The “Vorkurs Mathematik”
at the RWTH Aachen University

Max Neunhöffer

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Number of participants
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Provocative statement

IDEA league workshop, Mathematics in Engineering,
April 25th, 2006
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

⇒ wide range of different preparatory education
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 \times 90 \text{ min} \ lecture every morning
- and 1 \times 90 \text{ 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
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Number of participants / Feedback

The Vorkurs has become quite popular:

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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
  \[\Rightarrow\] 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 abilities 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%

⇒ 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.