

Value-added indicators for Polish schools: an overview

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Abstract

In this paper, I first briefly describe Polish education system, including the external exams at the end of each level of compulsory education. Then, I explain the methodology we have developed in Poland to compute the value-added indicators of school effectiveness – the so-called Educational Value Added (EVA) – at the lower- and upper-secondary level. I focus on three issues: the data used, the methods to obtain test scores and the form of the regression models.

Keywords: value-added, school effectiveness, external examinations

1. Introduction

The external examination system, which has been present in Polish education since 2002, has caused an increasing pressure of the public opinion and policy makers on evaluating schools on the basis of examination scores. The motivation for developing value-added indicators in Poland was the desire to obtain fairer indicators to assess how well schools work. In the period of 2005-2007, research activities were launched in order to develop the Educational Value-Added Models for Polish schools. The methodological team has created EVA indicators for lower- and upper-secondary schools. It has also trained the potential users in analysing these indicators¹.

2. Educational system in Poland

The compulsory education in Poland is divided into three stages: primary education (ISCED 1), lower-secondary education (ISCED 2) and upper-secondary education (ISCED 3). Children have been required to go to school at the age of seven years, but now a reform has been introduced lowering this age to six years. Education in primary schools lasts for six years and is followed by a three-year-long lower-secondary school in the so-called *gimnazjum*.

Both primary schools and *gimnazjum* are compulsory: all children from a designated area attend them (the designation is made by local authorities). Generally, primary and lower secondary education in Poland is uniform, i.e. schools provide all students with the same general education profile and there is no pupils' selection to schools. In practice, however, it is possible for schools to recruit students from outside the designated area, and in big cities the selection for and segregation in *gimnazja* has been observed.

At the upper-secondary level, three different tracks are available for students. The first one, the *liceum*, is a three-year-long general school that ends with a centralized exam (*matura*), which is a precondition for university education. The second option is *technikum*, a four-year-long mix of general and vocational training. It enables its pupils to take both *matura* and a vocational exam. The third school type, *zasadnicza szkoła zawodowa*, provides basic vocational education and it lasts for three years.

Nowadays, about 50% of students choose the general education (girls more likely than boys), about 35% of students go to *technikum*, and about 15% of students opt for the basic vocational school. The upper-secondary schools are selective, and the competition among students in big cities is intense.

¹ For more information please visit <http://ewd.edu.pl/educational-value-added-in-poland/>.

3. External examinations in Poland

In Poland there are external examinations at the end of each stage of compulsory education. The institution responsible for preparing examination test is the Central Examination Board. There are also eight Regional Examination Boards responsible for conducting the examination.

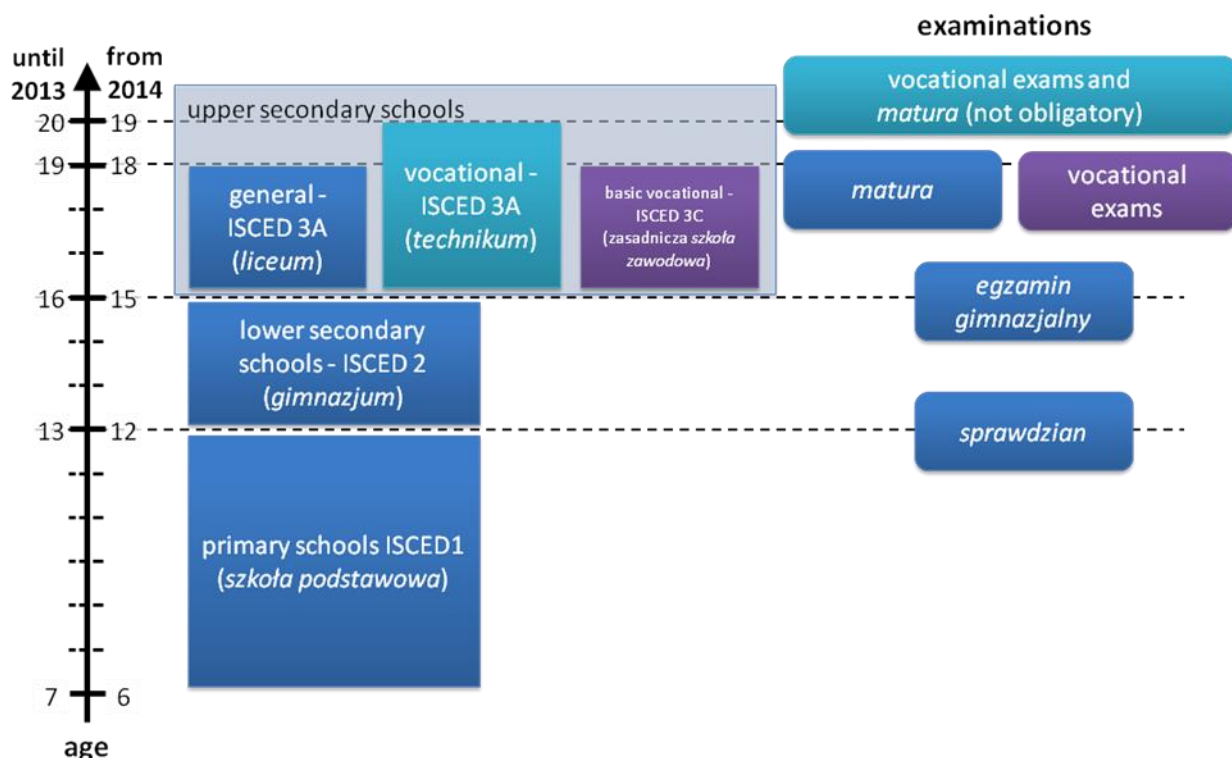
Sprawdzian is an examination taken at the end of primary school. This examination has mainly a diagnostic role and for most students the score achieved has no effect on which *gimnazjum* they will attend. Nevertheless, the results of the examination are important for schools because schools are evaluated - by public opinion and local authorities - on the basis of scores of their students. *Sprawdzian* is multidisciplinary test consisting of about 25 items. Most items are in selected response formats.

Egzamin gimnazjalny is an examination taken at the end of lower secondary school. Since year 2012 it has consisted of 4 tests: 1) the Polish language, 2) history and civic education, 3) mathematics, 4) science². Each test is 20-30 items long. In tests 2) and 4) there are only items in selected response formats. In tests 1) and 3) there are also two short essays (Polish language) or three constructed-response items (mathematics). It is an important examination for students, because recruitment for upper secondary schools is based on its scores.

Matura is an examination giving access to higher education. With very few exceptions the scores of *matura* are the only criterion for entering higher education. It is an examination of a very complicated structure. There is a choice of 24 subjects (out of which 12 are foreign languages), and each subject can be taken at the *basic* or at the *advanced* level. Pupils have to take the exam in three subjects: the Polish language, mathematics and a foreign language, either on the basic or advanced level. Additionally, they can choose other subjects that are required for their area of study. Students can improve their scores on *matura* by taking the exam in the chosen subjects as many times as they wish in the following years.

As for the vocational exams, there are more than two hundred kinds of them. Some of them are organized not only by Regional Examinations Board but also by crafts organizations. Because no value-added indicators utilizing the scores of the vocational examinations exist in Poland they are not discussed here in detail.

² Before 2012 *egzamin gimnazjalny* consisted of two tests: one covered the Polish language, history and civic education and the other one covered mathematics and science.



Picture 1. Educational system in Poland.

4. Value-added indicators for Polish schools

4.1. Types of indicators

Polish Educational Value-Added indicators can be classified according to two main criteria: 1) the school type and the subject the indicators refer to, 2) the period covered. Regarding the second criterion there are *one-cohort* indicators and *three-cohorts* indicators. *One-cohort* indicators are based on the results of a single cohort of students taking exam at the end of school in the same year. They are intended mainly for internal evaluation of schools and are not publicly available. *Three-cohorts* indicators take into account the results of three consecutive cohorts of students. As they are more stable and reliable they are publicly available on the website. The tools developed to present both types of indicators are described in the paper of Mateusz Żółtak (also presented at the conference).

Regarding the first criterion, different types of indicators are summarized in the table below. The parts of examinations used to compute indicators are given in the two last columns.

It has to be stressed that for upper-secondary schools of a mixed general-vocational educational track (*technikum*), the Educational Value-Added indicators take into account only achievements in the field of general education ignoring the vocational training. It is a serious limitation of Polish value-added indicators regarding this type of schools.

Indicators for lower-secondary schools were published in year 2008 for the first time and indicators for upper-secondary schools two years later.

school type	type of indicator (domain covered)	one / three year	“entrance” exam	“exit” exam
<i>gimnazjum</i> (lower-secondary)	math & science	O/T	overall score of math test and science test of <i>EG</i>	<i>Sprawdzian</i>
	humanities	O/T	overall score of Polish language test and history & civic educ. test of <i>EG</i>	
	mathematics	O	math test of <i>EG</i>	
	science	O	science test of <i>EG</i>	
	Polish language	O	Polish language test of <i>EG</i>	
	history & civic educ.	O	history & civic educ. test of <i>EG</i>	
<i>liceum*</i> (upper-secondary, general track) <i>technikum*</i> (upper-secondary, mixed track)	math & science	T	scores of 6 math & science subjects on <i>matura</i>	overall score of math test and science test of <i>EG</i>
	humanities	T	scores of Polish language, history and civic educ. subjects on <i>matura</i>	overall score of Polish language test and history & civic educ. test of <i>EG</i>
	mathematics	O/T	scores of mathematics on <i>matura</i>	math test of <i>EG</i>
	Polish language	T	scores of Polish language on <i>matura</i>	Polish language test of <i>EG</i>

*Indicators for *liceum* and *technikum* are calculated and presented separately, but there are analogous types of domains of indicators for both type of schools.

O - *one-cohort* indicators available; T - *three-cohorts* indicators available; O/T - both *one-cohort* and *three-cohorts* indicators available;

EG stands for *egzamin gimnazjalny*.

4.2. Exclusions

The idea behind the value-added indicators is to show the average achievements of students of a given school compared to achievements of similar students in other schools. But there are some specific types of schools that cannot be reasonably compared to typical schools, so they should be excluded from the computation of the value-added indicators. With regards to Polish Educational Value-Added those are: 1) schools for adults, 2) schools for students with mental disabilities, 3) schools in hospitals, sanatoria, youth detention centers, etc.

In the computation of the Educational Value-Added indicators, only students taking the „exit” exam for the first time are taken into account. Students who repeated a grade once during the given educational stage are included into model, but treated specially. Students who repeated a grade more than once are excluded.

4.3. Transformation of examinations scores

Examination results are reported by examination boards as *raw scores* or a percentage of correct answers. Unfortunately, the distributions of those scores may differ considerably between years. To ensure better psychometric properties and an easier interpretation of scores from different years some methods of examinations scores transformation are applied before computing Educational Value-Added indicators.

Different methods are used with respect to different types of value-added indicators:

1. The quantile normalization (Hazen formula) of overall score for *one-cohort* indicators.
2. The IRT 2 Parameter Logistic/Graded Response models for single tests (parts of exams). Those are used to obtain estimates of students' abilities in the *egzamin gimnazjalny* for the *three-cohorts* Educational Value-Added indicators.

3. The IRT 2 Parameter Logistic/Graded Response models of general skills (i.e. affecting scores in different subjects) when not all students take all the subjects. Those are used to obtain estimates of students' abilities in the *matura* for the *three-cohorts* Educational Value-Added indicators for upper-secondary schools.

All examination scores are presented using a normalized scale with a mean of 100 and a standard deviation of 15.

4.4. Regression models

In the value-added models students' prior attainments (i.e. scores on "entrance" exam) are used to predict scores achieved on the examination at the end of school. In the Polish models also information on students' sex and having a dyslexia certificate are included into prediction. Recently, it has been investigated how to properly include information on students' age and school's mean score on the „entrance" exam. Unfortunately, there are no other students' characteristics that could be used for computing the value-added indicators in Poland.

The relationship between "entrance" and "exit" examination scores is described in the Polish models by a polynomial of up to 5th degree as there are considerable deviations from linearity. Different polynomial parameters are estimated for every cohort of examinees (in models used to compute *three-cohorts* indicators) and for every cohort of grade repeaters. Because there is no vertical equating between Polish examinations, an absolute students' gain in skills cannot be inferred from the model.

Depending on the type of indicators, one of two methods is used to obtain value-added indicators:

1. To compute *one-cohort* indicators an OLS regression with Educational Value-Added computed as a mean of residuals among group of interest (particularly students of a given school) is employed.
2. To compute *three year* indicators a mixed-effects (multilevel) regression with random effect for intercept connected with division of students into schools is used. The educational Value-Added indicators from those models are computed as Bayesian posteriori predictions of random effect (so called BLUPs: Best Linear Unbiased Predictors).

5. Summary

The methodology of value-added indicators in Poland has been developed for nearly a decade. At the beginning, rather simple solutions were adopted, but with time more sophisticated methods were introduced, improving different aspects of computing the indicators. Since several years the Educational Value-Added indicators for lower-secondary and upper-secondary schools have been publicly available attracting growing attention of teachers, headmasters, policy-makers and parents.

Nevertheless, the methodology of computing the Polish Educational Value-Added is still being developed. Perhaps a more important aspect of this process is a longitudinal research to assess validity of the value-added indicators for Polish schools. Main results of such a study in lower-secondary schools are described in the paper of Aleksandra Jasińska (also presented at the conference).

Although value-added indicators are far from being perfect determinants of school quality, they provide important information that should be taken into account in school management. In Poland we are still learning how to make the best use of it to improve our education.