

TELMME for Linear Algebra

Some Experiences

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Where innovation starts

The student



Linear Algebra

- **14 two-hours lectures**
- **7 two-hours instructions**
- **in Sep/Oct and in Feb/Mar**
- **for HBO-students following the pre-master program**
- **in Feb/Mar also for bachelor students in
Computer Science and Innovation Sciences**

Contents (1)

- System of linear equations, matrix, matrix multiplication, matrix transformation, *computer graphics*.
- Echelon form of a matrix, solving a linear system, elementary matrix, finding the inverse of a matrix, equivalent matrices.
- Properties of determinants, cofactor expansion, the inverse of a matrix.
- Vectors in the plane and in the space, vector space, subspace, span, linear independence, basis and dimension, homogeneous system, coordinates, rank.

Contents (2)

- Length and direction in the plane and in the space, inner product space, Gram-Schmidt process, orthogonal complement, *least squares*.
- *Homogeneous coordinates*.
- Eigenvalues and eigenvectors, diagonalization, similar matrices, diagonalization of a symmetric matrix.

Literature / Complications in Teaching

- Elementary Linear Algebra with Applications, Bernard Kolman, David R. Hill, 9th edition, Pearson
- Large variation in math knowledge and skills of HBO-students, but commitment is excellent
- Some HBO-students cannot follow all lectures
- Commitment of bachelor students is not excellent
- Gaining insight, i.c. relations between notions, is difficult

TELMME for Linear Algebra

- 7 tests of 10 exercises
- Each test is open for a week
- Students can make exercises many times
- Actual numbers in exercises vary
- Max 10 credits per test
- # credits / 70 = bonus
- Bonus improves mark of written examination

Active Participation!

Bonus	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
# students	9	5	2	4	8	4	9	6	30	31	59

- 120 of 166 students have gained a bonus of at least 0.8, i.c. 72 %
- At least 11 views per student per test, so students have done each test several times

Does TELMME improves the results?

HBO	Bonus ≤ 0.7	Bonus ≥ 0.8
Exam not passed	20	6
Exam passed	4	29

Bachelor	Bonus ≤ 0.7	Bonus ≥ 0.8
Exam not passed	24	39
Exam passed	2	18

Discussion

- E-learning improves math skills ?
- Does E-learning improves math insight ?
- Added value of E-learning compared to paper exercises ?
- E-learning needs much feed-back ?
- How to learn without a teacher ?