

Value-added indicators for Polish schools: tools for publication and analysis

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Abstract

Over the last decade, the methodology of the value-added evaluation of schools has been being refined and popularized in Poland. So far, we have developed the so-called Educational Value-Added indicators of school effectiveness at the lower-secondary (ISCED 2) and upper-secondary (ISCED 3) level. Here, I present two instruments for making the EVA indicators publicly available:

- a web page that provides EVA indicators and makes comparative analyses at a school level possible to conduct;
- the „EVA-Calculator”, i.e. a stand-alone program that allows teachers, headmasters and school authorities to perform within-school analyses of EVA indicators.

These instruments make it possible to compare the EVA indicators between various groups; the comparisons include calculating confidence intervals, conducting time trends analysis and others. While providing an in-depth evaluation of school effectiveness, these tools are simple enough to be used and understood by people without statistical knowledge.

Keywords: value-added presentation analysis tools

1. Introduction

Over the last decade, the methodology of the value-added (VA) evaluation of schools has been being refined and popularized in Poland. So far, we have developed the so-called Educational Value-Added (EVA) indicators of school effectiveness at the lower-secondary and upper-secondary level. These indicators are targeted at schools themselves and at their institutional environment, rather than e. g. parents, so the main audience is teachers and headmasters, local government authorities, schools' supervisors, etc. Polish schools have a legal obligation to evaluate their work, but using the VA indicators in evaluation is not compulsory. Nevertheless, the VA indicators have been catching more and more interest, because they are perceived as fairer and more accurate than the other quantitative indicators available (based on raw or standardized examination scores). To make it possible to use the VA indicators effectively some tools for presentation and analyses have to be developed. This article describes these tools.

2. Requirements for the tools

The first question is what we expect from VA indicators presentation and analysis tools. On the one hand, such tools should be easy to use, but on the other, they should provide flexible and precise analyses. Also, while the analyses should be methodologically correct, the results must be presented in an understandable way (bearing in mind that users do not have statistical knowledge). These expectations led to the following decisions:

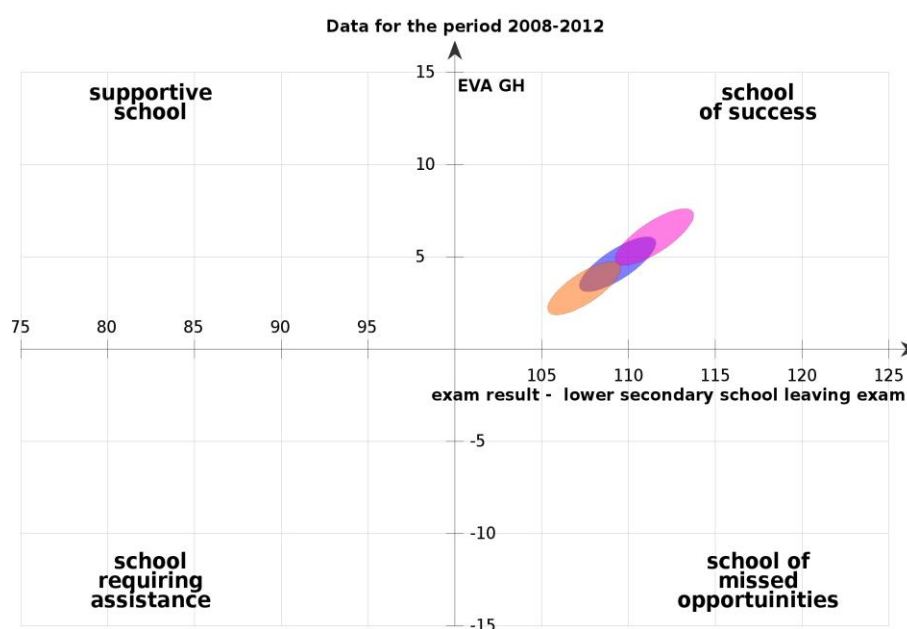
- Two tools are prepared – one for a wider audience and the second one for more advanced users.
- Examinations scores and VA indicators values will be presented on standardized scales (mean of 100 and standard deviation of 15 for examination scores, and mean at 0, standard deviation of 15 for the VA indicators values) to make comparisons between years possible.
- Graphs are the main way of presentation, as they are easier to interpret than tables and they allow for introducing some statistical concepts to people without statistical knowledge easily (especially the concept of confidence intervals).

The first tool, the publicly available website, which is described in section 3, is targeted on a wider audience, and the tool for advanced users, the standalone statistical software “Value-Added Calculator”, which is described in section 4.

3. The website

The website is a tool for a wide audience, so the emphasis was put on the ease of use on the one hand, and on preventing users from drawing wrong inferences on the other. This has been achieved by limiting the VA indicators available (only three-cohorts periods at school level) and by limiting the available analyses to comparisons of the time trends for a given school (see Picture 1.) and of different schools for the same period (Picture 2.). The three-year periods provide more stable indicator values and also reduce the confidence intervals (due to larger sample size), making it easier to interpret the indicators correctly.

All analyses are presented as the same type of graph (Picture 1. and 2.) with the mean of the external examination score of a school on the exit exam on the X axis, the VA indicator value of a school on the Y axis and the confidence intervals for both of them marked by an ellipse. If two ellipses do not intersect, the difference between schools (or different periods for the same school) can be interpreted as statistically significant at the 0.95 confidence level. The centre of the graph marks an average examination score in the whole population (value of 100 on the X axis) and an average VA indicator value in the whole population (value of 0 on the Y axis). The value of 15 on both axes equals the standard deviation of the VA and of the examination score in the whole population. Each graph can be downloaded as a PNG image.



Picture 1. Graph example from the website: data for 3 succeeding periods for one school

If data for one period are displayed, the graph contains also two ellipses covering the mean examination scores and the VA indicator values of 50% and 90% of all schools. In such case, a mean examination score and a mean VA indicator value for the whole municipality (NUTS-5), district (NUTS-4) or a region (NUTS-2) can also be displayed (Picture 2.).

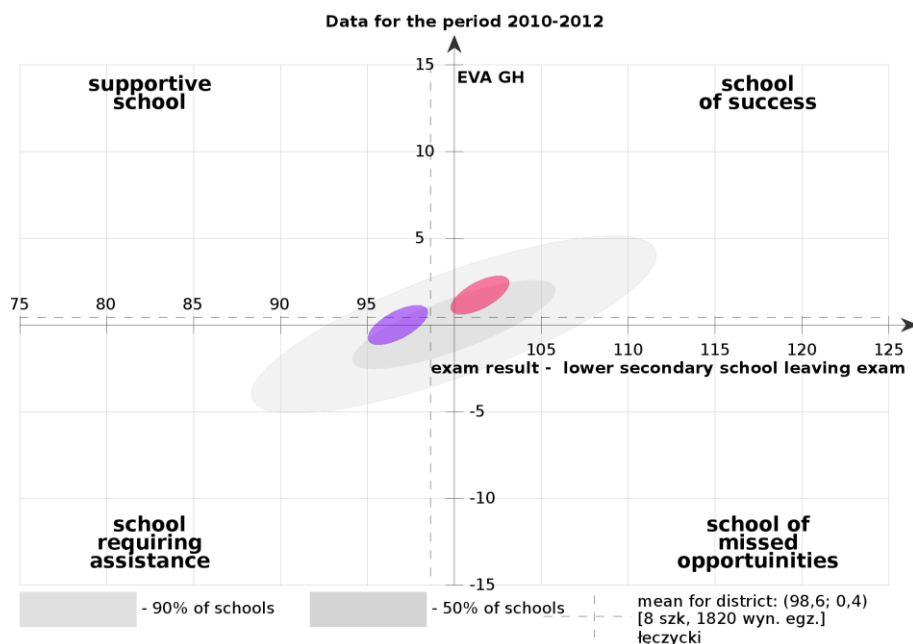
There are two separate websites for lower secondary schools (<http://gimnazjum.ewd.edu.pl>) and upper secondary schools (<http://matura.ewd.edu.pl>). Due to differences in curricula between general and vocational upper secondary schools it is impossible to display data of these two kinds of schools on one graph. One has to analyze them separately.

Separate VA indicators are available for different parts of external examinations:

- humanities and math&science indicators for lower secondary school leaving exam;
- humanities, math&science, math and Polish language indicators for upper secondary school leaving exam – separate indicators for general and vocational schools.

Due to methodological issues indicators for a given period are available only for schools, where at least 30 pupils take the external school leaving exam during this period. If this condition is not met, appropriate message is being displayed on the screen. All indicators available on the web page are pre-calculated by the Polish VA team – an update takes place each year in October. Users do not

have to provide any data: the necessary information is available on the website. Besides the tools for analyses and searching schools, there are also short introductions to methodology and to interpretation of the indicators available on the two websites.



Picture 2. Graph example from the website: comparison of two schools in the same district with means for a district displayed

4. The Value-added Calculator software

For more advanced users, separate software, the “VA Calculator”, has been developed. It allows in-depth analyses, but it also has some limitations. The main limitation is that users have to provide the software with data on pupils' examination results and pupils' characteristics (e. g. information about pupils' sex, disabilities, SES, etc.) themselves¹. Such data can be easily collected by teachers, headmasters and other people involved in the education system, but it is rather impossible for people from outside the system (especially parents). This might be seen as a drawback, but it prevents unqualified people (e. g. journalists) from performing analyses and drawing misleading conclusions from them. Taking into account that Polish schools are afraid of being unfairly rated and that such a fear can be a major obstacle in introducing the VA indicators into education system, we see this limitation as beneficial. The second limitation is that the “VA Calculator” is more complicated to use and most users require some training to be able to perform analysis by themselves.

The “VA Calculator” provides users with analyses for one-cohort periods and the user can choose the level of analysis on his/her own (e.g. school level, cohort level or class level). For each analysis pupils can be grouped by any variable provided in data (like sex, dyslexia, socio-economic status, level of achievements on entering the school, etc.). This ensures a great flexibility of analyses and enables in-depth analyses of various aspects of school's work. The available VA indicators include:

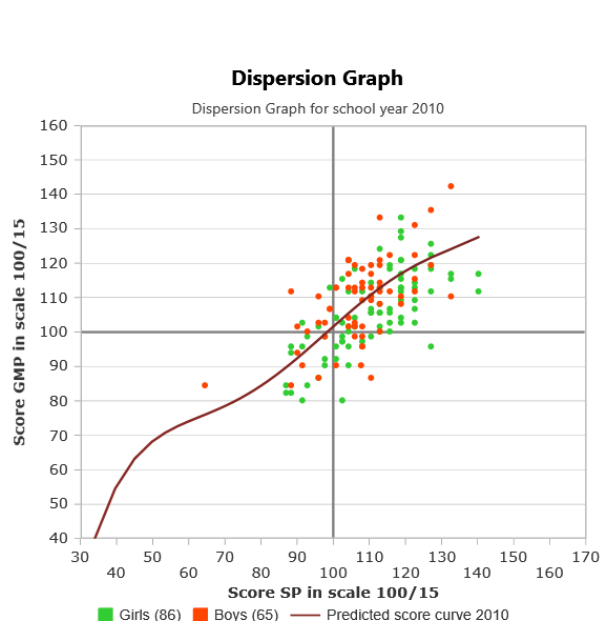
- humanities and math&science indicators for lower secondary school schools;
- math indicator for upper secondary schools (separate indicators for general and vocational schools).

Indicators available for upper secondary schools have been limited math indicator because of poor psychometric characteristics of Polish external examinations at the end of upper secondary schooling (called “matura”) in other subjects.

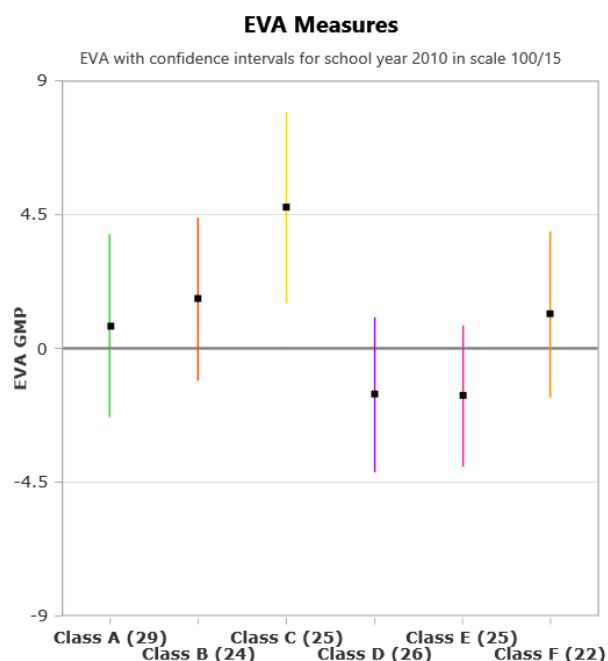
¹ Data are provided as a simple MS Excel or CSV file.

There are 8 different types of analyses available in the “VA Calculator”:

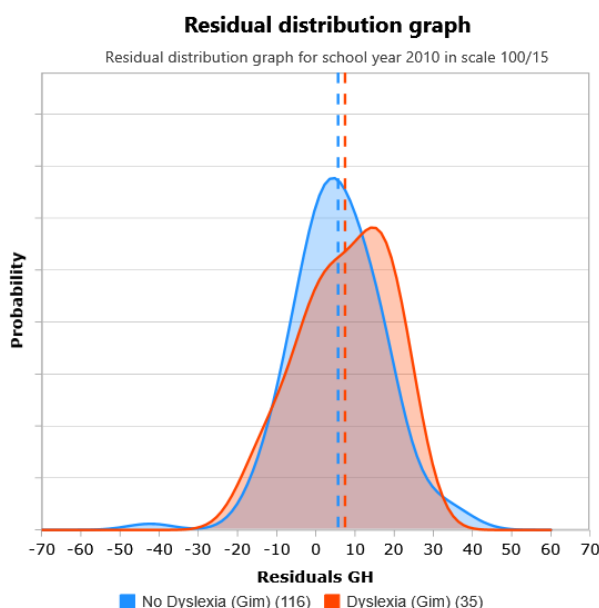
- A dispersion graph (Picture 3.), which is the most complicated one. It shows the position of each pupil with “entry examination score” on the X axis and “exit examination score” on the Y axis. The difference on the Y axis between pupil's position and the line of predicted examination score² is the “pupil's VA”³. Different groups are marked in different colors.
- The VA measures graph (Picture 4.). It is a simple graph displaying confidence intervals for a given VA indicator for a given groups. It allows the users to easily identify groups of pupils, for whom the difference in VA statistically significant.
- The average scores graph. This graph is very similar to the VA measures graph but here the confidence intervals for mean examination scores for a given examination (instead of a given VA indicator) and for given groups are plotted. It allows the users to easily identify groups of pupils, for whom the difference in the mean examination score is statistically significant.



Picture 3. Graph example: dispersion graph.



Picture 4. Graph example: VA measures graph.



5. Graph example: residuals distribution graph.

Picture

² Formally it is a residual of a regression predicting “exit examination score” by “entry examination score”.
³ The mean of those differences over a group of pupils is a VA for a given group.

- The educational potential graph. It is a simple graph displaying the distribution of the “educational potential” in the given groups. There are three levels of “educational potential” distinguished. “Educational potential” of each pupil is based on his/her entry examination score. It allows checking, how pupils are allocated to classes and how strong the segregation is due to the educational potential).
- The residual distribution graph (Picture 5.), the predicted scores graph and the score distribution graph. All three graphs show the distribution of a given attribute for each given group. The residuals distribution graph shows the distribution of regression residuals (residuals could be imagined as “VA of each pupil”) for a given VA indicator; the predicted scores graph shows the distribution of predicted scores for a given examination; and the score distribution graph shows the distribution of real examination scores for a given examination. The mean VA/predicted score/achieved score for each group is also plotted. Many distributions for different groups of pupils can be shown on one graph. Unusual shapes of distributions allow us to find differences in teaching effectiveness, pupils educational potential, pupils educational needs, etc. between groups and within groups.
- The data table. For pupils grouped by given characteristics (school, cohort, class, sex, dyslexia, etc.), it displays: frequencies of pupils, mean exam scores (on the standardized and raw scales, VA indicators values and confidence intervals.

5. Conclusion

The presented tools met well expectations of the audience. The publicly available website is easy to use and the analyses presented on it are quite easy to understand. We observe a positive reception of this tool by many different groups of people involved in Polish education system (especially by headmasters and schools supervisors). It is important that the way, in which the VA indicators are presented on the website, do not cause any serious controversies among Polish schools, teachers, etc., even though the results are available to everyone. Also the “VA Calculator” has received a good reception from users, but it should be stressed that people needed training to know how to use this tool. In our opinion a tool like the “VA Calculator” is important for high-quality schools evaluation, because instead of just delivering predefined reports it makes the user think what kind of analyses to conduct. It should be also stressed that the good reception was largely due to the extensive explanation of the VA methodology and of the described tools to people involved in the education system (especially to teachers and headmasters). For this purpose many seminars and trainings have been held and are still being held periodically.