The school of independent thinking

entuzjaści edukacji

HUMAN CAPITAL
NATIONAL COHESION STRATEGY

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The idea for the study

The general requirements of the core curriculum for Polish schools include the mastery of *complex skills*, namely: the ability to understand what is read, interpret texts, express one's thoughts, present one's viewpoint, analyse a situation, reject irrelevant factors and take into account the factors required to solve a problem, choose relevant mathematical models, draw conclusions from premises, present arguments and understand the arguments of others. These skills are essential in contacts with other people and in the course of solving everyday problems.

Main study aims

The aim of the study "The School of Independent Thinking" was to assess the skills emphasised in the new core curriculum as reflected in Polish language and mathematics education, and to provide schools with tools to support the development of these skills.

In addition to the study, the project is also aimed at strengthening teaching by disseminating research results and their analysis, as well as the research tools used. Teachers are the main beneficiaries of the study results, as it provides data enabling a comparison the level and development of pupils' skills at various stages of education. These data are important in shaping education policy.

Study methods

10,365 pupils participated in the study.

Tests measuring selected complex skills in the fields of Polish language and mathematics constituted the main source of data. PAPI questionnaires (paper questionnaires) were used in the study. In the case of the youngest pupils (4th grade of primary school), an additional "Parent Questionnaire" was filled out by parents or guardians (a total of 1,836 respondents).

The directors of the surveyed schools, as well as the Polish and mathematics teachers of the randomly selected classes tested were also included in the study through a CAWI interview (computer-assisted interview using a web page). The CAWI questionnaire was filled out by all directors of the schools selected for the study (350 questionnaires) and Polish language and mathematics teachers (500 surveys) of the randomly selected classes.

An example of a task used to determine the ability to find specific information

This skill was tested by two assignments requiring closed multiple choice questions relating to information contained in a text (to be answered).

The first assignment (*How many types of mineral waters are produced in Poland?*) required a search for information explicitly stated in the sentence: *Of the several hundred bottled waters manufactured in Poland, less than thirty can be called mineral.* In earlier parts of the text, starting from the first paragraph, some information which a pupil could mistakenly take as pertinent to the question appears. Thus, the search for information should be accompanied by a second activity – very careful selection.

Differences in the levels of mastering skills

It is interesting to observe the differences in the levels of mastering problem-solving skills at different stages of education. The study shows that for some skills, the greatest differences occur in the second stage, i.e., in grades 4-6 of primary school. One of the mathematics problems was correctly solved by 19.43% of pupils in the second stage of education (grade 4), already by 52.21% of pupils in the third stage of education (1st grade of lower secondary school), by 57.08% of pupils at the beginning of the fourth stage of education (1st year of post-lower secondary school), and by 64.89% of pupils at the end of the fourth stage of education (the final year of post-lower secondary school).

This is also the case when pupils were asked to search for specific information during Polish language classes. Results are already quite good at the second stage of education, as roughly half of the pupils in the 4th grade of primary school can perform this task. Then the proportion of correct responses clearly rises systematically, with a 20-30 percentage point increase at the beginning of lower secondary school and at the post-lower secondary school stage – reaching 98% in general upper secondary schools and 83% in vocational schools. The most significant difference exists, however, between primary school and lower-secondary school. This difference is evident when pupils are asked to combine and compare information derived from a variety of texts, to understand the entire text, and language awareness.

A noticeable difference also occurs between grades 4-6 and lower-secondary school in the skill of developing an argumentative text. A similar difference is seen in the level of mastering the skill of interpretation. But the very small differences in the number of highest scores (full interpretation, logical justification) is most striking, at 0.1%, 0.2%, 1.2%, 1.9% respectively. This result is a cause for concern because it shows that very few pupils, probably the especially talented ones,

are able to think independently, understand complex statements, and argue effectively.

In the case of other skills, the disproportion between various stages of education is much greater. However, the differences in the levels of mastery in problem solving skills and justification, though noticeable, were deeply unsatisfactory. The highest scores at successive stages of learning were attained by 3%, 10.4%, 17.6% and 27% of pupils respectively. The increase noted in the fourth stage of education may be of some comfort, but it is quite alarming that most pupils in the last year of lower-secondary school are still unable to justify the result of a problem being solved.

An analogous situation is seen in the analysis of differences in the level of mastering the skill of drawing conclusions from information contained in texts, which is developed in Polish language classes. Poor results for this skill were obtained at every educational stage. Similar results were found for the ability to identify the mechanism of a language game. As many as 88.9% of primary school pupils received 0 points for the problem which verified this skill. Equally, and perhaps even more worrying is the fact that as many as 31% of pupils in the final year of upper secondary school were unable to perform this task, and only 29% of these pupils were able to justify their opinion, scoring 2 points.

The opinions of teachers

The opinions of teachers also reflect the unsatisfactory differences in the levels of skill mastery among pupils. It is interesting that at the primary school level, the assessment of pupils' competencies is quite high. The overall level of knowledge and skills in mathematics is considered high by 12% of teachers, and low or very low by 13%, with only 3% of teachers assessing this as very low, whereas Polish language skills are judged as high or very high by 8%, and low by 6%, with no one indicating the very low level. The higher the stage of education, the more stringent are the assessments (in lower secondary school, mathematics is assessed at 9% and 33% respectively, in upper secondary school at 9% and 29%, the Polish language is assessed in lower secondary school at 8% and 35%, in high school at 16.6% and 15.8%). Teachers believe that pupils' arithmetic knowledge and skills are quite good, with primary school teachers expressing the best assessments of their learners (up to 27% of these teachers rates these skills highly, whereas at higher educational levels, this percentage decreases). The results are much worse with regard to the skills of using and generating information. Primary school teachers assess this as high or very high (13%), while at higher stages of education, there are no very high ratings and high ratings are at roughly the same level. The same is true of the remaining skills – using and interpreting representation, mathematical modelling or using and developing strategies. It is also interesting that primary school teachers declare the greatest belief in their pupils' intellectual abilities. They, more often than their colleagues teaching at higher stages of education, believe that pupils should be allowed to discover their own ways of solving problems and

be encouraged to do so, that the pupil who solved a problem with a different method than the one presented during the lesson should be appreciated, and to acknowledge that it's the idea that counts the most when a pupil proposes a different way of solving a problem. If teachers' declarations are compared to the achievements of pupils after the second stage of education, a relationship is seen between the declared optimism about the learners and achieved outcomes. Lower secondary school and post-lower secondary school teachers seem conservative, less creative, more reliant on ready-made formulas and traditional methods, especially lecturing.

Mathematics

It was found that the higher the stage of mathematics education, the more dominating are teaching methods based on explaining to the pupils how a problem should be solved. Methods based on activating independent thinking are used with less frequency. Fun activities and games in mathematics – used in primary school – disappear almost altogether or are marginalised in lower and upper secondary schools. Incentives for solving problems with a variety of methods are quite uncommon, and become even rarer in successive stages of education. Most teachers declared that they present different solutions to the same problem only during some of their lessons, so it can be assumed that this occurs very rarely. Not many teachers stated that they encourage pupils to invent problems, but again, the higher the stage of education, the less frequently this happens.

The vast majority of vocational upper secondary school teachers assess the level of their pupils' mathematical knowledge and skills as low or very low (80%). In basic vocational schools, the percentage of teachers making such an assessment is a little more than half (58%), whereas in upper secondary schools, this assessment is made by a minority of teachers (29%). Pupils with a high level of skill are either not perceived or almost not perceived in vocational upper secondary and basic technical schools, while in general upper secondary schools, teachers perceived every tenth pupil as talented.

Polish language

In terms of Polish language skills, the ability of pupils to understand written texts was the given the highest rating by teachers – assessed as highly mastered by 31% of respondents from primary schools, and at a similar rate only by teachers from general upper secondary school, at 30.8%. This assessment is decidedly worse in lower secondary schools, basic vocational school and vocational upper secondary school.

The proportion of vocational upper secondary school pupils scoring the maximum number of points in tests of Polish language skills (reading, argumentation, interpretation) for almost every type of problem was lower or at best comparable to the percentage of first year lower secondary school pupils attaining such high scores; the differences in the level of mastery of these skills as education progresses in this type of school is very small. In the case of interpretation, at times pupils of basic vocational school performed at the same level as their colleagues from the 4th grade of primary school, i.e., their responses were limited to one or a few written sentences, they were unable to read in a disciplined manner, they were unable to analyse a text, not to mention use professional vocabulary and consciously apply a chosen methodology.

A jump in skills abilities occurs only in general upper secondary school during the fourth stage of education. To a large extent, this is due to the selection of pupils occurring as a result of recruitment to post-lower secondary schools.

Changes in how problems are solved

It turns out that since the introduction in lower secondary school of mathematical tools for solving specific types of problems, and their intensive practice during lessons, the thinking of pupils has become rigid, and their actions – mechanised. Creative thinking is gradually being pushed out. Pupils apply the learned tools even in situations where it is irrational or uneconomical.

Avoiding problem solving

Sometimes interesting conclusions can be drawn from observations related to avoiding problem solving. It was noted that an especially large proportion of pupils did not even try to solve a geometry problem (solved only by the third and fourth levels). In first class of upper secondary school, 19% of pupils skipped over the problem, 35.6% of pupils did so from vocational upper secondary school and profiled upper secondary school, and as many as 62.7% of pupils from basic vocational school did not solve this problem. While it is true that for the last year of school, this percentage dropped in each type of school, it still remained high (10.4%, 23.2%, and 55.6% respectively). If we add that a correct answer with the proper proof was given by very few basic technical school pupils (2.8% at the third level, 3.7% at the fourth level), we see that knowledge of geometry, particularly the ability to formulate proofs, is beyond the ability of most vocational school pupils.

Differences among different types of post-lower secondary schools

The differences in results between general upper secondary schools, vocational upper secondary schools (and profiled secondary schools) and basic vocational schools is not surprising. What is striking, however, is the huge magnitude of the disparities between pupils of these types of schools. While 71.32% (first year) and 76.44% (last year) of upper secondary school pupils solved the first assignment, this figure totalled 55.81% and 61.4% respectively for vocational upper secondary school pupils and 23.35% and 27.63% for basic vocational school pupils. It should be noted that basic vocational school pupils fare even worse than the entire population of lower secondary school pupils, while vocational upper secondary school pupils only slightly surpass these achievement levels. The performance of basic vocational school pupils in justifying the solution of another problem was analogous to the results from primary school pupils (and there was almost no difference at all between the pupils in the first and last years of basic vocational school)!

The differences between the types of schools appears in the early grades, and then is sustained almost without change, and the difference in the level of mastering skills in vocational upper secondary school is no longer very high. On the other hand, internal differences in the various types of post-lower secondary schools is moderate, much smaller than in primary and lower secondary schools.

Differentiation also applies with respect to books and reading. A correlation is seen between reading (including reading by parents to young children) and pupil achievement. This is shown with full force in the differences between the various types of post-lower secondary school pupils. General upper secondary school pupils read much more often than their colleagues from basic vocational school, more often find pleasure in reading, and have more books at home. In this context, it is worth noting a significant factor – the ability to focus on reading a longer text. In the last year of vocational school, only 61% of pupils were able to concentrate on reading for more than a few minutes. In comparison, this figure is 73% in lower secondary school and 86% in the last year of general upper secondary school. This largely explains the lack of success among pupils from basic vocational schools.

The study results presented above indicate that the causes of failure among vocational school pupils are not only due to their intellectual deficiencies, and not even to the school selected for attendance after lower secondary school, but also to the attitudes and didactic skills of teachers, from their frustration, and lack of belief in the success of their pupils, as well as the lack of pressure from the pupils' parents. Perhaps negative selection applies not only to the pupils of vocational schools, but also to the teachers employed there, though the causes of the frustration felt among teachers may be different.

Conclusions

The analysis of survey results confirmed the conclusions also reached by other studies (the importance of the educational level of pupils' parents in achieving educational success).

The study confirms that mothers assume responsibility for the educational paths taken by pupils. Most often, they are involved in helping children with their lessons, also from the earliest stages of education. Moreover, the mother's educational level influences the success of children much more than the educational level of the father.

It is very interesting that a large number of parents declare that they are committed to the educational success of their children, but to a much lesser degree are ready to help their children learn. This suggests that doing homework together is treated more like a chore, rather than an opportunity to have fun together.

The significance of daily contact with children and communication-oriented relationships are worth emphasising. The study highlighted the inconsistency between the declarations of pupils and parents relating to everyday contact. It seems important in this context to emphasise the differences in the quality of communication as assessed by pupils and parents. What an adult considers a conversation (questions about the day at school, homework, etc.), is not one for a child, who (it seems) needs deeper contact and more focus on building relationships. This is especially important, since those pupils who declared having frequent conversations with parents attained higher scores in skills tests.

The large differences in the level of mastering complex skills takes place in the second stage of education, which is grades 4-6 of primary school. The differences are less visible at the higher stages, which may result from the fact that once these skills become known, they are then only practiced and improved.

The degree of mastery of the tested skills is not satisfactory. But it should be remembered, that these are especially difficult skills, and the problems which the pupils were asked to solve were not typical for standardised education.

In analysing the problems in the Polish language part of the test, observations of the interpretation of the poetic text are important. On this basis, much can be said about pupils' attitudes towards solving intellectual problems, such as understanding literary expression. The qualitative analysis shows that a large group of pupils remains helpless in the face of this challenge. At the level of primary and lower secondary schools, pupils often answer with single or several sentences, which are very short and barely an attempt to formulate an interpretive hypothesis. Pupils frequently answer the banal question "what did the poet have in mind?" Their reading of the poem is often moralistic. Interpretive skills are much higher in post-lower secondary school, which testifies to the fact that the third

and fourth stages of education are of particular importance to the science of interpretation. At this time, the appropriate professional vocabulary appears, as well as an awareness of the method and structure of the interpreted text. Some pupils are able to understand the deep content of a work (e.g., irony, paradox). It cannot be forgotten, however, that an unusually low number of pupils even in the fourth stage of education scored the maximum number of points (1.9%) for this task.

The very poor results of pupils in basic vocational schools are most worrisome; in some cases a regression of skill levels can be observed.

The increase in the mastery of the tested skills is high in general upper secondary schools. The price of this, however, is a visible schematic approach, the search for the one correct solution, the one which is also, if possible, in full compliance with the answer imposed by the teacher. This is observed both in mathematics and the Polish language.

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