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Attention, abstract thinking, competence and GPA in Finnish school context

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1. Background

Finnish PISA success and reputation is well-known:

PISA; 2000 reading 1., math 4., science 3.
2003 math 2., reading 1.,
The latest 2006 science 1., (reading 2., & math 2.)

General trends of the results:

- Reading: Girls are doing better
- Math: Boys are doing better
- Science: no significant differences

Demographic factors:

- Parents' SES have influence on students' achievement level
- Achievement level variates quite equally around Finland
- Between schools differences regarding achievement levels are the smallest internationally

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- Between students differences are the smallest,
- The weakest students in Finland are the best when comparing internationally.
  - → This does not result from segregated teaching of the students with SEN but integrating them to ordinary classes ("comprehensive education system")
- Cost-benefit evaluations are that showing Finnish comprehensive system is very effective

Focusing to the theme of this conference

- When comparing the best students internationally (PISA 2006; science), the Finnish students are the best students, as well.

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PISA 2006 science "top scorers":

1. Achievement level 6; over 708 points "Top"
2. Achievement level 5; 633-708 points "Excellent"
3. Achievement level 4; 559–633 points "Good"
4. Achievement level 3; 484-559 points "Satisfactory"
5. Achievement level 2; 410-484 points "Modest"
6. Achievement level 1; 335-410 points "Weak"

OECD % average	Finland
1,3	**3,9**
7,7	**17,0**
20,3	32,3
27,4	29,1
24,0	13,6
14,1	3,6

FOCUSING TO THE TWO HIGHEST ACHIEVEMENT LEVELS:

1. FINLAND 20,9% 2. NEW ZELAND 17,6%, 3. HONGKONG 15,9 % ...(OECD 9%)

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There is neither official programs nor special curriculum modifications for the G/T students in Finland (…only recommendations for individual learning adaptations and counseling)

Lately, many upper-secondary schools have introduced and named their "special" subject areas (math, science, music, etc. and/or accordingly selective classes ...with entrance tests...). Would this actually explain our better results?

→ School and class effect on students' achievement

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Theoretical frame of the study

- In order to learn one has to be able to activate oneself to work and prioritize and organize tasks. In addition, one has to be able to self-regulate action, effort and processing speed.
- In this study, we use neo-Piagetian view, in which executive functions (e.g., attention) are regarded as a central agent of the cognitive development (Pulkkinen 2003; Russell 1999; Miyake et al. 2000 and and 2008)
- Role of the school environment can either be viewed as threatening or supporting the learning, i.e., self-determination of students depending on how well it takes the basic psychological needs of *competence, relatedness* and *autonomy* (cf. Ryan & Deci 2002)

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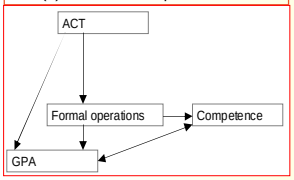
2. Methodology of the study

Measured variables:

(a) abstract thinking
(d) attention
(c) GPA
(b) academic competence



1. Sample:

Two different cities:

7 schools
53 classes
N=769

2. Measures:

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a) Abstract thinking:

Formula-1 test (Hautamäki 1984; Hautamäki & al. 2002)

(modified version from the classic Pendelum –test),

Shayer & al, 1979; Inhelder & Piaget, 1958)

Example:

Compare following pairs

driver	*car*	*tires*	*race*	*lap time*
Räikkönen	*McLaren*	*Michelin*	*Monaco*	*measured*
Schumacher	*Ferrari*	*Michelin*	*Monaco*	*measured*

What could you reason according to given information?

	no	perhaps	yes
Effect of driver	*1*	*2*	*3*
Effect of car	*1*	*2*	*3*
Effect of tires	*1*	*2*	*3*

Russell, J. (1999). Cognitive development as an executive process—in part: A homeopathic dose of Piaget. *Developmental Science, 2*, 247–295.

b) Attention

Attention Concentration Test (ACT) Ad van der Ven, 2005

- Additionally, this project explores the efficiency of relatively new test of attention concentration (the ACT-test of Ad van der Ven) which is based on the Inhibition theory.
- The idea of the test is to reveal student's latent attentional capacities which most probably cannot be revealed only by observing superficial behavior. Identification of the attention and behavioral deviations by observation, have so far been the main means of detecting e.g., attention deficits.

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Prerequisities for the test according to the Inhibition –theory

- The Attention Concentration Test (ACT), primarily measures attention or more specifically the concentration of attention
- The test is based on the following assumptions:
  1. Knowledge should not play a part in the final test score.
  2. Individual differences in previous experience with the task should not be allowed (testee needs to get familiar with the task)
  3. Temporal moods and feelings should not play part. Therefore, the testee is allowed to do the test as many times as he/ or he wants to.
- The test is especially developed as attention-screening test for primary and secondary schools.

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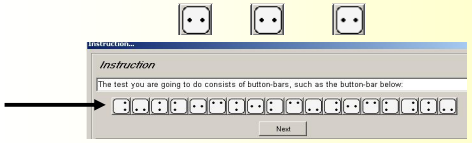
The computer-based test

- In the this version testee needs to follow with the mouse a bar line from left to right and he or she has to click right positions on that line.



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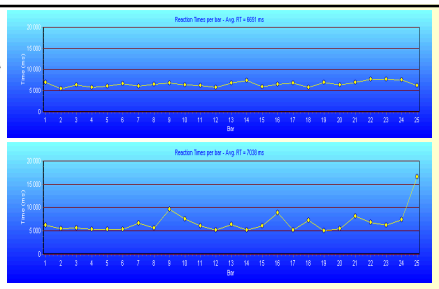

Ven, A.H.G.S. van der. (2001). A Theoretical Foundation of Speed and Concentration Tests. In: Frank Columbus (Editor): *Advances in Psychology Research, Volume 4*, Hauppauge, NY: Nova Science Publishers.
Shmulevich, Ilya & Ven, A.H.G.S. van der (2002). An inhibition-based stochastic countable-time decision model. *British Journal of Mathematical and Statistical Psychology*, **55**, 17-25.
Ven, A.H.G.S. van der, Gremmen F.M. & Smit, J.C. (2005). A Statistical Model for Binocular Rivalry. *British Journal of Mathematical and Statistical Psychology*, **58**, 97-116.
Ven, A.H.G.S. van der & Gremmen F.M. (2006). A Statistical Test of the Beta Inhibition Model for Binocular Rivalry. *British Journal of Mathematical and Statistical Psychology* (In Progress).

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c) Academic competence

Basic Psychological Needs at School, self-evaluation

(modified school version, Deci & Ryan, 2000)

d) GPA

Grades from the last school report (winter season) before finishing comprehensive school

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3. Analyzing method:

ML Win package: Multilevel modeling

(class – school – individual)

Study of intercorrelation and it's meaning for the studied sample

→ (0-hypothesis there are no statistically significant intercorrelations)

(Goldstein, 1995; Kreft & de Leeuw, 2006; Snijders & Boske, 1999; Steele, 2008)

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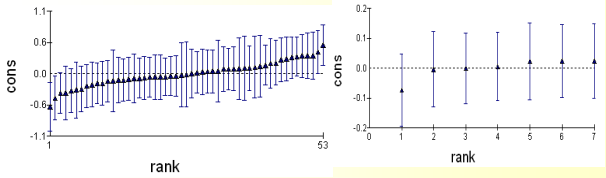
4. Results

(A) School achievement, y=GPA

A1. Variance Component analyzes, 0-model

Class has meaning for GPA.
Class explains 9% (p<.01) from the GPA variance.

Schools are homogeneous,
School explains less than 1% (non-significant).



Classes (left) and Schools (right) are ranked according to GPA

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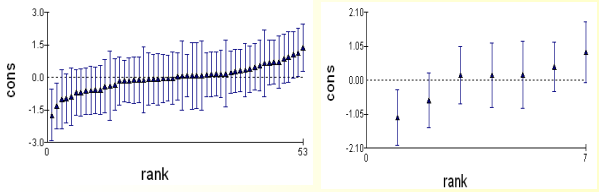
(B) Abstract thinking, y=level of cognitive operations

B1. Variance Component analyzes, 0-model

Class has meaning for abstract thinking.
Class explains 10% (p<.001) from the Abstract thinking variance.

Schools are heterogeneous with this regard, as well.
School explains 1% (p<.01).



Classes (left) and Schools (right) are ranked according to Formula 1; abstract thinking test

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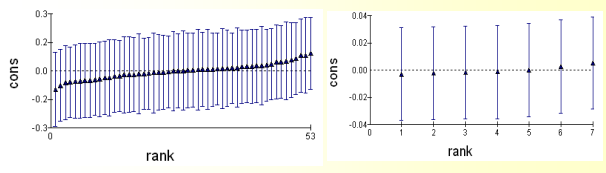
(C) Competence experience, y=Academic comepetence

C1. Variance Component analyzes, 0-model

Neither class nor school do not have statistically significant effect on competence experience.



Classes (left) and Schools (right) are ranked according to Comptence experince

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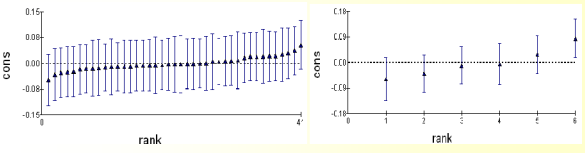
(D) Attention, y=LnMeanRt25

D1. Variance Component analyzes, 0-model

Class has no statistically significant meaning for Attention (4%)

School has statistically significant, but modest (LnMeanRT25) effect on Attention 6%, p<.05.



Classes (left) and Schools (right) are ranked according to Attention (LnMeanRT25)

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However, when focusing to the very best (octaile)

Does the class and school has effect on performance?

(a) abstract thinking
(d) attention
(c) GPA
(b) academic competence

Answer:

Some average classes (n=5-7) along with special classes do not have “highest achieving students”
→ after; classes difference between average & selective classes
→ Neither class nor school do not have statistically significant effect on any tested variable

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5. Conclusions

- There are variance effects caused by the class level
- Recommendation:

→ the school and class effects should be taken into consideration when making analyzes on students' school related performance and experience

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