European Commission

Eurydice Report

Developing Key Competences at School in Europe:

Challenges and Opportunities for Policy

2011/12

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FOREWORD

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INTRODUCTION

The need to improve the quality and relevance of the skills and competences with which young Europeans leave school has been recognised at EU and national level. The urgency of addressing this issue is further underlined by the current situation in which Europe faces high youth unemployment and, in some cases, serious skills mismatches.

In recent years, the concept of key competences has gained prominence in European education systems. Most European countries have made significant progress in incorporating the key competences into national curricula and other steering documents ([1]). There have been positive developments in defining specific learning outcomes and work is underway in developing a range of assessment tools to support the learning process ([2]). The European Policy Network on the Implementation of the Key Competences (KeyCoNet) analyses emerging initiatives for the development of the key competences ([3]). However a number of challenges remain. One of them relates to the need for a more strategic approach in supporting the key competences approach at school. A second one is related to the efforts to enhance the status of the transversal competences (digital, civic and entrepreneurship) as compared to the traditional subject-based competences. Furthermore there are the imperatives of lowering the proportion of low achievers in the basic skills (mother tongue, mathematics and science) and encouraging more young people to pursue higher-level studies and careers in mathematics, science and technology (MST).

This cross-country report has been produced in support of the European Commission's Communication on *Rethinking Education* ([4]). The main objective of the report is to present the findings on some of the challenges that European countries face in the implementation of the key competences approach, and to identify problem areas and common obstacles. Based on research evidence and national practices, the report will also outline a range of measures that have the potential to effectively address these challenges.

The comparative analysis is organised in five chapters that address the following questions:

- Chapter 1: How do countries support the development of the key competences approach?
- Chapter 2: How do countries implement the new competence-based curricula?
- Chapter 3: How do countries assess the key competences?
- Chapter 4: How do countries tackle low achievement in schools?
- Chapter 5: How do countries encourage young people to pursue further study and careers in mathematics, science and technology?

Each chapter concludes with a section on policy challenges and possible responses. These concluding sections are, in turn, brought together in the Key findings section.

Definitions and scope

Eight key competences have been defined at EU level, which represent a combination of knowledge, skills and attitudes that are considered necessary for personal fulfilment and development; active citizenship; social inclusion; and employment ([5]):

([1]) Joint Progress Report of the Council and the Commission on the implementation of the Education & Training 2010 work programme, Key competences for a changing world, January 2010.

([2]) Commission Staff Working document, Assessment of key competences in initial education and training: Policy Guidance, 2012.

([3]) http://keyconet.eun.org

([4]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Rethinking Education: Investing in skills for better socio-economic outcomes', 2012.

([5]) Recommendation 2006/962/EC of the European Parliament and the Council of 18 December 2006 on key competences for lifelong learning, OJ L 394, 30.12.2006.

- communication in the mother tongue;
- communication in foreign languages;
- mathematical competence and basic competences in science and technology;
- digital competence;
- learning to learn;
- social and civic competences;
- sense of initiative and entrepreneurship;
- cultural awareness and expression.

This report, however, does not cover the key competences of learning to learn and cultural awareness and expression.

Across Europe, the adoption of the broad concept of key competences has been accompanied by a number of variations in the specific terms and the exact content of the set of competences or skills that are being developed. Depending on the country and context, policy documents make reference to 'core competences', 'basic' or 'key' skills and other similar terms. In this report, the terms competences and skills will be used as synonyms.

Methodology

This analysis builds on the findings from recent Eurydice reports that focus on specific key competences. These reports include extensive reviews of the academic literature, national policy documents, and the results of international surveys (PISA, PIRLS, TIMSS and ESLC). The comparative analysis of national policies is based on national responses to questionnaires developed by the Eurydice and Policy Support Unit within the Education, Audiovisual and Culture Executive Agency. National information has been collected at the level of central education authorities and therefore does not include data about practices at school level or small scale projects. Information from the following Eurydice reports has been extensively used:

- *Teaching Reading in Europe: Contexts, Policies and Practices.* Eurydice, 2011.
- *Mathematics Education in Europe: Common Challenges and National Policies.* Eurydice, 2011.
- *Science Education in Europe: National Policies, Practices and Research.* Eurydice, 2011.
- *Key Data on Learning and Innovation through ICT at School in Europe*. Eurydice, 2011.
- *Entrepreneurship Education at School in Europe: National Strategies, Curricula and Learning Outcomes.* Eurydice, 2012.
- *Citizenship Education in Europe*. Eurydice, 2012.
- *Key Data on Teaching Languages at School in Europe*. Eurydice, 2012.

The other main sources of information for this report are the 2012 Eurydice country overviews on the implementation of the six key competences covered by this study. Information is provided on 31 Eurydice Network countries (the EU Member States, Croatia, Iceland, Norway, and Turkey). The information covers compulsory and secondary general education (ISCED levels 1-3). The year of reference is the school year 2011/12.

KEY FINDINGS

This analysis of current national policies to support young people's acquisition of the key competences, as defined in the European Framework of Key Competences for Lifelong Learning, highlights a number of encouraging policies and positive developments. It also highlights four challenges that must be overcome if the key competences agenda is to be successful, make a major contribution to economic growth and jobs, and help European countries keep pace with the changing demands for skills. Taking into account their national context and priorities, education authorities have a range of policy options at their disposal to address each of these challenges.

Towards a more strategic approach in improving students' competences

- This analysis reveals that European countries have adopted different approaches to guide and support the development of the key competences approach. A number of countries or regions have launched, or are in the process of developing, national strategies to improve teaching and learning, either across the full range of key competences or by focusing on specific skills. The majority of countries have developed national strategies for at least three key competences – almost all have put in place national strategies that address the development of digital and entrepreneurship competences.
- At the same time, it appears that despite concerns about skills levels and the political commitment at EU level to raise achievement, around one third of European countries have not developed a national strategy for any of the basic skills (mother tongue, mathematics and science), and half of the countries do not have a national strategy for foreign languages.
- In the absence of a national strategy, almost all countries have put in place centrally coordinated initiatives to promote specific key competences. Overall, large-scale initiatives are more commonly observed for mother tongue and science, while they are less frequent for the remaining key competences.
- While a national strategy is not a prerequisite for the introduction of reforms, it could be argued that in certain contexts, and especially where there is a need for a significant improvement or rapid transformation, there might be a rationale for adopting a more strategic and comprehensive approach. A strategy or action plan containing clearly defined policies and goals for improvement, together with a timeframe for completion, may help mobilise effort and bring about the substantial changes needed. It may also allow a range of actions (curriculum reform, teacher education and professional development, or support for low achievers) to be implemented across the whole education system.

Further support needed for the development of transversal or cross-curricular competences

- Transversal or cross-curricular competences such as in ICT, entrepreneurship and civics are widely integrated into the curriculum at primary and secondary levels. In one third of European countries, however, the focus on entrepreneurship education does not start until secondary level.
- European countries tend to combine several approaches to delivering transversal competences: they can be taught as a stand-alone subject, as part of a wider curriculum or

learning area and they can also be delivered across the whole curriculum where all teachers share responsibility for delivery.

- Although integration is widely promoted through the curricula established by central authorities, the actual extent to which the transversal competences are integrated into other subjects should not be overestimated. For instance, several recent international surveys attest to a low level of integration with respect to digital competences in the teaching of mathematics, science and languages, even in countries where computer availability is high. Some experts highlight the need for specific guidelines and support for teachers to better integrate transversal competences into other subjects. The clarification of the learning outcomes associated with each relevant curriculum area is considered to be particularly important.

- Assessment can play a significant role in improving the quality and relevance of the skills that are acquired at school. A number of national initiatives have been designed to develop assessment methods which can capture the complexity of the whole range of key competences and can measure students' ability to apply their knowledge in context. A further focus on better integrating the transversal competences in all types of assessment would contribute to strengthening the coherence of the learning process and emphasise the equal importance attributed to all key competences.

- Across Europe standardised national tests, which are used for summative or formative purposes, or for monitoring the education systems, focus on the basic skills, especially the teaching of the mother tongue (or the language of instruction) and mathematics, and to a much lesser extent science and foreign languages. Among the transversal competences, only civic and social competences are tested through nationally standardised assessment. One significant development in recent years has been the increase in the number of countries that organise national tests in the social and civic competences.

Tackling low achievement in the basic skills (mother tongue, mathematics and science)

- The majority of European countries provide national guidance to help teachers address students' difficulties in the basic skills. However, according to PIRLS 2006 data, for instance, the proportion of students who receive additional support varies greatly among EU countries, and on average it is lower than the actual percentage of low achievers.

- Research findings indicate that effective measures to tackle low achievement must be comprehensive, addressing a range of factors in and out of school, and they must be timely. Further focus is needed on early interventions, children at risk, and effective use of assessment for improvement. Individualised support, including by specialised teachers, who are currently available in only a minority of European countries, could also be strengthened.

- Teachers' competences in dealing with students with a range of abilities and interests are essential in tackling low achievement. Research affirms the importance of access to effective initial education and professional development which allows teachers to select and use the appropriate methods and strategies to suit the topic, the type of student and the particular learning context. Another important factor is the availability of qualified primary teachers who have solid foundations in teaching reading and mathematics-related knowledge and skills for teaching.

- Effectively addressing low achievement also depends on the use of evidence from research, evaluations and impact studies to inform new policy decisions. Information gathering on classroom practices, research into the effectiveness of specific teaching methods and the evaluation of support measures are not always carried out in a structured and systematic way. Currently, only a minority of countries have set national targets for reducing low achievement in basic skills.

Improving student motivation to learn mathematics, science and technology and encouraging the take-up of careers in these fields

- International surveys and research confirm the link between motivation, attitudes and self-confidence, on the one hand, and achievement and career choices, on the other. Motivation to learn mathematics and science is not only important for performing well at school, but is also necessary if students are to choose careers vital for the competitiveness of our economies.
- Education authorities and business organisations in a number of European countries have expressed concerns regarding skills shortages in mathematics, science and technology (MST) related fields and the take-up of MST fields in higher education. Some of these shortages also impact on the availability of qualified mathematics and science teachers at secondary level.
- In the European Union, on average, the proportion of graduates in MST fields, as compared to the total number of graduates, has declined from 24.4 % in 2001 to 21.4 % in 2010. Compared to 2001, the majority of countries have experienced a decrease in the share of MST graduates.
- Measures that are taken to redress this situation include: support for teaching methods that improve engagment; strenghening partnerships with science centres where professionals provide information on careers and act as possitive role models; general awareness campaigns; and the adoption of specific measures at tertiary level. Another important action is to widen the provision and improve the quality of both MST-related and gender-sensitive careers guidance to encourage students to choose careers in these fields, while also emphasising the employment opportunities available in these areas. Currently specific guidence to encourage careers in science exists in half of the European countries studied.
- National initiatives to improve student motivation to learn mathematics and science often involve individual projects focusing on extra-curricular activities or partnerships with universities and companies, but large-scale initiatives covering all school levels (from primary to upper secondary) and including a wide range of actions are not very common.
- The majority of initiatives to encourage motivation often concentrate on high achievers and do not target the broader student population. In addition, specific measures rarely focus on vulnerable groups such as underperforming boys; students with low socio-economic background; immigrants and minorities with difficulties in, for example, reading; and girls with respect to their under-representation in the areas of mathematics, science and technology.

CHAPTER 1: HOW DO COUNTRIES SUPPORT THE DEVELOPMENT OF KEY COMPETENCES?

Supporting the development of key competences is a complex process. It involves introducing or adapting policies to improve the quality of education and to ensure that learning and teaching continues to reflect the needs of both individuals and society. The process takes place at several levels and involves a range of different bodies. In many countries an important element is the introduction of a strategic and coherent approach to improving students' knowledge, attitudes and skills in the form of a national strategy, action plan or similar policy. While such an approach is not a pre-condition for undertaking reforms, its adoption may indicate to the education community that a particular issue is considered a government priority. A national strategy or plan can also bring together a number of actions such as curriculum reform, teacher education and professional development or support for low achievers, and it can address a variety of educational issues in a comprehensive way. In addition, a national strategy can provide direction and guide efforts at local and school level, whilst taking into account developments such as growing decentralisation and school autonomy. The absence of a national strategy might indicate that central authorities consider that local bodies are best positioned to direct activities in the field; or it may simply indicate that a national strategy has either run its course, or is still in the development stage.

Strategies that guide and support the implementation of key competences may differ in scope. They may be confined to a particular stage of education and training, cover all levels of the education and training system, or extend to society as a whole. This last option, widest in scope, is most usually applied to areas relating to literacy and information and communications technology (ICT). A strategy may take the form of a specific policy focusing on the development of key competences or it may be part of a broader legal, regulatory or policy framework relating to education, youth and culture, lifelong learning or other general government programme. In the latter case, the emphasis given to one or more key competences can vary considerably.

This chapter first provides an overview of the scope and objectives of existing strategies ([1]). It then concentrates on strategies that deal with a single competence and those that include two or more competences. Finally, the chapter reviews the existence of large-scale initiatives to promote key competences in the absence of a national strategy. Policy measures that deal mainly with tackling low achievement are presented in detail in Chapter 4. The following sections summarise the different approaches and provide some country specific examples. Additional country examples of national strategies and large-scale initiatives are included in Annex 1, which also contains information on national strategies currently being developed.

([1]) The key competences of learning to learn and cultural awareness and expression are not discussed in this report.

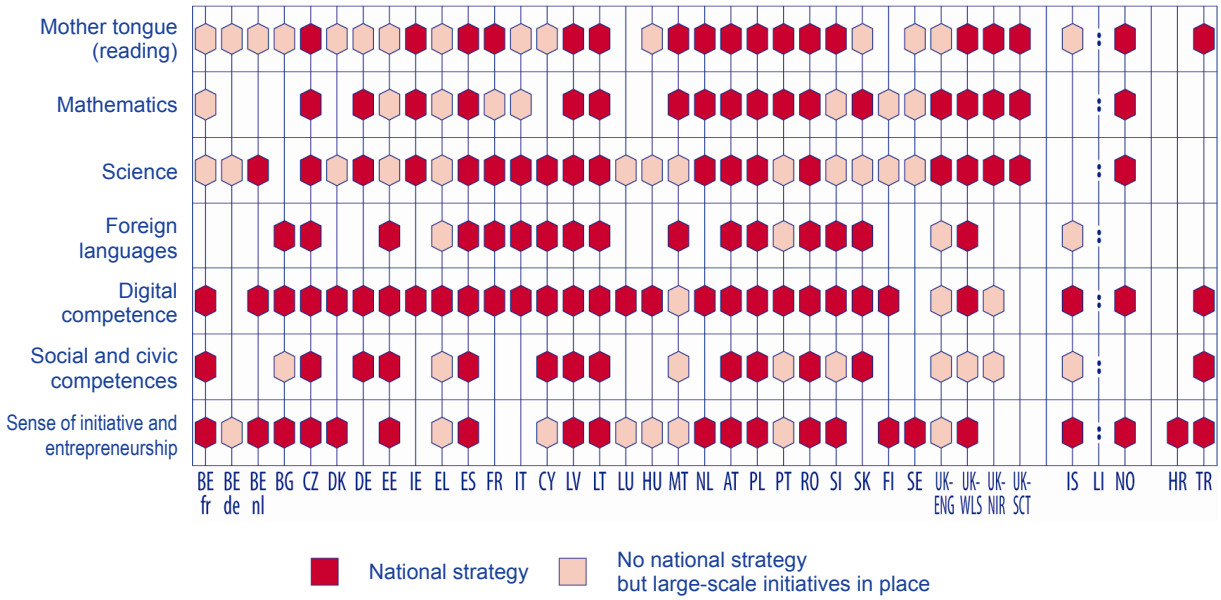
1.1. National strategies to promote key competences

European countries (or regions) have adopted different approaches in supporting the acquisition of key competences. Depending on the countries and the key competences concerned, national strategies may concentrate either on a single competence or they may cover two or more key competences.

The majority of countries have developed national strategies for at least three key competences (see Figure 1.1). The objectives of national strategies and the groups targeted vary according to the key competence(s) concerned. Generally, strategies directed at reading aim to improve literacy levels and promote good reading habits, and usually target society as a whole. In strategy documents for mathematics, science and technology, concerns about the decreasing number of graduates in these fields seem to be the main driving force for European countries. The most common aims mentioned in these strategies are to: promote a positive image of science; improve knowledge of science in general; improve school-based science teaching and learning; raise pupils' interest in science subjects and consequently increase the uptake of science studies at upper secondary and tertiary education levels; strive for a better gender balance in MST studies and professions; and provide employers with the skills they need, thereby helping to maintain competitiveness.

The most common educational aims in strategy documents on digital competence are to improve the integration of ICT in teaching and learning, equip pupils with the necessary ICT skills, provide ICT training for teachers and improve the ICT infrastructure in schools.

Figure 1.1: Existence of national strategies to promote key competences in general education (ISCED 1 and/or 2-3), 2011/12



Source: Eurydice.

Country specific notes

Czech Republic: There is only an overarching strategy which includes general measures to support key competences.
Sweden: The large scale initiative for reading concerns only ISCED levels 1 and 2.

1.2. Examples of national strategies

National strategies may concentrate on one or more of the key competences. Poland has introduced a national strategy which incorporates objectives for all the key competences defined in the 2006 Recommendation ([2]). Spain, Lithuania and Austria are some other countries with strategies that include actions to promote all or most of the key competences.

In **Poland**, the Strategy for the Development of Education in the years 2007-2013 envisages curriculum changes whereby more emphasis is given to the development of key competences to help the employability prospects of future graduates. As a result, the new core curriculum (2008) has taken on a new approach and is organised around key competences such as learning to learn, communication, mathematical thinking, etc.

In **Spain**, the Organic Act on Education 2/2006 (LOE) included, for the first time, the term 'basic competence' in the education regulations establishing that the 'curriculum is understood as the set of objectives, basic competences, contents, pedagogic methods and assessment criteria'. The State regulations developed by the LOE setting the common core curriculum for compulsory education for the whole State have defined eight basic competences and have described how each area or subject contributes to the development of these basic competences. Specific strategies for mother tongue (reading), foreign languages, science, digital competence and sense of Initiative and entrepreneurship have also been put in place.

The promotion of reading, mathematics, science, foreign languages, civic education and entrepreneurship are mentioned in **Lithuania's** Provisions of the National Education Strategy 2003-2012. The objectives set for basic skills are to reduce by half the percentage of 15 year-old students who fail to achieve the minimal level in reading, writing, arithmetic, natural and social sciences; and to reduce the relative difference between the number of males and females graduating in mathematics, informatics, natural sciences and technology studies at least by half. The core curricula have been re-organised on the basis of seven key competences: learning to learn, communication, cognition, initiative and creativity, social, personal and cultural competences. Lithuania also has specific strategy documents for reading literacy and entrepreneurship.

National strategies which target two or three key competences are also common. These strategies generally focus on basic skills and address competences in mother tongue and mathematics, or the broader competence of mathematics, science and technology.

Mother tongue

Literacy skills are usually the focus of attention with respect to children's competency in their mother tongue (or the language of instruction). In around half of European countries, national strategies or action plans for reading are in place; these often focus on promoting reading as a lifelong learning activity.

In **Portugal**, the national reading literacy strategy promotes a set of initiatives: reading in the family; health and reading; television advertisements related to reading; the slogan 'READ+' ("*Ler* +"), with activities in different institutions such as public libraries, cultural associations, etc. ([3]).

In other cases, countries have put in place specific educational literacy strategies that concentrate on acquiring literacy skills in the mother tongue, mainly in the school context. As mentioned above, in a number of countries literacy strategies are combined with numeracy strategies.

In **Ireland**, the National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020 aims at ensuring that every child leaves school having mastered literacy and numeracy skills. It sets out a wide-ranging

([2]) Recommendation 2006/962/EC of the European Parliament and the Council of 18 December 2006 on key competences for lifelong learning, OJ L 394, 30.12.2006.

([3]) http://www.planonacionaldeleitura.gov.pt; http://www.iplb.pt

programme of reforms in initial teacher education and professional development for teachers and school principals. It also promotes greater parental and community involvement, commitments to students with additional learning needs and reforms in the content of the curriculum at primary and post-primary levels in order to achieve these vital skills.

Mathematics and science

National strategies that are specifically devoted to either mathematics or science are not very common. It is more usual for countries to develop broader strategies incorporating objectives for both subject areas. In many cases, these strategies aim to encourage students to pursue further studies or choose careers in MST fields with a view to meeting the needs for skilled staff in the workforce (see also Chapter 5).

In **Portugal**, the Ministry of Education and Science launched the Plan of Action for Mathematics (*Plano de Ação para a Matemática* – PAM), in 2006/07. In the 2011/12 school year, the following issues are still being addressed: 1) generalisation of the mathematics curriculum; 2) development of a database of educational resources for mathematics; 3) evaluation of mathematics textbooks; and 4) the development of school projects focused on the improvement of students' mathematics learning (from the 1st to the 9th grade).

In the **United Kingdom (Wales)**, the 2012 document 'Science for Wales: A Strategic Agenda for Science and Innovation in Wales' addresses the role of science in education, and highlights areas which are of particular concern. The role a good science education at school plays in ensuring that young people go on to further science study and careers is discussed, as is the problem of the decline in numbers of pupils taking STEM subjects (Science, Technology, Engineering and Mathematics) at GCSE and A level.

In the **Netherlands**, the *Platform Bèta Techniek,* commissioned by the government, education and business sectors, works towards preventing skills shortages in MST fields. The initial aim was to achieve a 15 % increase of students in scientific and technical disciplines. This target has been reached. The strategy, started in 2004, was evaluated in 2010 and has a new timeframe lasting until 2016. The objective is not only to make careers in science more appealing, but also to introduce educational innovations that improve motivation and challenge young people. There are specific programme lines for primary and secondary education, vocational and higher education. Activities target schools, universities, businesses, ministries, municipalities, regions and economic sectors. The main objective is to ensure that the future supply of knowledge workers will meet future demand, but the programme also seeks to make certain that talented professionals already in the job market are more effectively deployed. Particular attention is paid to girls/women and ethnic minorities.

Foreign languages

Less than half of European countries (or regions), have a national strategy in place to encourage the development of foreign language skills. One example is the long term programme in foreign languages that has been introduced in Spain.

The Comprehensive Programme for Learning Foreign Languages (2010-2020) implemented by the **Spanish** Ministry of Education, Culture and Sport in collaboration with the Autonomous Communities, focuses on the promotion of language learning from an early age, and is the first comprehensive public policy for improving knowledge of languages. In addition, the Plan for Boosting the Learning of Foreign Languages aims at fostering improvements in foreign language learning.

Civics and entrepreneurship

Similarly, less than half of countries have developed national strategies for 'social and civic competences', although national strategies to develop a 'sense of initiative and entrepreneurship' are more common. Some examples of strategies implemented by countries in these two areas are given below:

In the **French Community of Belgium**, a Parliamentary Decree from 2007 aims to strengthen education for active and responsible citizenship at school. According to this decree, a comprehensive approach to citizenship education which includes organising interdisciplinary thematic activities, creating student representatives bodies at school and the teaching of several topics within various subjects should be implemented in primary and secondary schools. The decree also provided for an expert commission of academic and teaching staff which, in 2009, published a reference document entitled 'Being and Becoming a Citizen' as well as pedagogical tools for teaching and evaluating citizenship education in upper secondary education.

In **Denmark**, the Strategy for Education and Training in Entrepreneurship (2009) was developed through a partnership between four ministries: the Ministry of Science, Innovation and Higher Education, the Ministry of Culture, the Ministry of Children and Education and the Ministry of Business and Growth. The strategy describes an active investment in entrepreneurship training at educational institutions. In future, laws, executive orders and performance/development contracts will address education and training in entrepreneurship wherever relevant, involving every level of education, earmarking funds and included entrepreneurship in the management of educational institutions.

In **Norway**, the Action Plan Entrepreneurship in Education and Training – from compulsory school to higher education 2009-2014 was launched in September 2009. The main objective of the action plan is to strengthen the quality and the scope of entrepreneurship education and training at all levels and in all areas of the education system. More generally, the education system is seen as vital for the development of a culture for entrepreneurship and a creative society. Training in entrepreneurship can help students to become acquainted with local working and business life, and by striving for a better collaboration between the education system and working life, local workplaces can be used as contexts for learning.

Digital competence

Contrary to the picture for the other key competences, almost all European countries have a specific national strategy related to digital competence. These strategies may be wide-reaching, encompassing several areas such as e-Government, infrastructure and broadband connectivity, ICT security and e-Skills development along with ICT in schools, or they may focus exclusively on ICT in education. In the majority of the countries with a national strategy on the use of ICT in education, there is also a general national ICT strategy.

1.3. Large-scale initiatives to promote key competences

In the absence of a national strategy, almost all countries have put in place centrally coordinated initiatives to promote specific key competences. Most commonly, these large-scale initiatives aim at increasing interest in the respective subject area, via national campaigns, large-scale projects, school partnerships and others ([4]). It should be noted that many countries which have developed national strategies for key competences also have several related initiatives or measures in place.

Overall, in countries without national strategies for certain key competences, large-scale initiatives are more commonly observed for the two basic skills of communicating in the mother tongue and science, while they are less frequent for mathematics and the remaining key competences. It is quite common for initiatives promoting science and mathematics to be focused on secondary education (ISCED levels 2-3).

Large-scale initiatives for the promotion of reading literacy may target wider society or they may focus on specific groups such as children and adolescents. When the emphasis of the initiative is on children, parental involvement in the process is usually encouraged. In their attempts to improve the

([4]) Initiatives that mainly target talented students such as competitions and olympiads are not taken into account in this analysis.

levels of reading literacy and promote interest in reading, European countries have developed a wide range of activities, the most common being national campaigns or projects on particular themes. For example, national or children's book weeks, days dedicated to national or official languages in which various activities are held, or the promotion of school visits to libraries.

As is the case with reading, almost all countries without a national strategy for the promotion of science have put initiatives in place to support the development of science skills. Many of these initiatives are aimed mainly at increasing interest in the field; they often include projects, programmes and school partnerships involving a wide range of activities, as well as the establishment of science centres.

Initiatives to promote a 'sense of initiative and entrepreneurship' most commonly take the form of developing small business projects, setting up model mini-enterprises, and encouraging cooperation between schools and businesses to develop the entrepreneurial spirit of students as well as to familiarise them with the world of business.

1.4. Towards a more strategic approach to supporting the development of key competences

This analysis reveals that European countries (or regions) have adopted different approaches to guide and support the development of key competences. The majority of countries have developed national strategies for at least three key competences, while almost all countries have national strategies that address challenges related to the acquisition of digital and entrepreneurship competences.

Despite concerns, however, about performance in reading, mathematics and science, and the shortage of skills in some areas, around one third of European countries do not have a national strategy in place for any of the basic skills. Similarly, despite the challenges posed by globalisation, around half of the countries studied have no national strategy to improve foreign language learning.

It is true that European countries are continuing to introduce reforms and improvement measures in the area of key competences and these can, and often are implemented outside of the framework of a national strategy. However, it could be argued that in certain contexts, and especially where there is a need for significant improvement in areas such as basic skills or foreign languages, there might be a rationale for adopting a more strategic and comprehensive approach. A strategy or action plan developed by a national or regional government containing clearly defined policies and goals for improvement, together with a timeframe for completion, may help mobilise effort and bring about the substantial improvements needed. It may also enable a range of actions to be implemented across the whole education system, bringing with it dedicated funding to support the schools and students experiencing the greatest difficulties.

CHAPTER 2: HOW DO COUNTRIES IMPLEMENT THE NEW COMPETENCE-BASED CURRICULA?

Education authorities in all countries issue guidelines on what should be taught or learnt in schools. Usually these guidelines are included as part of curriculum documents or syllabuses. In recent years, reforms in many countries have reshaped curricula on the basis of new concepts such as 'key competences' and 'learning outcomes' and some have introduced achievement scales. In many countries, a subject-based organisation with a focus on subject content has given way to a more complex curricular architecture built, in part, on practical skills and cross-curricular approaches. In addition, new curriculum areas have been either introduced or given a higher profile in many European curricula. This is notably the case with entrepreneurship education, ICT and citizenship education.

This chapter first examines very briefly the impact of the new concepts on curriculum development. It then outlines the variety of curricular approaches being adopted for the teaching of the transversal competences. Finally, the chapter discusses some implications of the new curricula for school organisation and culture, teacher education and professional development ([1]), working practices and classroom management. This last section focuses particularly on the transversal competences which present the greatest challenge for schools. Issues concerning the process of assessment are discussed in Chapter 3.

2.1. New concepts shaping modern curricula

All European countries have revised their curricula during the last decade (EACEA/Eurydice, 2011b, 2011c, 2011d). This section focuses on two new concepts that have impacted on curriculum development and implementation.

2.1.1. The shift to the learning outcomes approach

Learning outcomes are concerned with learner achievement rather than the objectives of the teacher; they are usually expressed in terms of what the learner is expected to know, understand and be able to do on completion of a level or module (Adam, 2004). The European Qualifications Framework (EQF) uses a similar definition, describing the content of learning outcomes in terms of knowledge, skills and competences ([2]).

In many countries, recent reforms were triggered by the need to bring curricula more closely in line with the key competences approach.

> For instance, recent reforms in the **Czech Republic**, **Spain, Italy** and **Lithuania** have largely reshaped the curriculum on the basis of the 'key competences' concept. In the **Czech Republic**, the new curriculum, implemented in schools since 2007, aims at developing life skills and preparing students for everyday life. In **Spain**, the State regulations which define the core curriculum for each stage of education (2006) define eight basic competences; these are the essential learning which must been developed by students by the end of compulsory education. In **France** too, the Common base of Knowledge and Skills (2006), which is the guiding Framework for teaching in compulsory education, identifies seven major skills. This document stresses the importance of developing abilities built from knowledge.

([1]) Generally on policy developments regarding the teaching professions, see Commission staff working document, Supporting the Teaching Professions for Better Learning Outcomes, 2012.

([2]) Recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European qualifications framework for lifelong learning, OJ C111, 6.05.2008, pp. 1-7.

2.1.2. The use of achievement scales

In a minority of countries, learning outcomes describing different levels of attainment are arranged in a scale of progression. Teachers use achievement scales to assess students' work and obtain information to guide their teaching and students' learning. These tools are also used to provide information about student progress and educational achievement to educators, parents or policymakers.

> In the **United Kingdom** (**England**), for instance, the curriculum for English as a subject includes 'programmes of study' and 'attainment targets'. Programmes of study set out what students should be taught in English at key stages 1, 2, 3 and 4 and provide the basis for planning schemes of work. The curriculum for English has three achievement scales defined for three broad 'attainment targets': 'speaking and listening', 'reading' and 'writing'. Each scale contains eight performance levels describing the knowledge, skills and understanding expected of students aged 5 to 14. There is a ninth level corresponding to exceptional performance. A typical student should pass from one level to the next every two years ([3]). However, the government is planning to introduce a new National Curriculum from 2014, which would remove and not replace the current system of levels and level descriptions. Instead the new programmes of study should emphasise what pupils should know and be able to do, setting out the content that each child should be expected to master each year. Some form of pupil grading in mathematics, science and English would still be required to recognise the achievements of pupils and to provide for a focus on progress. The Government is considering further the details of how this would work.

In 2001, the Council of Europe provided all stakeholders involved in foreign language teaching and learning with a tool that provides a good example of what a broad achievement scale looks like. The Common European Framework of Reference for languages (CEFR) gives a comprehensive description of the competences necessary for communication in a foreign language, the related knowledge and skills and the different contexts for communication. It defines six levels of proficiency: A1 and A2 (basic user); B1 and B2 (intermediate user); C1 and C2 (proficient user) ([4]). Its main aim is to facilitate transparency and comparability in the provision of language education and qualifications. It has a wide variety of users including curriculum planners, assessment designers, language learners and teachers.

In the majority of European countries, the CEFR is used to establish the minimum attainment levels in foreign language proficiency. In most countries, a particular level of attainment is set for the end of a particular stage of education (e.g. end of compulsory education, end of upper secondary education, etc.). In most countries, these levels are different depending on whether they apply to the first or the second foreign language learnt by students. Not surprisingly, the expected level for the second foreign language is usually lower as the period of time spent learning it is generally shorter. At the end of compulsory general education, the minimum level generally varies between A2 and B1 for the first language and between A1 and B1 for the second. At the end of upper secondary education, the minimum level of attainment ranges between B1 and B2 for the first foreign language and between A2 and B2 for the second. Luxembourg has set particularly high levels of language proficiency. In this country, the first two foreign languages learnt from the very beginning of primary education – i.e. German and French – become languages of instruction, which requires from students a high level of language proficiency.

Some countries have set different levels of proficiency for different skills. For example, in Finland, even though the curriculum does not explicitly specify that priority should be given to any of the four main skills, the expected level for receptive skills (listening and reading) is higher than for productive

([3]) See description levels at http://curriculum.qca.org.uk/index.aspx

([4]) http://www.coe.int/t/dg4/linguistic/cadre_en.asp

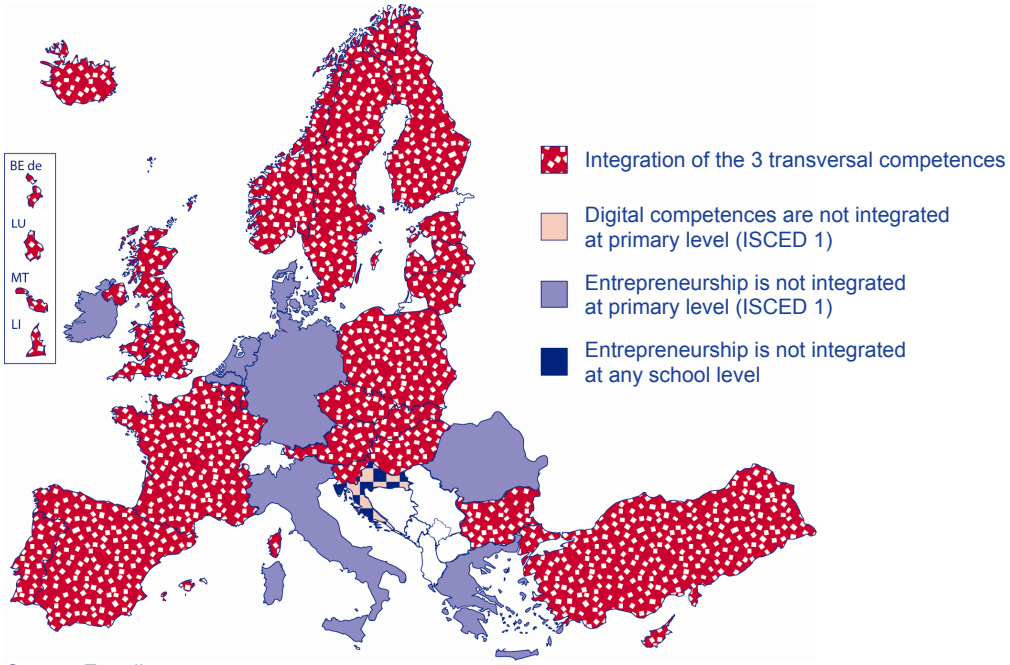
skills (speaking and writing). The logic is that language skills naturally develop from receptive skills to productive skills. In Belgium (Flemish Community), it is the opposite: the expected level for productive skills is higher.

2.2. Curriculum organisation – approaches to the transversal competences

In contrast to the basic skills (mother tongue (or language of instruction), mathematics and science), transversal competences, such as citizenship and entrepreneurship and, to a lesser extent, ICT skills, are not associated with school subjects that derive from traditional academic disciplines. Encouraging the development of these skills is nevertheless equally important in the context of our knowledge-based, globalised and fast-evolving societies. The following analysis looks at whether transversal competences are integrated into national curricula across Europe and, if so, how this is achieved.

In most countries, citizenship, entrepreneurship and ICT education are integrated into the curriculum for primary and secondary education (see Figure 2.1). However, nine European countries do not explicitly recognise entrepreneurship in central steering documents at primary level and the national curriculum for ISCED level 1 in Croatia does not refer to digital competences. This changes significantly at secondary level with respect to entrepreneurship, where virtually all countries, except Croatia, integrate this competence into the curriculum in some form.

◆◆◆ **Figure 2.1: Integration of digital, civic and entrepreneurship competences into national curricula (ISCED 1-3), 2011/12**



Source: Eurydice.

Country specific note

Belgium (BE nl): Even though entrepreneurship is not explicitly recognised in the national curriculum for ISCED 1, there are a few learning outcomes related to pupils' general knowledge of the world of work and business.

◆◆◆

There are three main ways in which the transversal key competences may be integrated into the curriculum in primary and secondary education: they may have cross-curricular status, they may be integrated into existing curriculum subjects or they may be introduced as separate curriculum subjects.

Where the transversal key competence is given a **cross-curricular status**, related learning objectives or outcomes are incorporated into the parts of the curriculum that are not subject-bound. They are often included in sections dedicated to cross-curricular objectives, themes or competences. Alternatively, they may be included in introductory sections devoted to general objectives or, in some cases, a distinct cross-curricular learning area is designated which all teachers have a duty to implement.

> For instance, in the 2007 national curriculum of the **United Kingdom** (**Northern Ireland**), the area of learning 'Personal development and mutual understanding', which address elements of citizenship, should be implemented at primary level through a variety of learning opportunities provided during play and in planned activities/topics in all curricular areas.

Indeed, a cross-curricular status implies that all the different learning areas and subjects constituting the curriculum should contribute to the acquisition of the related competences. Regarding teaching of digital competences, in particular, it requires teachers across the different curriculum subjects to use ICT as a tool for demonstration purposes and students to use it to perform specific tasks.

Transversal competences may also be **integrated into existing curriculum subjects**. Where this occurs, learning objectives or outcomes related to digital, civic or entrepreneurship competences feature within the specific curricula for these subjects. The choice of subject is relatively consistent across countries, although some differences are apparent. For instance, the subjects which incorporate citizenship education are mostly the social sciences, history, geography, languages, and ethics/religious education; but sciences and mathematics, as well as physical and artistic education are also mentioned by some countries. ICT is in most cases taught as part of a technology subject. Entrepreneurship education is generally addressed at primary level by social sciences, but also by mathematics, natural sciences and technology. At secondary level, social sciences is still the locus of entrepreneurship education in many countries, but the subject areas most likely to incorporate it are economics, business studies and careers education.

Finally, a specific subject can be wholly dedicated to one of the transversal competences, which is expressed here by the 'separate subject' label.

At **primary level** (ISCED 1), a majority of countries award a cross-curricular status to civic and entrepreneurship competences (see Figure 2.2). The cross-curricular status is even more widespread in the case of digital competences, with only Bulgaria, Romania and Croatia not having adopted this approach. The cross-curricular status is the only approach used for the development of digital and entrepreneurship competences in 17 and 15 education systems respectively. Almost all countries incorporate elements of civic competences into a variety of subjects, whereas this is less common in the case of digital and entrepreneurship competences; with 15 countries using this integrated approach for digital and only 10 for entrepreneurship competences. Finally, for each of the transversal competences under consideration, less than a third of countries offer a separate subject approach. In the case of entrepreneurship competences, only Slovakia provides a separate subject at this level of education.

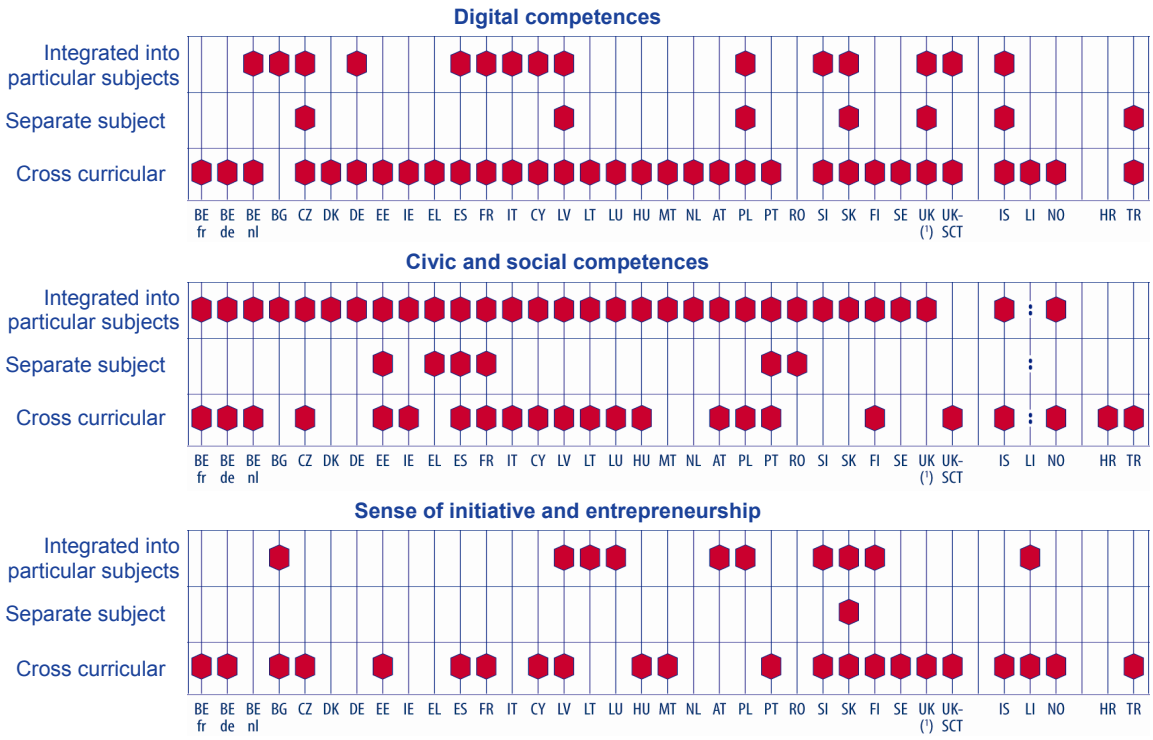
Explanatory note (Figure 2.2)

Both compulsory and optional subjects are taken into account. The use of the term competence does not imply that all aspects of the knowledge, skills and attitudes included in the European Qualifications Framework are covered by national curricula.

'Integrated into particular subjects' means that subject curricula not wholly dedicated to transversal competences do, nevertheless, contain related learning objectives or outcomes.

Transversal competences have a cross-curricular status where the related learning objectives or outcomes are mentioned in the parts of the curricula which are not subject-bound, such as the introductory sections on general objectives; sections on cross-curricular objectives, themes or competences; or cross-curricular learning areas.

Figure 2.2: Approaches to delivering transversal key competences, as specified in national curricula for PRIMARY education (ISCED 1), 2011/12



Source: Eurydice.

UK (1): UK-ENG/WLS/NIR

Country specific notes

Belgium (BE fr): The cross-curricular element for social and civic competences arises from the recommendation that school heads should organise interdisciplinary activities related to education for active and responsible citizenship throughout ISCED levels 1 to 3.
Germany: For citizenship education, the Figure shows existing policies agreed between *Länder*. The situation may differ at *Land* level.
Romania: Although no particular teaching approach is recommended for digital competences, there is a general reference to the use of ICT in national curriculum for primary education.
Finland: As schools have full autonomy for implementing entrepreneurship, practice varies. Normally, however, it is integrated into general subjects such as social studies; schools may also organise separate entrepreneurship courses.
United Kingdom (ENG/WLS/NIR): Cross-curricular approaches apply to Wales and Northern Ireland. In England, the non-statutory citizenship programme of study at primary level may be delivered as a separate subject, integrated into other subjects or taught on a cross-curricular basis.
Turkey: For the purposes of comparison with other countries, grades 1 to 5 can be treated as ISCED 1, and the 6th, 7th and 8th grades can be treated as ISCED 2, although formally there is no ISCED level 2 in the Turkish education system.

At **general secondary level** (ISCED 2-3), the transversal competences have a stronger presence in national curricula compared to primary level in relation to each of the teaching approaches considered here (see Figure 2.3). The cross-curricular and integrated approaches can each be found in a majority of countries for all competences, while there is more variation in the number of countries adopting the separate subject approach for the three transversal competences. Separate subjects on citizenship education and ICT are both widespread since they can each be found in around two thirds of countries at secondary level. In Norway, however, the distinct subject incorporating elements of citizenship education 'Pupil council work' introduced in 2007 will be removed from the curriculum from 2012/13, and its content will be integrated into other subjects, social studies in particular. Compared to the two other competences, teaching entrepreneurship education as a separate subject is less common. So far, ten countries have introduced this approach, the subjects concerned being compulsory only in Lithuania, Poland and Romania. Two more countries (Estonia and Ireland) have planned to start

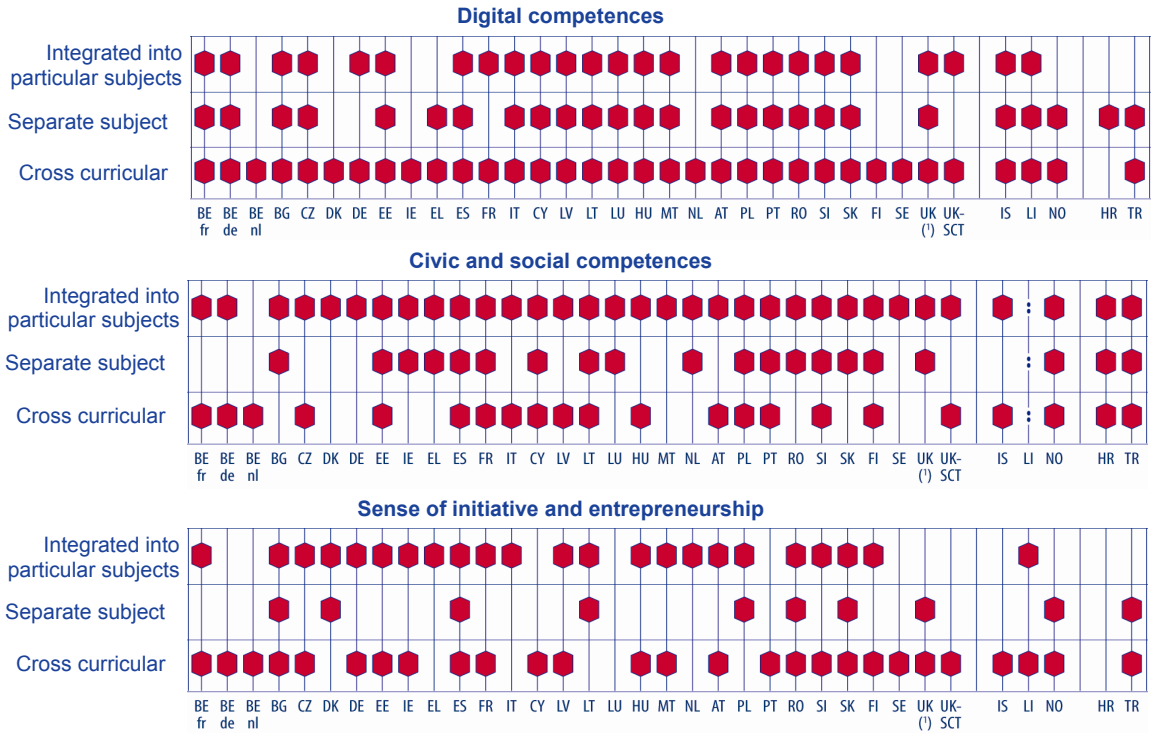
offering similar separate subjects at upper secondary level in the near future, whilst Spain intends to widen the provision of a separate subject at lower secondary level.

In **Estonia**, an optional separate subject 'Economic and business studies' will be offered not later than from 1st September 2013.

In **Ireland**, the National Council for Curriculum and Assessment has developed a senior cycle short course on enterprise; the implementation of which in the curriculum is subject to on-going discussion with education stakeholders.

In **Spain**, education authorities in the Autonomous Communities were already free to implement a separate subject from 2011/12, but as of 2014/15, all schools will have to offer a new elective subject 'Professional guidance and entrepreneurial initiative' in the 4th grade of lower secondary education.

Figure 2.3: Approaches to delivering transversal key competences, as specified in national curricula for GENERAL SECONDARY education (ISCED 2-3), 2011/12



Source: Eurydice.

UK (1): UK-ENG/WLS/NIR

Explanatory note

See explanatory note to Figure 2.2. These approaches to transversal competences may apply to either lower or upper secondary education, or to both.

Country specific notes

Belgium (BE fr), Germany, Finland and **United Kingdom (ENG/WLS/NIR)**: See note to Figure 2.2.
Czech Republic: The provision of a separate subject focused on citizenship education at ISCED levels 2 and 3 depends on the given school.
Spain: Entrepreneurship education is a separate subject in ISCED 2-3 only in some Autonomous Communities.
Portugal: In ISCED 3 (first year), entrepreneurship education may be included as one of the topics of the subject 'Civic training', depending upon the school board's decision.
United Kingdom (ENG/WLS/NIR): The separate subject at secondary level applies to England.

As seen throughout this section, European countries have been working towards developing transversal competences in schools. In order to reach their objectives, they have reformed their curricula in a way that usually combines several approaches and subjects. For instance, across primary and secondary levels of education, transversal competences are rarely taught only through the separate subject approach. Where the separate subject approach does exist, it is usually complemented either by integrating elements related to transversal competences into other subjects, or by awarding the competence a cross-curricular status; in some cases both these approaches contribute. Consequently, a large proportion of subject teachers are expected to contribute to the delivery of citizenship, ICT and entrepreneurship. Such requirements pose challenges in terms of school organisation, which are further discussed in Section 2.3.

2.3. From new curricula to new practices

Implementing the curriculum is a challenging task for teachers and education staff (Glatthorn, A. A., Boschee, F. A., and Whitehead, B. M., 2006; Ornstein, A., and Hunkins, F., 1998).Recent changes to curricula in Europe pose new difficulties. Education approaches based on key competences and learning outcomes, which today shape a growing number of curricula in Europe, imply important shifts in the way teaching is envisaged. In the same way, teaching effectively new – or relatively new – curriculum areas, such as entrepreneurship education or ICT, positioned in the curriculum as cross-curricular subjects or integrated into other subjects, requires particular teaching approaches as well as changes to school organisation and culture. Teaching cross-curricular subjects requires that teachers work in close collaboration, crossing boundaries of traditional subjects. In practical terms, this means that teachers need to work together in order to develop the school curriculum or parts of it, discussing assessment standards and exchanging information about the learning development of specific students.

These changes in working practices and teaching approaches might be more difficult to achieve in countries where the curriculum has a strong tradition of subject-based organisation and where teachers are specialised in one academic subject only, which is often the case in secondary education. Initial education and professional development of teachers can play a major role in helping teachers develop new working habits, skills and techniques. However, education authorities need to make the necessary financial resources available to schools so that they can provide time and space for teachers to meet and work together.

In many European curricula, the development of transversal competences is conceived as a collective process within schools, to which all teachers should contribute. The allocation of responsibilities throughout this process should not be neglected. Indeed, as some experts warn, giving all teachers a shared duty for developing transversal competences might lead to a situation where nobody feels responsible (Van Woensel, 2010). In this respect, developing clear guidelines on how transversal competences should be taught within the boundaries of given subjects, or providing teachers with an overview of the principal relationships between competences and particular learning areas or subjects, might contribute to a more effective implementation of competences (Roca and Sánchez, 2008).

For the effective acquisition of transversal competences, teachers need to design integrated learning activities that allow pupils to progress towards the learning outcomes of more than one competence at the same time. For instance, mathematics teachers may be expected to improve students' reading skills by highlighting the specific language patterns which are critical for the understanding of a mathematics text (Shanahan and Shanahan, 2008). The development of tasks that incorporate several learning objectives or outcomes crossing traditional subject boundaries calls for a clear definition of all relevant curriculum areas and the contribution each makes to transversal competences.

Recent data on the use of ICT in teaching across the curriculum provide a good example of some of the potential difficulties in adopting a cross-curricular approach. In most countries, ICT is used in the curriculum as a tool for teaching and learning other subjects – either as a general tool or as a tool for carrying out specific tasks. In some cases, ICT is only used for this purpose; it is offered neither as a separate subject, nor is it taught within the boundary of a technology-related subject. Significantly, the latest data from TIMSS (2007) reveal that across the European Union, the primary and secondary teachers of around half the student population do not use computers for activities during mathematics or science lessons, even where computer availability is high (EACEA/Eurydice, 2011a). More recent data collected in the context of the European Survey on Languages Competences (2012) also highlight the fact that ICT is regularly (i.e. at least few times a month) used during language lessons only for a significant minority of students (less than 20 %) (EACEA/Eurydice, 2012d). The low level of integration of digital competences into the teaching process might be due to the lack of specialised knowledge and skills among teachers, but it may also occur because of their attitudes toward ICT; as some teachers might consider it as no more than a support for teaching which they can put aside in order to focus on the content of their specialist subject. Teachers therefore need to be provided with or encouraged to develop precise and tangible learning outcomes or objectives related to the development of digital competences in the context of other subjects.

It appears that the integration of transversal key competences into other subjects such as civics (most countries) or entrepreneurship (a majority of countries) presents challenges for effective teaching. Learning outcomes or objectives must be sufficiently developed and made explicit in the curriculum of the host subject. Where this does not occur, there is a danger that the transversal key competences are given less attention, especially in school systems where the curriculum is still very much organised on a subject basis.

CHAPTER 3: HOW DO COUNTRIES ASSESS STUDENTS IN KEY COMPETENCES?

Student assessment forms an integral part of the teaching and learning process and is an essential tool for improving the quality of education. Across Europe, student assessment takes a variety of forms and uses different assessment instruments and methods. The models used may be internal or external, formative or summative, and results can be used for different purposes (EACEA/Eurydice, 2009; OECD, 2011).

What is taught in schools is often determined by what is assessed; particularly where the assessment results are used for high stakes purposes. The nature and content of the assessments could determine the nature of teaching and learning and may limit the use of more innovative modes of teaching (Burkhardt, 1987; NCETM, 2008). Assessment is also a crucial aspect in the implementation of the key competences ([1]).

This chapter firstly examines the extent to which the key competences are assessed in national tests during compulsory education and how this is carried out ([2]). The data analysed relates to all types of tests, regardless of whether they are used for summative or formative purposes, or for the monitoring of education systems and whether they are administered to the whole student population or only to a sample of students. The second section of this chapter reviews other forms of assessment used to evaluate performance in some of the transversal or cross-curricular competences. Finally, the chapter discusses some of the implications of current assessment practices for the development of key competences.

3.1. The scope of national testing

The national testing of students, which in this analysis is defined as the national administration of standardised tests and centrally set examinations, is a widespread practice in European education systems (EACEA/Eurydice, 2009). Currently five countries or regions (Belgium (German-speaking Community) ([3]), Czech Republic, Greece, and the United Kingdom (Wales)) do not administer any national tests in compulsory education. The United Kingdom (Wales) and the Czech Republic plan to introduce such tests from 2013 and 2014 respectively. In addition, education authorities in Italy, Lithuania, Romania and the United Kingdom (England) plan to add new national tests in specific school years.

The results of national tests are used to award certificates, and/or to monitor and evaluate schools or the system as a whole. National tests are less frequently used for formative purposes i.e., to identify the specific learning needs of students. National tests may be taken by all students, or they may be administered to only a sample of students ([4]).

Following the gradual shift in national curricula from subject knowledge to a competence-based approach, some national tests have adopted an explicit emphasis on competences. This trend is probably best reflected in the situation in Hungary and Spain. In the Hungarian National Assessment

([1]) Commission Staff Working Document, Assessment of key competences in initial education and training: Policy Guidance, 2012.

([2]) The analysis focuses on compulsory education where the majority of national tests take place. The final examinations at the end of upper secondary general education are not considered here due to the diversity of provision in different branches of education and the great variety and combinations of compulsory and elective areas of study.

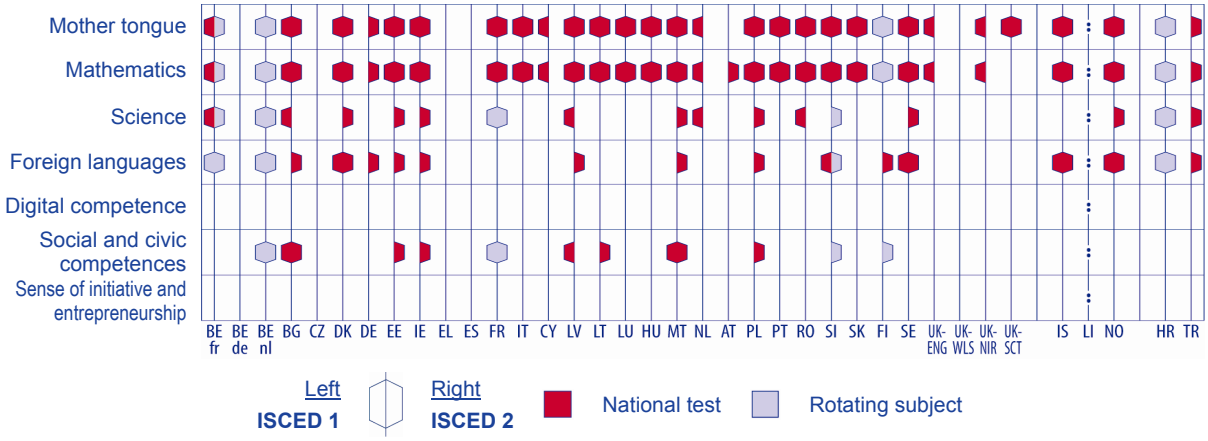
([3]) In Belgium (German-speaking Community), all 15-year old students participate in the PISA tests.

([4]) For further information on the objectives, organisation and use of national tests results, see EACEA/Eurydice, 2009.

of Basic Competences (NABC), evaluation concentrates not on the subject material itself but on whether students are able to use their knowledge and skills in reading and mathematical literacy in real life situations. Furthermore, Spain has defined eight 'basic competences' and some of them have been evaluated in national tests. Finally, in France, from 2013, the *diplôme national du Brevet* (DNB) at the end of ISCED 2 will include a validation of all the competences in the Common Base of Knowledge and Skills.

As Figure 3.1 shows, in most European countries, standardised national assessments in compulsory education focus on the basic skills, especially mother tongue (or language of instruction) and mathematics, and to a much lesser extent science, foreign languages and social and civic competences.

Figure 3.1: Key competences assessed through national testing (ISCED levels 1 and 2), 2011/12



Source: Eurydice.

Explanatory note

The figure refers to the national administration of standardised tests and centrally set examinations.

The use of the term key competences does not imply that all national tests assess all elements of the concept, i.e. knowledge, skills and attitudes.

Rotating subjects are not tested on a year by year basis but according to a rotation principle determined by the central authorities.

Country specific notes

Belgium (BE fr): The national test at ISCED level 1 refers to the CEB *(Certificat d'études de base)*. The remaining national tests in ISCED 1 and 2 rotate the subjects that are tested,
Belgium (BE nl): National assessments for monitoring purposes take place in different subjects depending on government priorities.
Estonia: Foreign languages are tested as optional subjects in the national test at the end of compulsory education.
Slovakia: At ISCED level 1, the tests in 2012 were part of a pilot project based on a sample of pupils.
Spain: The last national standardised tests took place in 2008-2009 for primary, and 2009-2010 for lower secondary compulsory education. The areas evaluated were linguistic communication, mathematical competence, knowledge and interaction with the physical world, and social and civic competences.
Finland: Tests usually cover only one subject on a rotating basis, either mother tongue, or mathematics, or less often, a third subject or cluster of subjects according to national priorities.
United Kingdom (ENG/WLS/NIR): Statutory teacher assessment which must be centrally reported is not covered in the figure.

Generally, some countries test only two or three subjects – viewed as the core curriculum – while others test a broader range. Eight countries, namely Bulgaria, Estonia, Ireland, Latvia, Malta, Poland, Slovenia and Belgium (Flemish Community) ([5]) organise national tests in mother tongue (or language of instruction), mathematics, science, one or more foreign languages, and social and civic competences.

([5]) On a rotation basis and therefore not all five competences are tested in school year 2011/12.

Some countries that test a broader spectrum of the curriculum do so on an annual basis, in which case it is often part of the certification process at the end of lower secondary education. Other countries rotate subjects in cycles or use a combination of tests in compulsory and optional subjects.

Out of the three transversal or cross-curricular competences for which information is available, only civic and social competences are tested through standardised assessment, and this in only around a third of European countries. One significant development in the past few years has been the increase in the number of countries (from 4 in 2008 to 11 in 2012) ([6]) organising national tests in the area of social and civic competences. In contrast, countries continue to leave digital competence and entrepreneurship out of their national testing system.

In addition, some countries have adopted an approach which provides for the testing of other cross-curricular skills, mainly related to the effective use of various information sources.

> In **Belgium** (**Flemish Community**), the domains 'Society, Space, Time and Use of different information sources' from the subject 'Environmental studies' were tested in 2010. In **Poland**, the test at the end of primary education is entirely based on cross-curricular material and assesses performance in reading, writing, reasoning, using information and the practical application of knowledge.

3.2. Other forms of assessing the transversal competences

The transversal competences, as well as other generic skills like creativity or problem solving, relate to more than one subject area and are more difficult to assess with traditional instruments. Therefore it is worth exploring what forms of assessment instruments are available for teachers to assess student progress in these fields.

In most countries, a variety of subjects incorporate learning objectives or learning outcomes related to transversal competences (see Chapter 2). Consequently, student achievement in ICT, social and civic competences and entrepreneurship are assessed through the various subjects in which they are taught, whether they are stand-alone subjects or broader curriculum areas into which aspects of transversal competences have been integrated. In some cases, teachers of subjects in which social and civic competences are integrated are provided with assessment tools that specifically focus on the transversal competence.

> For instance, in **Sweden**, where social studies teachers are responsible for the development of students' civic competences, the National Agency for Education has developed a set of six tests for school years 7-9 to support them in carrying out formative assessment of students' understanding of democratic principles.

Transversal competences call for new ways of learning and teaching which go beyond traditional subject boundaries. Corresponding assessment tools, which reflect student achievement acquired through different subjects, are necessary to evaluate the progress of students in these areas. France and Austria offer interesting examples of assessment instruments which cross the boundaries of various subjects and learning activities.

> In **France**, students' proficiency in using multimedia tools and the internet acquired through a large variety of learning activities has been evaluated since 2001 within the framework of the *Brevet informatique et internet* (B2i), at primary, lower and upper secondary education. Five areas of digital competences are further described which are associated with distinct reference points for each of the three levels of education considered. These areas are: mastering an ICT-based work environment; behaving responsibly; creating, producing, processing and using data; acquiring information; communicating and exchanging information.

([6]) For information on school year 2008/09, see EACEA/Eurydice, 2009, pp. 29-31.

In **Austria**, in autumn 2011, the Centre for Citizenship Education published a new brochure dealing with the question of assessing young people's competences in their ability and willingness to find solutions to problems independently, decision-making skills, and conceptual thinking. The publication provides practical lessons and diagnostic exercises *(Diagnoseaufgaben)*, which help teachers to establish students' existing abilities in these areas. It is available to all Austrian teachers.

Standardised tools for the classroom assessment of digital competences are quite widespread in Europe (EACEA/Eurydice, 2011a). A European level certificate, the European Computer Driving Licence (ECDL) ([7]), is either regularly or occasionally used in around half of European countries, mostly in upper secondary education. The assessment process for obtaining this certificate relies on a mastery of seven groups of computer skills and competences. A few more countries issue publicly recognised ICT certificates at different levels, which generally cover a similar set of competences as in the ECDL.

Belgium (**French Community**) has a non-compulsory ICT passport for primary and secondary education. **Germany**, **Lithuania**, **Romania** and the **United Kingdom** offer additional recognised qualifications in ICT skills while the Scottish Qualifications Agency also offers ICT certificates. .

Given that competences are a combination of knowledge, skills and attitudes, they cannot be exercised in an abstract manner and their acquisition has to be demonstrated within given contexts, (Scallon, 2007). For example, students may be given a number of case-studies describing particular situations where they need to demonstrate how they would have reacted or behaved. In this regard, there are examples of ICT-based assessment tools in, for instance, Denmark and the United Kingdom (England), that replicate real life problems and require the use of multimedia resources to solve these problems (IPTS, 2012). Furthermore, appropriate situations in which pupils should be assessed might extend to informal learning contexts, as for instance in the case of social and civic competences. Students' active participation in school and community activities is an integral component of social and civic competences in the vast majority of European countries; a third of these take this participation into account in summative forms of assessment (EACEA/Eurydice, 2012b). The assessment of student participation takes various forms, including recording in personal profiles or validating student contribution to school life through a final certificate, and recognising participation in community-oriented out-of-school activities. Other approaches involve criteria related to active participation in discussions and debates at school level, assessment in a citizenship-related subject or marks for behaviour.

In **Bulgaria**, since 2009, at the end of each year of primary and secondary education, the class teacher gives students a personal profile which presents an assessment of their participation in out-of-school activities (e.g. projects, conferences, competitions, Olympiads, etc.). Upon completion of primary and secondary education, a more comprehensive personal profile is an integral part of school leaving certificates.

In the **Netherlands**, since 2007, students have had to complete 30 hours of community service in order to obtain their upper secondary certificate.

In **Slovakia**, the national curriculum for the separate subject citizenship science at lower secondary level suggests project-based assessment for student attendance at municipal council meetings.

([7]) For more information, see: What is ECDL/ICDL? http://www.ecdl.org/programmes/index.jsp?p=102&n=108&a=0.

3.3. Implications for the implementation of key competences

National tests used for either summative or formative purposes, or for system monitoring, provide comparable and standardised information about the performance of students, schools and education systems. The information gathered is used to measure and monitor progress and to design improvement measures. A number of countries report that various education reforms are supported by the analysis of performance in nationally standardised tests and/or the results of international surveys. The fact that only a minority of countries consistently test students' performance across the wider curriculum is significant. It might indicate that in certain cases the key competences are not addressed in a consistent way and that a hierarchy of importance might exist.

At the same time, policy-makers need to balance the need for performance data against the risk of over-testing. A further concern is the well documented tendency to adapt or restrict teaching to those aspects of the curriculum that are tested. This is a situation that occurs especially where the tests have high importance for students, teachers or schools (EACEA/Eurydice, 2009).

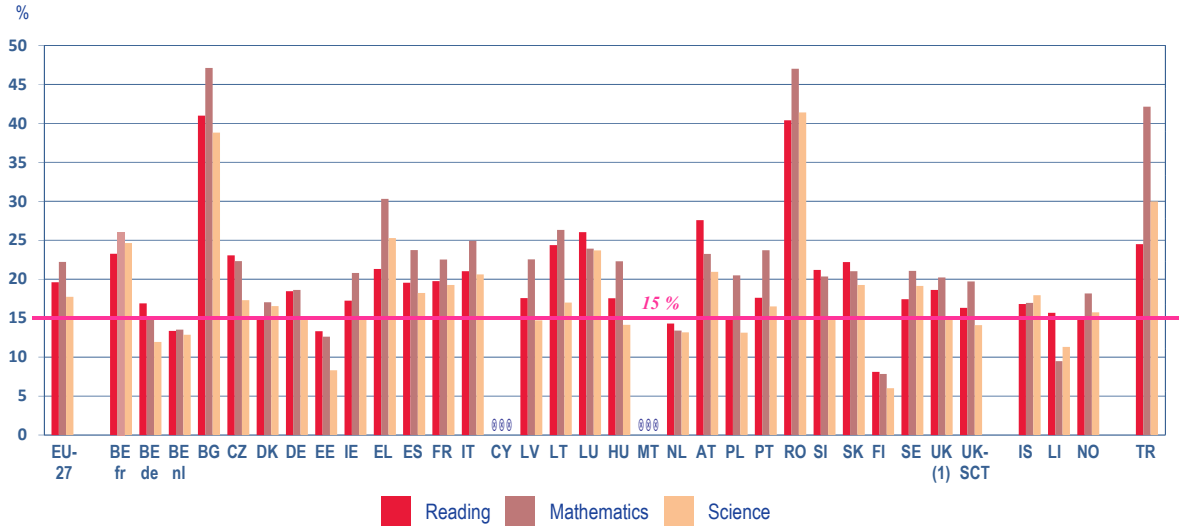
While recognising the real methodological and practical difficulties in designing tools for the assessment of the whole range of the key competences, there might be a case for better integrating all competences within a coherent assessment framework. This could serve as one of the drivers for minimising the differences in the status and importance attached to the transversal or cross-curricular competences. It could also help address a certain fragmentation of the learning process. Designing assessment tools which summarise students' progress in acquiring the transversal competences taught through various subject areas might also be a way to make learning and teaching across the curriculum more consistent. Finally, a greater emphasis on the transversal competences in all types of assessment, as well as an increased focus on the application of knowledge and on practical skills in general could also help to make students' skills more relevant to the demands of the labour market and the needs of modern society.

CHAPTER 4: HOW DO COUNTRIES TACKLE LOW ACHIEVEMENT IN SCHOOLS?

Low achievement among students is a concern for many European countries. It is an issue associated not only with the effectiveness of teaching and learning, but also with providing an equitable system of education. Moreover, becoming fully integrated into society and being able to respond to the changing demands of the competitive global economy is a significant challenge for many of the students who have not yet acquired basic skills in reading, mathematics and science. Recognising the need for targeted action, in 2008 the Council adopted an EU-wide benchmark related to basic skills, which aims to reduce the proportion of 15-year-olds underachieving in reading mathematics and science to less than 15 % by 2020 ([1]).

The latest PISA results from 2009 (see Figure 4.1) show that, on average in Europe, 22 % of students are low achievers – defined as performing below Level 2 in the PISA test. Only Finland, Estonia Belgium (Flemish Community) and the Netherlands have already achieved the EU target of less than 15 % of low achievers in each of the basic skills. In contrast, the proportion of students that underachieve in Bulgaria, Romania and Turkey, is around 40 %, and the figure is even higher for mathematics.

Figure 4.1: Percentage of low achieving 15-year-old students in reading, mathematics and science, 2009



	EU-27	BE fr	BE de	BE nl	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU
Reading	19.6	23.3	16.9	13.4	41.0	23.1	15.2	18.5	13.3	17.2	21.3	19.6	19.8	21.0	x	17.6	24.4	26.0
Mathematics	22.2	26.1	15.2	13.5	47.1	22.3	17.1	18.6	12.6	20.8	30.3	23.7	22.5	24.9	x	22.6	26.3	23.9
Science	17.7	24.6	12.0	12.9	38.8	17.3	16.6	14.8	8.3	15.2	25.3	18.2	19.3	20.6	x	14.7	17.0	23.7

	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK (1)	UK-SCT	IS	LI	NO	TR
Reading	17.6	x	14.3	27.6	15.0	17.6	40.4	21.2	22.2	8.1	17.4	18.6	16.3	16.8	15.7	15.0	24.5
Mathematics	22.3	x	13.4	23.2	20.5	23.7	47.0	20.3	21.0	7.8	21.1	20.2	19.7	17.0	9.5	18.2	42.1
Science	14.1	x	13.2	20.9	13.1	16.5	41.4	14.8	19.3	6.0	19.1	15.1	14.1	17.9	11.3	15.8	30.0

Source: OECD, PISA 2009 database.

UK (1): UK-ENG/WLS/NIR

([1]) Council conclusions of 12 May 2009 on a strategic framework for European cooperation in education and training ('ET 2020'), OJ C 119, 28.5.2009.

This chapter reviews research evidence on effective measures to address low achievement ([2]). It also outlines the main elements of national policies to raise achievement, as well as common practices for addressing low achievement in and outside the mainstream classroom. In terms of subject areas, this analysis is concerned with the basic skills, and in particular with reading and mathematics, following the priority given to performance in these areas at EU and national level, and also due to the fact that the available national information almost exclusively refers to policies and practices in these two areas (EACEA/Eurydice, 2011b, 2011c).

Significantly reducing the proportion of low achievers requires a combined approach that simultaneously targets a range of factors in and out of school. The following sections, however, concentrate primarily on factors that can be directly influenced by education policies.

At school, a comprehensive approach to tackling low achievement should comprise measures that are suitable for all students, but benefit underperforming students in particular; it should also include arrangements for providing targeted support for students with individual needs both inside and outside the normal classroom. Research evidence indicates that accommodating the diverse range of students' learning needs in terms of readiness to learn, interest, and individual learning profiles has a positive impact on achievement and engagement (Tieso, 2001, 2005; Lawrence-Brown, 2004).

Teachers' competences in dealing with students with a range of abilities and interests are essential in tackling low achievement ([3]). Research findings on effective teaching indicate that teachers need to choose appropriate methods and strategies to suit the topic, the type of student and the particular learning context. However, in order for teachers to be able to provide this flexibility in pedagogy, which is key in tackling low achievement, it is crucial that they have access to effective professional development (EACEA/Eurydice 2011c, p. 51-52).

Another important factor is the availability of qualified primary teachers who have solid foundations in teaching reading and mathematics-related knowledge and skills for teaching. According to PIRLS 2006 data, however, on average in the participating EU countries, only 25 % of fourth grade pupils were taught by teachers whose initial education emphasised the teaching of reading. These teachers were more likely to report using a number of targeted teaching approaches. (EACEA/Eurydice 2011b, pp. 89-91).

Achievement in one of the basic skills closely correlates with performance in the other two areas (OECD 2010a, p. 154). Research has demonstrated the relationship between language factors such as reading comprehension and performance in other disciplines (Grimm, 2008). It has been emphasised, that the interrelation between literacy and numeracy problems, in particular, should be considered when planning support (Williams 2008, p. 49).

Motivational factors should also be taken into account. Teachers need to set and communicate high expectations and encourage the participation of all students (Hambrick, 2005). They also need to develop 'soft skills' such as connecting with students, and managing the classroom in a way that can prevent disengagement at secondary level (Gibbs and Poskitt, 2010). A wider variety of reading materials provided in schools might be particularly helpful in increasing students' and in particular boys' interest in reading. Also, reading outside formal schooling should be further promoted, especially when targeting boys, immigrants and other groups at risk. Moreover, teaching methods should address the perceptions that mathematics and science are difficult, abstract and not relevant to real

([2]) In this analysis, low achievement refers to student performance that is below the expected level of attainment. It does not address the provision of support exclusively related to special needs education.

([3]) Generally on policy developments regarding the teaching professions, see Commission staff working document, Supporting the Teaching Professions for Better Learning Outcomes, 2012.

life. One way of doing so is to organise lessons around 'big ideas' and interdisciplinary themes that help establish connections with everyday life and other subjects.

Increasing parental involvement in the learning process is another important area that needs to be strengthened. Parental involvement is particularly important for children's reading development (Brooks et al., 2008; McElvany and Steensel, 2009; McElvany et al., 2010; Steensel, 2009). Many family literacy programmes encourage parents to read aloud to their children. But research indicates that to be effective such programmes should also help parents teach their children specific literacy skills (EACEA/Eurydice 2011b, pp. 132-133). Parents should also be encouraged to help their children to learn and enjoy mathematics. Moreover, their involvement is vital for the success of intervention programmes (Williams, 2008). At the same time, in view of some national data on the level of adult numeracy skills, it should be recognised that some parents might not be able to provide adequate support for their children's learning.

4.1. National policies to tackle low achievement

In the majority of European countries, central education authorities provide guidance and support to teachers and schools to address low achievement. In around half of these countries, there are general policies on the provision of student support but no distinction is made between subjects. It appears that specific polices exist only for literacy and numeracy at central level. For other curriculum areas such as science or foreign languages, countries report the existence of small scale projects.

Several countries report that policies to tackle low achievement have been developed at national level. It is important to emphasise that even where central guidance exists, it is usually up to the individual classroom teacher to decide whether and what type of support should be given.

In **France**, detecting learning difficulties in any subject includes using the results of the national tests in French and mathematics (primary years 2 and 5) and the portfolio designed for assessing the competences of the *Socle commun*, as well as assessment materials developed by teachers. It is the class teacher who provides support. Support measures are based on the pupil's individual learning plan (*Programme personnalisé de réussite éducative* – PPRE). The programme is based on a small number of objectives, mainly in mathematics and French and, in rare cases, science subjects. The support measures comprise differentiated learning and small group instruction and sometimes ability grouping.

In **Estonia**, one of the objectives of the General Education System Development Plan for 2007-2013 is to create opportunities for individualised learning that take into account students' different learning abilities. Test results are being analysed by an independent research group and are published annually. Specific approaches that are prescribed include the use of an individualised curriculum, supplementary classes, consultations, remedial groups *(parandusõpe)* and counselling parents.

In **Ireland**, in accordance with the Learning Support Guidelines issued by the Department of Education, early detection and intervention and differentiated teaching are the key approaches promoted in classrooms. The use of these strategies complements the learning support provision (i.e. supplementary teaching) delivered by learning support teachers provided on the basis of withdrawing students from their normal lessons, although there is a growing emphasis on the provision of support to individual students within classrooms. In-class cooperative support, one-to-one withdrawal and team teaching also feature.

In **Portugal**, within the framework of the programme *Mais Sucesso Escolar*, the Ministry of Education and Science supports schools in developing projects to raise achievement, as part of four-year contracts by implementing different organisational models in the classroom and in curriculum management, involving mainly the subjects of mother tongue, mathematics and foreign language (English).

In **Germany**, the Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder of 4 March 2010 calls for, among other things, action to reinforce individual support through diagnostic procedures as a basis for assistance and differentiated support beyond normal lessons. It also proposes the development of new forms of learning through the use of new teaching material, teaching small groups of pupils with similar achievement levels and alternative forms of learning that strengthen the links with the world of work ([3]).

In **Spain**, regulations state that support mechanisms should be implemented as soon as learning difficulties are detected. The mechanisms relate to both the organisation of teaching as well as the curriculum and comprise individual tuition in the normal class, flexible grouping or curricular adaptations. In lower secondary education, regulations emphasise attention to diversity and responsiveness to the specific educational needs of students. The measures that are prescribed include the offer of optional subjects, reinforcement measures, adapting the curriculum, flexible grouping and split classes.

In some countries, central authorities issue relatively general recommendations that leave the choice of practical measures entirely to the discretion of teachers.

In the **United Kingdom (Scotland)**, in March 2012, the Government produced advice for teachers on improving attainment for all. This advice focused on six key areas: increasing the ambition, aspiration and expectations of every child and young person; delivering excellent learning and teaching in every classroom, every day; developing effective leadership at all levels; engaging family and the wider community; focusing on literacy and numeracy as platforms on which to build future learning; and using information intelligently to understand progress ([4]). This advice will be part of a wider programme of work intended to support teachers, schools and other parts of the system in raising attainment.

In **Sweden** and **Norway**, school providers are responsible for providing all the tools and support mechanisms necessary for the completion of the achievement goals that have been set for each education level.

4.2. Specific support measures for low achievers

A variety of approaches to support underperforming students can be employed both inside and outside the normal classroom (Dowker et al., 2000; Gross, 2007). The following overview presents examples of the most commonly employed methods and measures.

In terms of the share of students that are affected by the various forms of additional support, some indications are available in the data from the PIRLS survey on reading literacy. According to data from 2006, the proportion of students in the fourth grade (7-8 year olds) who were receiving remedial teaching in reading varied from 3 % in France to 19 % in Poland. However, in all the European countries participating in PIRLS, teachers tended to report that there were more pupils in need of remedial instruction than those actually receiving it. On average, in the participating EU countries, approximately 12 % of fourth grade pupils received additional instruction in reading. According to teachers' estimates, 17 % of pupils needed such help. Furthermore, on average, teachers slightly underestimated the share of students in need of remedial instruction, as compared to the actual percentage of struggling readers defined by PIRLS (EACEA/Eurydice 2001b, pp. 66-68).

([3]) http://www.kmk.org/fileadmin/veroeffentlichungen_beschluesse/2010/2010_03_04-Foerderstrategie-Leistungsschwaechere.pdf

([4]) Raising Attainment, http://www.scotland.gov.uk/Publications/2012/03/7159

Early identification and intervention

Identifying difficulties in the first years of primary education, or even as early as pre-primary level, can prevent children from developing inappropriate strategies and misconceptions that can become long-term obstacles to learning (Williams, 2008). Early intervention can also combat the development of anxiety about mathematics which can become a significant factor among older students (Dowker, 2004).

In **Finland**, for instance, early detection and support is the most common approach in tackling low achievement. The Ministry of Education and Culture organises targeted in-service professional development and maintains a web-site ([5]) with information on the most common learning problems in mathematics in the early school years. The site provides access to computer-assisted instruction methods for mathematics. In addition, specific tests for the diagnosis of learning problems are available for purchase from private companies.

In **Norway**, 'TRAS – Early Registration of Language Development' is one of the measures for early intervention. It aims to prevent reading and writing disorders by detecting language problems as early as the pre-primary stage. TRAS provides material to be used for observing and working with children in a dynamic way.

Role of assessment ([6])

The use of a variety of assessment tools is recommended for the accurate identification of individual strengths and weaknesses. The identification of students with learning difficulties is often based on a combination of continuous assessment by teachers and standardised tests used for diagnostic and formative purposes.

In **Ireland**, for instance, the range of assessment tools includes teacher observation, work analysis, screening tests, standardised test results and diagnostic test results. In **Norway**, compulsory mapping tests in numeracy and arithmetic skills are organised in year 2. These are supplemented by voluntary tests in numeracy and arithmetic skills in years 1 and 3. In addition, Norwegian teachers are encouraged to use web-based diagnostic tests ([7]). In **Germany**, a so-called 'tripwire test' (LUST-1 – *Leseuntersuchung mit dem Stolperwörter Test*) has been developed for use in primary school to help teachers identify individual pupils' reading difficulties.

However, the role of assessment should not be limited to diagnosing potential problems, but should also extend to measuring progress at the end of any period of specific support.

Improving motivation

An additional constraint on learning progress is related to low motivation and engagement. For example, research indicates that students who enjoy reading usually read more frequently, thus further improving their reading skills, which in turn supports their learning in a range of other subject areas (Mullis et al., 2007). Findings from the PISA survey suggest that student engagement in reading has the potential to balance the achievement differences between boys and girls or between students from various social backgrounds (OECD, 2002, 2010b).

Access to books from an early age and a large choice of reading material in later school years are crucial for becoming a proficient reader. At school, some of the best ways to encourage reading are through collaborative learning among students and through the discussion of diverse texts. Offering a choice of different reading materials to pupils is an important way to encourage their motivation to read. Most curricula underline the importance of developing pupils' pleasure and interest in reading

([5]) www.lukimat.fi
([6]) For a general discussion on assessment, see Chapter 3.
([7]) KIM (Quality in Mathematics education): http://www.udir.no

and support the use of a broad range of books and other written materials in reading instruction. The general trend is to encourage teachers to use a wide range of fiction and non-fiction as well as non-book material such as magazines and newspapers, rather than rely solely on a traditional canon of literary texts (EACEA/Eurydice, 2011b).

International survey results show, for example, that online reading has a positive effect on reading performance. Students who are engaged in online reading activities, such as reading e-mails, chatting online, reading news online, using an online dictionary or encyclopaedia, participating in online group discussions and searching for information online, are generally more proficient readers than students who do little online reading (OECD, 2010b). However, despite its increasing significance in students' lives, there is little focus on reading and learning opportunities through computers or the internet among the main initiatives for promoting reading in European countries. Initiatives aiming to raise motivation for and engagement in reading still mostly focus on fiction books (EACEA/Eurydice, 2011b).

Support for reading outside the formal learning environment and for the development of a general reading culture can also have significant impact. A number of reading encouragement programmes are implemented, both as bottom-up initiatives and as state-supported actions. National bodies for reading promotion have been established in many countries to coordinate and fund actions in the field. Several countries have adopted specific strategies for reading promotion.

Many reading promotion initiatives, however, take the form of literacy activities which may largely attract those who are already interested in reading. Events such as book fairs, meetings with authors, public readings and discussions in book clubs are more likely to cater for the needs of already active readers. However, PIRLS 2006 survey results indicate that approximately one quarter of students in the fourth grade in Europe never read a novel or short story. Such students, who probably do not participate in many of the existing reading programmes and have low literacy levels, require a special focus. Reading activities, for instance, that focus specifically on children from disadvantaged backgrounds or boys, are rare among the major reading promotion programmes in Europe (EACEA/Eurydice, 2011b). Some examples of targeted initiatives for improving reading literacy and engagement include:

> In **Norway**, the Reading Action Plan**,** covering the period 2010-2014, puts a special emphasis on improving boys' reading competencies. In July 2012, in the **United Kingdom (England)**, the Boys' Reading Commission issued a series of recommendations including weekly access to male reading models, and parenting initiatives that involve fathers ([8]). Moreover, a new literacy 'catch up' programme will provide extra lessons for disadvantaged pupils who fail to reach the expected level of English by the end of primary school ([9]).

Individualised support

A review of research evidence on *'What works for children with mathematical difficulties'* has concluded that 'interventions should ideally be targeted towards an individual child's particular difficulties' (Dowker, 2004).

There is evidence that individual support has a positive impact on children's performance (Wright et al., 2000, 2002). Experts suggest that 'in most cases, if interventions start early and concentrate on specific weaknesses, they might not need to be very long or intensive' (Dowker, 2009). Nevertheless,

([8]) http://www.literacytrust.org.uk/policy/nlt_policy/boys_reading_commission

([9]) http://www.education.gov.uk/inthenews/inthenews/a00211482/%c2%a310m-literacy-catch-up-programme-for-disadvantaged-pupils-

individual and small group support could also have unintended effects related to the reinforcement of ability grouping. This method also requires significant financial resources.

Some national examples of the use of one-to-one tuition include:

In **France**, at primary level, the Ministry has prescribed two hours of personalised work per week, which can be used for remedial work with students in classes CE1 and CM2. Support usually lasts a few weeks but varies according to the pupil's difficulties and progress made. At the end of the programme, a project-based assessment allows a decision to be taken on the need for any additional support. In **Latvia**, teachers in basic and secondary education are required to have two additional hours per week for individual work with pupils who need extra help. Simultaneously, the education institutions are required to develop individual support plans for students with learning difficulties. In **Greece**, also at primary level, students can have up to six hours per week of individual work. In **Romania**, this approach is mainly used in recovery programmes in rural schools.

Tuition in small groups is another common approach. It can be practiced either in or outside the normal classroom.

In **Ireland**, additional teaching is delivered by learning support teachers; students are usually withdrawn from their normal classes and taught within small groups, although there is growing emphasis on the provision of support to the target students within classrooms. Schools are advised that the duration of the support should cover a school term of 13 to 20 weeks, and not exceed two to three years.

In **Bulgaria**, the national programme 'With care for every student' offers extra tuition in small groups for an average duration of 100 academic hours to students identified in national assessments as low achievers or potential low achievers.

In **Malta**, primary school pupils receive personalised literacy support from specialist teachers, both in groups of less than five pupils and in the classroom setting. Primary teachers can be assisted by Literacy Support Teachers and Mathematics Support Teachers who visit classrooms and provide focused support. At secondary level, Basic Skills classes in Mathematics, English and Maltese have been introduced in order to support students who need to improve their basic skills.

In **Slovenia**, individual or small group assistance is provided within normal classes or at the end of the school day; teaching assistance is provided by teachers or by specialist and remedial pedagogues.

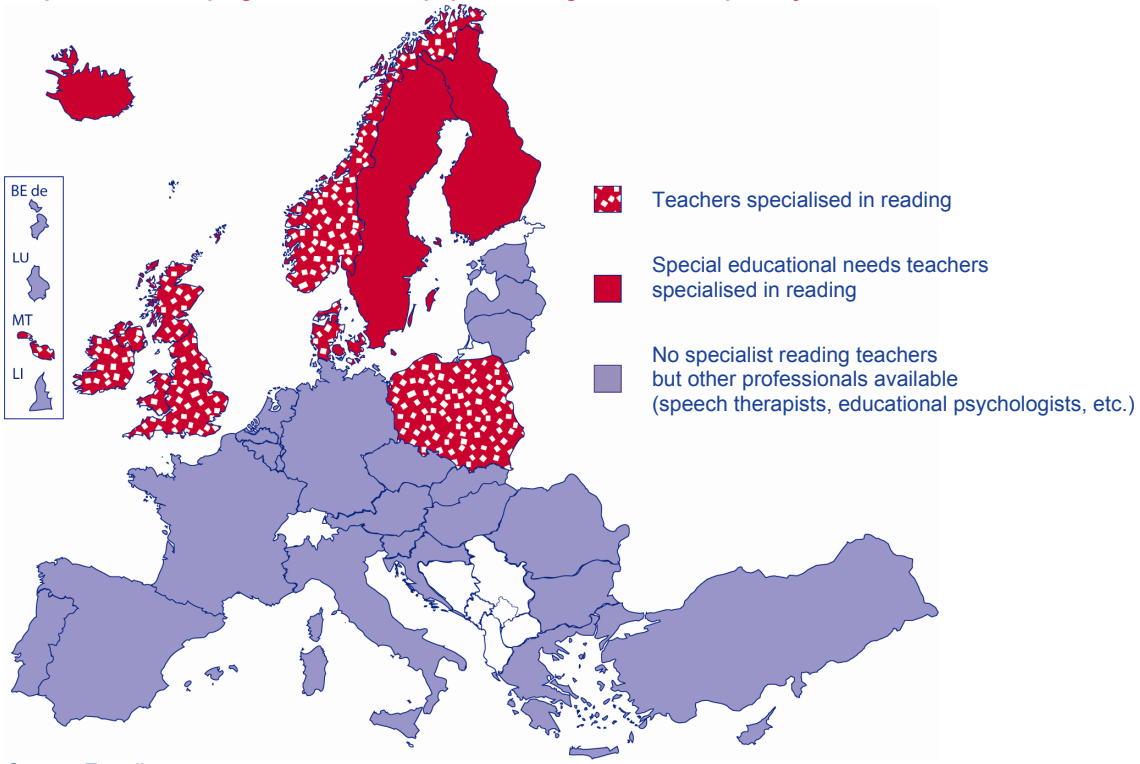
Specialist teachers

The availability of additional support in the classroom is another factor in tackling low achievement. There is research evidence that well-trained reading specialists that provide individualised support can be highly effective when dealing with struggling readers (Snow, Burns & Griffin, 1998). Furthermore a secondary analysis of PISA 2009 data reveals that the availability of reading specialists for providing targeted support to students with difficulties is a measure that correlates closely with the proportion of low achievers (Motiejunaite-Schulmeister et al., 2012).

However, teachers who are specialised in learning difficulties in reading or mathematics or assistants who can help classroom teachers are available in only a few European countries. With respect to reading for instance, Figure 4.1 shows that primary school teachers in Ireland, Malta, the United Kingdom, and in all five Nordic countries can request the help of specialist reading teachers to assist them in the classroom. There has been no change in the availability of specialist reading teachers in Europe since the first data collection in 2009 (EACEA/Eurydice, 2011b). In the rest of Europe, professional staff such as speech therapists or psychologists can be available to help teachers with some tasks related to reading. However, in most countries, this help is not immediately available and there are usually certain criteria that need to be met or procedures to be followed before professional

support is provided. As a consequence, pupils may not receive the required support in good time; the longer the procedures take the more likely it becomes that the student falls behind not only with regard to reading, but also in all other school subjects where reading is a prerequisite (EACEA/Eurydice 2011b, pp. 36-44).

◆◆◆ **Figure 4.2: Availability of specialist reading teachers, according to official documents or widespread practice, for helping teachers tackle pupils' reading difficulties in primary schools, 2011/12**



Source: Eurydice.

Explanatory note

The figure focuses on the availability of specialist reading teachers to support classroom teachers in schools at primary level when dealing with pupils with reading difficulties. It is based on what countries envisage in their official documents, or based on reported practice for those countries or regions where schools and education authorities have full autonomy regarding pupil support – Denmark, Netherlands and the United Kingdom (Scotland).

◆◆◆

4.3. National targets on low achievement

Measuring progress in achievement in basic skills using results from international surveys, and in particular PISA, is an approach that has been taken up at European level ([11]). However, it appears that this policy is not widespread at national level. Despite the widely reported use of results from international surveys, few countries have established national targets linked to performance in international or national tests to reduce the numbers of low achievers.

Ireland, Italy, Lithuania, the Netherlands, the United Kingdom (England) and Norway have set national targets on low achievement based on the results from international and/or national standardised tests.

In **Ireland**, national targets for reducing low achievement in literacy and numeracy will be implemented in the period 2011-2020. Six targets have been outlined in the *National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020*. They focus on low achievement rates in PISA and national tests, as well as on the

([11]) Council conclusions of 12 May 2009 on a strategic framework for European cooperation in education and training ('ET 2020'), OJ C 119, 28.5.2009.

percentage of students taking advanced mathematics in the examinations at the end of compulsory education. Some of the targets are cited below:

- Reduce the percentage of children performing at or below Level 1 (i.e. minimum level) in the National Assessment of Mathematics and English Reading by at least 5 percentage points at both second class and sixth class by 2020.
- Halve the percentage of 15-year old students performing at or below Level 1 (the lowest level) in PISA reading literacy and numeracy tests by 2020.
- Increase the percentage of students taking the Higher Level mathematics examination at the end of the junior cycle (i.e. Junior Certificate examination or its equivalent) to 60 % by 2020 ([11]).

In **Latvia**, the National Development Plan for 2014-2020, to be adopted by the end of 2012, will include PISA-based targets on low achievement in reading literacy.

4.4. Promoting evidence-based policies on low achievement

Raising the quality of teaching and learning also depends on the collection, analysis and dissemination of evidence about effective practices.

The results of international surveys, as well as other research evidence point to the fact that low achievement occurs for a number of reasons linked to home background and school-related factors and these often reinforce each other (Mullis et al., 2008; OECD, 2009b; Wilkins et al., 2002; Chudgar and Luschei, 2009). At national level, collecting evidence on performance trends, factors contributing to underachievement, and effective approaches for raising attainment can provide significant support to the policy making process. However, such surveys or reports are not conducted systematically in all European countries. For instance, half of European countries report investigating which teaching methods and activities are being used in mathematics lessons, while fewer countries look at the methods teachers use to assess their students. Clearly, this kind of information gathering can be expanded to both inform new policy decisions and evaluate the success of previous initiatives (EACEA/Eurydice, 2011c).

Most commonly, countries report that they use results from international surveys like PISA, PIRLS and TIMSS to monitor performance and identify the reasons for low achievement. In some cases, analyses of these results are supplemented by reports based on results from nationally standardised tests and inspectorate reports. Such reports highlight factors that have significant importance in specific national contexts. These factors can relate to regional differences in performance (for instance between the northern and southern parts of Italy), or specific difficulties in providing quality education in rural schools (high turnover, low motivation, and inadequate qualification of teachers in Romanian rural schools, as well as the grouping of pupils in mixed age classes at primary level), or the effects on structural reforms like decentralisation of school management, resource allocation and streaming (Sweden) (EACEA/Eurydice 2011c, pp. 81-83).

In addition, in some countries, national studies provide data on problematic subject content and skills. For instance, mathematical communication, problem solving and understanding the role of mathematics in context have been identified as common problematic areas for students (EACEA/Eurydice 2011c, p. 83).

([11]) *National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020, pp. 17-18.* http://www.education.ie/admin/servlet/blobservlet/lit_num_strat.pdf

It appears that in most countries independent evaluations of support programmes for low achievers are uncommon. Where these do exist, their findings point to implementation problems related to inadequate resources, lack of appropriate diagnostic tools, and insufficient teacher qualifications and skills (EACEA/Eurydice 2011c, p. 92).

Another important constraint is linked to the heterogeneity of approaches which makes it difficult to compare support measures and their effectiveness. There is also a need for longitudinal studies that assess the long-term benefits of interventions (Williams, 2008; Dowker, 2009).

Research evidence and impact studies can inform policy development by indicating the extent to which new policies have been embedded in schools as well as highlighting practices that have proven to be successful. Some European countries report that information on classroom practice is being collected and analysed by teaching centres or research institutes that have been set up by education ministries themselves or by institutions which work in close collaboration with ministries. However, other countries have no such organisations to routinely carry out these types of activities. Overall, it appears that there is a marked need to strengthen the use of research results in the policy making process and to focus on monitoring and evaluation of measures for low achievement.

CHAPTER 5: HOW DO COUNTRIES ENCOURAGE YOUNG PEOPLE TO PURSUE FURTHER STUDY AND CAREERS IN MATHEMATICS, SCIENCE AND TECHNOLOGY?

In recent years the important role that education and training should play in supporting growth and jobs has been repeatedly emphasised at European level ([1]). Mathematics and science education are two areas of education that can make a significant contribution but they need to adapt to reflect labour market needs and the demand for particular skills. Apart from the necessity of reducing the proportion of young people lacking basic skills in mathematics and science (Chapter 4), another important challenge in some countries is to maintain sufficient numbers of graduates in mathematics, science and technology (MST).

Against the background of research and statistical evidence, this chapter first highlights Eurydice information about policy concerns regarding skills shortages in the MST fields, as well as some measures that are commonly taken at school level to redress the situation. The analysis then focuses on the research evidence that suggests links between motivation and achievement, before turning to the provision of specific career guidance in secondary school. Finally, the chapter outlines some challenges for national policies to increase interest in MST careers and points to areas where action needs to be strengthened. The analysis concentrates on policies and initiatives that relate to school education and does not provide a detailed discussion about measures that are taken at tertiary level.

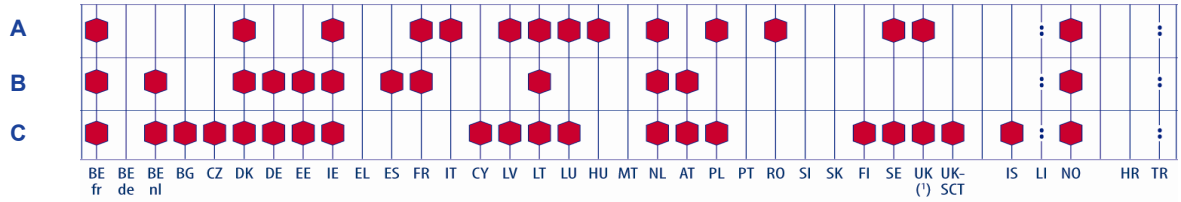
5.1. Policy concerns regarding skills shortages in MST fields

Maintaining high-level skills in MST fields is crucial to the economy, and therefore aiming for a high proportion of MST graduates is an important objective in the majority of European countries. However, European education systems face significant challenges in encouraging students to take up further studies and careers in MST-related fields.

According to Eurydice information, education authorities in 15 European countries or regions have concerns about declining numbers of higher education graduates in MST fields (see Figure 5.1). A higher number, 21 countries or regions, highlighted skills shortages in areas requiring high levels of MST knowledge as an important concern. Another issue raised is the need to improve the gender balance among higher education students in MST subjects. Education authorities in Belgium (French Community), Denmark, Ireland, Lithuania, the Netherlands, and Norway expressed policy concerns in each of the three areas. At the same time, seven countries or regions did not indicate that any of these issues was a pressing concern and hence do not identify them as a potential problem area in the near future.

([1]) Council conclusions of 14 February 2011 on the role of education and training in the implementation of the 'Europe 2020' strategy. OJ C 70/1, 4.3.2011.

Figure 5.1: Policy concerns related to skills shortages and the take-up of MST-related disciplines in higher education, 2011/12



A The number of HE graduates in MST-related disciplines is declining

B The gender balance among HE students in these disciplines needs to be improved

C There are skills shortages in areas requiring high levels of MST knowledge

Source: Eurydice.

UK (1) = UK-ENG/WLS/NIR

Increasing the number of MST graduates

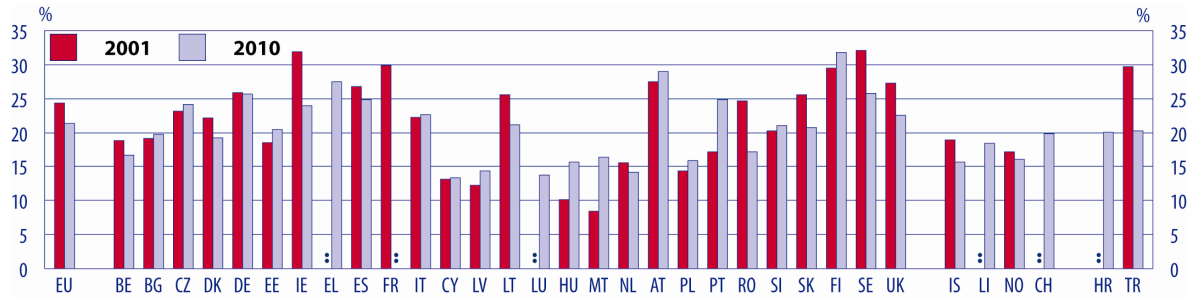
In the past decade there has been a positive trend in the number of MST graduates in the EU. The 2010 EU benchmark of increasing the total number of MST graduates by at least 15 % was achieved several years earlier (European Commission, 2011a). However, the significant growth in the number of MST graduates in the past years can be seen to be partially due to the general increase in the number of tertiary graduates in the EU, as well as to some double counting of graduates resulting from the Bologna reforms in degree structures (Eurostat, 2011).

When analysing the share of MST graduates compared to all university graduates a different picture emerges. In fact, the percentage of MST graduates compared to the total number of graduates in the European Union is decreasing, which is raising concern not only among education authorities but also among businesses.

According to Eurostat data (see Figure 5.2), in the European Union, on average, the share of graduates in MST fields is in decline – from 24.4 % in 2001 to 21.4 % in 2010. Compared to 2001, more than half of the countries have experienced a decrease in the share of MST graduates. The lowest percentages of MST graduates in 2010 (around 14 %) were found in Cyprus, Latvia, Luxembourg and the Netherlands; while the highest rates of MST graduates (around 30 %) were found in Austria and Finland (Eurostat, 2012). Since 2001, the highest decrease in the share of MST graduates was registered in Ireland, Romania and Turkey, whereas the highest increase was in Portugal.

Common measures taken to redress this situation focus on improving teaching and learning at school level by introducing curriculum reforms, new national tests and examinations and targeted teacher professional development. At tertiary level, measures to increase the attractiveness of MST courses include the allocation of additional state-funded places, special government funds for MST faculties, including compensatory programmes in mathematics, and various promotion campaigns (EACEA/Eurydice, 2011c, 2011d).

◆◆◆ **Figure 5.2: Trends in the share of MST graduates (ISCED 5-6) as percentage of graduates in all fields, 2001-2010**



	EU	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU	HU
2001	24	19	19	23	22	26	19	32	:	27	30	22	13	12	26	:	10
2010	21	17	20	24	19	26	21	24	28	25	:	23	13	14	21	14	16
	MT	**NL**	**AT**	**PL**	**PT**	**RO**	**SI**	**SK**	**FI**	**SE**	**UK**	**IS**	**LI**	**NO**	**CH**	**HR**	**TR**
2001	8	16	28	14	17	25	20	26	30	32	27	19	:	17	:	:	30
2010	16	14	29	16	25	17	21	21	32	26	23	16	19	16	20	20	20

Source: Eurostat.

Explanatory note

Mathematics, Science and Technology (MST) covers science, mathematics and computing (EF400) and engineering, manufacturing and construction (EF500) (Eurostat 2011).

◆◆◆

Concerns about insufficient numbers of graduates in these areas of high demand are shared by other non-EU countries. A 2012 report by the US President's Council of Advisors on Science and Technology emphasised the need to produce one million additional graduates in Science, Technology, Engineering and Mathematics (STEM) over the next decade. Policy recommendations to bring about this change concentrate on tertiary education and range from improving the retention rates in STEM fields and expanding research-based courses in the first two years, to training faculty members in evidence-based teaching practices and diversifying pathways to STEM careers ([2]).

Redressing the gender imbalance

Although research and international surveys do not register a significant gap in achievement between boys and girls, the differences in self-confidence and self-efficacy remain, and women continue to be underrepresented in MST-related professions, and especially in disciplines like computer science, physics and engineering. The opposite trend is, however, true for other study fields like medicine and biology.

Concerns about the gender balance among higher education students in MST-related disciplines have been reported by 12 European countries or regions (see Figure 5.1). According to Eurostat data, the percentage of females as a proportion of all MST graduates in the EU-27 increased only slightly over recent years, from 30.8 % in 2000 to 32.1 % in 2009. A proportion of female MST graduates of around 40 % (in 2009) can only be found in Estonia and Iceland. The Netherlands, on the other hand, has the lowest share of female graduates in MST (19.7 %), followed by Austria (24 %). The largest increase in the percentage of female MST graduates over recent years can be noted in Denmark, Germany and Iceland.

([2]) President's Council of Advisors on Science and Technology, Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics, Washington, 2012. http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-executive-report-final_2-13-12.pdf

Only a few countries have launched large-scale, centrally promoted actions to address the gender imbalance among MST students (see Section 5.2).

Reducing skills shortages

A number of countries indicate shortages of highly qualified graduates in MST fields which have also been the subject of concern for European employer organisations ([3]). The 2012 Annual Growth Survey has also noted pronounced skills shortages in some areas, for instance in the IT field. In this particular field, the number of IT graduates has not increased since 2008, and if this trend persists, the EU may lack up to 700 000 IT professionals by 2015 ([4]). Recent mapping of national initiatives for forecasting skills needs indicates that the vast majority of European countries have established regular activities in this area (CEDEFOP, 2008; EACEA/Eurydice, 2010). However, in the context of the acknowledged concerns over the insufficient numbers of MST graduates, economic and skills forecasts could be more widely used to estimate the future demand.

It should be added that some shortages in MST fields relate to insufficient numbers of specialist mathematics and science teachers at secondary level. Thus, according to data from PISA 2009, around 15 % of 15-year-old students in Europe are studying in schools where mathematics and science instruction is hindered by the lack of qualified teachers; the situation in Belgium, Germany, Luxembourg, the Netherlands, and the United Kingdom (England) being particularly serious (EACEA/Eurydice 2012c, p. 113-114).

5.2. Improving motivation to study mathematics, science and technology

The level of motivation to learn mathematics and science is an important determinant of student achievement in school. The academic literature has clearly shown that attitudes and motivation are important factors for achievement (e.g., Zan & Martino, 2007; Akinsola & Olowojaiye, 2008; Deci & Ryan, 2002; Urdan & Turner, 2005). Students' belief in their own abilities can also play an important role in achievement (e.g., Hackett & Betz, 1989; Pajares & Graham, 1999; Pajares & Kranzler, 1995). Research evidence shows, for instance, that self-efficacy, measured as the level of student confidence, can predict performance (Pajares & Miller, 1994; Pajares & Kranzler, 1995; Pajares & Graham, 1999). Negative feelings or anxiety towards mathematics, on the other hand, can become a barrier to achievement (Zientek & Thompson, 2010; Zientek et al., 2010).

Furthermore, there is research evidence that students who enjoy mathematics increase their intrinsic motivation to learn, and vice-versa (Nicolaidou & Philippou, 2003). When students are motivated to learn mathematics, they spend more time on mathematical tasks and tend to be more persistent in solving mathematical problems (Lepper & Henderlong, 2000). They may also be more open to taking a larger number of mathematics courses and to pursuing a career related to mathematics (Stevens et al., 2004).

Thus increasing motivation to learn mathematics and science is important not only for the general improvement of performance at primary and secondary level, but also for encouraging the choice of MST disciplines at tertiary level. Regarding further studies and career choices, research into students' attitudes and perceptions conclude that school students do not see the relevance of their mathematics and science studies for their future working lives (Bevins, Brodie and Brodie, 2005; Cleaves, 2005). In addition, they often have stereotypical and narrow views about these careers, or sometimes no

([3]) See for instance BusinessEurope, Plugging the Skills Gap, Brussels, 2011. http://www.businesseurope.eu/Content/default.asp?pageid=568&docid=28659

([4]) Annual Growth Survey 2012, Communication from the Commission, 23.11.2011 COM (2011) 815 final, p. 11-12. http://ec.europa.eu/europe2020/pdf/ags2012_en.pdf

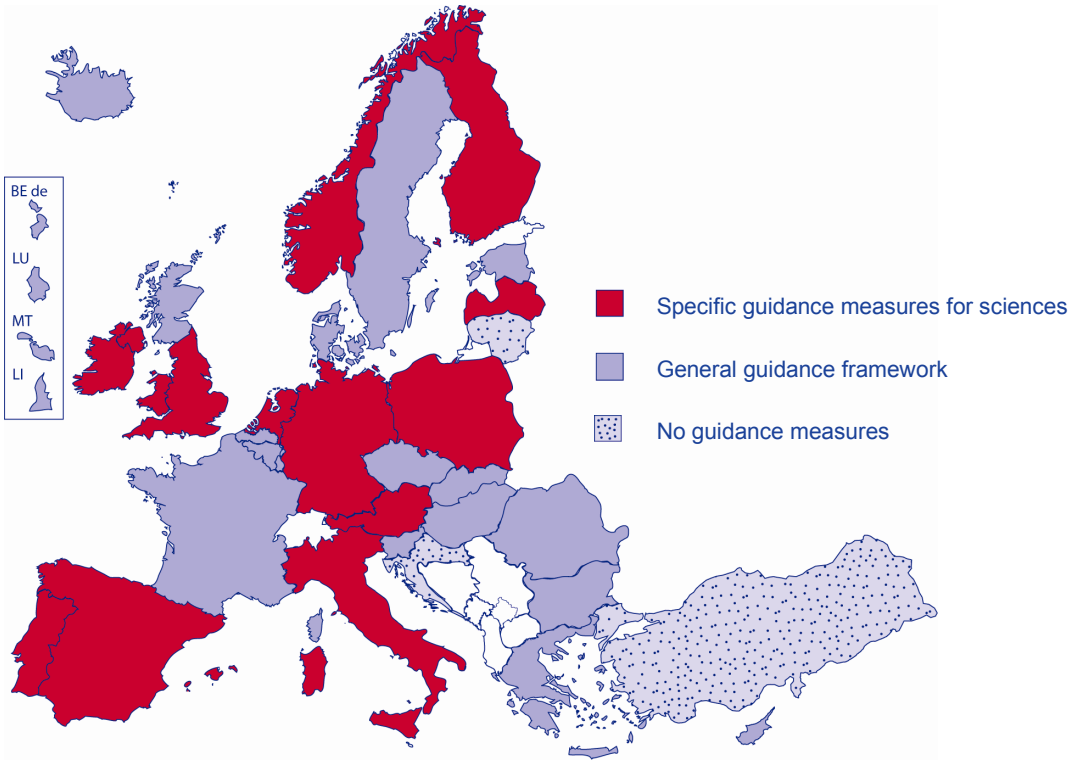
information at all about what it means to be a scientist or an engineer (Ekevall et al., 2009; Krogh and Thomsen, 2005; Lavonen et al., 2008; Roberts, 2002). Gender issues also affect career aspirations, with girls being much less interested in choosing careers in mathematics or science (Furlong and Biggart, 1999; Schoon, Ross and Martin, 2007; van Langen, Rekers-Mombarg and Dekkers, 2006).

At school level, some of the recommendations to address these problems include teaching mathematics and science in context, and strengthening partnerships with scientific centres where mathematics and science professionals could provide information on careers and can act as positive role models (Bevins, Brodie and Brodie, 2005; Lavonen et al., 2008; Roberts, 2002). Students can also benefit from an opportunity to apply the knowledge acquired in school in real work situations or research activities.

Specialised career guidance

In secondary education, another important measure is the provision of high quality careers guidance and counselling services. It has often been emphasised that careers advisors are not well-informed about science careers and are therefore not well-equipped to advise students on these issues (Lavonen et al., 2008; Roger and Duffield, 2000). Indeed, as Figure 5.3 shows, specific guidance to encourage science careers exists in only around half of the European countries or regions studied.

Figure 5.3: Specific guidance measures to encourage careers in science (ISCED 2-3), 2011/12



Source: Eurydice.

Country specific note

Italy: Specific guidance measures concern only students in ISCED 3.

Countries emphasise that the principal reason for the development of specific career guidance in sciences is the need to avoid a potential shortage of science graduates. In the majority of cases, the national programmes that are in place bring together a range of stakeholders. Typical activities include

visits to universities and companies, and interactions with university teachers, students and/or employers. Schools and teachers are also helped to introduce educational innovations that encourage students to consider scientific careers. Some examples of nationally coordinated initiatives to promote MST-related career choices are presented below.

In **Spain**, several nationwide programmes operate in parallel with action at the level of the Autonomous Communities. For instance, the programme *Campus Científicos de Verano* (Summer Science Campus) ([5]) involves ten universities from six autonomous communities. Grants are available for students who have shown special skills in science in the fourth (last) year of lower secondary education and in the first year of scientific upper secondary education *(Bachillerato)*. The activities proposed within this programme allow students to have their first experience of research through participation in scientific projects designed and conducted by academics in collaboration with secondary school teachers.

The project *Rutas Científicas* (Scientific Routes), involves upper secondary students who participate in one-week internships in laboratories, research centres, technology industries, natural parks or science museums. The objective is to complement the scientific knowledge acquired in the classroom by discovering its application and usefulness in everyday life.

In the **Netherlands**, in the framework of the *Platform Bèta Techniek* ([6]), companies help schools enhance the appeal of their science curriculum by using a variety of activities as well as allowing pupils to gain a better understanding of their future career prospects in industry and technology. Major national events include the *Jet-Net* Career Day, the National *Jet-Net* Teachers' Day and Girls' Day. In addition, a range of smaller programmes has been developed, e.g. mentoring activities, company-assisted research, guest lectures, expert meetings and teacher workshops.

In **Poland**, the government programme 'Contracted Programmes, launched in 2008, targets mainly students in departments of science, maths and technology (ISCED 4 and 5). However, higher education institutions organise promotional activities in science-related fields for students in lower and upper secondary education. During university open days, potential students are informed about the courses offered by the institution and participate in meetings, lectures and workshops with professors and students. An example of good practice is the Physics Summer School ([7]) organised at the University of Warsaw.

In the **United Kingdom (Northern Ireland)**, in 2008, the Department of Education launched the STEM Careers Education, Information, Advice and Guidance (CEIAG) programme, aimed at improving young people's knowledge and understanding of the opportunities for entering careers which require a background in STEM subjects. This work is focused on developing materials to inform young people about STEM-related careers and the benefits of seeking employment in these areas.

In **Norway**, the ENT3R nationwide motivation programme ([8]) is implemented and evaluated by the National Centre for Recruitment to Science and Technology (RENATE). Within this programme young people aged 15 to 18 years old meet mentors who are university and college students. The mentors are meant to be role models with the ability and mission to make science and technology more attractive and to inspire teenagers in their choice of education and careers. In addition, RENATE's website is providing the 'Role Models' database which contains the profiles of a variety of people with scientific or technological training. There are also monthly presentations to students by science- and technology-based enterprises on the relevance and importance of maths and science education. It also allows students to meet possible future employers.

([5]) http://www.campuscientificos.es
([6]) www.platformbetatechniek.nl or www.deltapunt.nl
([7]) http://www.fuw.edu.pl/wo/lsf/ (in PL)
([8]) http://www.renatesenteret.no/ent3r/h

Gender issues are not often explicitly addressed within the existing science-related guidance measures. Only a few countries have developed specific science-related guidance programmes which focus on young women and/or have integrated female-oriented guidance initiatives within existing guidance programmes or science projects.

In **Germany**, the National Pact for Women in MINT (mathematics, informatics, natural sciences and technology) Careers – 'Go MINT!' ([9]), offers assistance in deciding on a course of study and facilitates contacts with the working environment. In one of the several Go MINT projects, called 'Cyber mentor', women working in MINT careers are put in touch with female students and answer questions on MINT topics. In other projects, such as 'taste MINT', female secondary school graduates are given a chance to assess their potential for MINT study areas. Various partners participate in MINT projects.

In the **Netherlands**, girls constitute one of the target groups of the *Platform Bèta Techniek*. The aim is to allow girls to become aware of their own talents and to acquire positive science-related experiences. Some specific actions of the *Jet-Net* programme (e.g. the Girls' Day – see above) focus specifically on girls who are provided with female role models and a broad overview of career opportunities in science.

In **Poland**, since 2006, a coordinated campaign under the slogan 'Girls, study at technical universities!' *(Dziewczyny na politechniki!)* has been run by the Education Foundation *Perspektywy* and the Conference of Rectors of Technical Universities to promote engineering and technology programmes among young women. Thanks to subsequent editions of the project the number of female students has increased by 14 000 while the overall number of students gradually decreases.

In **Finland**, the GISEL (gender issues, science education and learning) Project being carried out by the University of Helsinki has sought to find ways to influence girls' attitudes towards science and technology. In practice, science teaching methods have been developed which demonstrate the attractiveness of science and promote young people's interest in science, particularly girls. The intention is to motivate them to study science and to choose advanced science courses in upper secondary school.

In the **United Kingdom**, there are national initiatives to counter the gender imbalance in science and engineering. One of the best known is Women into Science, Engineering and Construction (WISE). The WISE campaign collaborates with a range of partners to encourage girls of school age to value and pursue science-, technology-, engineering- and construction-related courses in school or college as well as to move on into related careers ([10]).

In **Norway**, girls' lack of self-esteem in maths and science constitutes one of the reasons for launching the ENT3R programme. 'Girls and Technology' is another collaborative project of the University of Agder. The university has directly benefited from this career guidance by significantly increasing the number of female applicants to their engineering and technology studies. The project *Realise* aims to develop measures to increase the recruitment of girls into science. The target group for the project is grades 8 to 13. The measures are aimed at students, teachers, counsellors, school administrators and school owners. The focus is on the recruitment of girls to science, especially mathematics, physics, technology, earth science and ICT ([11]).

([9]) www.komm-mach-mint.de
([10]) http://www.wisecampaign.org.uk
([11]) http://www.naturfagsenteret.no/c1515373/prosjekt/vis.html?tid=1514707

5.3. Challenges for national policies to increase interest in MST careers

Young people's interest in mathematics and science is a strong determinant of career choice in MST-related fields. Detailed analysis of centrally supported initiatives to improve motivation in learning mathematics and science reveals that actions rarely cover all levels of school education, from primary to upper secondary, and do not always include a wide range of activities. Currently such broad and comprehensive initiatives for mathematics and science exist only in Austria and Finland, where they also incorporate activities in pre-primary education (EACEA/Eurydice, 2011c, 2011d).

More commonly, countries focus on specific projects, such as support for extra-curricular activities, partnerships with universities and companies, and the promotion of teaching methods which encourage student engagement. Less often supported at national level are, for instance, general awareness campaigns on the value of mathematics and promotion of the involvement of parents in mathematics and science learning (EACEA/Eurydice, 2011c, 2011d).

Initiatives to promote motivation often concentrate on the high achievers, whereas they should target the broader student population. In addition, specific measures to improve motivation seldom focus on vulnerable groups (low socio-economic background, immigrants, minorities), or have as one of their primary objectives to attract more women in MST study fields and professions.

While there is a sound rationale for developing comprehensive MST strategies, the overall effect could be increased if mathematics-specific initiatives are scaled-up to incorporate activities from an early age and take into account the particular motivational challenges that concern this subject area. These challenges include addressing the perceptions that mathematics is difficult, abstract and not relevant to real life, and preventing the development of negative attitudes and anxiety (EACEA/Eurydice, 2011c).

Finally, evaluations of past national strategies and actions have also emphasised the need for coordination at national, regional and local level, for the encouragement of a bottom up approach, and a certain independence from the Ministry of Education, for securing the involvement of a range of stakeholders and for clearly defining the roles of the various players. In this area also there is need to set up measurable objectives and performance agreements and to effectively report results (EACEA/Eurydice 2011d, pp. 30-31).

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GLOSSARY

Country codes

EU-27	European Union
BE	Belgium
BE fr	Belgium – French Community
BE de	Belgium – German-speaking Community
BE nl	Belgium – Flemish Community
BG	Bulgaria
CZ	Czech Republic
DK	Denmark
DE	Germany
EE	Estonia
IE	Ireland
EL	Greece
ES	Spain
FR	France
IT	Italy
CY	Cyprus
LV	Latvia
LT	Lithuania
LU	Luxembourg
HU	Hungary
MT	Malta
NL	The Netherlands

AT	Austria
PL	Poland
PT	Portugal
RO	Romania
SI	Slovenia
SK	Slovakia
FI	Finland
SE	Sweden
UK	The United Kingdom
UK-ENG	England
UK-WLS	Wales
UK-NIR	Northern Ireland
UK-SCT	Scotland
EFTA/EEA countries	The three countries of the European Free Trade Association which are members of the European Economic Area
IS	Iceland
LI	Liechtenstein
NO	Norway
Acceding country	
HR	**Croatia**
Candidate country	
TR	Turkey

Statistical code

: Data not available

International Standard Classification of Education (ISCED 1997)

The international standard classification of education (ISCED) is an instrument suitable for compiling statistics on education internationally. It covers two cross-classification variables: levels and fields of education with the complementary dimensions of general/vocational/pre-vocational orientation and educational/labour market destination. The current version, ISCED 97 ([1]) distinguishes seven levels of education.

ISCED 97 LEVELS

Depending on the level and type of education concerned, there is a need to establish a hierarchical ranking system between main and subsidiary criteria (typical entrance qualification, minimum entrance requirement, minimum age, staff qualification, etc.).

ISCED 0: Pre-primary education

Pre-primary education is defined as the initial stage of organised instruction. It is school- or centre-based and is designed for children aged at least three years.

ISCED 1: Primary education

This level begins between four and seven years of age, is compulsory in all countries and generally lasts from five to six years.

ISCED 2: Lower secondary education

It continues the basic programmes of the primary level, although teaching is typically more subject-focused. Usually, the end of this level coincides with the end of compulsory education.

ISCED 3: Upper secondary education

This level generally begins at the end of compulsory education. The entrance age is typically 15 or 16 years. Entrance qualifications (end of compulsory education) and other minimum entry requirements are usually needed. Instruction is often more subject-oriented than at ISCED level 2. The typical duration of ISCED level 3 varies from two to five years.

ISCED 4: Post-secondary non-tertiary education

These programmes straddle the boundary between upper secondary and tertiary education. They serve to broaden the knowledge of ISCED level 3 graduates. Typical examples are programmes designed to prepare pupils for studies at level 5 or programmes designed to prepare pupils for direct labour market entry.

ISCED 5: Tertiary education (first stage)

Entry to these programmes normally requires the successful completion of ISCED level 3 or 4. This level includes tertiary programmes with academic orientation (type A) which are largely theoretically based and tertiary programmes with occupation orientation (type B) which are typically shorter than type A programmes and geared for entry into the labour market.

ISCED 6: Tertiary education (second stage)

This level is reserved for tertiary studies that lead to an advanced research qualification (Ph.D. or doctorate).

([1]) http://unescostat.unesco.org/en/pub/pub0.htm

ANNEX

Examples of national strategies and large-scale initiatives to promote key competences ([1])

1.1. Examples of national strategies to support the development of individual key competences.

Mother tongue/language of instruction

In **Norway**, the Reading Action Plan covering the period 2010-2014 puts a special emphasis on improving boys' reading competences.

In **Spain**, the national 'Plan for Promoting Reading' *(Plan de fomento de la lectura)* ([2]), and the Act on Reading, Books and Libraries ([3]) *(Ley de la lectura, del libro y de las bibliotecas)* of 2007 aim to foster reading and further develop school libraries. Other initiatives include the 'Programme Reading for learning. Reading in the digital age' (2011) *(Programa leer para aprender. La lectura en la era digital)* and the portal '*Leer.es*' ([4]), as well as the Project to Promote Newspapers in the classroom *(Mediascopio)* ([5]).

Science

In the **Flemish Community of Belgium,** the Department of Economy, Science Policy and Innovation has launched the action plan Science Communication and a related science information network. Their objectives are to: raise awareness among the public about the importance of science and technology in society; provide information about scientific developments in such a way that social debates about these issues can be correctly organised; promote cooperation with the educational sector to raise students' interest in science and technology, and increase the number of pupils taking science and technology subjects.

In **Spain**, the National Strategy for Science and Technology (2007-2015) (*Estrategia Española de Ciencia y Tecnología* – ENCYT) provides a framework for territorial cooperation in this matter. The strategy recommends that, from an early age, the education system should promote: creativity, an interest in science and technology, a better understanding of the world, and skills for identifying problems and finding solutions ([6]).

Foreign languages

In **France**, in 2011, the Ministry of Education set up the Strategic Committee for Languages which has delivered a report with detailed recommendations for the early start of foreign language learning, the improvement of oral skills, better use of ICT and support for the mobility of teachers and students. Some of these recommendations have already been acted upon ([7]).

In the **United Kingdom (Wales)**, in 2010, the Government published *Making languages count – A national modern foreign languages strategy*. The document sets out actions to improve the learning and teaching of foreign languages in secondary schools in Wales to ensure that pupils have a positive experience of language learning during the key stage when this is a compulsory subject (key stage 3,

([1]) For further information on national strategies and initiatives and other aspects of the implementation of key competences see the country overviews, available at http://eacea.ec.europa.eu/education/eurydice

([2]) http://www.mcu.es/libro/MC/PFL/index.html

([3]) http://www.boe.es/boe/dias/2007/06/23/pdfs/A27140-27150.pdf

([4]) http://leer.es

([5]) https://www.educacion.gob.es/mediascopio/IrASubSeccionFront.do?id=3

([6]) http://www.idi.mineco.gob.es/portal/site/MICINN/menuitem.7eeac5cd345b4f34f09dfd1001432ea0/?vgnextoid=1a25128e6f0b1210VgnVCM1000001a04140aRCRD&lang_choosen=en

([7]) http://media.education.gouv.fr/file/02_Fevrier/91/5/Apprendre-les-langues-Apprendre-le-monde_206915.pdf

ages 11-14) and before students select optional subjects for the final two years of compulsory education.

Civics

In **Latvia**, in 2011, the Cabinet of Ministers approved the *National identity, civil society and integration policy guidelines 2012-2018*. The document sets out the aim to develop citizenship education by using both formal and non-formal education approaches. Regular monitoring of citizenship education provision in general education programmes and the development of competencies are among the main tasks defined in the document.

Entrepreneurship

In the **Netherlands**, the Ministries of Economic Affairs, Education, Culture and Science, and Agriculture, Nature and Food Quality have been promoting entrepreneurship and enterprise in education since 2000. In 2005, the ministries started with the Programme 'Partnership Leren Ondernemen' which was followed by the Education and Entrepreneurship Action Programme 2007 and the Education Networks Enterprise 2009, through which the Netherlands provides a specific subsidy scheme to help educational institutions to integrate entrepreneurship education into their policies, organisation and curricula. The objective is to have more students demonstrating an entrepreneurial mind set and behaviour, and to increase the number starting up their own business within a period of five years following the completion of their education.

In **Romania**, the Government has launched a Strategy for the Development of Small and Medium-Sized Enterprises (SMEs) Sector. The measures and actions proposed range from 'promoting an entrepreneurship culture and making entrepreneurship education efficient' to the 'continuous development of the education system in order to efficiently support the promotion of an entrepreneurship culture'. Actions include: developing specific modules within the school curriculum which provide students with the opportunity to learn practical skills, and the option of extending their entrepreneurship knowledge; providing relevant teacher training; supporting the partnership between businesses and the education system with a view to promoting entrepreneurship by developing curricula in cooperation with local businesses; providing students with the opportunity for hands-on experience through activities in a company setting ([8]).

1.2. Examples of national strategies covering several key competences

In **Austria**, the national programme IMST (Innovations Bring Schools to the Top) aims at improving instruction in mathematics, science, information technology, German language and related subjects. It started in 1998 and in 2013 it will be extended for a further three years. The programme helps teachers to put innovative instructional projects into practice and to receive support in terms of content, organisation and finance. It involves about 7 000 teachers who participate in projects, attend conferences or cooperate in regional and thematic networks. In order to investigate the impact of IMST, evaluation and research is integrated at all levels. The programme is conducted by the Institute of Instructional and School Development (IUS) of the Klagenfurt University with support from the Austrian Educational Competence Centres (AECC) and the *Pädagogische Hochschulen* (university colleges of teacher education). Gender sensitivity and gender mainstreaming are important principles of the programme, and their implementation is supported by the Gender Network.

In **Malta**, a National Policy and Strategy for the Attainment of Core Competences in Primary Education has been in place since January 2009. This policy targets the acquisition of core competences in Maltese and English literacy, eLiteracy and mathematics. It proposes an integrated approach that includes four components: preventing underachievement through early support; the early identification

([8]) http://www.fonduri-structurale.ro/detaliu.aspx?t=Stiri&eID=8780

of those at risk of not reaching the required levels of attainment; the integration of core competences into mainstream teaching; and intervention to support pupils in early primary education who are at risk of underachieving. From school year 2012/13, this policy will be extended to the first two years of secondary education (ISCED level 2). Schools and colleges have been assisted in reviewing and rethinking their educational practices, with an emphasis on teaching/learning strategies and home-school links through the use of a Virtual Learning Environment (VLE).

In March 2011, a national strategy to improve literacy and numeracy 'Count, Read: Succeed – A Strategy to Improve Outcomes in Literacy and Numeracy' was launched in the **United Kingdom (Northern Ireland)**. The strategy aims to support teachers and school leaders in their work to raise overall levels of attainment in literacy and numeracy among young people and narrow the attainment gap in educational outcomes.

In **Germany**, the Federal Ministry of Education and Research launched the High-Tech Strategy in August 2006 to encourage the development of new products and innovative services. This strategy was extended to 2020. The aim is to meet the requirement for skilled workers primarily through training and continuing efforts in education, but also to keep up with the international competition for qualified specialist workers by ensuring that conditions for workers from outside the country are made more attractive.

The aim is therefore to attract more young people to courses in the so-called MINT subjects (mathematics, information technology, natural sciences and technology). In this context, the National Pact for Women in MINT Professions will better use the potential of women to meet the need for skilled labour. Additionally, the *Kultusministerkonferenz*, issued a list of recommendations in 2009 for reinforcing MST education, including improving the image of science in society, supporting the science education already taking place in early childhood education, changing curricula and teaching approaches at primary and secondary levels, and creating opportunities for continuing professional development for science teachers.

In **Italy**, the 'Scientific Degrees' Project *(Progetto Lauree Scientifiche)* is a collaboration between the Ministry of Education, University and Research, the *Conferenza Nazionale dei Presidi di Scienze e Tecnologie* (National Conference of Science and Technology Deans) and of *Confindustria* (Industrial Federation). Among its main objectives are increasing the number of students attending science faculties (to study mathematics degrees in particular), engaging students in mathematics and research, and strengthening cooperation between schools and university teachers ([9]).

The Science, Technology, Engineering and Mathematics (STEM) programme throughout the **United Kingdom** began in 2004 and is scheduled to run for 10 years. It aims to increase students' STEM skills in order to: provide employers with the skills they need; help to maintain the UK's global competitiveness; and make the UK a world-leader in science-based research and development. The STEM Programme has eleven action programmes focusing on teacher recruitment, continuing professional development, enhancement and enrichment activity, curriculum development, and infrastructure. Each area of work is driven forward by a specialist lead organisation, working collaboratively with the National STEM Centre. This centre was opened in 2009. Its key objectives are to house the UK's largest collection of STEM teaching and learning resources, which will provide teachers of STEM subjects with access to a wide range of support materials; and to bring together STEM partners with a shared mission to support STEM education, thus supporting the STEM Programme.

([9]) http://www.progettolaureescientifiche.eu/il-piano-lauree-scientifiche/le-finalita-del-pls

The main goals of **Norway's** national strategy for Strengthening Mathematics, Science and Technology (MST) 2010-2014 are: to increase interest in MST and improve recruitment to the subjects at all levels, particularly with respect to girls; and to strengthen students' skills in science subjects. The strategy has been developed by the Ministry of Education and Research and is implemented by the National Forum for MST, an advisory body consisting of education authorities, local and regional authorities, the Research Council, the higher education sector, organisations of employers and trade unions. For primary and secondary education, the following targets have been set: students should perform at least as well as the international average in international surveys in science subjects; the proportion of students who choose and complete a specialisation in mathematics, physics or chemistry in upper secondary education and training should increase by at least five percentage points by 2014; the strategy should focus on curricular reform, the provision of teaching material, guidance, the work of science centres, and teacher recruitment.

1.3. Examples of large scale initiatives to promote the key competences in the absence of national strategies ([10])

Mother tongue/language of instruction

'Rage to read' is an annual reading event in **Belgium (French Community)**, mainly taking place in public libraries and bookshops, with the aim of promoting reading through interviews with authors and illustrators, storytelling family walks, reading aloud to children, exhibits on comics, etc.

In **Germany**, the programme 'Reading Start – Three milestones for Reading' was introduced by the Federal Ministry of Education and Research and the Reading Foundation in December 2010. The programme provides support for parents and their children in the early years. Children are presented with books and parents are instructed on the benefits of reading out aloud and on how they can promote reading ([11]).

In the **United Kingdom (England)**, the Government promotes reading for pleasure as part of its commitment to improve literacy skills for all pupils. Ofsted, the schools inspectorate, recommended in March 2012 that all schools should develop policies to promote reading for enjoyment and a new national reading competition was launched by the Department for Education (DfE) in October 2012. These new initiatives are in addition to a number of well-established schemes: Booktrust receives funding from the DfE and publishers to provide babies and young children with books through the Bookstart, Booktime, Booked Up and the Letterbox Club. Specialist books are also offered for children who are blind or partially sighted (Booktouch) and for deaf children (BookShine). The Summer Reading Challenge, coordinated by the Reading Agency, aims to encourage children (aged 4 to 11) to visit the public library and read over the long summer break when their reading skills can decline without regular reading activity at school.

Science

The objectives of the 'Programme TeaMe' in **Estonia** are to increase public awareness of the impact of research and development on the competitiveness of the economy; to inform young people and popularise science-related professions and career options; and to disseminate scientific thinking. Programme activities result in an increase of scientific discussion in the media and the production of learning materials for young people interested in MST. The programme which is funded by the ESF will run until 2015. Moreover, the Ministry of Education and Research, the University of Tartu and the city of Tartu founded the AHHAA Science Centre ([12]) in 1998. It develops new methods for explaining science and technology to the public and in particular to young people. The Science Centre is supported from

([10]) The vast majority of countries that have developed national strategies for key competences have also put in place various large-scale initiatives, which are not presented in this Annex.

([11]) http://www.lesestart.de

([12]) http://www.ahhaa.ee/en/

the state budget, European Structural Funds and private sector funding. It includes interactive educational exhibitions, 'science theatre' shows, planetarium lectures and fun laboratory experiments.

In **Slovakia**, the non-governmental organisation 'Schola Ludus' promotes science, research and scientific knowledge in a user-friendly way to a wide public, including children and young people from pre-primary to lower secondary level. *Schola Ludus* cooperates with universities, science centres and museums as well as private companies. In addition to providing professional development for teachers, *Schola Ludus* supports schools in developing educational programmes in science subjects. It also organises exhibitions and non-formal educational activities for summer camps.

In **Finland**, the national 'LUMA Centre' ([13]) is an umbrella organisation for cooperation between schools, universities, business and industry, coordinated by the Faculty of Science of the University of Helsinki. Its main objective is to support and promote teaching and learning of MST at all levels. The LUMA Centre works together with schools, teachers, students of education and several other partners in order to achieve its goals. The centre develops activities for pupils, such as MST camps, as well as providing in-service training and workshops for teachers. In addition, LUMA serves as a resource centre for mathematics, supplying various teaching and learning materials.

Foreign languages

In **Portugal**, a national project at ISCED 1 has been running since 2005. English Language Learning as a Curriculum Enrichment Activity *(Atividade de Enriquecimento Curricular – Inglês)* intends to improve motivation in foreign language learning and its provision is compulsory in every primary school.

Civics and entrepreneurship

In **Malta**, students' cooperatives have been set up, and students in Grade 10 have the opportunity to undergo a period of job shadowing in various industries. One of the Strands of Learning of the new Social Studies curriculum (Grade 1-11) deals with the impact of industry and enterprise. The subject 'Personal and Social Development' aims to develop, among others, effective communication skills, teamwork, problem solving and decision-making skills.

1.4. Examples of national strategies that are currently in the development stage

In the **Czech Republic**, conceptual material under the working title 'Strategy for the development of reading and mathematical literacy in basic education 2012-2017' is being prepared by the Ministry of Education, Youth and Sports. The strategy aims at defining a system of measures to support the development of reading and mathematical literacy of basic school pupils. The measures will include modifications of the curriculum, teaching methods and the content of teacher professional development.

In **Estonia**, the main objectives of the action plan currently being developed are to enhance capacity-building in the mathematics, science and technology community, increase the number of MST graduates and ensure the sustainability of MST education.

In **Ireland**, work has been completed on a draft foreign language education policy, within the Council of Europe framework, but this has yet to be mainstreamed in the Irish system.

In **Italy**, the Ministry of Education, University and Research issued the new guidelines for the curriculum for pre-primary, primary and lower secondary education in September 2012. One of the main changes is that the key competences for lifelong learning as defined by the European Parliament and the Council of the EU (Recommendation of 18 December 2006) have been cited as aims for the Italian education system.

([13]) http://www.helsinki.fi/luma/english/index.shtml

In **Hungary**, the Institute for Education Research has prepared recommendations for a strategy to educate active, responsible citizens. In addition, strategies and action plans are planned for entrepreneurship education from the school year 2012/13.

In **Malta**, the science education strategy consultative document, *A vision for science education in Malta*, was published in May 2011. It provides an overview of the state of science education and examines the various programmes and resources available in order to identify the predominant approaches to teaching and learning science. It predicts logistical and training needs, resources, and time frames for the implementation of the strategy. Since then, a number of consultation seminars and meetings have been held with science educators and interested stakeholders. Feedback about the document was gathered until the end of December 2011 and is currently being analysed by the Directorate for Quality and Standards in Education before a final version of the document is published. It aims to give greater importance to science education in Maltese primary schools and a new approach to science education in the secondary sector.

Poland is working on several strategy documents. The Strategy for the Development of Social Capital 2011-2020 is currently subject to public consultation. The strategy refers directly to the provision of key competences, to basic and complex skills as well as to the development of students' creativity within the framework of general education. It also aims to respond to the most important challenges related to the development of civic activity and social participation in public life. The Strategy envisages support for the development of ICT competences – in parallel with the more traditional competences such as reading or working with texts. It recommends the wide use of ICT in learning activities. A document entitled the *LLL Perspective* has been annexed to the above-mentioned strategy. In its fourth aim 'Education and training tailored to the needs of the economy and to changes in the labour market', the document includes a direct reference to the development of key competences. Finally, the National Programme for the Development of Reading 2011-2020 is being prepared by the Ministry of Culture and National Heritage.

In **Slovenia**, the public consultation on the draft of the Resolution on the National Programme for Language Policy 2012-2016 is in progress.

In the **United Kingdom (Wales)**, the 'National Literacy and Numeracy Frameworks' for learners aged 5 to 14 were introduced in schools on a non-statutory basis in September 2012. They will become a statutory part of the National Curriculum in Wales in September 2013.

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This report reviews national policies for the development of key competences at school in Europe. It acknowledges the progress made so far in implementing the key competences approach and discusses several policy challenges that are directly linked to the contribution of education and training to meeting changing skills demands: tackling low achievement in reading, mathematics and science; increasing the number of mathematics science and technology graduates, and further support for the acquisition of transversal competences such as IT skills, entrepreneurship and civics.

The report covers 31 European countries (EU Member States, Croatia, Iceland, Norway, and Turkey) and takes the reference year 2011/12. Information covers compulsory and secondary general education.

The **Eurydice network** provides information on and analyses of European education systems and policies. It consists of national units based in 34 countries participating in the EU's Lifelong Learning programme and is co-ordinated and managed by the EU Education, Audiovisual and Culture Executive Agency in Brussels, which drafts its publications and databases.

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