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The "Vorkurs Mathematik" at the RWTH Aachen University

Max Neunhöffer

Lehrstuhl D für Mathematik RWTH Aachen University

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

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What is "Vorkurs"?

The "Vorkurs Mathematik" is a

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

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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?

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In Germany, mathematics education in schools is diverse:

• 16 Bundesländer, each responsible for education

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- different curriculae for mathematics teaching

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- 16 Bundesländer, each responsible for education
- different curriculae for mathematics teaching
- different number of years (12 vs. 13)

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- different style of mathematics in schools and universities

In addition one encounters:

natural differences between teachers

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In addition one encounters:

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- individual differences between students

⇒ wide range of different preparatory education

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

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

revise school mathematics

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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

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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

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- cushion the difference in style of mathematics
- help students to discover their deficiencies

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- give opportunity to acclimate to the university and to being responsible for their own learning

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- takes place in the last few weeks before the first semester
- runs for 5 weeks

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- takes place in the last few weeks before the first semester
- runs for 5 weeks
- is voluntary and free of charge

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- is divided into four (independent) modules:
 - Foundations of Mathematics
 - Calculus
 - Linear Algebra
 - Probability and Statistics

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 - Foundations of Mathematics
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 - 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)

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- Foundations of Mathematics: (Prof. Dr. Rudolf Stens)
 - fractions, powers, quadratic equations
 - sets, logic, methods of proofs
 - real and complex numbers

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- Calculus (Dr. Yubao Guo)
 - inequalities, absolute value, elementary functions
 - sequences, convergence, continuity
 - derivatives, integrals

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- Linear Algebra (Dr. Max Neunhöffer)
 - systems of linear equations, Gaussian elimination
 - analytic geometry, scalar product
 - vector spaces, linear maps, linear independence

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 - 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:

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

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

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mostly positive

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Feedback:

- mostly positive
- we get both "too easy" and "too difficult"
- seems to depend on quality of preparatory training ⇒ impossible to satisfy all needs!

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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 ⇒ impossible to satisfy all needs!
- can be different after half a year

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We perform a test before and after the Vorkurs:

 astonishing inabilities in basic mathematics (e.g. fractions)

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- astonishing inabilities in basic mathematics (e.g. fractions)
- a clear correlation between Leistungskurs/Grundkurs and success in tests

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- astonishing inabilities in basic mathematics (e.g. fractions)
- a clear correlation between Leistungskurs/Grundkurs and success in tests
- significant improvement during the course:

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- 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%

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 - fraction of exercises solved by less than 20% of participants: dropped from 39% to 15%

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 - fraction of exercises solved by at least 41% of participants: increased from 39% to 65%

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 - 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

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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.