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

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Finnish PISA success and reputation is well-known:
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 varies quite equally around Finland
Between schools differences regarding achievement levels are the smallest internationally

"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.

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"

FOCUSING TO THE TWO HIGHEST ACHIEVEMENT LEVELS: 1. FINLAND 20,9% 2. NEW ZEALAND 17,6%, 3. HONGKONG 15,9 %   ...(OECD 9%)

School and class effect on students’ achievement

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?

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 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)
2. Methodology of the study

1. Sample:
   Two different cities:
   - 7 schools
   - 53 classes
   - N=769

2. Measures:

a) Abstract thinking:
   Formula-1 test (Hautamäki 1984; Hautamäki & al. 2002)
   (modified version from the classic Pendulum -test),
   Shayer & al, 1979; Inhelder & Piaget, 1958)

   Example:
   Compare following pairs
   - driver: Räikkönen McLaren Michelin Monaco measured
   - driver: Schumacher Ferrari Michelin Monaco measured

   What could you reason according to given information?
   - Effect of driver: no, perhaps, yes
   - Effect of car: 1, 2, 3
   - Effect of tires: 1, 2, 3

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.

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.

Prerequisites 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.


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

3. Analyzing method:

ML Win package: Multilevel modeling
(class - school - individual)

Study of intercorrelation and its meaning for the
studied sample

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

(Goldstein, 1995; Kroft & de Leeuw, 2006; Snijders & Bosker, 1999;
Steenbeke, 2008)

4. Results

(A) School achievement, \( y = \text{GPA} \)

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).

(B) Abstract thinking, \( y = \text{level of cognitive operations} \)

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).

(C) Competence experience, \( y = \text{Academic competence} \)

C1. Variance Component analyzes, 0-model

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

(D) Attention, \( y = \text{LnMeanRT25} \)

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.
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

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