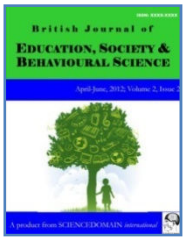

British Journal of Education, Society & Behavioural Science
4(2): 226-240, 2014

SCIENCEDOMAIN *international*
www.sciencedomain.org

The Romanian Mathematics and Informatics Education

Vasile Postolică[1,2*], Elena Nechita[2] and Costică Lupu[2]

[1]Academy of Romanian Scientists, 54 Splaiul Independenţei, 050094 Bucharest, Romania.
[2]"Vasile Alecsandri" University of Bacău, 157 Calea Mărăşeşti, 600244 Bacău, Romania.

Authors' contributions

Vasile Postolică proposed and studied this subject before and during this development. Elena Nechita elaborated section 4 regarding the education in ICT and Informatics in Romania, participated in framing the authors' suggestions and the conclusions of the study. Costică Lupu has in view the subsequent applications. All authors read and approved the final manuscript.

Original Research Article

Received 10th July 2013
Accepted 7th October 2013
Published 8th November 2013

ABSTRACT

Aims: The main aim of this report is to set forth a survey of the Romanian Mathematics and Informatics Education at the present time. We emphasize some of the recent, specific and significant Romanian methods concerning the teaching and learning of Mathematics and Informatics, starting from pre-school and primary level to the university mathematics and informatics education, the role of national and international mathematical competitions, the education of mathematics and informatics teachers, the formation of researchers in mathematics and informatics, their contributions and perspectives, the mathematics and informatics education in society and culture, the technologies in mathematics and the future of computers in education, links between research and practice, and developments in both these fields. Our considerations show, in a concise manner, the significant details regarding the current Romanian Mathematics and Informatics Education and the corresponding scientific studies.
Conclusion: In Romania, mathematics and informatics are taught, learned and applied by inter- and trans-disciplinary related applications, honoring both pupils and the teachers, aiming and succeeding at properly synchronizing the traditional forms of education and the

**Corresponding author: Email: vpostolica@ambra.ro;*

international ones, in particular those corresponding to the forms existing in the European Community, following the new Law of Education and starting from the pre-education given in the family.

Keywords: Mathematics education; Informatics education; teachers education; curricula; Olympiads; higher education; Bologna process; scientific research.

1. INTRODUCTION

The following considerations present significant details regarding the current Romanian education in mathematics and informatics.

In Romania, mathematics and informatics are taught and learned by inter- and trans-disciplinary related applications, honoring both pupils and the teachers, aiming and succeeding at properly synchronizing the traditional forms of education and the international ones, in particular those corresponding to the forms existing in the European Community, following the recent Law of Education (released in January 2011) and starting from the pre-education given in the family. Some of the main considerations of this research work are in accordance with [1,2]. Together with teaching Romanian language, Mathematics has an over-whelming role in molding the graduates of the pre-university levels. Actually, one of the goals of mathematical education in schools is to train for a rigorous and objective way of thinking, as well as for a precise way of expressing.

The last decade meant a serious outcast of the Romanian schooling issues, which grew in number and became more serious, reaching a level that threatens the economical future itself. Indeed, being too theoretical and having a teaching staff that is growing more detached from the rigors of the profession, this education did not succeed to meet the internal needs of the work force market. Presently, school faces not only the family's indifference but also that of society and media, in general. We can notice that a stronger message is sent out by the televisions where a number of characters/individuals boast about how mediocre they were in school and how well they are now.

There is a term in mathematics, "isomorphism", with which we identify similar situations. This can also be exemplified in the realities of the Romanian society.

Teachers have begun to generalize tutoring among their pupils, the latter being conditioned by grades on different disciplines. Along with the teachers, the school inspectors together with all kinds of business people are to be blamed for selling different alternative manuals, exercise books and magazines, some of them being useless.

There are still plenty of schools where there are classes in which the pupils receive a proper education and based on their success we harbor the illusion that the pre-academic education functions smoothly. It is the story of the king's clothes.

2. SCHOOL CURRICULA AND MANUALS

The idea that school education must keep up with the development of the society is correct, but education has a high degree of inertia and thus its reply to different actions is not immediate. Being subjected to a continuous stream of changes, not sufficiently prepared,

hesitant and not having a clear perspective, the pre-academic mathematical education is in a big deadlock.

Although we see many well prepared, enthusiastic teachers they also have started questioning the purpose of their activity. This fact has as background the inequity of budgetary remuneration and the continuous depreciation of the social status of the teachers (see also the school curricula for mathematics and, as examples, see, for instance: the mathematical analysis and the study of geometry in the high schools which is almost symbolical). At the meetings of the Romanian Mathematical Sciences Society and those of the Faculties of Mathematics and Informatics representatives, the question "Who are the people that develop these syllabi?" was often discussed: who is responsible for making decisions of such importance? But the things stopped here and no official steps have been made to clarify an issue that is negatively affecting the mathematical pre-academic education. Summarizing, the lack of mutual respect between the various decision makers in education, superficiality and rush remain the main faults of the curriculum reform of the pre-academic education.

This fact seriously damaged the specific management system's credibility, but the toll will be paid by the entire Romanian society.

3. THE NATIONAL SCHOOL CONTESTS, THE NATIONAL OLYMPIAD AND GOING TO THE INTERNATIONAL OLYMPIAD

Due to a tradition starting over 100 years ago by the founders of the Mathematical Gazette, Romanian pre-academic school proved, in the Mathematical competitions, results that well surpass its medium level.

For decades, we notice the permanent existence of some school centers, both in secondary and high schools, in almost all the towns, whose devoted and talented teachers are educating children with excellent qualities in mathematics. The tradition regarding the Romanian school contests, the national and the international mathematical Olympiads was kept alive by involving teachers from universities or some researchers that have gone through this experience when they where young (see, for instance, [3], [4]).

The Olympiads offered us the opportunity of witnessing an infinite flow of children with real potential of walking on the path of academic education in mathematics. If we are to make a statistic of the last 15 years almost all the young world-known Romanian mathematicians we can see that, with small exceptions, they have participated in the Olympiads and, in many cases, they have chosen mathematical studies just because their passion when they were children. In the world of mathematics there is an unanimous acceptance of the importance of this direct experience of mathematical competitions, leading to future excellence in mathematical research.

Here are some statistical data. The average ranking of Romania at IMO for the last 15 years is place 5-6 (in 1997, Romania got first place). Every year, with small exceptions, Romania had students that got, individually, in the first 10-15 of the approximate 550 participants (from approximately 80-90 countries).

As an average, over half of the international Olympic students study abroad, having scholarships at prestigious universities. Often, while there they continue to participate at

these competitions (see the members of the Princeton University team, that won the Putnam Contest in 2006).

There is a fact that should raise some thoughts: the majority of the Olympics that remained to study in Romania are focusing on polytechnic studies, usually the Computer Faculties, avoiding the Science Faculties.

4. HOW ARE WE PREPARING THE FUTURE TEACHERS?

This is one of the most distressing issues at this moment. If the representatives of various universities didn't find the time to properly react to what is happening in the pre-academic education is because, generally speaking, the training of future teachers is extremely poor.

The ones that will pass the diploma exam this year have studied in the university some syllabus and when they will go in schools in September, as teachers, they will find a totally different reality. Where they trained to face such a situation? The answer is simple and tragic in its simplicity: No.

The current bachelor syllabus, developed over a period of 3 years, is not different in spirit from the one described above. Thus, what does a graduate student take with him at the schoolteacher's desk? As a high school teacher, the following courses can be of help: logics and set theory, analysis on the real straight line, linear algebra, algebraic structures, analytic geometry, complex analysis, statistics and probabilities elements, history of mathematics, the fundaments of mathematics. Along we these it is worth mentioning also the methodology of teaching mathematics and the pedagogical practice. The rest of his work, i.e. 60% of the credits, is useful only in the eventuality of a research path.

We have discussed with many prestigious teachers from the pre-academic education and all of them stated that the current syllabus is inadequate for the preparation of high school teachers. For secondary schools the situation is even worse because a future schoolteacher should be self-educated. Many decision factors support the current bachelor syllabus stating that this offers serious mathematical knowledge. The real advantage is that it selects persons with a higher degree of mathematical capabilities (and then they will be able to fill in their gaps).

Thus, a paradox arises. While the main reason of bachelor graduate is getting a position in a school, the ones that achieve this have to go on a artificially crammed path, when in fact they will perfect their training on the job. If we add the fact that the Statute of the teaching staff states that the bachelor studies are sufficient only for the secondary schools, for high schools the master studies being required, then the paradox is deepened. Nobody will be able to point out the utility of a teaching career from high-school and that could be taught within the syllabus. And then, what is the reason? Should it be that the specific management system chose the specialized teaching masters? Although a positive answer was talked about earlier, it will force the reconsidering of the bachelor syllabi from their very foundations. Is the academic community ready for this?

First of all, we think that the bachelor studies should offer more methodical training. The current syllabus includes a semester of pedagogical practice, which gives the student the opportunity to assist several hours and to perform at most two hours in front of a class, as teacher. This is more than insufficient. The organizational, communication, or interpersonal competencies cannot develop in such short time. Moreover, the teachers supervising this

practical stages are by no means motivated and cannot offer psycho-pedagogic and methodical counseling to large groups of students, as these are organized today. The time resources should be redistributed: instead of studying dynamical systems, students that are to teach mathematics in secondary schools should better dedicate more hours to the pedagogical practice.

Another issue refers to the admission procedures. Currently, students are allowed to enroll in the Mathematics (as well as in the Informatics) study programmes no matter their educational background. For example, a student who graduated the high school on a theoretical track in humanities (philology or social sciences) and studies mathematics will face serious difficulties even in the first year, and he/she will not be able to overcome them.

The changes in the school curricula demand a preliminary training of the teachers, that are seldom presented as perfecting courses, held by university professors. But the syllabi of the pre-academic system are practically unknown to the latter and a question appears: does the specific management system think that eventually the things will work out by themselves or will the management ask the specialists in didactics to train their colleagues?

At the junction between the pre-academic and the university education lay the exams for a definitive position, to obtain the second degree and also the activities related to obtaining the first degree in the Romanian education system. Instead of becoming the means of promoting quality, sometimes they have become trifles, getting to the point when the predominant mark given at the inspection for obtaining the first degree to be 10.

5. The Mathematical Gazette

We can't speak of the Romanian mathematical education without mentioning this magazine, whose existence helped emulating the love for mathematics for tens of generations of pupils. All our great mathematicians admit that they have made their debut as solvers of the problems published in the Gazette.

Nowadays, the magazine is published in two series: series A (having a scientifically-methodical feature, meant for teachers and students) and series B (meant for pupils). Due to collaboration with the Romanian software company SOFTWIN (http://www.softwin.ro/), the contents of the magazine is available electronically starting with its first issue from September 15, 1895, at http://ssmr.ro/publicatii/gma/volume_gma (Mathematical Gazette, series A) and at http://ssmr.ro/publicatii/gmb/volume_gmb (Mathematical Gazette, series B).

The public request for the Gazette was significantly reduced also because many new mathematical magazines have been issued. We think that the school libraries and the academic ones should have the complete collection of both series of the Gazette, as these are priceless sources of information for the new generations of pupils and teachers. Moreover, series A of the Mathematical Gazette is a genuine platform of discussion of the phenomena of the current mathematical education.

6. THE MATHEMATICAL HIGHER EDUCATION

6.1 The Bologna Process – the Core of the European Higher Education Area

The Bologna process is one of the dimensions of the process of creating a united Europe. It was initiated with the Statement of Bologna (June 19, 1999), whose authors had a vision of a united continent where the intellectual, cultural, social, and technical dimensions are considered together with those of the Euro, banks, and economy. The intellectual, cultural, social, and technical dimensions have been established with the help of universities that continue to play a central role in their development.

The Bologna process has been consecutively improved with ideas and new lines of action in Prague (2001) and in Berlin (2003), clearly defining the European Space of the University Education. Within this space, the diplomas are acknowledged throughout Europe, education is focused on the student and the classes are defined by the European Credits Transfer System (ECTS). The credits facilitate the students' mobility within and between institutions, the flexibility of study tracks, and also the implementation of modern teaching-learning methods. According to the vision of Bologna process, education is a public good and it has a public responsibility, and the students are partners in making all the decisions within the higher education, at any level (faculty, university, ministry, etc.). Quality is the responsibility of each institution that has to implement a Quality Management System, but this is evaluated from outside with the help of the national systems of Quality Assurance, that are connected at the European level.

An anniversary Ministerial Conference and Third Bologna Policy Forum took place in Bucharest, in April 2012. The participants assessed the results of the start of the second decade of the Bologna Process and discussed political orientations for the next period.

6.2 The Bologna Process in Romania

The adhesion of Romania to the Bologna Process was made with a lot of declarative enthusiasm, also due to the adhesion of Romania to the European Union in 2007. It immediately became clear that things are much more complex and require in-depth costly changes. The national strategy is still inconsistent, therefore Romanian education at all levels in trying in vain to find a balance. Many Romanian personalities couldn't make their opinions heard and generally the Romanian civil society didn't pay the deserved attention to education.

With the current situation, Romania had to state explicitly that the role of education is that of developing in the young generation the respect towards work and towards the human values, and also to prepare it for a good professional and social integration in the European society. But clear objectives regarding the purpose of the different stages of education are lacking (for example, the manner of elaborating the subjects for school-leaving exams).

There is a suspicious lack of understanding of the concept of university, which seems to be an almost disjoint gathering of faculties in our society. This structure does not reflect the challenging society we live in, where competition and quality standards must have a primordial role.

In 2011, the classification of the Romanian higher education institutions based on quality criteria has been realized by the Romanian Ministry of Education. Also, all the study programmes of the same type have been put into a hierarchy, as the students are entitled to know, from the very beginning, the performance level of the institution they wish to attend. But this process did not solve all the problems. The performances of the private universities are below the allowed level, but still they "throw" in the work field thousands of graduates annually. This issue doesn't appear to impress anyone, not to speak about the state administration that employs this kind of "specialists".

There is also an encouraging side: at about ten universities are separating themselves from the others due to the good performance they have. This fact gives us the certainty of a good future of the Romanian higher education. In order to continue with the application of the quality standards there is need of political will both for the Parliament and the Government. From a formal point of view, the specific management system has an impressive bureaucratic structure, but its performance proved a great lack of professionalism and coherence in developing the strategies, accepting some serious compromises, having groundless claims and self-indulgence.

6.3 Somme Issues on University Mathematics

The first and the most important issue is that of the status of this discipline.

The increase of the role of computers in the economical and social life has created the (extremely dangerous) illusion that mathematics can be massively avoided and that its study is no longer useful. While this issue was rapidly solved in foreign countries, coming back to reality, in Romania it got to the point where, starting with 2007, the curricula of most of the faculties of economical studies do not include any specific course of differential and integral calculus, of linear algebra or of analytical geometry, thinking that the students can supplement related knowledge using programs like Matlab or Maple. And thus (with small exceptions) mathematics has been reduced to a single course of one semester, having only two teaching hours!

A worrying picture is found also in the technical faculties, where besides reducing the number of hours dedicated to mathematics there is also the taking over by engineers of some classes like operational research, numerical analysis, dynamic systems theory, waves theory and applications, etc.

There are some voices from the departments of informatics, which request the elimination of the mathematical courses, forgetting the fact that informatics only programs the algorithms (and these are created by people that have been trained in mathematics).

As a sign of the understanding of the Bologna spirit it would mean that inside the universities some mathematics classes be taught in the same way to all the enrolled students to fields like exact sciences (for example those like Differential and Integral Calculus and Linear Algebra). Only this way we can create the premises of a real mobility of the students. "Keeping the students in captivity" raises serious existence issues to all the exact sciences faculties. The pre-university teaching career is no longer attractive, nor materially or socially. Moreover, the number of teachers is continuously decreasing, and their management is left at the good will of the school inspectors and of the school principals. Valid alternatives for graduates couldn't be identified and that's because in Romania the economical signs are weak during the last years of crisis.

However, we have some positive facts, too. After long debates, the curricula for the mathematics-informatics specialty study programme has been agreed by the mathematicians' community as a principle.

A nice incentive for the students' challenging spirit was Traian Lalescu Competition. This contest ceased to exist for a while, after the Revolution in 1989, but revived during the last years. The possibility of participating at some of the international contests appeared for the Romanian students within this context.

6.4 Higher Education and Scientific Research

One of the main targets of the universities is developing scientific research. If five decades ago the main goal was passing on knowledge, nowadays the governments of all European countries seriously consider the university scientific research dimension. Basically, as the material resources are consumed, the human resource appears to become the most valuable good.

Within the Romanian universities, the mathematical research has two main motivations: the doctorate theses and the contracts of scientific research, that can be the outcome of a national or international cooperation.

The visibility and the impact of the scientific production are well displayed on http://www.ad-astra.ro/cartea-alba/.

The doctoral schools have to become incubators of innovative ideas for scientific research, and these structures need to make the difference between the universities that have only bachelor programmes and those that have both master and doctorate programs. An analysis of the situation in the last 5 years shows that only a maximum of 7 universities are qualified to have mathematical doctorate programs. We will see below that a certain detail in the project for the *Statute of the teaching staff* will trigger serious pressure on the master programmes.

There are, in the big Romanian university centers (like Bucureşti, Iaşi, Cluj-Napoca, Craiova) successful attempts to establish excellence programmes, be they official by doctorate programmes, or by scientific student domains. For example, the Students' Scientific Session, annually organized by "Alexandru Ioan Cuza" University of Iaşi proved to be very stimulating. The excellence of the university research can be obtained only if excellence in the didactic training programmes is achieved. And the importance of the bachelor programmes should always be considered.

It appears that the mathematical studies are not appropriate to the needs of interdisciplinary research and to the collaboration between teams that have different specializations. It is true that a graduate also has informatics knowledge, but apart from some limited notions of mechanics he knows absolutely nothing from the other sciences. The focus of the research has shifted nowadays to fluids mechanics issues, on the optimization and control theory, on elaborating analyses and prognoses, on shape recognition, on securing the data transfer etc.

This orientation towards inter- and transdisciplinarity should give the academic staff the ground for numerous real-life applications to be approached with the students, during the bachelor and master studies. This is actually happening in many universities, but still there is

a lot of space to improve this. Especially at the master level, when the mathematical apparatus is already under control, interdisciplinary research can be proposed for the dissertation theses. Lately, student conferences or science cafes have been organized in order to promote interdisciplinarity and team work. As about the syllabus, this includes elective courses that the students can attend, courses that are compulsory in the other faculties' curricula. For example, the students in Mathematics can attend courses such as: Accounting, Marketing, Genetics, Philosophy, meant to open their horizon for discovering the links between scientific domains.

Moreover, the inter- and transdisciplinary perspective should be promoted in high schools and even during the primary education, where integrated activities are highly recommended. But this leads us back to the specialty training for pre-university education teaching staff.

The mathematical departments still appear like isolated islands within the universities, although they should play an important role in the collaboration between departments. Following the efficiency principle, we propose an annual classification of the research record of the entire teaching staff, with the proper projections to the pre-university mathematics education. Following this way, the persons that don't meet the requirements established and based only on the real competence by the specific management system will no longer be allowed to be a part of the contest committees and, why not, to stop being eligible for managing positions. This measure will solve another delicate issue as well: that of the grades/points that are given to the new contracts, regarding the researcher status of the contract manager and of the members of his team. The annual classification will ensure the transparency of the specialization issue. What defines a specialization? Here is a problem that the future *Statute of the Teaching Staff* needs to clarify. It is stated there that teachers should have the doctor's degree, but the fact that the doctorate has to have the job specialization is deliberately avoided.

Regarding the new *Statute*, the possibility that a teacher requests to go exclusively on research, paid by the specific management system, needs to be discussed. Is this statement grounded, knowing that the granting of sabbatical years never functioned? Or is this the expression of the desire of assuring the teachers that in the process of reorganization none will lose their job?

6.5 The Superior Normal School

The Superior Normal School in Bucharest (SNSB, http://imar.ro/~dbeltita/SNSB/) was created after the Superior Normal Schools from Paris and Pisa and after the colleges of Cambridge and Oxford Universities, following a project that was developed by young researchers that have obtained doctorate programs at prestigious foreign universities (Massachusetts Institute of Technology, École Normale Supérieure de Paris, and Pennsylvania State University). SNSB is certified as school for academic, post-university studies by the Government Decision no. 693 from June 12, 2003. This school has a singular position within the Romanian higher education system. The main objective of SNSB is to encourage the best students to complete their studies in Romania and, at the same time, to relate them to the best Romanian specialists (be they in Romania or abroad).

The Scientific Council, made up of world personalities from every field of activity, supervises the scientific activities. The classes, as well as the teachers, are changing every year. The Scientific Council annually elects the most appropriate classes from a list that can be proposed by teachers and researchers from any Romanian or foreign institution.

Every year there can attend the classes for each discipline ten students at the most, that are in their third year at university. They become students of the school for three years. During the first two (the preparation cycle) the students graduate from their initial universities and attend complementary classes, specialization ones, at SNSB. The last year (the master cycle) is dedicated to the master classes organized by SNSB, lasting one year and finalized by obtaining the master diploma.

The classes of the Mathematics Department started in October 2001, and the classes of the Informatics Department started in October 2002. Currently, SNSB grew by organizing preparation schools for students that are in their first years or for pupils in their last years at high school, in order to guide them towards the study of sciences.

The activity of SNSB takes place in the headquarters and with the help of the "Simion Stoilow" Institute of Mathematics of the Romanian Academy. Therefore, SNSB is able to ensure and run some post-doctoral programmes and workshops on major themes of nowadays research.

7. ON THE EDUCATION IN ICT AND INFORMATICS IN ROMANIA

In Romania, the evolution of the society during the last decades was deeply influenced by the orientation towards the digital content. In line with this global trend, the Romanian education system had to adjust its strategies in order to offer to the young generations the proper digital literacy and digital competencies, regardless the social origin of the pupils and students. Moreover, the need for a long-life education and the nature of the jobs determined the decision makers to find solutions for adults, as their ICT and e-business competencies – especially those for innovation and growth – have to increase both in quantity and in quality. Special measures have been taken to ensure that marginalized groups (such as the unemployed, elders, people with disabilities, and those in remote locations) are included in various digital skills projects. Therefore, the programmes to offer digital competencies and their recognition have been developed and enhanced every year. For example, since 2002, ECDL Romania (European Computer Driving License, www.ecdl.org.ro) aimed to spread digital literacy and certify it by a program with international recognition. The project, undertaken in close cooperation with stakeholders like the Romanian Government, Ministry of Education, private companies etc. ensured the opportunity of obtaining digital competencies for every citizen [5].

Meanwhile, the training in Informatics is a tradition in Romania, and performance has been proven at all levels. As a state member of the European Union, Romania integrated the learning of ICT and Informatics into the national policies of modern curricula of education and professional training.

In what follows we shall address mainly the ICT and Informatics education in the secondary and higher education systems. As about the gymnasium, this level is covered, at present, with optional courses in this fields, usually being part of the personalized curriculum decided by the schools. However, the interest that the pupils in gymnasium show for computers is great, so the diversity of the courses is also important: from film-making to high-performance applications. As well, it is worth mentioning that ICT teaching has a place even in the primary and pre-primary school, where the small pupils exhibit important user skills.

For the secondary education system, the curriculum of each educational track (theoretical, technological, and vocational) includes, for every profile and specialization, one of the disciplines *ICT* or *Informatics* in every year of study. The Schools of Arts and Trades also provide education in ICT. The content to be learned is adjusted in order to fit the educational route but, generally speaking, the key competencies they offer are the digital competencies, competencies in mathematics and basic competencies in sciences and technology. The targeted general competencies are the following: modern user skills, capacity to use several important applications and environments, and development of software products which foster the inventive spirit and creativity.

Informatics is taught in the theoretical track, for the Mathematics-Informatics profile. In Romania, secondary education in informatics started in 1971, with 5 informatics high-schools in five big cities of the country. After 1989, the number of the informatics schools and that of the informatics classes in ordinary schools increased rapidly. Today, in the Mathematics-Informatics classes, a pupil studies 1 hour/week in the 9th and 10th grades and 4 hours/week in the 11th and 12th grades. There are only a few special classes (called "intensive") teaching 4 and 7 hours/week respectively.

Starting with 2010, the Baccalaureate exam includes the certificate of digital competence. According to the actual methodology for the Romanian National Baccalaureate Exam, the assessment of the digital competencies is done during the second semester of grade XII (not during ordinary exam sessions) and lasts for 60 minutes. Irrespective of having passed the Baccalaureate or not, the digital competencies certificate is issued according to the European standards.

The National Olympiad of Informatics (held for the first time in 1978) is the most important Romanian competition in Informatics [6]. The problems are usually applications of graph theory, game theory, geometry and general use of data structures and algorithms. Nowadays, the National Olympiad in Informatics is organized for gymnasium students (5th to 8th grade), and for high-school students (9th to 12th grade).The best pupils get to this contest from every county of Romania, and those who pass the selections (made through three exams in each of the two training camps) enter Romania's team for International Olympiad of Informatics (IOI), Balkan Olympiad in Informatics (BOI) and Central-European Olympiad in Informatics (CEOI). The first BOI was initiated in Romania in 1993, and the first CEOI was also held in Romania in 1994.

Junior Balkan Olympiad in Informatics (JBOI), started in July 2007 in Belgrade, Serbia, is opened for students aged 15 and younger, residents of Balkan countries. The aim of this new competition is to discover, at an early stage, the most gifted students for Informatics.

In 1995, the International Computer High School of Bucharest (ICHB, http://liceu.ichb.ro/) was founded. ICHB is a private school which follows the standards and regulations of the Romanian Ministry of Education. Young people from all over the country may attend the classes at ICHB. With an excellent and passionate team of teachers, the results at national and international competitions were not late in coming.

As for higher education, at the bachelor level one can find three important tracks to study informatics. The first category is that of study programmes in universities, who offer Informatics (within the fundamental field Informatics) and Mathematics-Informatics (within the fundamental field Mathematics). The second track is that in the polytechnic universities, which prepares engineers specialized in the fields of Systems Engineering and Computers

and Information Technology, through modern study programmes that combine theoretical aspects with practical issues. The third direction is Economic Informatics & Cybernetics, present in the universities of Economic Studies. Basic courses in Informatics and/or Information Technology are taught in any other study programmes, according to their fundamental field and to other specific needs. Two courses (Informatics and Computer Assisted Learning) are included in the curricula of the Departments of Teacher Training.

At the master level, the range of courses related to informatics is very wide, mainly because ICT is used as an essential tool in achieving the competencies aimed by various master programmes. Informatics as a domain of study is also approached through various programmes at the master level, such as: Theoretical Informatics, Applied Informatics, Distributed Computing, Computational Optimization, Software Engineering, Computational Linguistics, Information Security, etc.

In Informatics, the third higher education cycle is completed in doctoral schools of the main universities in Romania.

Of course, the European Credit Transfer Systems (ECTS) and European Qualifications Framework (EQF) are in use in all the Romanian accredited universities.

Coming back to what teachers aim to develop at their students, besides ICT and Informatics' specific knowledge and skills, is to make them aware of the influence of Informatics over society and conversely. The students need to know about the benefits as well as about the disadvantages coming from the use of computers and networks, about the confidentiality of information, database protection, and ethics of these fields.

Moreover, we have to underline that mathematics gives a lot of basic concepts that are essential in studying informatics, such as: numeration systems, set theory, mathematical logics, relations, graph theory, etc. The analysis of the algorithms, sensitivity analysis, numerical algorithms and many others cannot be developed without a strong mathematical background. Therefore, teaching mathematics and informatics goes hand in hand. Open problems in mathematics expect computer scientists' approaches, while informatics needs mathematics in order to understand the power and limits of efficient computation [7]. As Steve Smale greatly stated, the problem of "P versus NP" is "a gift to mathematics from computer science".

8. SELECTIVE SUGGESTIONS

Education is one of the strategic investments of any nation. A healthy education is the guarantee of the success of social and economic development. Romania can't afford to waste the intelligence, the work strength and the enthusiasm of the young generation, by continuing to make decisions that are unclear and inconsistent with the previous ones.

It is necessary that the quality standards be firmly applied in order to stimulate excellence in teaching and scientific research, transforming education into the main premise of economical development of the society. At the same time, we need to understand the educational role of schooling at all levels when it comes to firmly cultivating the true human values and, in the first place, the morality and the respect towards work.

Mathematics, along with Romanian Grammar, is the discipline that has the most important implications in the socio-professional integration of the younger generation. Its role in day-to-

day life grows with the products that incorporate mathematical reasoning and research: mobile telephony, Internet, computer based graphics, GPS system etc.

We should pay maximum attention to what is going on in education in order to prevent getting in the point where we will need to import high school teachers.

9. CONCLUSION

The initial professional training for the didactic career is provided by the Teaches Staff Training Departments of the higher education institutions, according to the regulations issued by The Romanian Agency for Quality Assurance in Higher Education (http://www.aracis.ro/nc/en/aracis/). The educational curriculum for the initial psycho-pedagogic training is established at national level being integrated, as a unitary module, in the educational curriculum of the study programmes/faculties. The continuous training of the teaches is done through didactic degrees and various graduate continuous specialization and professional development programmes. We strongly believe that all these forms of education should be revised by the Romanian Ministry of Education in accordance with the realities and with the needs of the Romanian society. As well, consistency and continuity of all the decisions is vital for the success of this endeavor, because too many contradictions were raised by political changes and disputes.

The civil society and the stakeholders should provide in-depth analyses of the educational process (not only regarding Mathematics and Informatics) and the decision factors should take them into account. The voice of the teachers have to be heard and their experiences, with real students in real contexts, must be known by the Ministry and considered accordingly.

Our review has been done from the perspective of the academic staff who extracted these conclusions from the meetings with the teachers at the pre-primary, primary, and secondary levels, from observing the reality in the Romanian schools, and from working and talking to students at all levels. What we expect is a hopeful future for the Romanian education in Mathematics and in Informatics, whose tradition and former results are remarkable.

We conclude our study with an advocacy of the beauty of Mathematics, a field which gives all the other sciences tools and support. As about Informatics, it seems that it surrounds us. We have to take the best from this phenomenon, which appears to be continuously expanding.

The disciplinary dialogue is a major necessity in this trans-disciplinary era. Only this way we can prove that, for example, the infinite mathematics goes beyond the common place of everyday existence, to put us in contact with the anti-intuitive, paradoxical aspects of existence. The fractal objects of the fractal geometry of nature are all around us: clouds and ocean shores, snowflakes and Brownian movement, biological phenomena and the financial ones, fractal literature and fractal music. For the tool status, initially represented for engineering, mathematics became the only language that specifies, among other things, the manner of existence of physical phenomena and it represents the most important manner of expression of economical phenomena, and it combines mathematics with biology and informatics. This fact allows the shift from energy engineering to information engineering. Hence, nowadays, the border between science and engineering becomes more problematic, and ignoring the semantic dimension of education through mathematics by amplifying the syntactical aspect becomes almost impossible.

The show displayed by mathematics, as it was proven in actual human knowledge and existence, is amazing through: the intimacy of the mathematical language, its elements and functions, the theatricality derived from the "tragedy" and, respectively, the "comedy" of the ancient Greek philosophers (mathematicians), the local being solitary with the global and the other way around. But the language remains only the most visible part of mathematics.

Nowadays, the following facets of mathematics are immediately recognizable: field of knowledge and research, science, art, and tool of action in various situations; language, way of thinking, catalytic agent of multiple idea, methods and results transfer; discipline taught in various education institutions, social phenomenon, game, fashion, snobbery, means of intimidation or even terrorizing, possible pathological form; means of understanding the world, way of life, including the possible understanding of our own mind, element of spiritual life, philosophy and perspectives. And the list can go on.

Mathematics presents itself nowadays firstly through the various ways of thinking: inductive, deductive, triadic, binary, analogical, metaphorical, hypothetical, infinitely combining, probabilistic, recursive, topological, algorithmic, imaginative etc., having a huge cognitive and pragmatic universe, and that is so far away from the simple reduction: deduction and combination. Hence, the "metabolism" of mathematics with the other disciplines is very weak. The genuine education through mathematics is that dedicated not only to a few chosen ones but also to everybody.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Solomon M. The Loneliness of the Mathematician. Page Math Journal. 2008. Accessed 9 February 2013. Romanian
   Available: http://www.fmatem.moldnet.md/SING_MAT.pdf.
2. Niculescu CP. Report on the State of the Romanian Mathematics Education. Ad Astra Journal. 2007;6. Accessed 9 February 2013. Romanian
   Available: http://www.ad-astra.ro/journal/10/niculescu_matematica.pdf.
3. Postolică V. The Romanian Mathematics Education 2003-2004. Journal of the Korean Society of Mathematical Education. 2004;8(4):227-260.
4. Bătineţu Giurgiu DM. National Olympiads of Mathematics for High Schools 1954-2003. Bucharest: Enciclopedica Publishing Press; 2004. Romanian
5. Arsene M. Online Guide to Educational Systems. Around the World – Romania. NAFSA – Association of International Educators. 2011. Accessed 9 February 2013.
   Available: https://www.nafsa.org/_/File/_/ges/Romania.pdf.
6. Cerchez E, Andreica MI. Romanian National Olympiads in Informatics and Training. Olympiads in Informatics. 2008;2:37-47.

7. Smale S. Mathematical Problems for the Next Century. In: Arnold V, Atiyah M, Lax P, Mazur B, editors. Mathematics: Frontiers and Perspectives. International Mathematical Union; 2000.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=302&id=21&aid=2469