjects of study
- is divided into four (independent) modules:
  - Foundations of Mathematics
  - Calculus
  - Linear Algebra
  - Probability and Statistics
- offers 2×90 min lecture every morning
- and 1×90 min exercise class in smaller groups every afternoon
- in 2005 there were 1650 participants (out of about 6000 first year students at the RWTH altogether)

Mathematical contents

- Foundations of Mathematics: (Prof. Dr. Rudolf Stens)
  - fractions, powers, quadratic equations
  - sets, logic, methods of proofs
  - real and complex numbers
- Calculus (Dr. Yubao Guo)
  - inequalities, absolute value, elementary functions
  - sequences, convergence, continuity
  - derivatives, integrals
- Linear Algebra (Dr. Max Neunhöffer)
  - systems of linear equations, Gaussian elimination
  - analytic geometry, scalar product
  - vector spaces, linear maps, linear independence
- Probability and Statistics (Dr. Wolfgang Herff)
  - description and representation of data
  - regression analysis
  - foundations of probability, combinatorics
  - estimation of parameters

Number of participants / Feedback

The Vorkurs has become quite popular:

Year	1994	1995	1996	1997	1998	1999
Number	460	490	541	576	669	709
Year	2000	2001	2002	2003	2004	2005
Number	927	1087	1157	1377	1379	1650

The biggest lecture hall has 1043 seats, thus we have to give every lecture twice.

We have 25 tutors to form exercise classes with about 50 participants each.

Feedback:

- mostly positive
- we get both “too easy” and “too difficult”
- seems to depend on quality of preparatory training
  $\Longrightarrow$ impossible to satisfy all needs!
- can be different after half a year

Test: before and after

We perform a test before and after the Vorkurs:

- astonishing inabilities in basic mathematics (e.g. fractions)
- a clear correlation between Leistungskurs/Grundkurs and success in tests
- significant improvement during the course:
  - percentage of correct solutions for comparable exercises in both tests (best example): increased from 8% to 46%
  - fraction of exercises solved by less than 20% of participants: dropped from 39% to 15%
  - fraction of exercises solved by at least 41% of participants: increased from 39% to 65%

$\Longrightarrow$ many participants learn something

Provocative statement

In the current situation in Germany

- universities have to offer bridging courses in mathematics between school and university
- even if this does not fall into the traditional scope of duties for universities

due to the wide range of different preparatory education.