Validity analysis of the value-added indicators for Polish schools

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Introduction

In recent years, value-added indicators (or **educational value-added - EVA**) have often been considered much better **measures of school effectiveness** for policy purposes than raw tests scores (OECD, 2008). In national assessments, schools' mean scores are rarely considered an indicator of teaching quality due to their dependence on the socio-economic status and other students' characteristics. Thus, **value-added indicators**, which take into account prior student scores, are more often preferred when assessing schools and teachers.

These methods are still being developed in Poland. EVA undergoes continuous improvement and extensive quality check based on the following areas: properties verification of the achievement tests, adequacy of the statistical model, and validity of EVA estimates. For this purpose a **longitudinal research project** has been conducted in Poland.

The **aim of the study** was to assess **the validity of EVA** indicators for Polish lower secondary schools (LSS). We assumed that school effectiveness correlated with numerous processes and phenomena related to students' social, emotional and cognitive development. Inter alia, we expected EVA estimates to **correlate with pupils' relative intellectual growth** during lower secondary schooling.

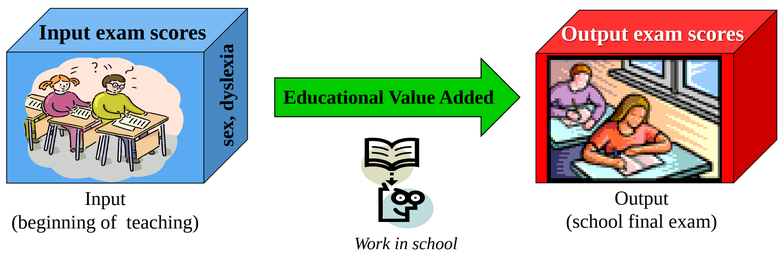
Theoretical framework

Cognitive functioning gradually improves over childhood, puberty and early adulthood (e.g. McArdle, Ferrer-Caja, Hamagami & Woodwock, 2002). Thus, gains in intelligence in course of education are not a surprise. Some researchers argue that **schooling is an important factor stimulating development of intelligence** (e.g. Ceci & Williams, 1997). However, it is not clear whether it exerts any significant influence on areas other than general knowledge or verbal skills. Nevertheless, students may be thought numerous strategies and skills helpful in effective management of cognitive resources and handling tasks' demands, e.g., emotional arousal management strategies, metacognitive & problem solving skills. In consequence, it may lead to better cognitive functioning which is reflected in higher IQ scores. If the hypothesis is true, **between-school differences** in students' mean relative intelligence gains should be observed. Moreover, **effective schools are expected to show higher mean intelligence gains** among their pupils.

Educational Value Added Model

Conceptual overview of the value-added modeling is as follows. The left-hand side of the graph represents children starting learning in a particular school. Their learning experiences, skills, knowledge and personal characteristics (e.g., gender, learning disabilities) are considered an input and a base for teaching process at school. The right-hand side of the graph represents the same students' skill level after a particular stage of education (expressed as, e.g., exams scores). Value-added is simply school's contribution to students' achievements.

FIGURE 1. EVA in brief



EVA is a relative measure informing whether **teaching effectiveness** in a given school was higher (positive EVA) or lower (negative EVA) than the national mean value for a given type of school (which equals 0).

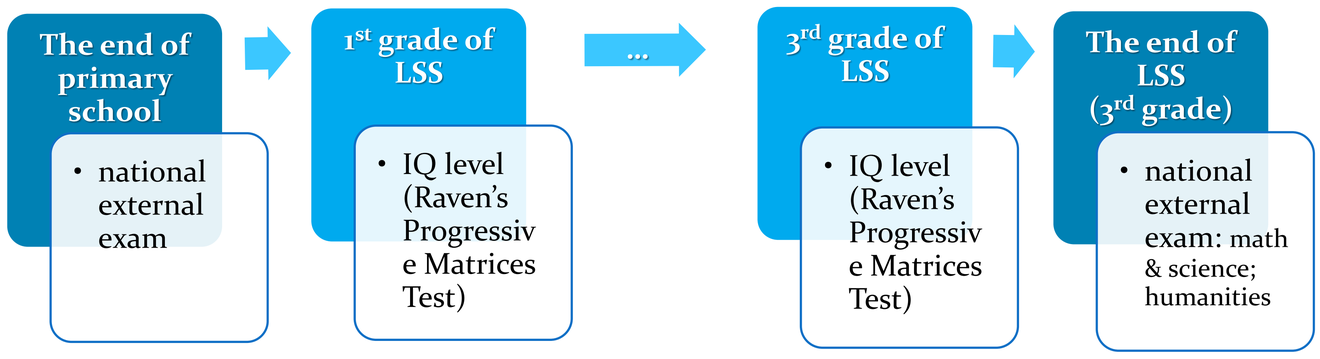
Polish EVA indicators are estimated with use of **random effect regression models** and calculated as the Bayesian predictions of random effects at the school level. School's final examination results are regressed on student characteristics (previous exam scores, gender, learning disabilities).

Method

Data and measures

- data gathered during **Educational Value-Added research project** (www.ewd.edu.pl)
- random, nationwide sample of 150 lower secondary schools; 291 classes, 5 223 students

FIGURE 2. Design and measures



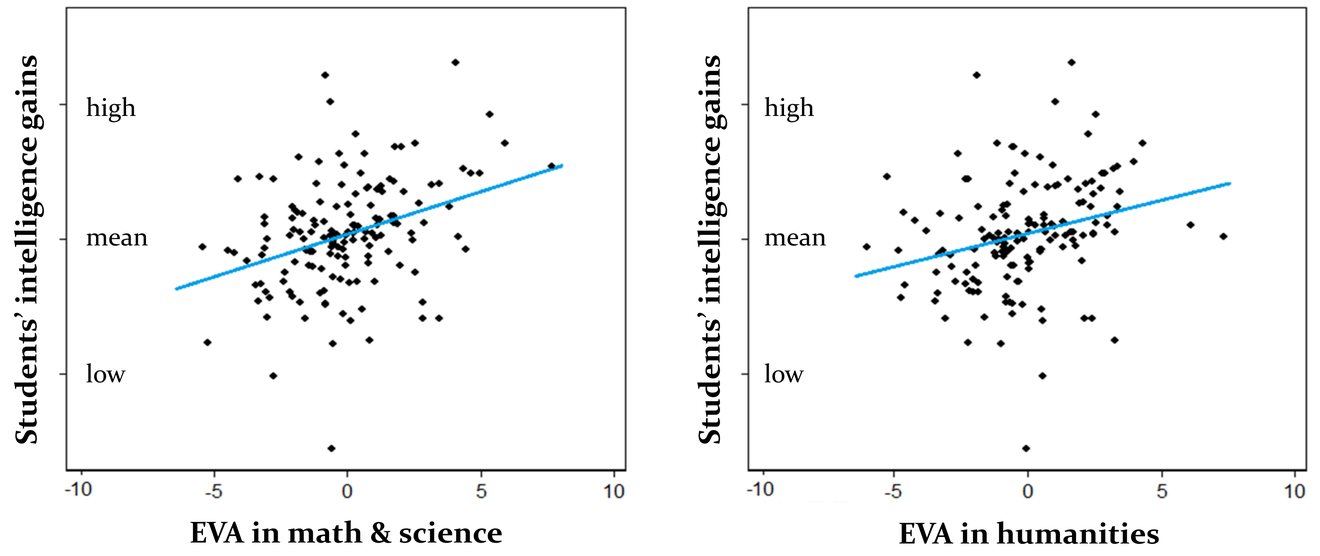
Intelligence gains

Average relative intelligence gains were estimated with the use of two-level regression model and calculated as the Bayesian predictions of random effects at the school level. Third grade IQ scores were regressed on 1st grade IQ scores.

Results

Significant differences in mean IQ gains between schools were observed. Between-school variance, calculated as a percentage of total variance of students' intelligence increments, equaled 14.5%. In other words, to such extent the chance for high intelligence increment of a given student depended on school they attended.

FIGURE 2. Relationship between intelligence gains (vertical axis) and EVA (horizontal axis)



Moreover, the analyses indicated the **existence of a correlation between EVA indicators and relative mean intelligence gains** among students (see Figure 2). It was positive, but not very strong.

Correlation coefficients equaled 0.32 and 0.24 for math & science and humanities, respectively. These correlations were statistically significant at $p<0.05$.

TABLE 1. Correlation coefficients between EVA and mean IQ gains

Correlation coeff.	Math & science	Humanities
Simple	**0.32**	**0.24**
Partial	**0.28**	**0.20**

However, analyses of Haworth et al. (2011) suggest that EVA indicators are **genetically influenced** and those influences may underlie the observed correlation. To control the effect of mean students' IQ at the beginning of the school, partial correlation coefficients were calculated. Despite their slightly lower values, they remained statistically significant (see Table 1).

Conclusions

The results partly **support validity of Polish EVA indicators** and prove utility of the chosen study design in checking their quality. They also show that more criteria to assess their validity are needed. Moreover, they give insight into patterns of human intellectual development.

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