

## LESSONS LEARNT FROM MATURA EXAMINATIONS IN LITHUANIA

Autor prezentuje filozofię nowej matury wprowadzanej na Litwie stopniowo od 1999 r. Egzamin obejmuje język litewski, który jest obowiązkowy oraz trzy przedmioty do wyboru z listy (matematyka, język angielski, francuski, niemiecki, rosyjski, historia, biologia, fizyka, chemia, geografia, muzyka, plastyka i informatyka). Formuła matury jest kompromisem pomiędzy dwoma różnymi celami egzaminów, którymi są: 1) potwierdzenie osiągnięć szkolnych i 2) selekcja uczniów. Jeśli abiturient nie ma zamiaru podejmować studiów, może przystąpić do matury jako egzaminu szkolnego, potwierdzającego jego osiągnięcia. Arkusze egzaminacyjne opracowuje, co prawda Krajowa Komisja Egzaminacyjna, ale egzamin przeprowadza szkoła. Nauczyciele sprawdzają prace i oceniają je w skali 1-10. Wyższe uczelnie akceptują taką maturę podczas rekrutacji, ale jej wartość jest niska. Matura zewnętrzna jest egzaminem naprawdę doniosłym. Jest przeprowadzana w regionalnym ośrodku egzaminacyjnym, a kodowane prace są sprawdzane przez egzaminatorów. Specjalna komisja ustala próg punktowy zaliczenia egzaminu, a następnie surowe wyniki przekraczające ten próg są konwertowane na centyle. Taka procedura powoduje, że nie więcej niż 1% maturzystów uzyskuje najwyższe wyniki. Na wyżej uczelni wynik takiej matury jest ważniejszy niż wynik matury szkolnej.

### PHILOSOPHY OF MATURA EXAMINATIONS IN LITHUANIA: THE SEARCH FOR COMPROMISE

Nobody likes examinations, but almost all of us were forced to pass many of them. Why? What was the goal for these exams? The answer is clear: certification or selection. These two goals usually are the main for all examinations and tests. Unfortunately, the test designed for selection is bad for certification, and *vice versa* – the test used for certification doesn't allow us to rank the best students. The differences between these two types of exams might be seen not only in the design of exams paper, administration procedures and marking, but in the stakes of exams, the backwash to the process of schooling, interests of different stakeholders. Nevertheless, the option to take several exams for the student graduating from the secondary school (one as the Matura certifying the graduation from the secondary school, another – for the admission to university) is critiqued by almost all educators, parents, and politicians. It pushes to find some compromise and to live with reality – we need one exam serving for the both goals.

The student graduating in the year 2002 from the secondary school in Lithuania should pass 4 secondary school leaving (Matura) examinations. One exam is compulsory for all students – it is Lithuanian language. For the other 3 exams the student chooses from the list of optional exams (this list includes mathematics, English, French, German, Russian as a foreign language, history, biology, physics, chemistry, geography, music, art and computer science. The student from the school of national minorities had more options – Russian, Polish or Byelorussian languages. The student should choose not only the subject, but also the type of examination: the state or the school examination. These two types of examination are the compromise between two different theoretical objectives of assessment – selection vs.

certification. If the student has no plans to study in university, he may take all 4 exams in his own school as school Matura examinations. The National examination centre will prepare the exam paper, will send it to school together with the marking instructions and the school teacher will administrate and will mark the student's script in a 10 point scale. Such examination is quite simple and low stake for student because the exam paper is designed just to certify the minimal level of attainment. The universities will take such examination into account, but the value of the grades will be low.

The state Matura exam is a really high stake examination. In order to take such exam the student should come to the regional centre, where an external administrator will administrate the exam. Coded by bar codes students' scripts in secure bags will come to National examination centre and will be checked by the team of teachers. The special committee will analyse the results and will set the minimal benchmark of the raw score needed to pass the exam. Later the raw scores above this benchmark will be translated into 100-point scale based on the statistical percentiles. Such procedure guarantees it will be not "too much" top grades – the top grade of 100 will be assigned just for 1% of students.

Academically, it means that school Matura exam is criterion-referenced; the state Matura exam is scaled using the mixture of criteria and norms. The pass-fail benchmark comes from criterion-referenced approach, but the distribution of the grades in 100-point scale is purely norm-referenced based. The general data on how many students chose Matura examinations in the year 2002 is presented in the Table 1.

Table 1. Number of students taken Matura examinations in the year 2002.

Examination	Number of students taken Matura exam	
	State	School
Lithuanian language (text analysis)	4800	35260
Lithuanian language (test)	20184	20156
Lithuanian language (in the schools of national minorities)	2742	3316
Mathematics	14372	23689
History	12213	17163
English language	9250	14151
German Language	1827	5019
French language	407	707
Russian language	1768	8249
Biology	2594	10673
Chemistry	1214	2911
Physics	3016	5236
Geography	n/a	5889
Music	n/a	873
Art	n/a	2476
Computer science	n/a	6615
Russian language (in the schools of national minorities)	n/a	1899
Polish language (in the schools of national minorities)	n/a	1110
Byelorussia language (in the schools of national minorities)	n/a	22

The state Matura examinations replaced former universities entrance exams. Therefore the student chooses the examination which is needed to enter the university, i.e. if the student is going to apply for the faculty of history (math hardly will be used for the selection to this faculty), he may choose math as a school level Matura examination. The universities announce the requirements for admission including the list of subject required for every study

program in advance. The university is allowed to choose any examination (using different weights for the calculation of the final score for admission), but the total number of subject used to characterise the student should not exceed 4.

The dilemma of comparison of the grades from two different Matura exams in one subject was resolved in a simple way. The priority will be given to the student who passed state Matura exam. But the student who passed the school Matura examination can enter university as well if there are no more applications from the students with state exam grades. It means that school Matura examination works for the "low stake" study programmes; state Matura is the only way to be admitted for "high stake" study programmes.

This agreement with universities now is stated in the new Law on higher education. The Article 47.3 of this law called *Admission to Higher Education Establishments* states:

*Students shall be accepted, by way of an open competition, to higher education establishments financed by the State in accordance with the field of studies, level and mode. The grounds of undergraduate study selection competition must consist of the results of secondary school graduation examinations of not more than four subjects taught. Not more than two examinations or tests may be organised by higher education establishments for identification of special abilities. If an institution authorised by the Ministry organises and administrates an examination of a subject taught, a higher education establishment shall not organise an examination or test of such subject.*

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It is worth saying, that this article was the result of long-lasting discussions with universities. The Universities accepted this approach and started to use the state Matura examinations instead of their own entrance exams from the year 1999. Therefore the Law just fixed the current situation.

In the Republic of Lithuania the reform of the examination system was started in the year 1997 and was supported by EU PHARE programme "Higher Education Reform in Lithuania". May be part of the success was in the name of this programme: the reform of Matura examination came together with higher education reform building the bridge between secondary school and university\*. The programme was short indeed: led by Scottish Qualification Authority SQA it jumped over the pilot in 1998, and finished with the real Matura exams in two by subjects (history and mathematics) in 1999. Later the number of subjects taken on board State Matura exams was continuously increased till 11 in the year 2002. The reform of Matura exams is now finished and the evaluation done by independent surveys showed, that school headmasters and students parents called this reform the most successful reform in Lithuanian educational system during the last 10 years. So the objective is achieved, and the ambition of the National examination centre now is just to keep such a first-class label.

## SECONDARY ANALYSIS OF DATA FROM MATURA EXAMS

The Matura examinations in Lithuania take place in May-June. The latest exams' results are released in July. The student has the possibility to apply for all universities through the Common admission system listing up to 20 his ranked wishes. Later he will get the invitation to study from one university according his achievements in Matura exams. The universities will check information on Matura exams with NEC via Internet connection. But this isn't

\* Bethell G., Zabulionis A., *Examination reform in Lithuania. Background, strategies and achievements. In English*, National Examinations Centre, Vilnius 2000 (electronic copy of this book might be found in NEC's website [www.nec.lt](http://www.nec.lt)).

the end of the story. The information on Matura examinations has great value for the educational system and should be carefully analysed. The subject exam report will show teachers the areas of weakness, but here we would like to point out more general reports related to the questions of equity in the education. The politicians and others stakeholders should learn how to understand and how to use information coming from examination for monitoring of the educational system. One of the key questions defining the quality of education is the equity issue: does every student have equal opportunities to learn? It's hard to answer such questions; it's even harder to find the way to measure the equity. One of the possibilities in this direction might be the analysis of the group factors having strong impact on exams results.

The simplest statistical method, which allows assessment of differences across groups, is coefficient  $\eta^2$  (*eta squared*) used in a single-factor dispersion analysis, and comparing the ratio SST/SSB (it might be calculated with the standard SPSS statistical software). The meaning of the coefficient can be illustrated by the following example. Let's analyse groups of students, combined so that students in one group belong to the same school. Let's assume that coefficient  $\eta^2$  of the test, which was taken by students from different schools equals 0,2. This means that 20% of differences (variation) in test results can be explained by differences in schools. i.e. those different results depend on **the group factor** (on a student's belonging to a group, defined by this factor). The remaining share of 80% depends on a student and his/her capabilities (**personal factor**). Very low values of coefficient  $\eta^2$  would indicate that all schools are similar in students who attend them, i.e. that there are very bright and not very bright schoolchildren, and those students are not differentiated according to their capabilities. The more differentiated the education system is (either officially – determined by the type of school – or non-officially, when students select the “prestigious” school or gymnasium), the higher the value of this coefficient (in terms of a group of students, i.e. a school). Education specialists from abroad most frequently observe the changes in the diversity of students in different stages of education, investigate and monitor the level of school differentiation. Politicians are frequently interested in whether there are any inappropriate differences between regional, ethnical, etc. groups. The value 0,3 of the coefficient  $\eta^2$  is considered to be a marginal one, if this value is exceeded, it is possible to conclude that major differences among groups really exist. The only thing is to decide whether this results from the educational policy, (either differentiation of educational system or internal structure of a school), or from discriminating processes of specific groups.

A student's results on examination depends on a number of factors, and most importantly, on a student's knowledge and skills (this is what organizers of exams strongly believe in). However, statistical analysis of examination results provides only indirect proof of the influence of this factor in analysing other factors with a potential impact upon the examination results. Most frequently analysis is focused on how the group a student belongs to, can affect results of the examinations, or to put it more simply, to what extent (indicated in numeric value, if applicable) the group factor influences student's examination results. There are a lot of aspects in the education system, which can be used in grouping students. Results of the Matura examinations in Lithuania might be analysed on the basis of groups defined by the following factors:

- Gender factor (female vs. male students)
- Regional factor (more than 50 municipal territories)
- A school factor (about 600 schools)

Under such classification, different groups will vary in number – only two groups defined by the gender factor, and hundreds of schools. Nevertheless, in all cases it is possible to estimate (using the above-specified methodology) the influence of each group on the examination results (in analysing the school factor, only those schools, where at least 5 graduates took the state Matura examination, were taken into consideration).

What are the conclusions from the analysis of the state Matura examinations in the years 1999-2001? Numeric values of the coefficient, reflecting the extent of dependency of the results for the state Matura examination on the group factor, are listed in Table 2.

Table2. The influence of the group factor on the results of the state Matura examinations. Comparison of examination results by subject in years 1999-2001

Factor/year	History			Mathematics		
	1999	2000	2001	1999	2000	2001
Gender	0.01	0.01	0.01	0.00	0.00	0.00
Region	0.04	0.06	0.04	0.07	0.04	0.04
School	0.30	0.26	0.21	0.34	0.25	0.27

How can this information be interpreted? The influence of two factors (gender, region) is not noticeable on the results of the state Matura examinations. Students are not discriminated on the basis of these factors. A bit higher values of the coefficient  $\eta^2$  of the regional factor can be explained by the difference between students (and their social-economic environment) in the largest cities of Lithuania (Vilnius, Kaunas, Klaipeda, etc.) and other regions of Lithuania.

The school factor has a larger influence on the examination results. Schools and teachers differ from place to place, but the influence of the school factor, if the network of various schools is not broad, poses serious problems in ensuring equal opportunities to receive high quality education. In comparing values of coefficient  $\eta^2$  of this factor in the state Matura examinations in history and mathematics in the years 1999-2001 it is evident that these values are decreasing. In 2000, the school factor had much more influence on the results of examinations in sciences (biology, chemistry and physics) than on results in the examinations in history or mathematics. We need more information in order to explain differences between examinations in science and history/mathematics. One reason for this could be the different number of graduates who decided to take these examinations. Examinations in science are not very popular.

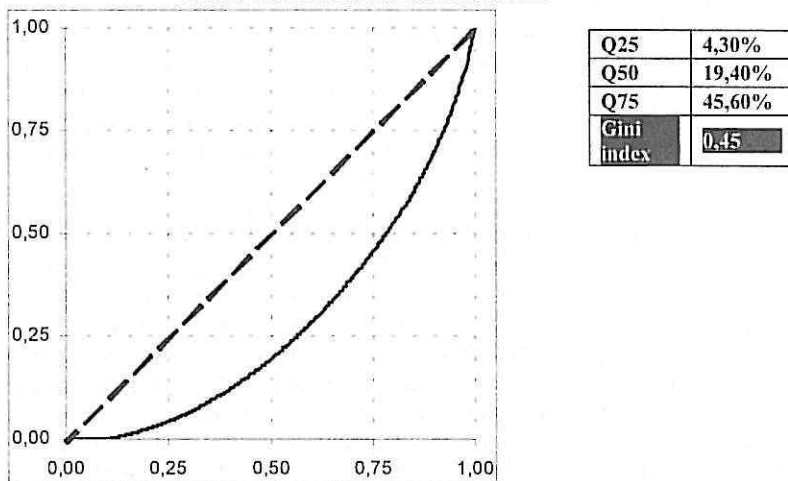
The method described above allows us to analyse the factors affecting the examination results, if we know these factors *a priori*. The next method works in a slightly different way. Instead of the analysis of factors it shows in visual and numeric forms the differences between groups. This method for the measurement and visualisation of the equity is based on so-called Lorenz curve and the Gini index and is widely used by economists to measure the degree to which a population shares resource unequally\*. In order to begin a derivation of these measures for education systems, consider the cumulative bottom 25% of the students in the schools, which are ranked by the mean results on examination starting from the lowest, and ask what portion of the top grades (graded above 50, i.e. above the country mean) is attributable to this 25% of students? If the corresponding proportion of total top grades is also 25%, we will call this fair. If it is less than 25% we will say there is some inequality. It cannot be more than 25%. In general, to measure this, we define a function  $F(t)$ , to be the fraction of the total value of a certain amount of top grades obtained by the  $(100t)\%$  of the students in the schools ranked by the average results on examination starting from the lowest. This curve of this function is defined on the interval  $[0, 1]$  and is referred to as the Lorenz curve. Then the Gini index of inequality is a measure of the difference between  $F(t)$  and the ideal which is assumed to be  $t$ . In an education system with perfectly equal top grade distribution, the cumulative share of students graded on examination above the mean would be equal to the cumulative students share. This mythical egalitarian education system is represented on the diagram by the  $45^\circ$  line. The gap between the actual lines and the mythical line

\* see, as example, World Bank website <http://www.worldbank.org/poverty/inequal/index.htm>

is a function of the degree of inequality. The Gini index measures the gap between the actual line and the 45° line. In the egalitarian system, the Gini would be 0,00, since the Lorenz curve would match the 45° line perfectly; the higher the Gini, then, the greater the distance, and the more unequal the distribution of the top results on examination. In a perfectly unequal educational system, in which all top grades would come to the students from one (large enough!) school, the Lorenz curve would look like a backwards "L," and Gini index would be 1,00.

The results on state Matura examination in Mathematics in the year 2001 were analysed, the corresponding Lorenz curve and Gini index are presented in the diagram 2 below.

Diagram 1. The Lorenz curve and the Gini index as the measures of the inequalities in the results of the state Matura examinations in Mathematics 2001



The quarter of the students in "bad" schools obtained just 4 % of the grades above the average per country. The half students were pleased with just 19 % of top grades. The top quarter of the students in some "good" schools got 55 % percents of top grades. Let us compare: two quarters (bottom and top) with two stacks of top grades (4 % against 55 %). The inequality is substantial indeed. The Gini index as a numeric value of this inequality equals to 0,45.

### BACKWASH EFFECTS TO EDUCATION SYSTEM

There is no need to explain for the education specialists the well-known true: the fastest way to change something in schools goes through examinations. The final school leaving examinations have very high stake and the impact on the school. This is very important reason why these exams should serve more for the secondary school. The tool to drive the school should be closer to the school, not to the university. Interesting educational value of the Matura examinations was pointed out in the discussions held by Russian teachers at the end of XIX century\*. They decided that there is no need to have final examination for short courses. But if the subject is taught more than a year, the final examination allows rethinking the course taught in several classes, to look to the subject from "bird's flight". So the final exam is welcome for the course taught several years.

Unfortunately, the educational value of examinations often is blanked by other factors out: corruption, cheating, private tutoring, and high psychological pressure on student (and on

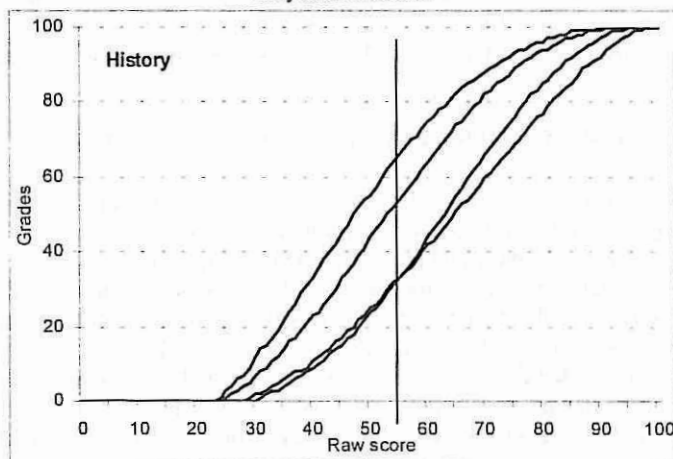
\* K voprosu ob ekzamenach. In Vstnik opitnoj fiziki i elementarnoj matematiki. pp. 204-212. Odessa, 1884.

parents!), etc. These issues are very painful for educational system, and sometimes cannot be discussed openly. Therefore it is difficult to analyse the situation, and it is even more difficult to take some actions for prevention. The examination itself is not the tool designed to fight against corruption and cheating in the schools. The overall picture during the exam cannot be very different from what's going in the daily lessons. So if we do not like how these exams are going on and if we do not want to trust the results on exams, we should think wider and to pay more attention on the daily processes in the schools.

As it was described earlier, there are two different types of Matura examinations in Lithuania – the state and the school Matura exams. The differences in objectives of these exams have the subsequence on the administration, marking, values of grades, the level of trust on results, and at last but not least on the amount of human and financial resources needed to run these exams. From the educational policy point of view, the value of state Matura exams is definitely higher, but unfortunately there are no resources to run such exams for all students. From another point of view, some students do not have any motivation to take such high stake exam: they do not need such precise measurement. Therefore, the dual exam system is some compromise between what do we want to have and what do we can run at the moment.

One of the most uncomfortable sides of the state exams is the highest stake of exams – student's future directly depends from the result on exams (to be or not to be a student...). There is no way to escape from such competition – universities should use *numerus causus* principle for admission to studies. So, if the school exams will not provide information on students, the universities will run own entrance exams. The norm-referenced scaling used for state Matura exams gives the student's result in the form needed for universities (with very high discrimination power of the grades ranging from 1 to 100). Such procedure has another feature – the result on the exam doesn't depend on the difficulty of exam paper. The analysis of the years 1999-2002 examinations' results points such danger: the difficulties of examination's tasks vary substantially. The diagram 2 presents the relationships between the raw scores and the grades on the state Matura examination in History per years.

Diagram 2. The relationship between the raw scores and the grades on the state Matura examination in History in the years 1999-2002



The result of 50 percent of raw score was on the 25<sup>th</sup> percentile in one year, but on 55<sup>th</sup> percentile in another year. It means that answering a half of all questions without mistakes the student was graded 24 in the year 2002, but even 55 in the year 1999. Such difference is hardly understandable for students and teachers. Does it mean, that the exam papers are eas-

ier? May be, the students know more. For math examination this diagram looks in opposite version – solving half of the problems correctly the student was graded 85 (sic!) in the year 2002, but only 46 in the year 1999. Does it mean the inflation of grades? In general, it leads to different speculations on the changes in the overall level of achievements of students. The main explanation of such fluctuations is simple – there are no possibilities to prepare equal exam papers without the pilot, but the pilot is impossible to run in such small country as Lithuania...

These differences in the “weight” of the grades give the feeling of an insecurity for student and the child wants to learn as much as possible. He is right, because he will be compared not against the criteria, but with the other students. All students are pushed to take some extra lessons in order to be higher ranked on the Matura exams.

The survey done by the Centre for Education Policy of Vilnius University found, that more than 2/3 students entered the university in the year 2001 took some extra-paid lessons in order to prepare for the state Matura examinations. It means that the role of private tutoring is changing from a pathway to the main road to university. The first negative side of such phenomena is linked with the social inequality (i.e. with the equity issues once again): these extra lessons are quite expensive and not every parent can afford them. The second – the students are overloaded and are learning just for the exam. The third side (I do not think that this is the last one...) – who is the person offering these extra lessons? The survey mentioned above found that for 4/5 cases he is the schoolteacher, and for 1/5 cases – the direct student’s teacher. Therefore we met the moral problem – for what services does the teacher ask to be extra paid? Why the students from gymnasias are taking more extra-paid lessons than the student from the ordinary secondary school? How can we measure the quality of education in the school, if the better part of the results on examinations comes not from the school, but from the private tutoring? And finally, this is not only social and moral problem: the overall level of this hidden education (just these extra preparation for Matura) can be estimated aver 25 mln Litass (for comparison: financial side of the schooling in Lithuania is based on so-called student’s voucher designed to cover educational services provided for the student. The parents’ supplement to this voucher was just a bit less than this voucher itself...).

There are no data about the level of the private tutoring for exams in previous years in Lithuania. Therefore we can just guess to which extend the situation in this educational “black marked” was affected by the state Matura examinations. Unfortunately, the indirect estimations show the great impact.

Resuming, we would like to attract more attention of “the assessment persons” to the educational, moral and policy related issues. The examination system is not the technical system only (surely, this side is very important and should be designed, implemented and executed professionally, otherwise there is no sense to speak about the examinations at all)), but has great impact on the school and society. This short presentation doesn’t allow us to discuss all possible problems, pitfalls, or even ideas. But everybody should understand the necessity and consequences of compromises as well as the awareness that the educational assessment effects (and might be affected by) the different aspects of our life – technical-technological, educational, moral and policy related.

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