mascil
mathematics and science for life

Analysis of the Romanian policy context

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mascil aims to promote a widespread implementation of inquiry-based teaching (IBL) in math and science in primary and secondary schools. It connects IBL in schools with the world of work making math and science more meaningful for young European students and motivating their interest in careers in science and technology.

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1.9 National Report of Romania

PART 1: A DESCRIPTIVE, EVIDENCE-BASED ACCOUNT OF THE NATIONAL CONTEXT

Introduction: Organization of education in Romania

Romania has a highly centralized educational system, there is a unique curriculum for each type of school and all the textbooks must be approved by a special organization of the Ministry of Education (CNCEIP - Centrul Naţional pentru Curriculum şi Evaluare în Învăţământul Preuniversitar). The textbooks for grades 1-10 (which represents the compulsory education) are free of charge (paid from governmental sources) while in the last two years of study the students must buy their textbooks. The curriculum is also established by the same organization and it was strictly content-based before 2005, when the last curricular reform started. This reform referred initially to primary school education and it is extended nowadays to secondary schools too. The new curriculum also contains some methodological suggestions and a brief description of competencies the students must posses. There is a final exam at the end of the secondary school which is required for further studies (most of the universities use the results of this exam as admission criteria). However the methodological suggestions explicitly refer to the use of student centered methods, the use of group works, the use of mathematics in various contexts, the use of mathematical modelling, this is not reflected either in the textbooks (see a sample of such a textbook in book.pdf) or in the final examination criteria (see a problem set in the exam.pdf and the program in program_exam.pdf). Moreover, most of the mathematics and science teachers use these suggestions and recommendations very rarely in the daily teaching practice. This can be explained with the huge amount of formal mathematics and science they have to teach, the final examination rules (contents, problems), the quality of the textbooks, the centralized control system in education, and in some cases with the quality of their professional development. It is important to understand that teaching is not an attractive career in Romania and for this reason the average age of teaching staff (especially in mathematics and science) is above 50 (these teachers were trained before 1989 under a communist system, where they received a good subject focused training with a minimal pedagogical training). The salary of a beginner teacher is around 180 Euros and while the highest salary (after 34 years of teaching and all compulsory grades) is around 480 Euro. So in international reports

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Romania appears as a country where a beginner teacher can double his salary in time, but this doubling needs more than 10 years and the level of this increased salary is still very low. On the other hand the market in Romania is quite expensive: food, cars, fuel are at the same price as in western Europe, the rent of a modest apartment start at 200/250 Euros. The number of students at universities where math and science teachers are trained is continuously decreasing.

The whole system is structured into seven disciplinary domains: language and communication, mathematics and science, mankind and society, arts, body and movement, technologies, transverse capacities (collaboration, communication, reflection, critical approach, creativity). Even though mathematics and science belong to the same domain, they are thought as different subjects, moreover, science is thought in several different disciplines (physics, chemistry, biology) and the correlation between the curriculum of these disciplines is very low (the uniform motion is studied in physics in the 6^{th} grade, while the concept of the function in mathematics is introduced in the 7^{th} grade, many physics and chemistry problems lead to polynomial equations in grades 8,9,10 while polynomials are studied only in the 12^{th} grade in mathematics). This structure is used also in the teacher training system, so most of the teachers are not prepared to use an interdisciplinary approach, their university studies and the whole professional development is based strictly on a single discipline. There are a few exceptions, some teachers (they had obtained their qualification before the Bologna process started) have double specialization (such as mathematics and physics or physics and chemistry) but in the current teacher training system there is no double specialization. Moreover, mathematics, physics, chemistry and biology can be studied at different departments/faculties at the universities. Between 1996 and 2000 there was an attempt to teach physics, chemistry and biology as a single discipline in lower secondary schools but due to the objections of teachers it was not viable. This creates a major impediment in the implementation of MASCIL's aims because usually an interdisciplinary approach can not be used and a very tight collaboration between mathematics and science teachers can not be expected. There are 4 main types of schools: primary schools, upper primary schools (usually these two categories are organized together), secondary schools (these can be theoretical or vocational schools, but there are schools with both theoretical and vocational classes, the type of program being linked to the class, not to the school), apprentice schools.

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Theme 1: State of affairs-recent changes

In the structure of the curriculum there is no evidence of prioritizing mathematics or science. The number of lessons/week for language and communication is usually the same as the number of hours for mathematics and science, the situation is even worse for minorities because they have additional subjects on national language, national history, etc. There is a very strong tradition in teaching mathematics and science through problem solving; there is a very strong focus on competitions and national exams. Teachers are often evaluated in concordance with the results of their students at different competitions and examinations and this creates a strong commitment to the existing teaching tradition (as far as the competitions and the examinations are not changed). In recent years the methodological recommendations were changed, but the effect of these document level changes are not palpable at the level of teaching practice.

In 2010 there was a new vision and an attempt to reorganize the teacher training system. According to this conception master programs in didactics of mathematics and science would have been organized and would have took over a major role in teachers' initial training. This idea was dropped, so in the existing system teachers for upper primary and secondary education are trained by a regular subject oriented BSc program with a complementary pedagogical module (30 credits in 3 years) and a master program is compulsory for teaching in upper secondary. This master program can be a scientific master with an additional pedagogical module (30 credits in 2 years). Basically the existing system was extended and adapted to the Bologna system without changing the structure and the aims of the training. There is no oral examination at the beginning of the Msc program, there is no recruitment and no selection. The number of candidates is very small at the mathematics and physics programs. As an example the number of candidates at the Babeş-Bolyai University, which is the largest university in Romania according to the number of students, is 22 students at the Mathematics program in the first year in Romanian, 12 in Hungarian while at the Physics programs (including medical physiscs, technological physics and physics with computers) are 22 and 7. These numbers represent the total number of students in the first year, so they include both future scientist and future teachers. These teachers will have only one specialization, so for most of them (especially for those from physics) it will be almost impossible to find a job in the educational system (there are a lot of small schools, especially primary schools

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in rural areas, where the number of physics lessons is less than it is mandatory for a full position).

On a national level universities have autonomy in preparing the content of the teacher training, but the didactics of mathematics (or science) is not a recognized field of science, there are no doctoral schools in didactics of any discipline, so the teaching staff at the Mathematics Departments, which provides the content knowledge for future teachers, usually has a PhD in Mathematics and is involved in mathematical research. Those teaching in the pedagogical modules can have a background in education, but usually not in the didactics of a discipline, but in general education or psychology and this aspect creates a lot of functional problems in the quality of training. In this context there are a lot of local initiatives in teacher training, but they are not correlated on a national level.

The style and approach of the Mascil project is completely different from the existing practice, even if at the level of documents there are recommendations that virtually facilitate the implementation. A lot of effort needs to be invested in order to keep the professional standards and to widen the audience of the project at the same time.

Theme 2: **Schooling and the world of work**

In national policy making documents there is no evidence of connecting the general education and the world of work. In the national curriculum at the level of general competencies there appear the use of mathematical language in different contexts and the analysis of different types of data, but as clear aims or objectives there are no recommendations on connecting the world of work and general education at the level of mathematics and science education. Moreover, this connection is not prioritized at the level of vocational education, the contents for these types of classes (e.g. art classes in upper primary, grades 5-8) is the same as in any other classes while in secondary education the compulsory contents for vocational classes are mostly included in the core curriculum for the theoretical schools (e.g. in the 12th grade for pedagogical and for sport classes we have abstract algebra with groups, rings, etc.).

The potential providers of informal education are usually not prepared to offer specific programs for students and the existing local initiatives are not for free (while the general

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education is for free, according to the law of education). In some cities there exists special clubs for students, where some additional activities are organized (such as chess training, dance clubs, etc.) but these clubs usually do not include mathematics or science activities, they are mostly complementing the formal school educational programs in fields that are not included in the formal education system. There are very few connections with industry and these are only based on local initiatives. On the level of upper primary from the point of view of the mathematics and science curriculum there is no difference between vocational (e.g. art schools) and general schools, the difference is related to the targeted vocation, not related to the general subjects. On the level of secondary education these type of schools have a slightly different curriculum (most of the contents for vocational schools is part of the content for theoretical school) and there are very few connections between these schools. Usually the theoretical schools are considered as "good (or elite) schools", while the vocational schools oriented to the world of work (with industrial profile) are not so "good". The art schools, pedagogical schools, military schools, theological schools usually are not connected to other theoretical schools.

Furthermore, there are no support materials for connecting the world of work and general or vocational education at the level of mathematics and science, the assessment is the same for all categories of students and the teaching methods are not significantly different in vocational and in theoretical schools.

If we want to work with students and teachers in vocational education including technological schools and we want to develop and provide materials for them, this will create a lot of extra work on the level of secondary education, because at this level the classes have too many profiles (corresponding to industry branches) and a specific material, that fits the needs of a profile and that connects the world of work with scientific content is usually not helpful for the many other profiles. If we focus on vocational schools like art schools, sport schools, military schools, pedagogical schools we need also a lot of extra work in organizing the courses, in selecting and developing materials. It seems very unlikely to work with teachers from a military school and a theological school on tasks that are related to the profile of the schools and can be used in both schools. On the other side if we do not do this, we can't provide materials that are useful for the teachers and corresponds to our aims. Supporting the teachers to form communities won't be effective, because most of them are teaching in a very traditional way.

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Theme 3: Science and Mathematics curricula and IBL

There is no evidence that IBL is prioritized. The methodological recommendations are not supported by textbooks, problem collections, contests, assessment or budget.

The existing recommendations are usually not applied and the opinion of most mathematics teachers is that it can't be applied until the national assessment, the funding, the content and the overall aims of mathematics and science education is changed.

There are no support materials and the assessment is completely against IBL.
The mascil project needs a series of materials that fits the national curriculum and the aims of the projects, is not too far from the existing teaching tradition and helps the teachers to understand how they can better facilitate the learning of their students by using these materials. This seems to be a very difficult task both on the level of general and secondary education.

Theme 4: Pre-Service teacher training in relation to i) IBL and ii) the world of work

The teacher training is not a priority in Romania although education is a national priority at the level of the law of education. There is no recruitment, no special support, a very low salary, so there are no efforts in making the teaching profession attractive. The only advantage that is visible from outside the educational system is that teachers have 18 teaching hours/week (the preparations are not visible from the outside) and they have a long holiday. At the level of training the system does not support a practical and effective training, the training is mostly theoretical and it is not even in accordance with the existing evaluation system inside the educational system.

Most beginning teachers have relatively good subject knowledge in their field, some theoretical background in physiology and education and a very poor practical training. The didactics of the subject and even the teaching oriented courses on the scientific

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content are under represented in the training programs. The prospective teachers are not recruited, there is no explicit selection, the training is provided mostly by scientists whose research interest is in the scientific subject (math, physics, chemistry, biology) or general education. There is a huge lack of specialists with a strong background in the didactics of the specific subject.

The pre-service teachers are motivated to obtain a good position and to become good teachers. This guarantees that they are usually very open and very motivated in experiencing IBL methods. On the other side most of them have no other working experience, so it is quite hard for them to connect the content to the world of work.

At the level of the Babeş-Bolyai University we intend to introduce a one semester course related to the Mascil project, but this course won't have an immediate effect on a national level.

Theme 5: **In-Service teacher training in relation to i) IBL and ii) the world of work**

There are no priorities for prospective teachers' training and the induction stage is not mentioned in the national documents. Teachers who graduated from a university program need to succeed at an examination after 2 years in order to have access to the teaching career (there are 4 different grades in the system: beginners in the first 2 years, beginners with the teacher status, second grade teachers and first grade teachers), but there is no special training or support for the first two years. There was a project to provide support for these teachers (a mentor for each of them) but for the moment it is not working.

The in-service teachers are mostly focusing on their school duties. The interest in PD has mainly two components: a compulsory part due to the necessity of gaining 90 credits every 5 years and a professional interest in courses that support teaching practice. There are a lot of accredited training courses that are not really practice oriented, but they are accessible for most teachers and there are only very few practice oriented professional courses that support local communities and continuous professional development.

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If we focus on the target numbers, we need accredited courses, and we can have a lot of participants that are not really motivated in changing there practice or in experiencing new practices, so we need also some informal courses, where we can better support teachers that are willing to experience new materials, new approaches.

PART 2: EMERGING ISSUES FOR REFLECTION

Equity specific issues

In Romania, according to the statistics girls have better results. On the other hand, among the finalists of contests the girls are under represented. This phenomenon has to be studied in detail because the general statistics and PISA results do not make an exploratory analysis on the causes. As long as a scientific career is attractive only for top researchers (as in Romania) and needs many years of hard work to achieve a stable social status this phenomena seems to be normal. At the Mathematics and Computer

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Science Faculty girls are underrepresented at the computer science programs and most of the excellent students are attracted to the IT sector, not to a scientific career.

Addressing low achievement

IBL offers better chances for low achieving students, but it may need extra effort from teachers' side. As long as all teachers are treated equally and not according to the invested effort, but according to the results obtained by the students, this gap won't even decrease.

Promoting entrepreneurship

Entrepreneurship is a separate subject in 10th grade, but it is not included in the upper primary curriculum. As a consequence of the introduction of this subject the rate of students who believe that they have the abilities to start a business increased from 29% in 2006 to 42% in 2011. On the other side this is not related to mathematics or science education and it is not connected to IBL or to professional development of math and science teachers.

Comments by the NAB

The NAB proposed the following strategy:

1. Communicate in a very clear way the main strength, main values and aims of the Mascil project.
2. Try to focus on a few types of vocational schools (art schools, theological schools, some specialization in technological schools) in order to develop relevant local teaching materials.
3. Support the existing local communities of professionals.
4. Organize both accredited and non accredited courses, involve the multipliers and the teachers in the development of teaching materials.
5. Disseminate the results in the local professional communities.

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