



## Mathematics Education in Europe: Common Challenges and National Policies

Competence in mathematics is integral to a wide range of disciplines, professions and areas of life. This Eurydice report reveals crucial elements of the policies and practices that shape mathematics instruction in European education systems, focusing on reforms of mathematics curricula, teaching and assessment methods, as well as teacher education. The report also explores how countries tackle low achievement and increase students' motivation to learn mathematics. It is based on an extensive literature review on mathematics education, main findings from the international surveys PISA and TIMSS and includes the results of a Eurydice pilot survey (SITEP) on the content of initial teacher education programmes. It covers 31 countries (all EU Member States, plus Iceland, Liechtenstein, Norway and Turkey) and takes the reference year 2010/11.

### What is Eurydice

The **Eurydice Network** provides information on and analyses of European education systems and policies. As of 2011, it consists of 37 national units based in all 33 countries participating in the EU's Lifelong Learning programme (EU Member States, EFTA countries, Croatia and Turkey) and is coordinated and managed by the EU Education, Audiovisual and Culture Executive Agency in Brussels, which drafts its publications and databases.



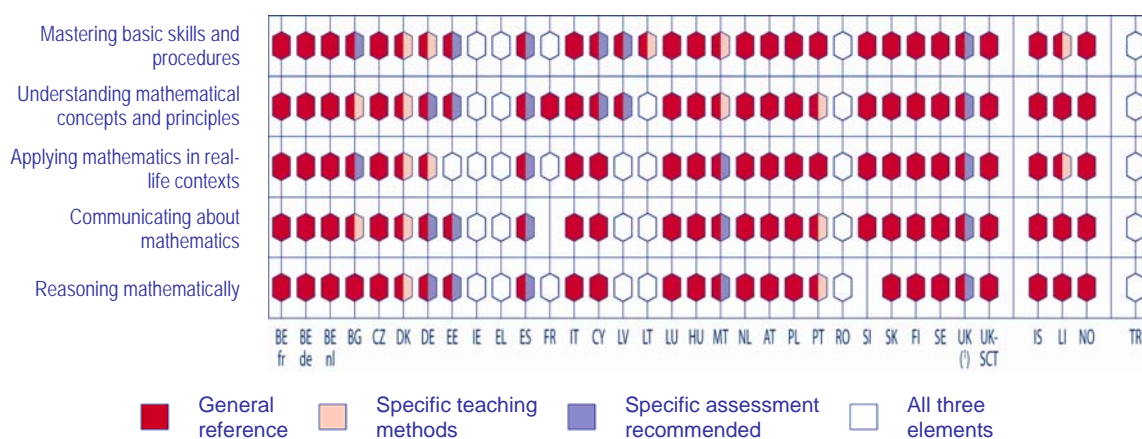
## Reforming the mathematics curriculum and ensuring its translation into classroom practice

Mathematics curricula lay down all the essential learning aims and outcomes of mathematics education. In the past years, and especially since 2007, the great majority of European countries have revised their mathematics curricula, adopting an outcome-based approach whereby the focus lies on developing students' competences and skills rather than on theoretical content. The amount of mathematics content in the curriculum has decreased while cross-curricular links, problem-solving and the application of knowledge has increased. This integral approach tends to be

more comprehensive and flexible in responding to the needs of a diverse range of learners, as well as to their ability to understand the purpose of mathematics applications in the real world.

However, the report also reveals that central authorities are generally falling short on providing sufficient guidance to teachers for implementing the revised curriculum. Providing the necessary support to teachers while respecting their didactic autonomy remains therefore a challenge in Europe.

**Figure 1: Skills and competences in the mathematics curriculum and/or other mathematics steering documents, ISCED levels 1 and 2, 2010/11**



Source: Eurydice.

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

### A range of teaching approaches to meet the needs of all learners

Effective mathematics instruction involves the use of a variety of teaching methods. At the same time, there is general agreement that certain methods such as problem-based learning, investigation and contextualisation are particularly effective for raising achievement and improving students' attitudes toward mathematics. While most central authorities in Europe report providing some form of guidance on teaching approaches in mathematics, there is further potential for strengthening support

for methods which promote students' active learning and critical thinking.

The report reveals that the use of ICT in mathematics is prescribed in the majority of countries. However, despite their general availability, computers are rarely used during mathematics instruction. This contradiction points to a failure to make mathematics relevant by connecting it with a technology that students use on a daily basis.

### Effective use of assessment methods

Mathematics is one of the main focuses of national tests in compulsory education as well as in school leaving examinations at the end of upper secondary education. National test results are reportedly used to inform curriculum development as well as teacher training and professional development. However, national information also suggests that they could be used in a more systematic way by policy-makers at the different levels of decision-making.

National guidelines for classroom assessment, in particular for innovative forms such as project-, portfolio-, ICT- or self/peer-assessment only exist in very few countries. Therefore, the report finds that teachers and schools could greatly benefit from guidance not only on how to prepare and administer assessment, but also on how to provide relevant feedback to students.

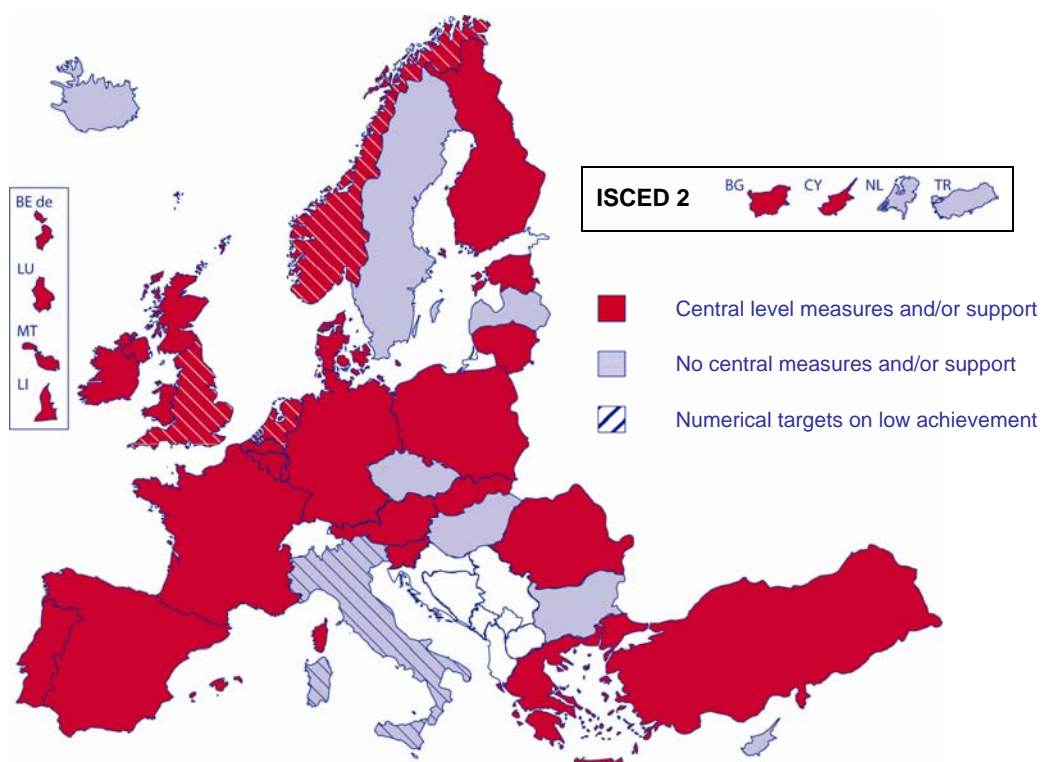
## Tackling low achievement: need to set up targets and monitor progress

The majority of European countries provide broad national level guidelines to address student difficulties in mathematics, recommending, for example, the use of individual and small group tuition or curriculum adaptations. In some European countries, however, the rate of students who do not have basic skills in mathematics remains significant. Despite this unsettling fact, few European countries have set national objectives regarding low achievement in mathematics. Less than half of

the countries conduct surveys or reports on causes of low achievement and even less common are evaluations of support programmes for low achievers.

This calls for more stringent action to tackle low achievement in mathematics at national level. Measures should be timely and comprehensive enough to address the various factors that have an impact on low achievement, ranging from parental education levels to insufficient teacher training.

Figure 2: National level guidelines in addressing low achievement in mathematics, ISCED levels 1 and 2, 2010/11



Source: Eurydice.

## Improving student motivation and engagement

Being motivated to learn mathematics not only boosts students' performance, but also increases their chances of pursuing a career requiring high levels of mathematical knowledge. However, across Europe, the share of Mathematics, Science and Technology (MST) students, when compared to other subjects, has been declining. Additionally, over the last years, the share of female MST graduates has stagnated. Many European countries have declared these trends as major policy concerns.

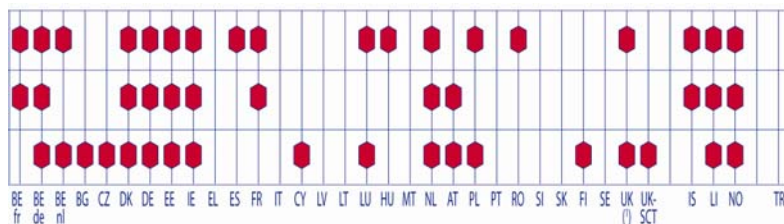
To date, less than half of European countries have national strategies for increasing motivation in learning mathematics, and often, these strategies form part of a broader science and technology

programmes. Most of them involve projects focusing, for example, on extra-curricular activities or partnerships with universities and companies. Only Austria and Finland have put in place large-scale initiatives that cover all education levels and include a wide range of actions.

Likewise, measures that specifically target students with low motivation and attainment or counteract the gender imbalance in mathematics learning need to be reinforced. Only four countries promote national activities related to gender issues in mathematics education and few others have implemented national campaigns to attract more women into the mathematics-related professions.

Figure 3: Policy concerns related to skills shortages and the take-up of mathematics and related disciplines in higher education, 2010/11

The number of HE graduates in mathematics and related disciplines is declining  
 The gender balance among HE students in these disciplines needs to be improved  
 There are skills shortages in areas requiring high levels of mathematical knowledge



Source: Eurydice.

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

## Teacher education to promote knowledge and skills for flexible instruction

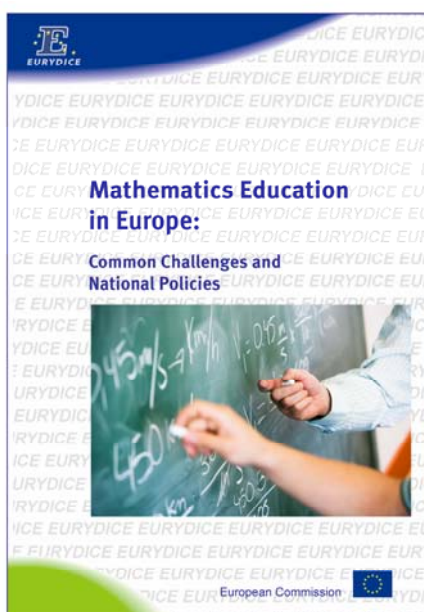
To be effective, mathematics teachers need sound knowledge of the subject, a good understanding on how to teach it and the flexibility to adapt their methods to respond to the needs of all students. In addition to the concern over aging mathematics teachers and an unequal gender imbalance in some countries, improving the competences of mathematics teachers represents a great challenge.

In most European countries, central guidelines for initial teacher education programmes cover a wide range of areas of mathematical knowledge and teaching skills. This is echoed by the findings of the Eurydice pilot survey of initial teacher education programmes (SITEP). However, both SITEP results and official regulations and recommendations

indicate that teaching mathematics to a diverse range of students and in a gender sensitive way are competences that need to be strengthened in future programmes.

One particularly positive development is the rise of teacher cooperation and the sharing of best practices via web platforms, social networking sites and other online resources. Most European countries increasingly promote this type of teacher collaboration, acknowledging its potential to achieve progress on a larger scale. On the other hand, teachers' low participation rates in professional development on specific mathematics teaching skills pose a problem that needs to be addressed.

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### The full study

*Mathematics Education in Europe: Common Challenges and National Policies*

can be found in English, French and German on the Eurydice website:

[http://eacea.ec.europa.eu/education/eurydice/thematic\\_studies\\_en.php](http://eacea.ec.europa.eu/education/eurydice/thematic_studies_en.php)

### Printed copies of the report

are available upon request at [eacea-eurydice@ec.europa.eu](mailto:eacea-eurydice@ec.europa.eu)

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