Engineering and science positioning test
= non-mandatory, non-binding outcome and yet powerful predictor for study success?

Reduce ravine between secondary and higher education

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Chairman positioning test
Historical context

– Flanders had strong tradition of entrance examination mathematics for engineering French style (± same as in the French part of the country)
– Flemish autonomy: free access to higher education important=> entrance examination abolished 12 years ago
– Impact: more students in first year of engineering, but more students failed in first year
– Since July 2013 at all Flemish universities (KU Leuven, UGent, VUB) organise the same positioning test on mathematics, and each year a larger percentage of students participate
What is the positioning test?

• **What?**
  – No entrance examination, not mandatory, not binding
  – No orientation test, but geared at students with clear choice for engineering
  – Increase the number of students with realistic chances of study success in first year
  – Positioning test allows participants to position with respect to expected knowledge in math and its applications, and with respect to peer group
  – Test skills for courses in first year
  – Topics mathematics in high school with ≥6 hours of math in last two years

• **Format** 30 multiple choice problems, with set of formulas, no calculator, 4 hours simultaneously in all provinces, at the end of high school, electronic registration, outcome with email in next few days.

• [https://www.ijkingstoets.be](https://www.ijkingstoets.be) with all the previous questions posted
Ambitions for the test for population of students with keen interest in engineering
Impact on “choice” of study program
Better score in positioning test ➔ more success in studies

Students that did not participate in the test have similar weak progress as those that failed the test.
More than 90% of students have a clear choice

High school HS

Integrate STEM in many subjects
Orientation phase
Positioning Test at end

Deeper understanding and appreciation of role of STEM in society
Inform, observe, Experience STEM
if successful: confirm
if border case: question
if serious failure: dissuade

first year at university

Special coaching if failed for positioning test or did not participate
Coach and reorient if study progress is insufficient

Monitor study activity and Study progress
Motivate students
Inform, observe, experience
Our experience on questions and impact

- **Quality of questions is essential**
- **Interuniversity committee drafts questions, validates, and evaluates outcomes afterwards**
- **Questions often suggested by problems detected by lecturer in first year**
- **Ambitions**: few questions with <50% success, no questions with <20% success or with >90% success, no questions with large rate of no answer >40%
- **→ overall success rate in test 60-65%**
- **Positioning test engineering has good predictive value**
- **Good cooperation between the Flemish universities is necessary**: same test for same study program at university; → better acceptance by students and teachers
Future and recommendations!

• No need to make it mandatory but stimulate serious participation by offering an incentive (at KU Leuven 1 study point in first year considered as externally acquired)

• Constructive interaction with teachers math and physics in high schools important

• In the mean time positioning test rolled out for 10 study programs in Flanders and taken by 1833 participants on July 1, 2015 and 517 on September 14, 2015

• Needs appropriate, well-designed questions for every study program !!

• Needs to learn from acquired experience over a number of years

• VLOR and minister of education plan to generalise such tests
Sample question on complex numbers  
(positioning test 1 juli 2015)

Assume that x and y are complex numbers that satisfy the set of two linear equations

\((-1-i)x-2y=4\)

\(x+(2-i)y=i\)

with \(i^2=-1\).

Determine \(x+y\)

\((A)x + y = -1 + 4i\)  \(\color{red}{(B)}x + y = -1 + 2i\)  \(\color{red}{(C)}x + y = -1\)  \(\color{red}{(D)}x + y = 1\)

\(\color{red}{(E)}x + y\) can have infinitely many values

Rather difficult question 46% correctly answered

Solution A and 34% blanc

Probably less known by a part of the participants because some schools do not deal with complex numbers sufficiently extensively

Anticipated duration ±5minutes
Laurien, Lennert and Lisanne observe birds. Each of the three saw a bird that none of the others saw. Each of them did not see a bird, that both others saw. One bird was seen by all three. Among the birds seen by Laurien, there were two yellow. Among the birds seen by Lennart, there were three yellow. Among the birds seen by Lisanne, there were four yellow. What is the total number of yellow birds they saw?

(A) 5  (B) 6  (C) 7  (D) 8  (E) 9
Solution

Strategy: Use set theory and mark the different subsets with the number of birds. Afterwards mark the number of yellow birds in the subsets.

Answer (A) 5 yellow birds
Sample question spatial awareness

Which cube can you unfurl to the figure below?

A
B
C
D
E

Rather easy question 97% correctly answered in calibration test Feb 2012