

Analysis of the Cypriot policy context

mathematics and science for life



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.



1.7 National Report of Cyprus

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

Introduction: Organization of education in Cyprus

The present report provides background information and figures for the current educational context in Cyprus and through this description makes an attempt to underline the possibilities for MASCIL dissemination and exploitation. The report begins with some background information on Cyprus. Cyprus has a highly centralised educational system; the development of educational policy and its implementation, the administration of public and private education and the enforcement of education laws, rests with the Ministry of Education and Culture.

Current Educational Context

Greek long tradition in philosophy and sciences, stressed back 2500 years, also had a great impact on Cyprus education. The ideas of Socrates, Plato, Aristotle, Democritus and many others have influenced both the subjects to be taught in schools and also the teaching practices. However, a distinction should be made here between the proposed methodology and guidelines from the ministry and the actual day-to-day practice in schools. For instance, regarding IBL, for a long time now a model of traditional teaching with a teacher lecturing and asking questions and passive pupils reply to close questions has been criticised and IBL approaches have been recommended. However, anecdotal evidence shows that teachers do not follow IBL based approaches in their day-to-day teaching due to various reasons related to time constrains, lack of resources, and absence of teacher training.

A major reform in all subject curricula in elementary and secondary school levels in all subjects is currently in progress. The reform started in 2009 and more than 80 university professors and more than 300 teachers participate in the working teams for developing the new curricula. It is actually the first time in the short history of Cypriot schools that Mathematics, Sciences and Technology are approached from a more inquiry based framework and problem solving is a core part of their curricula. The latter is quite important, especially for the MASCIL project, since it provides a venue for MASCIL implementation and dissemination at a country level.

In an attempt to improve the quality of the educational system Cyprus has included the EU Benchmarks. Some of the EU benchmarks and measures that are related to MASCIL objectives are: (a) Reduce the number of early school leavers, (b) Increase the number of graduates of Secondary Education and those with Universities Degrees, particularly in Mathematics, Science and Technology, (c) Increase the number of teachers participating in in-service training seminars, and (d) Increase the participation of adults in Lifelong Learning. Furthermore, the Lifelong Learning Strategy, as implemented with the above measures is aligned, among others, with the national Strategic Development Plan 2007-2013 as well as with the National Reform Programme of Cyprus, the Bologna Process, the Copenhagen Declaration concerning Vocational Education and Training, the European Employment Strategy and the European Human Resource Development Strategy.

Organization of the Education System

Education is under the supervision of the Ministry of Education and Culture. The organization and structure of the Cyprus educational system, as have been shaped since the formation of the Cypriot state resemble those of the Greek system. Specifically, it has the following general levels:

- Primary Education (Pre-primary & primary education)
- Secondary Education (Gymnasium & Lyceum)
- Higher Education (Higher & Tertiary Education)

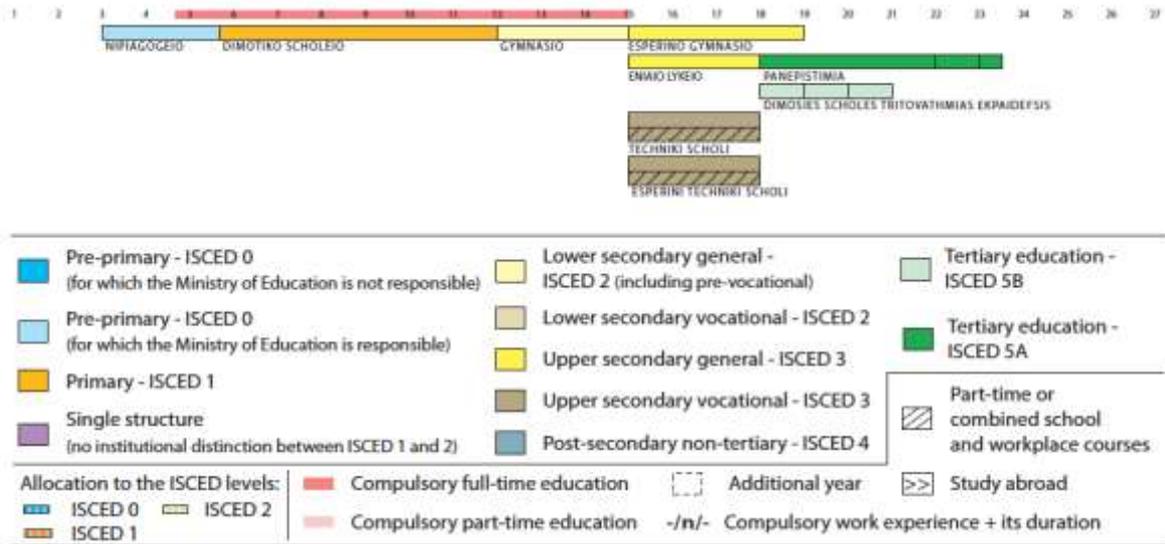


Fig. 1. Organization of the Cyprus Education System.

The Cyprus Educational System has the following main characteristics:

(a) Centralization; The responsibility for the formulation of educational policy rests with the Council of Ministers; The Ministry of Education and Culture is responsible for the administration of all levels, the application of educational laws that govern the operation of education, the preparation of educational legislation and the preparation of the budget on education and culture, which is submitted to Parliament for approval. Also, it determines the Curriculum, the books and the means of education; In the public educational institutions the teaching staff is appointed, promoted and subject to disciplinary proceedings by the Education Service Committee. The said committee promotes also the inspectors and the senior officers of education; The schools are controlled by the Ministry, via the school inspectors and school heads; The Ministry finances the Local School Commissions that are in charge of the construction, maintenance and equipment of school buildings; The private schools are managed by private individuals or bodies, but come under the supervision and control of the Ministry of Education and Culture.

(b) Compulsory Education; All children from the age of 4 years and eight months up to the age of fifteen are obliged to attend school.

(c) Free Education; The public primary and secondary education is free of charge. The

government pays the salaries of teachers, provides books and other material to schools and subsidizes all local Commissions on the basis of the number of registered pupils.

Primary Education constitutes the main and fundamental stage of education, which lays the foundation for the harmonious development of children in the cognitive, emotional and psychomotor sector. The various sectors of the department of Primary Education include pre-primary education (pre-primary schools: state, communal, private), primary education (primary schools in the free and occupied parts of Cyprus), and education for children with special needs (schools for children with special needs and the rendering of individualized help to children with special needs placed in primary schools).

The Ministry of Education and Culture of Cyprus, is responsible for the education of 3-year old children and over. It takes on the responsibility to complement the family's role, to provide ample support and augment the developmental stage of the children and to satisfy their basic needs for an integral personality in an experiential environment, so as to enable them to recognize their capabilities and enhance their self-confidence. From the school year 2004-2005, for children aged between 4 years and 8 months to 5 years and 8 months attendance is compulsory and free of charge, whereas children aged between 3 - 4 years and 8 months who take up vacant places in public institutions, have to pay fees, which are determined by the Ministry of Finance. The State covers all expenses for the functioning of the state institutions and continues to subsidize the functioning of the communal preprimary schools. There are no criteria for attendance.

Attendance in Primary School is compulsory for six years. Children should be at least five years and eight months old, in order to get enrolled in the first grade. The population of primary education for the year 2004-2005 was 57 626. The maximum number of children in classrooms is 25. The school year comprises 180 days, starting early September till late June. Schools operate five days a week with an average of 35 lesson hours per week.

Lower secondary education offers full- time compulsory education to pupils 12 to 15 years of age. Full attendance is also obligatory. A public primary school leaving certificate is required in order to enrol in the gymnasium without entrance examinations. On graduation, the students are awarded the 'Apolyterion Gymnasiou'. During the school year 2004-2005 the number of pupils attending the gymnasia amounted to 28 050 with an average of 25 pupils per class. The school year comprises 180 days, starting early September till late June. Schools operate five days a week with an average of 37 lesson

hours per week.

Upper secondary education consists of Lyceum and Secondary technical and vocational education. The upper secondary education offers a 3-year optional education programmes for pupils aged between 15 and 18. The holders of 'Apolyterio Gymnasiou' may enter a lyceum or a technical school without taking further examinations. During the school year 2004-2005 the number of pupils attending the Lyceum reached 23 303 with minimum 16 and maximum 24 pupils per class. In Lyceum courses are common for all students during the first year and students select courses on their own during second and third year of lyceum. The school year comprises 180 days, starting early September till late June. Schools operate five days a week with an average of 37 lesson hours per week.

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Theme 1: State of affairs-recent changes

Cyprus educational system is currently under reform. This reform covers all school subjects and all education levels, besides vocational education. A reform in vocational education took place quite recently, back in 2008. Current state in Cyprus with regard to this reform is presented below, with regard to wider policy perspectives (macro level), school level (meso-level) and classroom level (micro-level). The potential implications for the work of MASCIL are also considered and discussed in this presentation.

Wider policy perspectives

Although mathematics and science have been acknowledged as very important subjects in the school curriculum (and beyond), mathematics and science education are not prioritized in Cyprus, and consequently there is no priority and/or extra teaching periods for mathematics and science. For a long time there is no lack of scientists in the country and there is a trend among students to follow studies in the Sciences, Medicine, and Engineering, and as a result there has not been any need to further promote Mathematics and Science. However, like in other countries, there is a lack of quality education in these subjects; professionals (in those fields) and university professors often complain about students' knowledge and skills in science and mathematics. School curricula are currently under reform in Cyprus, but still there is no foreseen changes with regard to making mathematics and science education a priority. In concluding, there is no priority given to mathematics and/or science at the school level in Cyprus.

In Cyprus, the Curriculum and the timetable for primary and general lower secondary education schools are scheduled by the Ministry of Education and Culture. It is common for all schools at the same level, but the time allocated to each subject varies, in accordance with the school type (number of teachers). Modern Greek and Mathematics occupy a prominent position in compulsory school. All pupils also study History, Geography, Science, Environmental Studies, English, Art, Music, Physical Education, Design and Technology/Home Economics and Free Activities totalling to 35 teaching periods. In primary school teaching periods for mathematics are 6-7 (in total of 35) and 1-4 for science. In Gymnasium, teaching periods per week (total 37 periods) are 3-4 for mathematics (4, 3, 4 per grade) and 3-5 for science (3, 5, 5). Science covers physics, chemistry, earth science, natural studies, and biology. For upper secondary school level,

teaching periods for mathematics range from 2-4 and 2-5 for science, depending on the specialization students follow.

At a school level, there are no schools specialized in science and/or mathematics and/or technology/engineering. However, the school system after the nine years of compulsory education (last three years of the school system) has a strand on technical education. The certificate awarded at the end of compulsory education is an entrance requirement for upper secondary education. Pupils can attend the school of their choice within their catchment area. Pupils who have not completed compulsory education successfully can enter the labour market or enrol in the Apprenticeship Scheme (Systema Mathiteias). In schools that offer courses leading to the leaving certificate (apolytirio) the general compulsory subjects are the same for all pupils: Greek, Maths, History, Religion, Foreign Languages, and Physical Education. But each one of the 3 grades of upper secondary education has also its own additional compulsory subjects.

The STVE (Secondary Technical and Vocational Education) curricula (scheduled by the Council of Ministers following suggestions given by the Ministry of Education and Culture) offer balanced programmes of general education, technological education and workshop practice subjects. The subjects can be classified into the following six categories: Common Core Subjects; Related Subjects; Elective Subjects; Technological and Workshop Practice Subjects for the Branch; Technological and Workshop Practice Subjects for the Specialty; Industrial Placement. The Apprenticeship Scheme (Systema Mathiteias) provides practical and theoretical training alternately. Practical training takes place in industry, where apprentices are remunerated for their work, for three days per week. Theoretical training is provided on the premises of Technical Schools for two days per week.

As far as the teaching methods are concerned, these are decided by the teachers in cooperation with the inspectors of the Ministry of Education and Culture. Finally, there is no freedom to choose textbooks, since these are chosen by the Ministry of Education. The textbooks are the same for all primary schools and they are sent to schools at the beginning of each school year.

Science and mathematics teachers' education

In general, there is no specific setting and/or advantages for those trained to be mathematics or science teachers. On one hand this is because there is no distinction between those that study mathematics to work for instance in industry or finance and those study mathematics to be mathematics teachers (same for science teachers). Further, there is no pressure on taking policy measures, since there is no lack of mathematics and science teachers. Teachers in state schools have civil servant status. Teachers who work in pre-primary and primary education are University graduates who attended four-year studies. Teachers who work in secondary education are also University graduates who have completed their studies either abroad (the number of years depends on the country) or at a University in Cyprus (four years), state or private. Secondary school teachers have to attend a pre-service training programme. According to the recent, in-service training program launched in 2010, beginning teachers benefit from an induction phase. In school, they cooperate with a mentor-teacher during morning hours. They observe the mentor's classes, have time set aside for discussion between the two, share ideas and materials and generally get as much guidance as possible. The mentor-teacher is able to guide, assist and supplement the beginning teacher.

The Cyprus Pedagogical Institute (CPI) is the official source of teachers' professional development and provides training at its own premises or in schools. Professional development may also be provided by professional organizations (such as the Association of Teachers of Mathematics / Physics), which organise programmes for their members, universities and inspectors. These organizations offer professional development for teachers of their subjects, in order to inform them of policies, reforms in curricula and new didactic approaches. There are no agreed standards for professional development training programmes and participation in courses does not have a significant impact on promotion. Compulsory programmes are only provided for newly appointed primary and secondary head teachers and newly appointed primary and secondary deputy head teachers (Eurybase, The Education System in Cyprus, 2007/08). Professional development training provision in Cyprus is mainly informal, individual and voluntary and has not evolved into structured practices. The education legislation only makes reference to the possibility that "teachers could be asked to attend series of educational courses so as to improve their ability to respond to their duties" (OELMEK, 2004, p. 57). Moreover, teachers need to meet no specific requirements for professional development in order to keep their jobs.

Implementation in the classrooms

In Cyprus, official documents and inspectors from the Ministry of Education and Culture support a 'more contemporary' and IBL based approaches and methods; yet support for the teachers (extra teaching hours; training) is still a significant constraint. Existing (and also new) curricula fully support the adoption and implementation of student centered teaching methods. More specifically, teachers are encouraged to adopt an inquiry and investigative approach in their teaching, take into account student prior knowledge, and focus more on conceptual, rather on procedural knowledge. In science, lab work is emphasized, along with explorations and investigations. The inspectors of the Ministry of Education and Culture also support these teaching approaches. However, day-to-day practice shows that the intended curriculum is not implemented as such, because there is usually too much content to be covered within a small number of teaching periods. Teachers report that the latter, in conjunction with the limited training provided on inquiry based approaches results in a limited implementation of more student-centered methods and active learning.

In primary school teaching periods for mathematics are 6-7 (in total of 35) and 1-4 for science. In Gymnasium, teaching periods per week (total 37 periods) are 3-4 for mathematics (4, 3, 4 per grade) and 3-5 for science (3, 5, 5). Science covers physics, chemistry, earth science, natural studies, and biology. For upper secondary school level, teaching periods for mathematics range from 2-4 and 2-5 for science, depending on the specialization students follow. In concluding, there is no priority and/or extra teaching periods for mathematics and science.

With regard to assessment, there are not any recent (or foreseen) changes in relation to the way science and mathematics are assessed. In the primary school level there is no numerical grading of evaluation results. The theory behind this decision is that children develop at their own pace and it is the duty of the school to help them to enhance their abilities and skills to the highest possible degree. At the primary school level, student assessment takes place in the form of written tests, observations and communication. With regard to written tests, teachers are able to design their own assessment tests on various subjects of the curriculum. They also have at their disposal various books on testing covering the majority of subjects, including Mathematics and Science. These books are published by the Curriculum Development Unit and include a written test for

each unit, which can be used by teachers to assess the degree to which each pupil has been successful in achieving the aims of the unit.

At the lower secondary school level, written assessment is based on: (a) Short written tests. The number and frequency of these are at the discretion of the teacher, (b) Period-long compulsory written tests which are given with notice in each of the three terms, and (c) Written examinations held every year in June in the following subjects: Modern Greek, History, Mathematics and Physics (examinations are prepared at the school level).

At the higher secondary school level and at the vocational school level, written examination is the almost same like in lower secondary school. Among the differences is that although mathematics is required for all three years (10-12), physics is only compulsory for grade 10, while someone can choose physics, chemistry, biology (and other subjects) as optional stream subjects and therefore take final written exams on these subjects. Finally, final examinations at grade 12 are organized at a national level and also served as the entrance examinations for the state universities in Cyprus and Greece.

Constraints in relation to the aims of MASCIL project

In 2011, the Ministry of Education of Cyprus introduced the New Curriculum for public schools in Cyprus, with a new agenda - the emphasis shifting from the acquisition of important skills and knowledge to the development of children's Critical Mathematics and Scientific Literacy. It is a change of paramount importance. IBL (and therefore MASCIL objectives) is clearly promoted in curriculum texts and also in the developed teacher and student materials. However, similar like in other countries, no time has been allocated for the suggested 'discoveries' and 'explorations' promoted in the mathematics and science curricula. The latter, in conjunction with the limited teacher training, is expected to restrain teachers from adopting a more contemporary, IBL based approach in their teaching.

The problem mentioned above is even worse at the upper secondary level, when students are prepared to take the national examinations for entering the universities in Cyprus and Greece (similar with students taking the GCE and TOEFL exams). A strong emphasis on the procedural knowledge, in both mathematics and science, is a crucial component in mathematics and science teaching and learning.

Theme 2: Schooling and the world of work

The core aim of the MASCIL project is to promote a widespread use of inquiry based science and mathematics teaching in primary and secondary schools, with a main emphasis on connecting IBL teaching and learning in the two subjects to the professional world. MASCIL project will target its actions on both general education and vocational education, and their connections to the world of work. Three levels are to be considered: the macro-level in terms of policy orientation, the meso-level in terms of schools/institutions, and micro-level at the classroom settings.

Wider policy perspectives

In general, there is no actual connection between the general education and the world of work, and therefore this 'connection' is not a priority in policy documents. Further, there is no connection between schooling and the world of work in terms of aims and objectives of science and mathematics education. Further, there are no differences between primary and lower secondary education. The Secondary Technical and Vocational Education (STVE) curricula, which are scheduled by the Council of Ministers following suggestions given by the Ministry of Education and Culture, offer balanced programmes of general education, technological education, and workshop practice subjects.

Vocational education is placed in the upper secondary school level. Usually low-ability students choose to follow the vocational education line, and consequently vocational education is not prioritized. Part of the STVE education is the Apprenticeship Scheme (Systema Mathiteias), which provides practical and theoretical training alternately. Practical training takes place in industry, where apprentices are remunerated for their work, for three days per week. Theoretical training is provided on the premises of Technical Schools for two days per week. Vocational guidance is not a separate subject. It has an interdisciplinary character, only for higher secondary school level (technical and vocational education).

Issues regarding schools

There are not any actual connections at the primary and lower secondary school level. Connections, if any, take the form of 'informal links' between schools and providers of informal education. Science teachers often organize visits and fieldwork in science

museums and zoos. For mathematics education this is even more rare. Further, there are no links between general education and vocational education. However, there are discussions at the policy level (still informal) to merge the two schooling lines (general education and vocational education), but these discussions are still at a young stage.

The subjects offered at the STVE education are classified into the following six categories: Common Core Subjects; Related Subjects; Elective Subjects; Technological and Workshop Practice Subjects for the Branch; Technological and Workshop Practice Subjects for the Specialty; Industrial Placement. With regard to upper secondary school level, and more specifically to the Apprenticeship Scheme (Systima Mathiteias), which was presented above, there are strong connections between schools and industry, since students' practical training takes place in industry, where apprentices are remunerated for their work, for three days per week.

Issues regarding classrooms

With regard to mathematics, quite often the examples used in problem solving activities are connected to real world / world of work. However, these problems are not 'real problems', but are rather de-contextualized problems. With regard to science, there are often application problems and lab activities that are related to the world of work, but again very rarely actual problems are included in the curricula.

There is no connection between schooling and the world of work in relation to science and mathematics assessment. Assessment in both subjects is structured around core (pure) concepts from mathematics and science, with no connection to actual problems/world of work. At the vocational school level, written examination is the almost same like in lower secondary school. Among the differences is that although mathematics is required for all three years (10-12), physics is only compulsory for grade 10, while someone can choose physics, chemistry, biology (and other subjects) as optional stream subjects and therefore take final written exams on these subjects. Finally, final examinations at grade 12 are organized at a national level and also served as the entrance examinations for the state universities in Cyprus and Greece.

Usually the teaching methods used in the teaching of mathematics and science are passive (for both subjects), although in policy documents (and reformed curricula) teachers are encouraged to adopt more active and IBL oriented teaching methods. However, as researchers and teachers mention, teacher training is definitely required, if

we aim teachers to implement more IBL oriented approaches, and design and use IBL related materials.

Constraints in relation to the aims of MASCIL project

In 2011, the Ministry of Education of Cyprus introduced the New Curriculum for general education public schools in Cyprus, with a new agenda - the emphasis shifting from the acquisition of important skills and knowledge to the development of children's Critical Mathematics and Scientific Literacy.

Since vocational schools curricula are not under review (last review took place back in 2008), it is really important to implement innovative IBL (and therefore MASCIL related actions and objectives) teaching approaches and use real world problems in the teaching and learning of mathematics and science.

Theme 3: Science and Mathematics curricula and IBL

Cyprus curricula are reviewed under the aim to examine the extent to which they prioritise science and mathematics education, as well as IBL approaches. The review of the curricula is conducted in three levels: in a macro-level in terms of the aims, objectives, content and expected outcomes as envisioned by policy documents, the meso-level that regards how schools mediate the implementation of the policies, and the micro-level that regards the implementation in the classrooms.

Wider policy perspectives

Policy documents, accompanying the new curricula (currently under reform) promote the use of inquiry based learning and teaching in both mathematics and science. There are no differences between primary and secondary school levels, with regard to giving priority to IBL based approaches in the science and mathematics.

Curricula in Cyprus are currently under reform. One of the core aims of the new curricula in Mathematics and Science is the promotion of inquiry based teaching and learning. To this end, the new textbooks (currently under development; only one compulsory textbook

for each grade) are expected to promote IBL in Mathematics and Science. As IBL is among the core aims of the new curricula, teachers are encouraged to be involved in contemporary actions, like those proposed by MASCIL framework.

Issues regarding schools

Especially in secondary school time constrains struggle IBL related approaches, like those proposed by MASCIL. There are specific curriculum units that need to be covered within specific and tight time periods. Further, with regard to national assessment (especially in high school), there are not any IBL related activities and tasks in national assessment tests and therefore all related factors (teachers, students, parents, policy makers) usually expose negative attitudes towards IBL related activities. On the other hand, the lack of national assessment in elementary school makes it more feasible to adopt and implement IBL teaching and learning approaches in Mathematics and Science.

Issues regarding classrooms

Existing (and also new) curricula fully support the adoption and implementation of student centred teaching methods. More specifically, teachers are encouraged to adopt an inquiry and investigative approach in their teaching, take into account student prior knowledge, and focus more on conceptual, rather on procedural knowledge. In science, lab work is emphasized, along with explorations and investigations. The inspectors by the Ministry of Education and Culture also support these teaching approaches. However, the day-to-day practice shows that the intended curriculum is not implemented as such, because there is usually too much content to be covered within a small number of teaching periods. Teachers report that the latter, in conjunction with the limited training provided on inquiry based approaches results in a limited implementation of more student-centered methods and active learning.

Official documents and inspectors from the Ministry of Education and Culture support 'more contemporary' and IBL based approaches and methods; yet support for the teachers (extra teaching hours; training) is a constraint. Student assessment (especially at the secondary school level, both for general and vocational education) is not based on the notion of IBL. Informal assessment at the primary school level (no formal assessment at this school level) might include IBL based activities.

Constraints in relation to the aims of MASCIL project

Especially in secondary school time constraints might struggle actions like those integrated in MASCIL. There are specific curriculum units that need to be covered within specific and tight time periods. MASCIL PD should be very specific (regarding curriculum concepts) in these cases, as IBL approaches should be provided with regard to the corresponding curriculum concepts in that grade(s). Another negative facilitator is national assessment (especially in high school). Currently there are not any IBL related activities and tasks in national assessment tests and therefore all related factors (teachers, students, parents, policy makers) might expose negative attitudes towards IBL related activities. On the other hand, the lack of national assessment in elementary school makes it more feasible to run IBL PD courses and activities implementation in Mathematics and Science.

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

Pre-service teacher training in Cyprus is presented next, with the emphasis placed on the target groups of primary teachers, secondary science and mathematics teachers for both general and vocational schools. Emphasis is also given to the relations between professional development, inquiry based teaching methods and the world of work. Again, three levels are considered: policy-making level, school/institute level and classroom level.

Wider policy perspectives

There is no lack of mathematics and/or science teachers in Cyprus and therefore there is no policy and/or measures to encourage someone to become a mathematics and/or science teacher. In general, there is no specific setting and/or advantages for those trained to be mathematics or science teachers. On one hand this is because there is no distinctions between those that study mathematics to work for instance in industry or finance and those study mathematics to be mathematics teachers (same with science teachers). Further, there is no pressure on taking policy measures, since there is no lack of mathematics and science teachers.

Teachers in state schools have civil servant status. Teachers who work in pre-primary and primary education are University graduates who attended four-year studies. Teachers who work in secondary education are also University graduates who have completed their studies either abroad (the number of years depends on the country) or at a University in Cyprus (four years), state or private.

Secondary school teachers have to attend a pre-service training programme. According to the recent, in-service training program launched in 2010, beginning teachers benefit from an induction phase. In school, they cooperate with a mentor-teacher during morning hours. They observe the mentor's classes, have time set aside for discussion between the two, share ideas and materials and generally get as much guidance as possible. The mentor-teacher is able to guide, assist and supplement the beginning teacher.

Implementation

A Bachelor of Arts (BA) degree is the minimum requirement being a primary school teacher in Cyprus. The four-year degree can be obtained from the University of Cyprus (Department of Education), Greek universities (Departments of Education) and from any other university worldwide. A Bachelor of Arts (BA) degree is the minimum requirement being a primary school teacher in Cyprus. The four-year degree can be obtained from the University of Cyprus (Department of Education), Greek universities (Departments of Education) and from any other university worldwide. If the latter is the case, these candidates for being teachers need to have their degree accredited by the Cyprus Degree Accreditation Agency and take some Modern Greek language examinations. No other specific training on pedagogies or educational sciences is needed for being a primary school teacher. However, a significant number of primary school teachers hold postgraduate degrees (Master of Arts and PhD degrees).

The training of primary school teachers during their bachelor degree studies is based on the model of complementary alternation between theory and practice involving a general approach in educational sciences, including didactics of all teaching domains, lab courses, observation and supervised practice in close relation to theoretical approach. The field experience in school varied between universities from few weeks to a whole semester. In almost all universities in Cyprus and Greece the first three years of teacher training are the same for all students and student choose their specialization in the fourth year between various courses in mathematics, sciences, modern Greek language, arts,

inclusive education and physical education. Although primary school teachers are expected to teach all subjects in primary school, they usually focus their teaching on fewer subjects (especially in large schools).

The training for secondary school teachers is totally different from the training for primary school teachers. The training for lower and upper secondary education is the same. All teachers must have a university degree in one discipline (not specialised in education) equivalent to a four-year bachelor degree. Bachelor degree holders who would like to work as teachers need to participate in a one-year pre-service training course, currently offered by the University of Cyprus (since 2007). Before 2007, the course was offered by the Cyprus Pedagogical Institute. During this course, which takes place 1-2 years before their recruitment, candidate teachers have courses on subject didactics, on pedagogies, on psychology, on assessment and evaluation, and on core subject courses. Teachers also have a field experience course in schools four days a week for a whole semester.

Prospective primary school teachers' training aims to train teachers to "help the child to adapt smoothly to the wider school environment, to include itself in the society with comfort and safety and to secure, maintain and promote its healthy growth in all respects (intellectual, social, sentimental, moral, religious and aesthetic) to the maximum possible extent , depending on the stage of maturity' (Curriculum, Ministry of Education and Culture, p. 39).

Secondary school level training has an overarching goal is to provide pupils with general education within more flexible, comprehensive- teaching structures which prepare pupils for subject selection at the lyceum level. Through general education, with an emphasis on humanities (social sciences, physical sciences and aesthetics), it is expected that learners will have the opportunities to develop autonomy as a skill for lifelong learning, self-monitoring and self-direction and self- fulfillment. Further, the upper secondary school level, is characterized by focusing on general education (including technological and economy education) and developing a multifaceted personality by: a) the didactic process and the various pedagogical activities which nurture a wide range of skills and types of thought such as: critical thinking, creativity and originality, imagination, observation, cooperation, problem solving and coping with a variety of situations, analysis skills, and writing skills, and b) developing skills and attitudes so that a youth can cope with the challenges of the modern world as a pupil and later as a citizen.

Teachers' voice

Results from the data collected through the interviews revealed that teachers are aware of IBL and are in favour of inquiry based teaching and learning, although they underlined a number constraints. Results showed that teachers have IBL related experiences as part of their undergraduate studies, and specifically courses on problem solving in mathematics and the use of IBL and informal education settings in the teaching and learning of science.

Teachers reported various reasons for participating in IBL related courses. Among the most reported reasons was teachers' willingness to be educated in contemporary topics in their subject, the value they place in lifelong learning, and the need to cope with new developments in the teaching and learning in mathematics and science. Quite interesting was their willingness to participate in future training events, and specifically in training sessions that focused their agenda on the use of inquiry based approaches in mathematics and science and on connecting the subjects with real world applications and the world of work. Finally, with regard to connecting the teaching and learning of mathematics to the world of work, almost all teachers reported that it is important for students to acquire skills and competences needed for the world of work during schooling, and they underlined that such connection should take place in both general and vocational education.

Constraints in relation to the aims of MASCIL project

The minimum prerequisites for being a mathematics and science teacher in Cyprus is a bachelor degree in educational studies for elementary school teachers, and a bachelor degree and one year pedagogical studies course for secondary school teachers. Further, more than 30% of teachers hold master degrees. Their studies, in conjunction with a number of IBL related courses at the university level, appropriately equipped teachers to acknowledge the benefits from IBL based pedagogies and approaches and therefore to welcome MASCIL activities.

Pre-service teachers are to be contacted through existing and new courses that will be implemented at the University of Nicosia. In-service teachers will be contacted through master courses and through the in-service training courses, currently offered by the Cyprus Pedagogical Institute. Director of the Vocational Education at the Ministry of Education and inspectors of Vocational Education will assist the research team in

designing and promoting IBL approaches and activities that connect school and the world of work.

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

In-service teacher training (PD) in Cyprus is presented next, with the emphasis placed on the target groups of primary teachers, secondary science and mathematics teachers for both general and vocational schools. Emphasis is also given to the relations between professional development, inquiry based teaching methods and the world of work. Again, three levels are considered: policy-making level, school/institute level and classroom level.

Wider policy perspectives

The minimum prerequisites for being a mathematics and science teacher in Cyprus is a bachelor degree in educational studies for elementary school teachers, and a bachelor degree and one year pedagogical studies course for secondary school teachers. Further, more than 30% of teachers hold master degrees. Their studies, in conjunction with a number of IBL related courses at the university level, appropriately equipped teachers to acknowledge the benefits from IBL based pedagogies and approaches and therefore to welcome MASCIL activities.

There are no agreed standards for professional development training programmes and participation in courses does not have a significant impact on promotion. Compulsory programmes are only provided for newly appointed primary and secondary head teachers and newly appointed primary and secondary deputy head teachers (Eurybase, The Education System in Cyprus, 2007/08). Compulsory programmes are only provided for newly appointed primary and secondary head teachers and newly appointed primary and secondary deputy head teachers (Eurybase, The Education System in Cyprus, 2007/08).

Professional development training provision in Cyprus is mainly informal, individual and voluntary and has not evolved into structured practices. The education legislation only makes reference to the possibility that “teachers could be asked to attend series of educational courses so as to improve their ability to respond to their duties” (OELMEK, 2004, p. 57). Moreover, teachers need to meet no specific requirements for professional

development in order to keep their jobs. There are no agreed standards for professional development training programmes and participation in courses does not have a significant impact on promotion. Compulsory programmes are only provided for newly appointed primary and secondary head teachers and newly appointed primary and secondary deputy head teachers (Eurybase, The Education System in Cyprus, 2007/08).

Implementation

There is no systematic in-service training for teachers in tertiary education, either at the university or non university (public or private) levels. In the past, the task of providing opportunities for teacher development was the responsibility of the Primary and Secondary Inspectors. However, in-service training became more systematic with the establishment of the Pedagogical Institute. The training is conducted either by experienced teachers who have been seconded to the Pedagogical Institute, members of the permanent staff of the Institute, highly-qualified individuals from the private sector and academics from universities or experts from abroad.

The Cyprus Pedagogical Institute (CPI) is the official source of teachers' professional development and provides training at its own premises or in schools. Professional development may also be provided by professional organizations (such as the Association of Teachers of Mathematics / Physics), which organise programmes for their members, universities and inspectors. These organizations offer professional development for teachers of their subjects, in order to inform them of policies, reforms in curricula and new didactic approaches.

Compulsory courses are provided for the newly appointed primary and secondary head teachers and deputy head teachers, and for newly recruited teachers (induction programme). The Institute organised optional seminars (each seminar comprising 5 afternoon sessions and adding up to a total of 15 teaching periods) for all subjects, including seminars for mathematics, science, ICT in mathematics and in science etc.

Teachers' voice

Results from the data collected through the interviews revealed that the majority of teachers are in favour of inquiry based teaching and learning, although they all underlined a number of institutional, curricular and managerial constraints.

Results showed that teachers participate in a limited number of compulsory professional training events. These events varied a lot; for primary school teachers these training events might include didactics training on various subjects (including mathematics and science), new curricular approaches and teaching methods, like inquiry, explorations, problem solving, and the use of technology. Same topics are covered in the compulsory training provided for secondary school teachers. With regard to training events in which teachers participate on a voluntary basis, teachers reported that quite often participate in such events. Among the topics covered in courses teachers reported that participated are the use of complex problems in the teaching of mathematics at the primary and high school level, the use of Geogebra and other technological tools in the teaching of mathematics, and the use of IBL approaches in the teaching of mathematics and science.

Teachers reported various reasons for participating in such courses. Among the most reported reasons was teachers' willingness to be educated in contemporary topics in their subject, the value they place in lifelong learning, and the need to cope with new developments in the teaching and learning in mathematics and science. Quite interesting was their willingness to participate in future training events, and specifically in training sessions that focused their agenda on the use of inquiry based approaches in mathematics and science and on connecting the subjects with real world applications and the world of work.

It should be noted, however, that teachers' participation in such events is not an easy process. All teachers reported various constraints with regard to their participation in such events. Constraints include, among others, (a) the lack of time; almost all training takes place during afternoons and weekends, and thus makes it difficult for teachers to participate, (b) support by school and inspectors; sometimes schools and inspectors are not supportive in implementing more innovative approaches in the teaching of mathematics and science, like IBL and open-ended real world problems.

With regard to students' awareness of IBL approaches and methods, the results of the interviews revealed that many teachers were aware of IBL and quite often they try to implement IBL based approaches and methods in their teaching. Some teachers have received related training in IBL as part of their undergraduate and/or postgraduate studies, while others have received training in courses that have been offered as part of other initiatives (e.g., research projects). Teachers reported a number of benefits from using an IBL approach in their teaching. These benefits include opportunities for students to think critically, use their skills, collaborate with their classmates, document their results

and communicate, solve complex problems, and appreciate the use of mathematics and science concepts in solving real world problems.

Teachers have reported various constraints with regard to implementing IBL in their teaching, including: (a) time; IBL activities need a lot of time to be implemented and this makes the implementation of IBL too difficult, (b) students are not familiar with IBL and sometimes it is difficult for them to work in groups, and (c) designing and implementing IBL activities requires a lot of preparation and high managerial skills during classroom implementation.

Finally, with regard to connecting the teaching and learning of mathematics to the world of work, almost all teachers reported that it is important for students to acquire skills and competences needed for the world of work during schooling, and they underlined that such connection should take place in both general and vocational education. Teachers reported that there were not any real world problems and open investigations in current textbooks, and that was a major constraint. The use of informal education settings does not exist in the teaching and learning of mathematics, while the use of informal education is also limited in the teaching and learning of science and it is restricted to the willingness of a teacher to take such initiatives.

Constraints in relation to the aims of MASCIL project

The minimum prerequisites for being a mathematics and science teacher in Cyprus is a bachelor degree in educational studies for elementary school teachers, and a bachelor degree and one year pedagogical studies course for secondary school teachers. Further, more than 30% of teachers hold master degrees. Their studies, in conjunction with a number of IBL related courses at the university level, appropriately equipped teachers to acknowledge the benefits from IBL based pedagogies and approaches and therefore to welcome MASCIL activities.

Pre-service teachers are to be contacted through existing and new courses that will be implemented at the University of Nicosia. In-service teachers will be contacted through master courses and through the in-service training courses, currently offered by the Cyprus Pedagogical Institute. Director of the Vocational Education at the Ministry of Education and inspectors of Vocational Education will assist the research team in designing and promoting IBL approaches and activities that connect school and the world of work.

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PART 2: EMERGING ISSUES FOR REFLECTION

Equity specific issues

Data from international studies in which Cyprus has participated have not revealed any gender inequalities. The first time Cyprus has participated in PISA study was in 2012 and the corresponding results have not been released yet. However, Cyprus participated in TIMSS 1995, 1999, 2003, and 2007 studies, and in general the findings showed that girls usually perform better than (or equal to) boys, in both mathematics and science.

Specifically, in the TIMSS 1999 study there was no significant difference between lower secondary school boys' achievement and girls' achievement. In Mathematics, boys' and girls' results were 479 and 474 respectively, while their results in Science were 465 and 455 respectively. Further, in TIMSS 2003 study, the results for the 8th grade revealed that girls' achievement in mathematics (474) was statistically significantly better than boys' achievement (458). At the 4th grade, boys scored higher than girls. The achievement averages were 496 and 504 respectively. In science, girls outperformed boys in life science (448, 427) and in chemistry (446, 439) (both differences were statistically significant), while boys scored higher only in physics (451, 448) (this difference was not significant).

With regard to whether gender specific issues are prioritized (or not) in policy-making documents and the national curriculum, gender issues are prioritized in policy-making documents and the national curriculum documents. While gender equality was not expressed as a goal of the education system at present, in the recent reform of the education system, the gender dimension was integrated in the new public school curriculum. Although in the national policy documents there are references to different economic, cultural, and other differences, there are no references to gender inequalities, making it clear that Cyprus has progressed quite a lot with regard to gender issues. It should be also noted that in the new curricula (among other policy documents) both genders are indicated (different female and male nouns).

With regard to professional development, IBL and gender issues, in primary education, student teachers receive lectures and courses, as part of their undergraduate studies. It could be further noted that a UNESCO Chair on Gender Equality and Empowerment has recently been established at the University of Cyprus. Similar training is also provided for secondary school teachers, as part of their pre-service training, which focuses on

didactics, psychology, gender studies, and classroom management topics. Every teacher receives training in didactics of mathematics and/or science, and impact of affect on teaching and learning, and when it comes to IBL there is usually emphasis on gender issues, and how teachers can effectively deal with gender differences, as to make the best possible learning environment for both genders.

Addressing low achievement

With regard to primary school level, there is data from both national and international studies (TIMSS). According to the national survey conducted annually for the identification of the functional illiterate students (for Mathematics and modern Greek), students from the following groups are more likely to be included in the 'at risk' groups: (a) Boys, (b) students that enter schools before the age of six, (c) foreign students, and (d) students with low self-esteem. For the 3rd grade students, the percentages of very low achievers were 7.5% for both Mathematics and Greek, while for 6th graders the percentages for Mathematics and Greek were 6.9% and 5.5% respectively. With regard to data collected in TIMSS international study, the 2003 results revealed that in Mathematics, 11% of the 4th grade population did not meet the low international benchmark (400), while the respective percentage in the 1995 study was 21%. Similarly, the 2003 results for Science showed that 14% of students did not meet the low international benchmark, while the corresponding percentage for the 1995 study was 26%.

At the secondary school level, collected in TIMSS international study, the 2003 results revealed that in Mathematics, 23% of the 8th grade population did not meet the low international benchmark (400), while the respective percentage in the 1995 study was 18%. Similarly, the 2003 results for Science showed that 29% of students did not meet the low international benchmark, while the corresponding percentage for the 1995 study was 28%. Results from all TIMSS studies, in which Cyprus participated, showed that low achievers (in both Mathematics and Science) usually come from homes with low socioeconomic background, their parents have not completed secondary education, and have limited resources at home, such as books and computer/internet equipment and facilities.

Low achievement is prioritized in policy-making documents. Both at the primary and secondary school level, very low achievers (illiterate students) in mathematics and

science participate in focus groups (usually groups of less than 6-8 students or on an individual basis), in which they received teaching at a lower level, than the one they should do. Of course, as the European Commissioner for Education mentioned, policy-makers need to do more to help schools tackle low achievement in mathematics and science, according to two reports presented by the European Commission in November 2011. The report on mathematics education revealed that only five European countries (England, Italy, the Netherlands, Ireland and Norway) have set national targets to boost achievement levels, although a majority of EU Member States provide general guidelines to address pupils' difficulties in this area. The report on science showed that no Member States have specific national support policies for low achievers, although five countries (Bulgaria, Germany, Spain, France and Poland) have launched programmes to tackle low achievement in general. The reports conclude that although much has been achieved in updating mathematics and science curricula, support for the teachers responsible for implementing the changes is still lacking.

With regard to professional development and undergraduate studies, this is an issue related to the programme of studies in each university. However, with regard to the pre-service training programme offered by the Cyprus Pedagogical Institute for secondary school teacher, emphasis is placed on tackling low achievement and on how teachers can provide extra assistance and support for low achievers. However, this emphasis is not necessarily connected or related to IBL, but it rather takes place on a more general level.

Promoting entrepreneurship

Entrepreneurship education is not explicitly recognized. However, in the new curriculum for ISCED 1-3, to be implemented in the school year 2011/12, emphasis is given on attributes, skills and working methods that enhance entrepreneurial behaviour as a cross-curricular objective. Furthermore, one of the goals of the Ministry of Education and Culture during the last years has been to incorporate elements of entrepreneurship as part of other subjects such as science and economics. To get familiar with this basic aim of the New Curriculum and the ways for developing these skills and attributes, the Ministry of Education and Culture set for this academic year, 2011/12, the aim 'Our school – A workshop for developing critical thinking, creativity and collaboration' (CF circular). According to a circular, schools should be workshops of learning, where students have

the chance to raise problems and in collaboration with their peers and their teachers seek and find solutions. Schools are asked to achieve this goal, by working out an action plan.

Every year, one or two aims are described in a circular and guide the work of schools throughout the year. In the school year 2005/06 for ISCED 1, an emphasis was given to entrepreneurship education. Apart from defining the meaning and explaining basic elements, certain activities were proposed such as visits to businesses, role plays and other educational games. Moreover, a lecture with the title 'Entrepreneurship in primary education' was presented to all head teachers of ISCED 1 by the First Education Officer of Primary Education.

There are various actions that promote the entrepreneurship education. In ISCED 3 (2nd year), students follow a profession of their choice for a week, in order to gain professional related experiences. Further, the Enterprise Day programme takes place 2-3 times a year, and it gives the students the opportunity to get familiar with the workplace and daily activities of a businessman. A new programme has been introduced in some schools, called *Simulation Samples of Enterprises*. During a whole year, students are divided into groups to work on a specific subject of entrepreneurship, building their own understanding of what an enterprise is. The University of Cyprus in collaboration with the Ministry of Education and Culture conducts an annual competition on entrepreneurship for students of ISCED 3 (2nd and 3rd year).

Collaboration with the National Advisory Board (NAB)

The two appendices and the transcripts from the interviews with teachers have been communicated to the National Advisory Board (NAB) for feedback and comments. All comments and suggestions, and additional material have been integrated in the first version of the document and the revised version of the report is presented in the current document.

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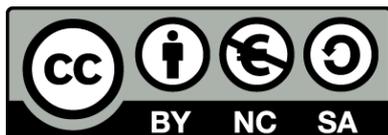
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