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Key Data on Learning and Innovation through ICT at School in Europe 2011

European Commission

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This document is published by the Education, Audiovisual and Culture Executive Agency (EACEA P9 Eurydice).

Available in English (Key Data on Learning and Innovation through ICT at School in Europe 2011), French *(Chiffres clés de l'utilisation des TIC pour l'apprentissage et l'innovation à l'école en Europe 2011)* and German *(Schlüsselzahlen zum Einsatz von IKT für Lernen und Innovation an Schulen in Europa 2011)*.

ISBN 978-92-9201-184-0

doi:10.2797/61068

This document is also available on the Internet (http://eacea.ec.europa.eu/education/eurydice).

Text completed in May 2011.

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FOREWORD

Strengthening education systems so that every young person can develop his or her full potential is at the heart of the European cooperation process. Innovation-friendly institutions that aim to enhance teaching and learning through new technologies can make an important contribution. For this reason, EU Member States agreed on the promotion of creativity and innovation, including through the use of new ICT tools and teacher training, as one of the priority areas for the first cycle of the Strategic Framework for education and Training ('ET 2020').

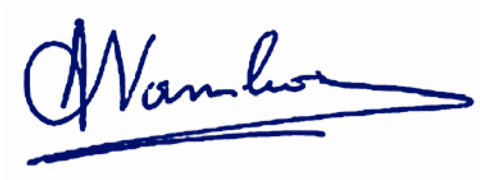
In addition, the Digital Agenda for Europe initiative defines the enhancement of digital literacy and skills as one of its main pillars and promotes the implementation of long-term e-skills and digital literacy policies.

Information and communication technologies (ICT) provide a variety of tools that can open up new possibilities in the classroom. They can particularly help tailor the educational process to individual students' needs, and they can also provide learners with the crucial digital competences needed in our knowledge-based economy.

The solution to an effective use of ICT in education, however, is not technology itself. Most European countries have made significant investments over the last years with a view to ensuring universal access to ICT, with considerable success. The focus of today's policy in the field should now move to advancing our understanding of how the new technologies are and can best be used in schools to support learning, and what are the barriers in the way of success.

The present report analyses the evolution of ICT use in education and the changes it has brought about in national policies and practices concerning teaching methods, contents and evaluation processes. It examines the promotion of transversal as well as job-related key competences, and the role of ICT in this process. It also sheds light on the strategies used in countries to train and support teachers in the use of ICT.

Information and communication technologies are evolving extremely rapidly and the issues associated with their use in education are increasingly complex. If ICT tools are to become effective and integral tools in education, monitoring and evaluation of this process are indispensible. This new report prepared by Eurydice provides an important set of indicators and invaluable insights that can support policymakers in their efforts to assess and enhance the impact of the use of ICT on learning.



Androulla Vassiliou
Commissioner responsible for
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CONTENTS

INTRODUCTION

This report on *Key Data on Learning and Innovation through ICT at School in Europe 2011* builds on the previous Eurydice publications on information and communication technology in schools in Europe ([1]). It also aims to extend the theoretical framework by looking not only at the teaching and learning of ICT but also at the use of ICT to promote innovation in educational processes and to foster the development of creativity in pupils and students.

The study examines the evolution of ICT infrastructure in schools in terms of networks, hardware and software. It then looks at how ICT is being used in educational processes and incorporated into curricula before focusing on its role in enabling the development of innovative teaching methods. Finally, the crucial part played by ICT in the development of 21st century skills is assessed.

POLITICAL CONTEXT AND BACKGROUND TO THE REPORT

The use of ICT in education is an important element in the European Commission's strategy to ensure the effectiveness of European education systems and the competitiveness of the European economy. In 2000, the European Commission adopted the eLearning initiative, an action plan which set out the central themes for development in the succeeding years (European Commission, 2000). eLearning has been defined as 'the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services' (European Commission 2008a, p. 6). Alongside existing ICT-based measures, the eLearning initiative looked at 'the effective integration of ICT in education and training' (European Commission 2000, p. 3). The i2010 strategy emphasised the need to promote education and training in the use of ICT (European Commission, 2005). Since 2007, ICT for education has also become one of four cross-cutting themes of the Lifelong learning programme (2007) and a general priority in the four vertical programmes (Erasmus, Comenius, Leondardo da Vinci and Grundtvig) (European Commission, 2008b).

In this context, the i2010 initiative on e-Inclusion identified specific areas directly related to teaching in schools where progress was needed. In the area of **infrastructure**, it focused on providing schools with high speed Internet connections and making Internet and multimedia resources available to all students in the classroom (European Commission, 2007).

Determining which **skills and competences** would be essential for young people and the future workforce has also been a crucial area of concern. The improvement of key competences was mentioned prominently in the eLearning initiative (European Commission, 2000) and further elaborated in the Communication on e-Skills, which highlighted the need to address digital (il)literacy (European Commission 2007, p. 8). The recently adopted initiative on new skills for new jobs provides a new overarching framework (European Commission, 2010) and the 'Digital Agenda for Europe' identified the lack of ICT skills as one of the seven most important obstacles to harnessing the potential of ICT (European Commission 2010, p. 6). Overall, the Commission's approach heeds the recommendations of, for example, the OECD (2005) to focus on the provision of competences rather than on knowledge. To successfully teach these competences to pupils, **teacher qualifications** were identified as an equally crucial aspect.

([1]) Eurydice 2001. Information and Communication Technology in European Education Systems (ICT@Europe.edu); Eurydice 2004. Key data on information and communication technology in schools in Europe; Eurydice 2010. Education on Online Safety in Schools in Europe.

In 2006, the International Association for the Evaluation of Academic Achievement (IEA) conducted the Second Information Technology in Education Study (SITES). It provided evidence that the use of ICT in the classroom has an effect on the **pedagogical methods** employed by teachers (Law, Pelgrum and Plomp 2008, p. 147 ff). The European Commission also emphasised the potential of ICT to encourage innovation in approaches to teaching and learning (European Commission, 2008c). The opportunities provided by ICT (e.g. networking, interaction, information retrieval, presentation and analysis) are seen as core elements in honing 21st century skills. This also required a more comprehensive embedding of ICT and its pedagogical use in the curriculum for pupils as well as in teacher training.

STRUCTURE OF THE REPORT

A precondition for using computers in educational contexts is that they are widely available and users are familiar with them. **Chapter A** examines the extent to which access to computers and Internet connections are available, and how well these tools are used both by the general population and in households with children.

This description sets the context for an in-depth look in **chapter B** into how ICT is used to develop key competences or skills, and digital skills in particular, in primary and secondary education.

In **chapter C,** the various innovative teaching approaches recommended by central authorities are examined as is the use made of ICT applications to support innovative teaching particularly with respect to different subjects in the curriculum. The second section of this chapter focuses on approaches to assessing students' ICT competences and on new methods of evaluation using electronic tools.

Chapter D studies teachers' knowledge of, and attitudes towards ICT, which are important if they are to make effective use of the new technologies in education. The ICT skills and competences that teachers develop during their initial education as well during continuing professional development programmes are also considered.

Finally **chapter E** looks at the available ICT infrastructure in schools, and at the impact that a lack of computers, educational software or technical support staff may have. The effects of ICT on school organisation, collaboration with the business sector and communication with parents are also investigated.

COVERAGE AND SOURCES

Member states themselves are responsible for implementing ICT measures to improve infrastructure and skill levels as well as for encouraging the integration of ICT into the curricula. This report therefore draws primarily on national information collected by Eurydice from 31 European countries. The educational levels covered are primary education (ISCED 1) and general secondary education (ISCED 2 and 3). The reference year for all the Eurydice indicators is the 2009/10 school year.

Further insights are provided through Eurostat indicators (Information society and National accounts statistics, 2010) and from the findings of the Trends in International Mathematics and Science Study 2007 (TIMSS) and the Programme for International Student Assessment 2009 (PISA).

These indicators reflect the most recent data. However, due to the time lag in collecting these data and the rapid development of technology it is likely that the use of, for example, social media will have increased by the time of publication.

MAIN FINDINGS

INFORMATION AND COMMUNICATION TECHNOLOGIES ARE PART OF OUR EVERYDAY LIFE AND UNDERPIN OUR CHILDREN'S EDUCATION

ICT has become an important driver of everyday life and economic activity. An overwhelming majority of people in Europe today use a computer for a variety of purposes; for the younger generation especially, using a computer is a normal, everyday activity. The integration of computers into the sphere of education reflects these tendencies.

The successful use of computers in educational contexts is dependent not only on their availability but also on users' familiarity with them. This also holds true for access to the Internet.

The indicators of the report paint a picture of a population – and especially a pupil population – fully embedded in a multimedia world.

- The relevance of GDP per capita as a determinant for computer availability at home is diminishing and households with children increasingly have computers (see Figure A1). At the same time, wide disparities between countries remain.
- Specific public financial support for buying education-related ICT equipment is provided in one third of European countries, but there is no direct correlation between the availability of public financial support and the availability of computers in households.
- Access to computers and the Internet at home for entertainment is quite widespread (see Figures A1 and A3) and students use them on a daily basis (see Figure A4), however, use of computers at home for school related learning activities is much lower with a difference of about 30 percentage points (see Figure A5).

NATIONAL POLICIES FOR ICT IN EDUCATION EXIST IN ALL EUROPEAN COUNTRIES AND USUALLY COVER THE COMPLETE LEARNING PROCESS

In 2010, the European Commission adopted a new Digital Agenda for Europe (European Commission, 2010b) that reaffirms and refines a number of challenges for the years to come. The objective of the Agenda is to maximise the social and economic potential of ICT. This can only be achieved through the development of high level ICT skills, including digital and media literacy.

All European countries have national strategies in place to foster the use of ICT in different areas including a specific strategy devoted to education. In many cases, these strategies aim to provide the necessary ICT skills to pupils (in particular literacy skills) as well as provide ICT training for teachers. Another defining feature is the provision of up-to-date technology and infrastructure at schools. The target groups for the measures in all countries are teachers/trainers and the activities focus on primary and secondary school education.

- Research projects and training measures for the development of digital and media literacy as well as e-skills are widespread across Europe. E-inclusion is another relevant area where more and more specific training is offered (see Figure A6).

- Almost all countries centrally monitor progress in meeting national ICT strategic objectives (see Figure A7).
- Policy and strategy development rest mainly with the central administrative level (see Figure A8), while implementation involves a significantly larger number of bodies including local administrations and schools (see Figure A9).
- Almost all countries publicly fund ICT actions in education; in approximately half of European countries this funding is supplemented by private contributions (see Figures A10 and A11).

NO GREAT DISPARITY BETWEEN SCHOOLS IN AVAILABILITY OF ICT EQUIPMENT BUT A LACK OF EDUCATIONAL SOFTWARE AND SUPPORT STAFF STILL AFFECT THE INSTRUCTION

Access to satisfactory ICT infrastructure is one of the most important factors contributing to the effective use of information technologies in all subjects and for all students. However, some infrastructure problems persist and these are hindering the integration of new technologies into teaching and learning. The existence of up-to-date ICT equipment in schools is a primary condition for the introduction of innovative teaching methods and use of interactive software and online materials. However, the integration of ICT into school education is a complex process and therefore it is affected by many different factors (Balanskat, Blamire and Kefala, 2006).

ICT technologies are crucial in helping teachers provide innovative teaching and learning opportunities but they also play a significant role in delivering effective school management. The European Commission even stated in a recent report that 'embedding ICT in education and training systems requires further changes across the technological, organisational, teaching and learning environments of classrooms, workplaces, and informal learning settings' (European Commission, 2008c).

- Education authorities use a wide variety of indicators to measure the availability of ICT hardware and software in schools (see Figure E1). Periodic reporting by institutions is the most common method for collecting information on the availability of ICT equipment. However, inspectorates also evaluate ICT availability using standard lists of criteria corresponding to national objectives or indicators for the development of the ICT in schools (see Figure E5).
- In 2009, in almost all countries, at least 75 % of the students were studying in schools with one computer for up to four students. During the last 10 years, the disparities between schools have been eroded and there are between two and four students per computer in schools in most European countries (see Figures E3 and E4).
- The updating of computer equipment and the procurement of educational software is a responsibility delegated to schools. However, in many cases, central or local education authorities supplement school ICT resources.
- The shortage of ICT resources still affects the instruction of around one third of students. In mathematics and science, the lack of computer software was considered to be a greater problem than the lack of computer hardware (see Figure E7a and E7b).
- Integrated information systems for monitoring student progression, managing human resource/teacher information as well as financial management have been developed as part of the modernisation process for school administration (see Figure E9).

NEW TRANSVERSAL AND DIGITAL COMPETENCES ARE WIDELY INCLUDED IN NATIONAL CURRICULA

The development of qualification and assessment frameworks based on competences is strongly linked to the current demands of globalisation, modernisation and the knowledge society. In addition to helping students to enter the workforce, key skills or competences are also regarded as a basis for ‘community cohesion, based on democracy, mutual understanding, respect for diversity and active citizenship’ as well as for ‘personal fulfilment and happiness’ (European Commission 2010a, p. 11).

These basic skills or competences are always defined as *outcomes* of the education process and therefore form part of the conceptual shift ‘from a content-based input approach to a competence-based output approach’ (Malan 2000, p. 27).

By transforming teaching and learning, ICT is considered to contribute to the acquisition of basic – or key – competences. Students need to achieve ‘digital fluency’ (European Commission/ICT Cluster 2010, p. 11). This is true whether these basic competences are subject-specific or cross-curricular/transversal and must therefore be acquired through the whole education process.

- Almost all countries include EU key competences in their steering documents and often recommend using ICT to teach these competences (see Figure B1). Where the assessment of key competences is recommended, it often applies to only part of them and only six countries recommend assessing all key competencies (see Figure B2).

- Most central steering documents include various cross-curricular or transversal skills as desired outcomes of the education process but only a few countries evaluate this process (see Figures B3 and B4). Learning and innovation skills, including creativity, problem solving and communication, are mentioned in all the steering documents analysed, and the use of ICT is commonly proposed as method for developing these skills.

- General learning objectives for ICT are included in curricula especially at secondary level. However, specific knowledge of, for example, the ‘social media’ or ‘how to use mobile devices’ is still not generalised in most countries (see Figure B6).

- ICT remains a separate subject in a group of countries largely at secondary level, but ICT content is increasingly embedded in the curriculum as a means of developing general or specific skills in other subjects (see Figure B7).

- Safe online behaviour and other online safety content are commonly included in education programmes. 'Downloading and copyright issues' and 'cyber-bullying' are becoming two of the most important topics in this area (see Figure B8).

ICT IS WIDELY PROMOTED BY CENTRAL AUTHORITIES AS A TOOL FOR TEACHING AND LEARNING BUT LARGE IMPLEMENTATION GAP REMAINS

The European Framework for Key Competences for Lifelong Learning ([1]) identifies and defines the key abilities and knowledge that people need in order to achieve employment, personal fulfilment, social inclusion and active citizenship in today's rapidly-changing world.

Schools can help their students develop these competences by teaching them, from an early age, to critically reflect on and manage their learning, to work autonomously and collaboratively, to seek information and support when necessary, and to use all the opportunities provided by new technologies (European Commission, 2008c).

The use of ICT by teachers can have various benefits, which may even be increased if students themselves are enabled to use ICT in the learning process. Research has shown that using ICT can raise students' motivation to learn through giving the learner more control over the learning experience (see e.g. Condi et al., 2007; Passey et al., 2003). Students' use of ICT can also facilitate personalised and individualised learning. Furthermore if ICT is used to support subject-specific learning, it can also have a positive impact on attainment.

- At both primary and secondary level, the great majority of countries recommend or suggest a wide range of innovative teaching methods that are based on active and experimental learning and thus aim to increase student engagement and improve results (see Figure C1).

- Teachers are encouraged through central-level recommendations, suggestions or support material to use a variety of ICT hardware and software in the classroom (see Figure C2), and in almost all countries this applies to all core curriculum subjects (see Figure C4).

- Evidence from international surveys shows that across the EU the teachers of around half the student population do not encourage the use of ICT for activities during mathematics or science lessons (see Figures C5 and C6) or in language of instruction or foreign language lessons (see Figure C7).

- An important consideration is the location of ICT equipment in schools. In several countries, computers are still not readily accessible to students in the classroom, but are located in computer labs where they can only be used under a teacher's supervision and during specific hours (see Figure C9).

- In most European countries there are central recommendations or suggestions promoting the use of ICT to support disadvantaged students in their learning and to help raise achievement (see Figure C10).

([1]) Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning, OJ L 394, 30.12.2006, p. 10-18.

ICT IS OFTEN RECOMMENDED FOR ASSESSING COMPETENCES BUT STEERING DOCUMENTS RARELY INDICATE HOW IT SHOULD BE APPLIED

To realise the potential of ICT, it should be used in the classroom not only as a learning tool but also as a means of assessment. For this to happen, changes need to be made to assessment frameworks to reflect the developments already taking place in teaching and learning as a result of using ICT (Osborne 2003, p. 40). Self-assessment, for example, can be achieved by integrating tests into e-learning software to 'allow learners to monitor their improvement throughout the course' (Webb 2006, p. 499). More conceptually, ICT has been hailed as a catalyst for a 'new teaching paradigm' (Pedro 2005, p. 400) focusing on continuous assessment based on learning outcomes.

The use of three approaches to pupil assessment which benefit from or genuinely build on ICT was considered: self-assessment which can benefit from ICT as pupils are provided with immediate feedback on their performance and information can be shared; the assessment of learning outcomes, which may include digital literacy, by the teacher (or other students); and the e-Portfolio which is a genuinely ICT-based assessment mechanism that facilitates the collection of evidence of students' achievements.

- Few countries have already implemented e-Portfolios as assessment approach, but a number of countries are planning to use them or are in the pilot phase (see Figure C11).

- Very few countries centrally recommend using ICT in pupil assessment in compulsory education, but if they do so they mostly recommend onscreen and/or interactive general pupil testing (see Figure C11).

- ICT skills are generally assessed in Europe. Where this occurs, practical and theoretical tests are often used side by side. Assessment is much more widespread in secondary education (see Figure C12).

- Attainment targets based on the European Computer Driving Licence (ECDL) are used in a number of countries to assess and certify students' ICT skills. However, national recommendations on the use of ECDL vary as does the actual form of certificates awarded to students (see Figure C14).

TEACHERS USUALLY ACQUIRE ICT TEACHING SKILLS THROUGH THEIR INITIAL EDUCATION BUT FURTHER PROFESSIONAL DEVELOPMENT IS LESS COMMON

Teaching staff are the key players in strengthening and fostering the new digital environment in schools. It is vital that the European Union has well-trained teachers, able to incorporate ICT into education in a way that leads to change from the old to the new paradigms of learning which are much more student-centred than before (Learnovation Consortium, 2008).

European Member States have recognised the importance of teacher education in this context. They have committed themselves in developing ICT skills during initial teacher education and to continue to encourage this through early career support and continuing professional development. This support enables teachers to make use of ICT in their teaching, in classroom management tasks, as well as in their personal professional development (European Council, 2007).

However, although a positive trend can be observed in teachers' use of computers in class, their general motivation to use ICT remains an issue (Korte and Hüsing, 2007). Education systems need to adapt to help remedy this situation. As technology is constantly changing, teachers need regular support to keep up-to-date through relevant professional development programmes and materials.

- Digital literacy is taught mainly by specialist ICT teachers at secondary level but in approximately 50 % of countries it is also taught by other specialist teachers such as mathematics or science teachers (see Figure D2).

- Around one third of all students in Europe attend schools where school heads report finding it difficult to fill teaching vacancies for ICT teachers (see Figure D3).

- Although ICT is included in regulations on teacher education, practical ICT-related pedagogical skills are rarely addressed at central level (see Figures D4 and D5).

- Teachers' participation rates in professional development on integrating ICT into the teaching process are higher for mathematics than for science, but they are particularly low for both subjects at primary level (see Figure D6).

- In almost all countries, centrally promoted online resources exist to support teachers' use of ICT to deliver innovative teaching and learning opportunities in the classroom (see Figure D8). Moreover, pedagogical support is generally available in Europe to help teachers with the practical implementation of ICT in the classroom (see Figure D9).

INFORMATION TECHNOLOGIES ARE PLAYING A CENTRAL ROLE IN COOPERATION BETWEEN SCHOOLS AND THE COMMUNITY AND TO ENGAGE PARENTS IN THE LEARNING PROCESS

The School-business forum promoted by the European Commission in 2010 stated that strong public-private partnerships can help schools to improve education processes. School-business co-operation can also help students to develop cross-curricular/transversal competences, raise their motivation to learn and take the initiative to create their own learning plans.

The new methods of communication between schools and parents are an important element of everyday school management. In many schools, an electronic newsletter is often available which parents can subscribe to, or in some cases even help to write. Finally, administrative information such as ministry circular letters or announcements are also available online and available to parents.

In many schools, the use of ICT is not only limited to communicating everyday information, but also for strengthening family engagement and encouraging learning outside the classroom.

- Public-private partnerships for promoting the use of ICT are mainly designed to improve the availability of equipment and training both for students and teachers (see Figure E10).
- Cooperation with external partners in curriculum development and developing new forms or modes of assessment is already established in one third of European countries.
- The use of e-registers or e-diaries is a fast growing tendency across Europe.
- Schools mainly use their websites to communicate general information about the school such as location, facilities, organisation, contacts, etc (see Figure E12).

The extra-curricular activities are widely promoted using information technologies, transforming the school into a learning environment which extends beyond the classroom (see Figures E11 and E12).

CODES, ABBREVIATIONS AND ACRONYMS

Country codes

EU/EU-27	European Union	**PL**	Poland
BE	Belgium	**PT**	Portugal
BE fr	Belgium – French Community	**RO**	Romania
BE de	Belgium – German-speaking Community	**SI**	Slovenia
BE nl	Belgium – Flemish Community	**SK**	Slovakia
BG	Bulgaria	**FI**	Finland
CZ	Czech Republic	**SE**	Sweden
DK	Denmark	**UK**	United Kingdom
DE	Germany	**UK-ENG**	England
EE	Estonia	**UK-WLS**	Wales
IE	Ireland	**UK-NIR**	Northern Ireland
EL	Greece	**UK-SCT**	Scotland
ES	Spain		
FR	France	**EFTA/EEA countries**	The three countries of the European Free Trade Association which are members of the European Economic Area
IT	Italy		
CY	Cyprus		
LV	Latvia	**IS**	Iceland
LT	Lithuania	**LI**	Liechtenstein
LU	Luxembourg	**NO**	Norway
HU	Hungary		
MT	Malta	**Candidate country**	
NL	The Netherlands	**TR**	Turkey
AT	Austria		

Statistical codes

(:)	Data not available	(–)	Not applicable

Abbreviations and acronyms

CPD	Continuing Professional Development
ECDL	European Computer Driving Licence
ESF	European Social Fund
GDP	Gross Domestic Product
ICT	Information and Communication Technologies
IEA	International Association for the Evaluation of Academic Achievement
ISCED	International Standard Classification of Education
OECD	Organisation for Economic Cooperation and Development
OS	Online Safety
P21	Partnership for 21st Century Skills
Phare	Phare programme financed by the European Union
TIMSS	Trends in International Mathematics and Science Study
PISA	Programme for International Student Assessment
SITES	Second Information Technology in Education Study
TALIS	Teaching and Learning International Survey

THE CONTEXT OF ICT IN EDUCATION: ICT IN EVERYDAY LIFE

Information and Communication Technology (ICT) has become an important driver of everyday life and economic activity. An overwhelming majority of people in Europe today use a computer for a variety of purposes; for the younger generation especially, using a computer is a normal, everyday activity. The integration of computers into the sphere of education reflects these tendencies. Over the last 15 years, educators have become increasingly focused on bringing ICT into the classroom and using it for teaching purposes.

The successful use of computers in educational contexts is dependent not only on their availability but also on users' familiarity with them. This also holds true for access to the Internet. The following paragraphs examine the extent to which access to computers and Internet connections are available, and how well these tools are used in households with children. Data from the TIMSS 2007 and PISA 2009 international surveys are also used to look more specifically at computer and Internet use by students. These indicators paint a picture of a population – and especially a pupil population – fully embedded in a multimedia world – both inside and outside school. This description sets the context for an in-depth look at the use of ICT by teachers and students in primary and secondary schools.

THE CORRELATION BETWEEN THE AVAILABILITY OF COMPUTERS AND LEVEL OF GDP DIMINISHES AS COMPUTERS BECOME MORE COMMONPLACE

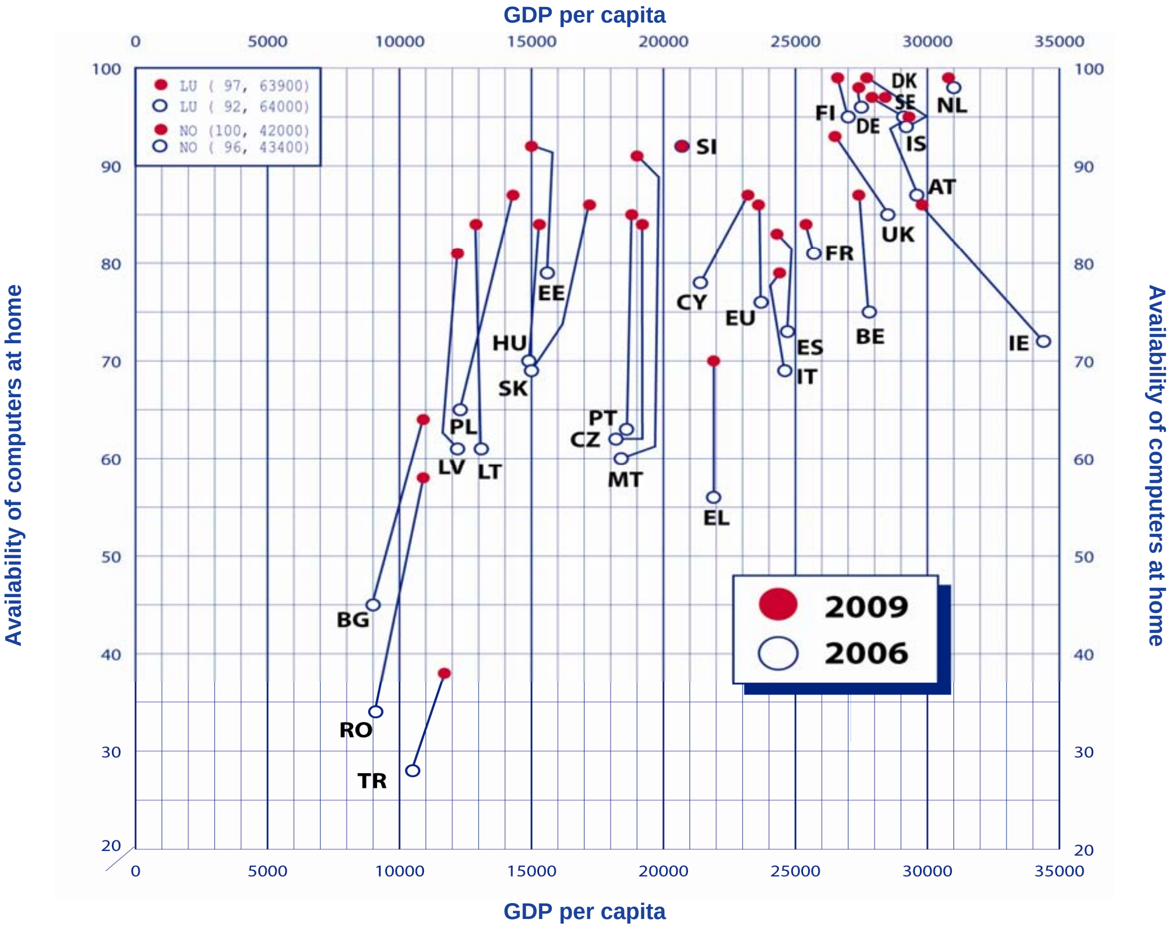
In 2006, on average 75 % of households with dependent children in the EU had a computer at home, but wide disparities remain. While in Germany, Finland, Sweden and Norway more than 95 % of households with dependent children reported having a computer, in Romania this was the case for only 34 %. By 2009, the percentage of households with children with access to a computer had increased in all countries except Slovenia, where it remained constant at a high level of 92 %. In some countries, the number had increased considerably. In Romania, for example, the percentage had increased from 34 to 58 %, while Turkey, although still lagging behind other countries, had a ten point increase to 38 % in that period. Overall, in most countries, the percentage of households with dependent children that had a computer in 2009 is approaching 90 %.

Between 2006 and 2009, Eurostat data show a significant decrease in the degree to which the size of a country's GDP per capita relates to the availability of computers in households with dependent children. Economic strength, however, remains an indicator for the increased availability of ICT. The higher the GDP per capita, the more households have computers.

However, even countries with a rather low GDP per capita have seen a significant increase in the percentage of households with dependent children that have a computer. While a majority of countries in 2006 reported that 60-80 % of their households had a computer, in 2009 that number had grown to 80-100 %.

So the decreasing correlation coefficient (0.64 in 2006 and 0.54 in 2009) indicates that the relevance of GDP per capita as a determinant for computer availability is less relevant today. Eurydice's Key Data on ICT in Schools in Europe even reported a 0.95 correlation in 2000/01 (Eurydice 2004, p. 13).

Figure A1: Relationship between availability of computers at home and GDP per capita, 2006 and 2009



		EU	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU
A	○	76	75	45	62	:	96	79	72	56	73	81	69	78	61	61	92
B	○	23 700	27 800	9 000	18 200	29 300	27 500	15 600	34 400	21 900	24 700	25 700	24 600	21 400	12 200	13 100	64 000
A	●	86	87	64	84	97	98	92	86	70	83	84	79	87	81	84	97
B	●	23 600	27 400	10 900	19 200	28 400	27 400	15 000	29 800	21 900	24 300	25 400	24 400	23 200	12 200	12 900	63 900

		HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK	IS	LI	NO	TR
A	○	70	60	98	87	65	63	34	92	69	95	95	85	94	:	96	28
B	○	14 900	18 400	31 000	29 600	12 300	18 600	9 100	20 700	15 000	27 000	29 100	28 500	29 200	:	43 400	10 500
A	●	84	91	99	95	87	85	58	92	86	99	97	93	99	:	100	38
B	●	15 300	19 000	30 800	29 300	14 300	18 800	10 900	20 700	17 200	26 600	27 900	26 500	27 700	:	42 000	11 700

A = Availability of computers at home **B** = GDP per capita

Source: Eurostat, Information society and national accounts statistics (data extracted December 2010).

Country specific note

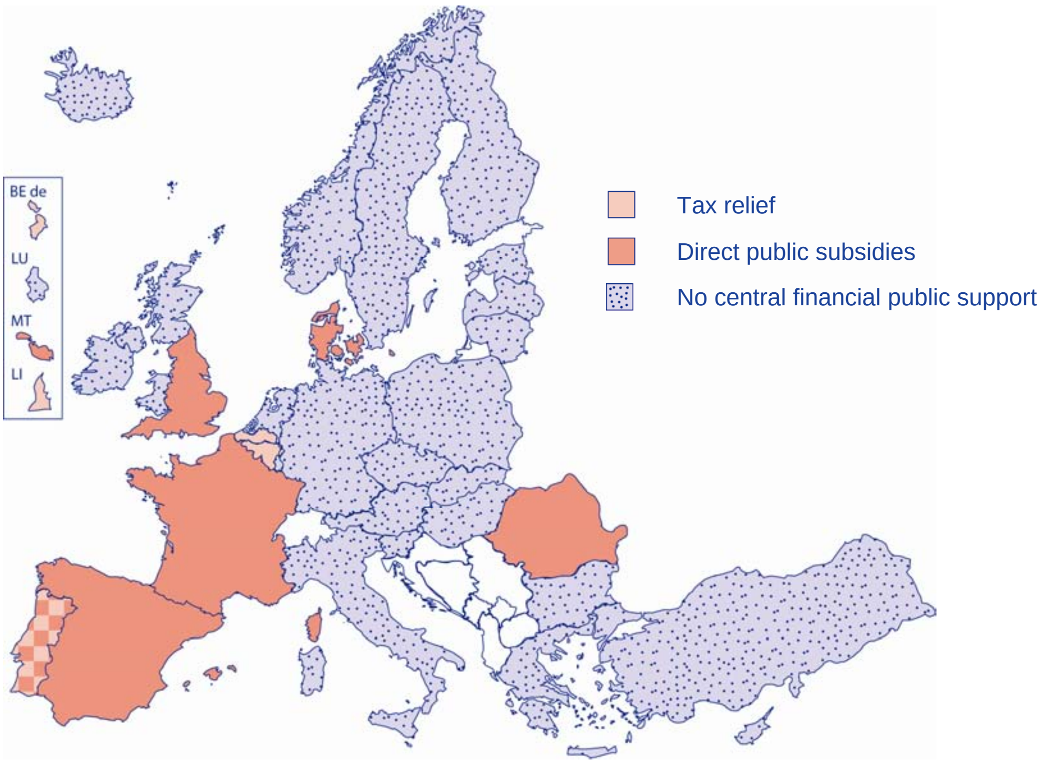
Slovenia: Break in series for the GDP per capita.

ONE THIRD OF EUROPEAN COUNTRIES OFFER DIRECT PUBLIC FINANCIAL SUPPORT FOR BUYING EDUCATION-RELATED ICT EQUIPMENT

Eleven countries/regions provide public financial support to parents for buying education-related ICT equipment. However, the type of support varies: in eight countries, support is provided exclusively through direct public subsidies; Belgium and Liechtenstein allow tax-relief for education-related ICT equipment; and Portugal offers both types of support. A number of countries also mentioned that private companies offer reduced prices for education-related purchases.

There does not appear to be any relationship between the provision of this type of public financial support and the availability of computers in households (see Figure A1). While the five countries with almost complete availability (i.e. more than 99 % of households with dependent children have a computer) do not offer public support, Denmark with a rate of 98 % does provide public subsidies to parents. Similarly, the level of GDP per capita does not seem to affect a country's decision on providing public financial support for the purchase of education-related ITC equipment. While the seven countries with the highest GDP per capita do not provide public support, the same is true for six countries in the group with the lowest GDP per capita. Out of this group, only Romania provides central public financial support.

Figure A2: Financial public support for parents for buying education-related ICT equipment, 2009/10

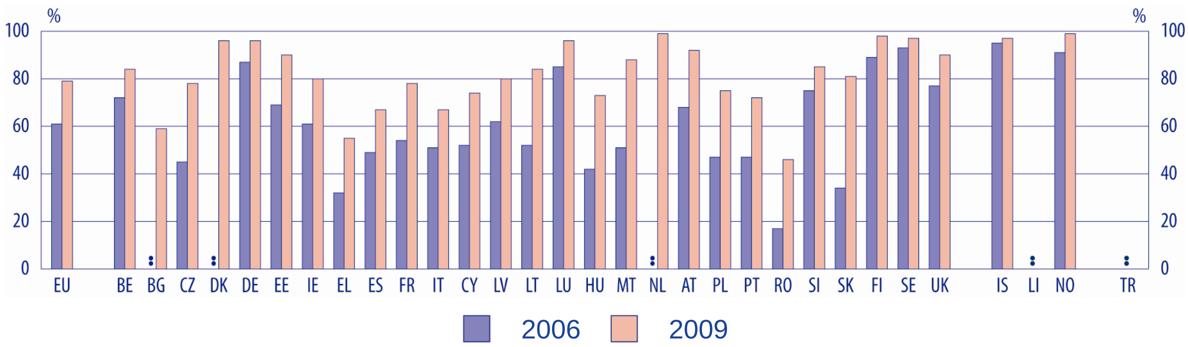


Source: Eurydice.

THE INTERNET IS INCREASINGLY AVAILABLE IN HOUSEHOLDS WITH CHILDREN BUT DISPARITIES REMAIN BETWEEN COUNTRIES

A similar picture is also emerging regarding the availability of Internet access. As the most recent report on the European *i2010* strategy shows, the number of households with dependent children that have home Internet access has significantly increased over the last decade (European Commission, 2010c). Figure A3 shows that the number of households with dependent children that have home Internet access is growing in all countries. As with computer availability (see Figure A1) in some countries, including Germany, Luxembourg, the Netherlands, Finland, Sweden and the United Kingdom, access is almost comprehensive. While in Greece and Romania less than 60 % of households have access to the Internet, the increase since 2006 has been extraordinary. The Czech Republic, Latvia, Lithuania, Hungary, Malta and Slovakia have moved from being below the EU average in 2006 to being the same or above in 2009.

Figure A3: Households with dependent children that have home Internet access, 2006 and 2009



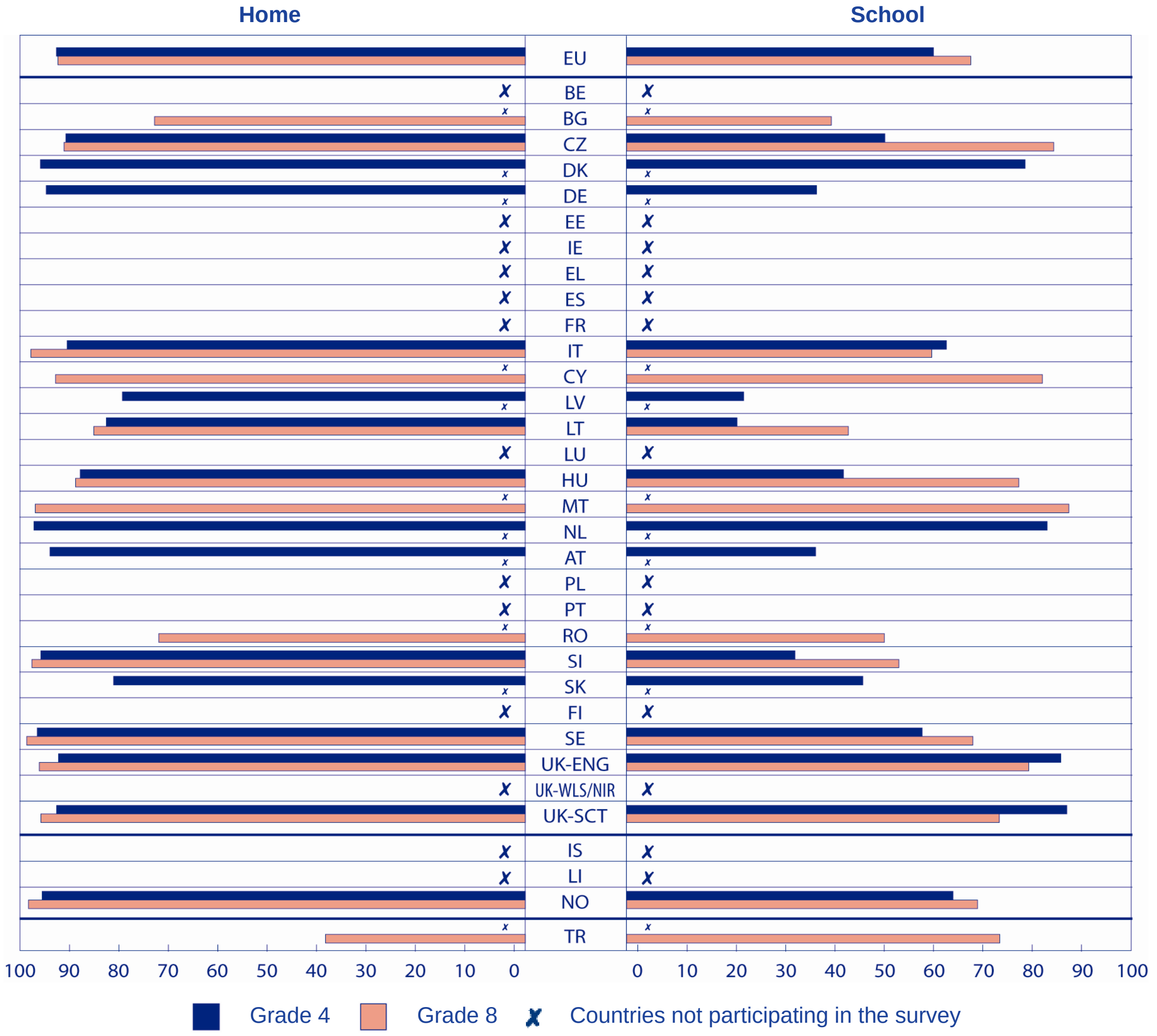
	EU		BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU
2006	61		72	:	45	:	87	69	61	32	49	54	51	52	62	52	85
2009	79		84	59	78	96	96	90	80	55	67	78	67	74	80	84	96
	HU	**MT**	**NL**	**AT**	**PL**	**PT**	**RO**	**SI**	**SK**	**FI**	**SE**	**UK**		**IS**	**LI**	**NO**	**TR**
2006	42	51	:	68	47	47	17	75	34	89	93	77		95	:	91	:
2009	73	88	99	92	75	72	46	85	81	98	97	90		97	:	99	:

Source: Eurostat, Information society statistics (data extracted December 2010).

STUDENTS USE COMPUTERS MORE REGULARLY AT HOME THAN AT SCHOOL

While access to computers and the Internet is widespread at home (see Figures A1 and A3), this does not necessarily mean that students use these facilities. However, recent Eurostat data on 16 to 24 year-olds does, in fact, show that practically all young European citizens use computers (Eurostat, 2010b). Bulgaria, Italy and Romania trail slightly behind other countries with usage rates of approximately 80 %. A similar picture emerges from the most recent Eurostat data on Internet use (Ibid.). The European Commission's ICT Cluster (European Commission/ICT cluster, 2010) has found that today's students are not only using computers, but they also access other mobile technologies such as multimedia devices as mobile phones with Internet access. Moreover, it has found that there is an increasing gap between the opportunities for using ICT at home and in schools. Education institutions should therefore be encouraged to develop a modern, technological environment in order to link students' experience of using these devices at home with their academic lives, and to provide them with the relevant ICT skills that will equip them for their life beyond school.

Figure A4: Percentage of students in the fourth and eighth grades using computers at home and in school, 2007



Home

	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
Grade 4	92.7	x	90.8	95.9	94.7	90.6	x	79.7	82.8	88.0	x	97.2	94.0	x	95.8	81.4	96.5	92.3	92.7	95.6	x
Grade 8	92.4	73.3	91.2	x	x	97.8	92.9	x	85.3	88.9	96.9	x	x	72.5	97.6	x	98.6	96.1	95.8	98.3	39.5

School

	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
Grade 4	60.7	x	51.1	78.8	37.5	63.2	x	23.2	21.9	42.9	x	83.2	37.4	x	33.3	46.7	58.5	85.8	87.0	64.6	x
Grade 8	68.1	40.5	84.4	x	x	60.3	82.2	x	43.9	77.6	87.4	x	x	51.0	53.8	x	68.5	79.5	73.7	69.4	73.8

Source: IEA, TIMSS 2007 database.

Explanatory note

EU average: Here and further the Eurydice calculated EU average refers only to the EU-27 countries which participated in the survey. It is a weighted average where the contribution of a country is proportional to its size.

The questionnaire asked students to indicate where they use a computer. The available responses were: a) At home, b) At school, c) Elsewhere (e.g., public library, friend's home, Internet café). In the above figure, only the options at home and at school are represented.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

Looking in more detail at the pupil figures, in 2007 more than 92 % of students in the EU in the fourth and eighth grades report using computers at home. The majority of countries for which data from the TIMSS 2007 international survey is available report numbers well above 90 %. Bulgaria, Romania and Turkey are clearly below that mark for the eighth grade while Latvia and Slovakia show lower numbers for the fourth grade. Computer use at school, in contrast, is much lower with 60 % of students in grade 4 and 68 % in grade 8. In addition, variations are wide, ranging from just over 20 % in Lithuania and Latvia to almost 90 % in Malta and the United Kingdom in grade 4 and under 40 % in Lithuania and over 85 % in Malta in grade 8.

TIMSS 2007 data also show that as students get older, the difference between computer use at home and at school diminishes. While in grade 4 the percentage of students reporting that they use computers only outside school is above 40 in Lithuania, Hungary and Slovenia, it drops for these countries to below 20 % in grade 8. While not as pronounced, the same tendency can be found in most other countries. Only in Italy and the United Kingdom (England and Scotland) do the responses show that the difference is higher in grade 8 than in grade 4. In Turkey a significant number of grade 8 students (almost 35 %) use the computer only at school. This might be related to the relatively low availability of computers at home (38 %, see Figure A1).

STUDENTS USE COMPUTERS AT HOME MORE FOR ENTERTAINMENT THAN FOR SCHOOL RELATED ACTIVITIES

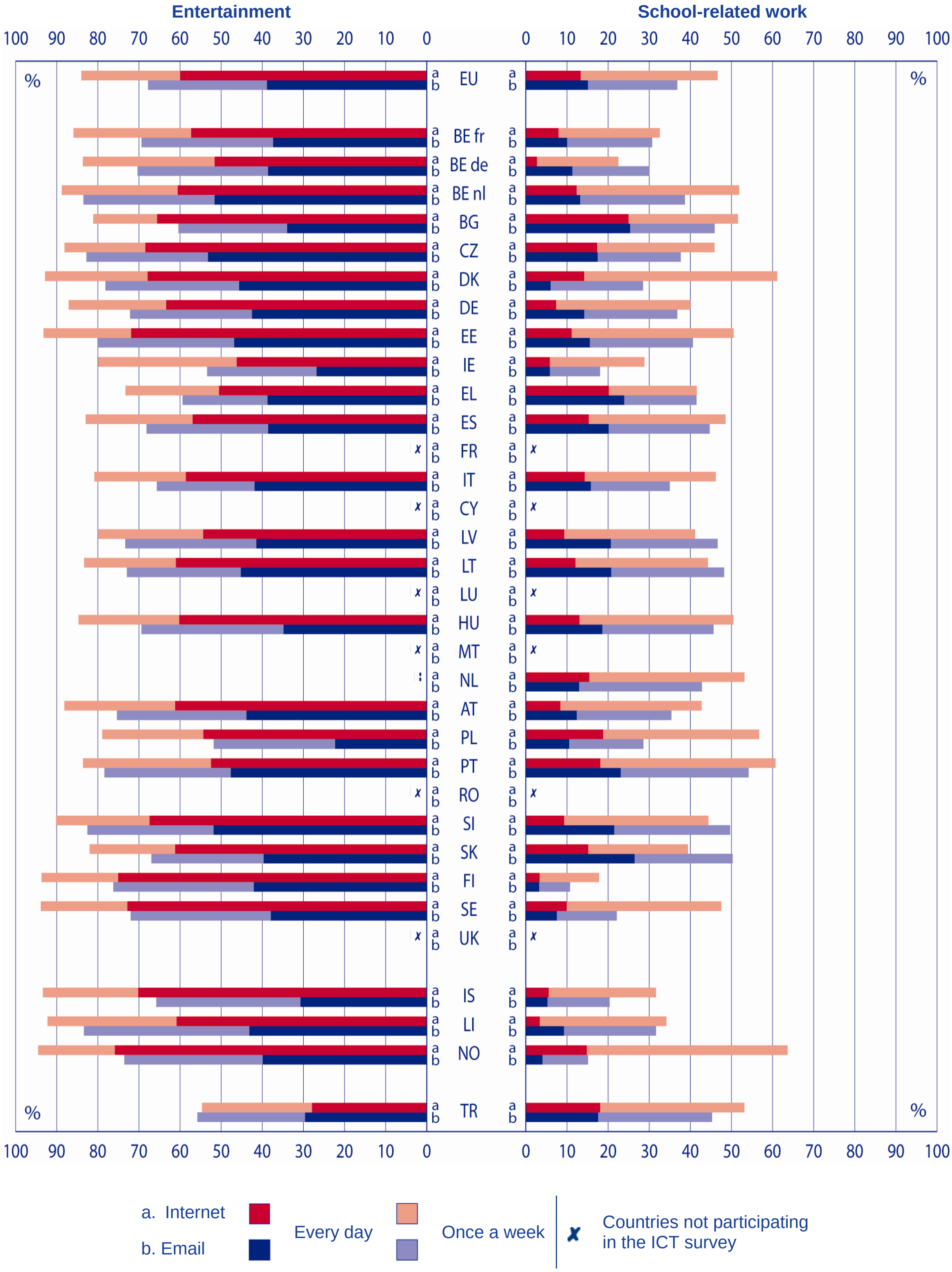
Most recent data from the Programme of International Student Assessment 2009 (PISA 2009) reveal that students use computers at home mostly for entertainment and quite rarely for school related work. In the European Union almost twice as many students browse the Internet for fun than for schoolwork at least once a week (83 %and 46 % respectively). With slightly lower overall numbers, the same pattern can be seen for the use of email, where 67 % use it in general at least once per week, but only 37 % for schoolwork.

Thirteen and fifteen percent of students browse or send emails for school purposes every day but in this category variation is strong. While more than 23 % of students in Bulgaria, Greece, Portugal and Slovakia send emails to communicate about schoolwork every day, in seven countries less than 10 % of students do so. The spread is even starker for using the Internet for schoolwork. Only in Bulgaria and Greece more than 20 % of students respond saying that they browse the Internet daily, while in 11 countries less than 10 % do so.

While total usage numbers vary considerably between countries, the pattern described is true for all European countries. In all countries more than 50 % of students report using email for fun, but only Portuguese and Slovak students report using email for schoolwork in more than half the cases. For the use of the Internet, in only 10 countries more than 50 % of students report browsing the Internet for schoolwork, while in eight countries more than 90 % of students report browsing for fun.

Looking specifically at Belgium shows that while the patterns for email use between the three communities is very similar, twice as many students browse for schoolwork in the Flemish Community than in the German-speaking Community, with the French Community being in the middle, but recreational browsing is very similar. Fluctuations in the use of either the Internet or email for school purposes may also correlate with teaching and homework patterns. In Finland, for example, homework is less frequent and the very low numbers of email and Internet for school compared to recreational use may be thus explained.

Figure A5: Use of computers at home by 15 year old students for entertainment and school related work, 2009



Source: OECD, PISA 2009 database.

Data (Figure A5)

Browse the Internet for fun			Use email				Browse the Internet for schoolwork			Use email for communication with other students about schoolwork		
Once a week	Every day	>1 / week	Once a week	Every day	>1 / week		Once a week	Every day	>1 / week	Once a week	Every day	>1 / week
24.0	60.0	84.0	28.9	38.9	67.8	**EU**	33.3	13.3	46.7	21.7	15.1	36.8
28.6	57.3	85.9	32.0	37.4	69.4	**BE fr**	24.7	7.9	32.6	20.7	10.0	30.7
32.0	51.6	83.6	31.7	38.6	70.3	**BE de**	19.8	2.7	22.5	18.8	11.3	30.1
28.2	60.6	88.8	31.9	51.6	83.5	**BE nl**	39.5	12.3	51.9	25.5	13.2	38.7
15.5	65.6	81.1	26.5	34.0	60.4	**BG**	26.6	25.0	51.6	20.6	25.3	45.9
19.6	68.5	88.1	29.5	53.2	82.8	**CZ**	28.6	17.3	45.9	20.2	17.4	37.7
24.9	67.9	92.8	32.5	45.6	78.1	**DK**	47.0	14.1	61.1	22.5	6.0	28.5
23.7	63.4	87.1	29.6	42.5	72.2	**DE**	32.6	7.3	40.0	22.6	14.2	36.8
21.3	71.9	93.2	33.2	46.8	80.1	**EE**	39.4	11.1	50.5	25.1	15.5	40.6
33.7	46.2	79.9	26.6	26.8	53.4	**IE**	23.0	5.8	28.8	12.2	5.8	18.0
22.7	50.6	73.3	20.7	38.7	59.4	**EL**	21.4	20.2	41.6	17.6	23.9	41.5
26.0	56.9	83.0	29.6	38.6	68.1	**ES**	33.3	15.3	48.5	24.6	20.1	44.7
22.2	58.6	80.8	23.8	41.9	65.6	**IT**	31.9	14.3	46.2	19.2	15.8	35.0
25.5	54.4	79.9	31.8	41.5	73.3	**LV**	31.8	9.3	41.2	26.0	20.6	46.6
22.3	61.0	83.3	27.7	45.2	72.9	**LT**	32.2	12.1	44.3	27.5	20.8	48.2
24.5	60.2	84.7	34.6	34.9	69.4	**HU**	37.5	13.0	50.5	27.0	18.6	45.6
:	:	:	:	:	:	**NL**	37.7	15.4	53.2	29.9	12.9	42.8
26.9	61.2	88.1	31.5	43.9	75.3	**AT**	34.4	8.4	42.7	23.0	12.4	35.4
24.6	54.3	78.9	29.5	22.3	51.8	**PL**	38.0	18.8	56.7	18.1	10.5	28.6
31.1	52.5	83.6	30.7	47.7	78.4	**PT**	42.6	18.1	60.7	31.1	23.1	54.2
22.7	67.5	90.2	30.7	51.8	82.5	**SI**	35.1	9.3	44.4	28.2	21.5	49.7
20.8	61.2	82.0	27.3	39.7	67.0	**SK**	24.3	15.2	39.4	23.9	26.4	50.3
18.6	75.1	93.7	34.2	42.1	76.2	**FI**	14.5	3.3	17.8	7.5	3.2	10.7
21.0	72.8	93.9	34.1	38.0	72.0	**SE**	37.6	9.9	47.5	14.6	7.5	22.1
23.1	70.2	93.3	35.0	30.7	65.8	**IS**	26.2	5.5	31.7	15.2	5.2	20.4
31.3	60.9	92.2	40.2	43.2	83.4	**LI**	30.8	3.4	34.2	22.4	9.3	31.7
18.6	75.9	94.5	33.7	39.9	73.6	**NO**	48.8	14.8	63.7	11.1	4.0	15.1
26.7	27.9	54.7	26.2	29.6	55.8	**TR**	35.1	18.0	53.1	27.7	17.6	45.3

Source: OECD, PISA 2009 database.

Explanatory note

EU average: Here and further the Eurydice calculated EU average refers only to the EU-27 countries which participated in the survey. It is a weighted average where the contribution of a country is proportional to its size.

ALL EUROPEAN COUNTRIES HAVE NATIONAL STRATEGIES TO FOSTER THE USE OF ICT IN EDUCATION

In 2010, the Commission adopted a new Digital agenda for Europe (European Commission, 2010b) which reaffirms and refines a number of central challenges for the years to come. They range from providing public services electronically (eGovernment) to fostering the deployment of fast and ultrafast broadband, better interoperability and security (Infrastructure and security) to providing the European population with a high level of ICT practitioner skills, including digital and media literacy (eLearning, digital/media literacy, eSkills).

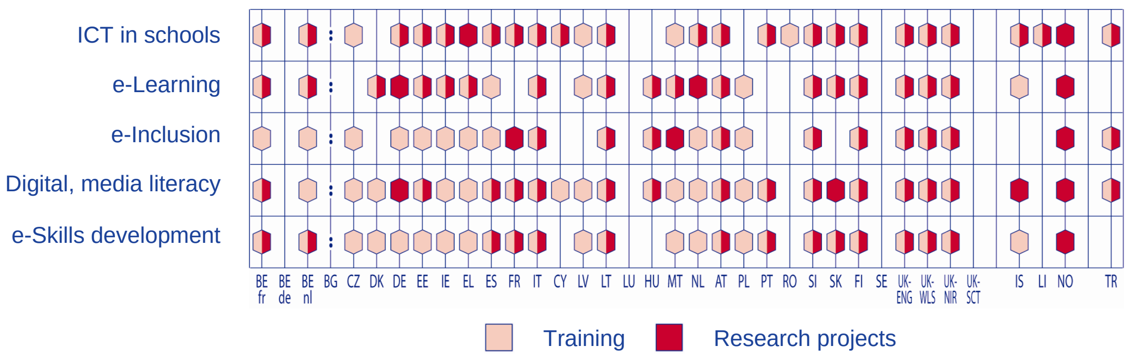
All European countries have national strategies in place to foster the use of ICT in different areas. In addition, 28 countries have adopted an ICT strategy devoted to education. These were in most countries adopted since 2000. Finland reports that ICT education strategies are currently being developed, while in Sweden education issues are addressed within the broadband strategy. In the Netherlands, education issues are targeted within the general ICT strategy. Poland is still developing its education-focused ICT strategy. In many cases, these strategies aim to provide the necessary ICT skills to students (in particular digital literacy skills) as well as provide dedicated training in ICT for teachers. Another defining feature is the provision of up-to-date technology and infrastructure in schools.

The target groups for these measures in all countries are students and teachers at primary and secondary education levels. The focus on higher education institutions and their students is slightly less widespread. In attempting to address the issue of the digital divide (the gap between people with effective access to digital and information technology and those with very limited or no access at all), half of all European countries also focus on parents while more than half focus on adults and the general public.

Countries'/regions' general ICT strategies usually cover a wide range of topics and use a range of measures to implement these strategies. Most important is perhaps the provision of training for those learning to use ICT for educational purposes – be they students or teachers. The relevant strategic areas in this respect are e-Learning, the provision of digital and media skills, the deployment of ICT in schools and e-Inclusion. In most countries, ICT training measures for schools usually cover several of the above topics. However, in Cyprus, Romania and Liechtenstein only one or two topics are covered in the training measures. Norway has only research projects rather than training measures on all the topics mentioned above. This shows that a general framework has been established since the early to mid-2000s within which ICT and education are being brought together.

In addition, many countries have claimed that research projects/studies have also been important instruments for implementing their general ICT strategies. Such projects increase understanding of the effects of the use of ICT and therefore enable measures to be more effectively targeted. This is particularly important for the use of ICT in schools as this is the area where most countries report the existence of research projects.

Figure A6: Training measures and research projects in areas covered by national ICT strategies, 2009/10



Source: Eurydice.

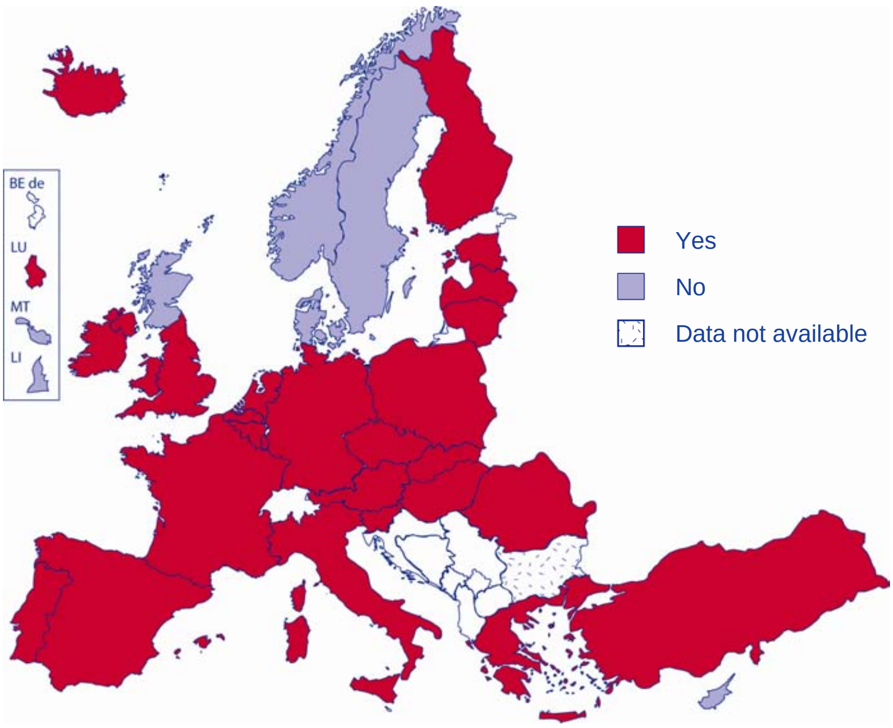
MONITORING OF CENTRAL ICT STRATEGIES IS WIDESPREAD BUT FORMS AND TIMING VARY

Only seven European countries do not have specific central monitoring mechanisms in place to evaluate their national ICT strategies. In some countries, implementation and evaluation take place at the local level and no national monitoring is undertaken.

Where central monitoring mechanisms have been reported, they take different forms, are carried out by different bodies and include different degrees of detail. Belgium (Flemish Community), Spain and Poland have developed indicators on infrastructure and on the information society in order to measure progress in implementing the ICT strategy. Belgium (Flemish Community) also includes stakeholder perceptions about the educational use of ICT. In Norway, an executive agency of the education ministry, the Centre for ICT in Education, monitors the implementation of the ICT strategy while in the Czech Republic the school inspectorate undertakes annual evaluations. Hungary and Slovakia evaluate in the context of EU-funded projects (Phare, ESF), while Italy involves partners in evaluating externally supported projects. Germany, Estonia, France, Latvia and Portugal have regular reports on activities and projects. However, in Sweden, evaluations will only be conducted when the action plans are nearing their completion.

France, Lithuania and Poland among others have dedicated institutions to monitor the implementation of their ICT strategy. These institutions, however, focus more on general ICT and /or broadband strategies rather than on educational aspects.

Figure A7: Existence of central monitoring mechanisms to evaluate national ICT strategies, 2009/10



Source: Eurydice.

Country specific note

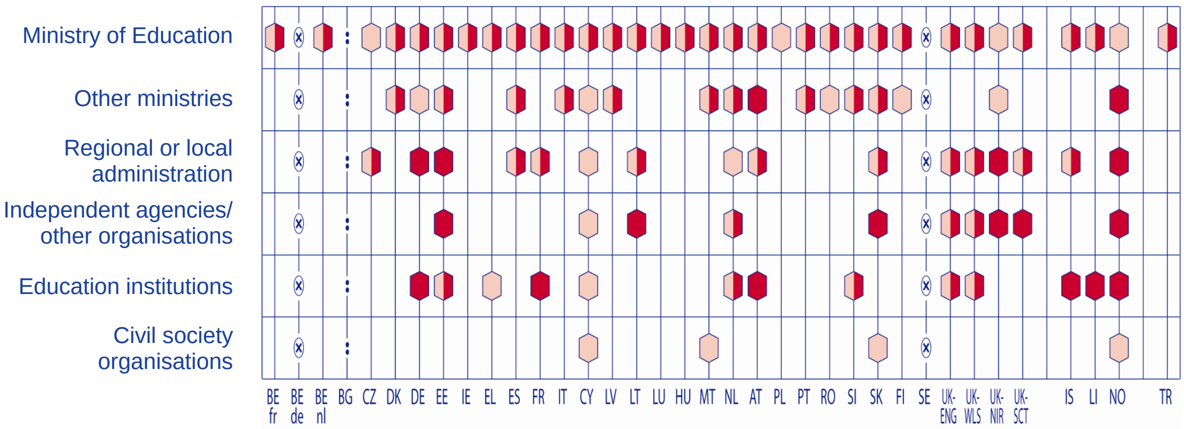
United Kingdom: Scotland does not have its own ICT strategy but is included in the UK-wide strategies and related evaluation mechanisms.

CENTRAL AUTHORITIES ARE MOSTLY RESPONSIBLE FOR POLICY FORMULATION AND COORDINATION

Formulating policy and coordinating its implementation are arguably the most politically sensitive tasks in the execution of the ICT education strategy. Unsurprisingly, this responsibility lies predominantly with the central administrative level of education ministries. In sixteen countries, the central level exclusively defines policy. In Hungary, this includes agencies under the ministry of education. In the other countries which have an ICT education strategy, policy formulation is jointly carried out by several bodies. In Cyprus, Malta, Slovakia and Norway, these include civil society organisations, while educational institutions themselves take part in Estonia, Greece, Cyprus, the Netherlands, Slovenia and the United Kingdom (England and Wales).

Closely related to the question of policy formulation is the question of strategy coordination. In twelve of the fourteen countries/regions where central administration exclusively formulates policy, responsibility for strategy coordination also rests with this level. For example, in Finland, this is the responsibility of the National Board of Education under the ministry. In other countries, collaboration takes place between bodies at different levels: in Slovenia and Liechtenstein, educational institutions collaborate with the central administration. Expanding on this approach, Germany, along with another five countries, involve public bodies from different levels of government as well as education authorities in policy coordination. Finally, several countries (Spain, Lithuania, Slovakia and the United Kingdom (Northern Ireland and Scotland)) rely on collaboration between bodies within the public sector, but from across different levels of administration.

Figure A8: Bodies responsible for POLICY FORMULATION and COORDINATION of national ICT strategy in education, 2009/10



Policy formulation | Coordination | ⊗ No specific ICT strategy in education

Source: Eurydice.

Country specific note (Figures A8, A9 and A10)

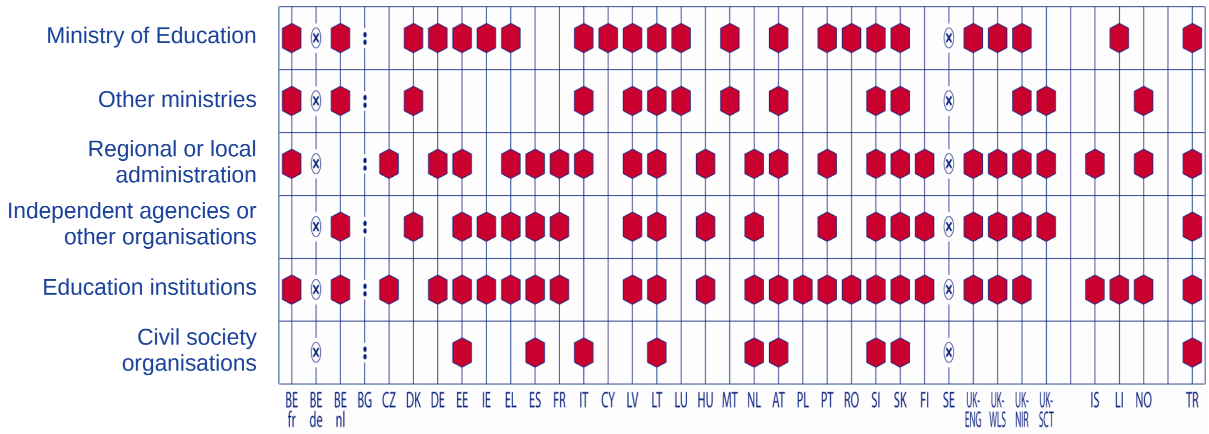
United Kingdom: Following the change of Government in May 2010, the independent agency 'Becta' was formally closed on 31 March 2011.

IN MOST COUNTRIES/REGIONS, EDUCATION INSTITUTIONS ARE RESPONSIBLE FOR IMPLEMENTING CENTRAL ICT STRATEGIES IN EDUCATION

Implementing central ICT strategies in education means ensuring that measures are put into operation and reach the target audiences. Thus, in most European countries education, institutions are involved in the implementation of these strategies. This is usually carried out in conjunction with local or regional administrations, depending on the degree of (de)centralisation in the education system.

However, in Cyprus, the Ministry of education is exclusively responsible for implementing the ICT strategy in education. In Malta, it is also the Ministry for Infrastructure, Transport and Communications. In Luxembourg, the Ministry of Education and other central level ministries are responsible. In other countries, local and/or regional administrations have joint responsibilities, while in Poland implementation is exclusively the domain of independent agencies, other organisations or education institutions.

Figure A9: Bodies in charge of the IMPLEMENTATION of national ICT strategy in education, 2009/10



⊗ No specific ICT strategy in education

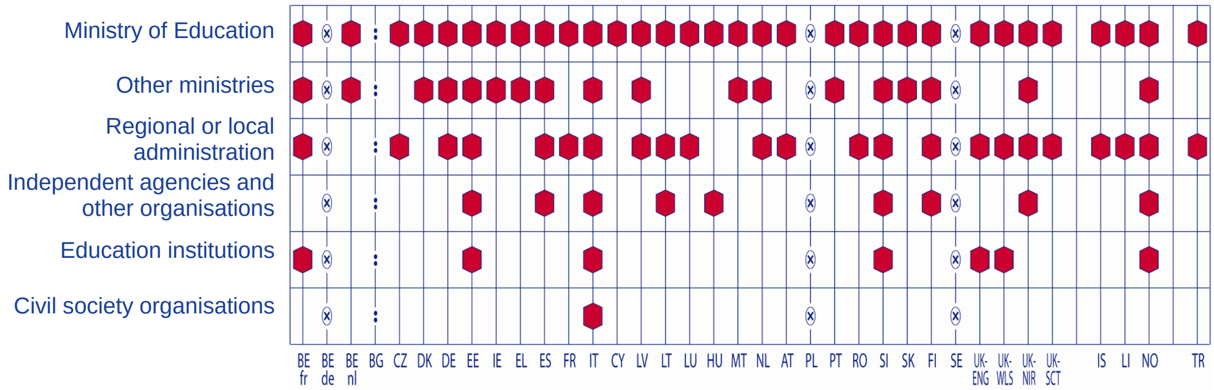
Source: Eurydice.

FUNDING IS PUBLIC BUT DIFFERENT ADMINISTRATIVE LEVELS ARE INVOLVED IN ITS DISTRIBUTION

As with the responsibility for policy formulation and strategy coordination (see Figure A8), the responsibility for providing funding for the delivery of the ICT strategy in education lies with public authorities at the central and regional/local levels. In the majority of countries, both levels are jointly responsible. In eight countries, only the central level is responsible for funding.

While implementation in most cases involves education institutions, in Belgium (French Community), Estonia, Italy, Slovenia, the United Kingdom (England and Wales) and Norway, education institutions are also involved in the funding of measures to implement the ICT strategy in education alongside central and regional/local administrations. In Italy, civil society organisations are also involved.

Figure A10: Bodies responsible for FUNDING the national ICT strategy in education, 2009/10



⊗ No specific funding for ICT strategy in education

Source: Eurydice.

Country specific note

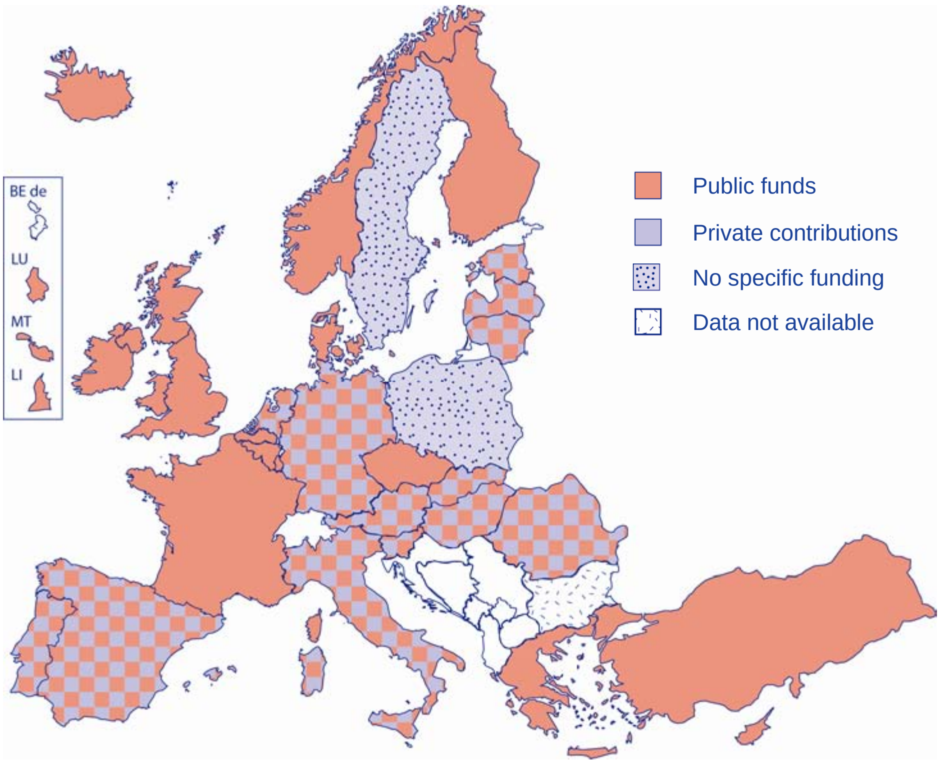
Iceland: Regional or local administrations are responsible only for primary and lower secondary education (ISCED 1 and 2). Upper secondary schools (ISCED 3) are funded by the state and it is up to each school or institution to decide how they use their budget.

PREDOMINANTLY PUBLIC FUNDS ARE USED TO DELIVER EDUCATION-ORIENTED ACTIONS OF ICT STRATEGIES

In nearly all countries, actions within the ICT education strategies are funded from the public budget. Only Poland and Sweden report no specific funding mechanisms. In Sweden, this is consistent with the fact that they do not have a national ICT strategy either general or education-oriented. It is also in line with the principle that the Swedish education system does not receive specific funding from the central level. In Poland, it is because there is no education-oriented ICT strategy.

Of the 32 countries using public funds for education actions with ICT, 14 report investing in specific projects, while others provide general public subsidies. For example, Austria is developing a future learning strategy; Hungary is funding an e-Paper pilot project, an eLearning mentor project and a workflow adviser system; and in Spain, the Avanza plan combines national and sub-national measures. Thirteen countries fund the education actions of their ICT strategies through a mix of public funds and private contributions.

Figure A11: Funding of ICT actions in education, 2009/10



Source: Eurydice.

Country specific note

Belgium (BE nl) and **Lithuania**: Use additionally loans to finance ICT actions in education.

ALMOST ALL COUNTRIES INCLUDE EU KEY COMPETENCES IN THEIR STEERING DOCUMENTS AND OFTEN RECOMMEND THE USE OF ICT

The notion of competences or skills is now widely used in education frameworks. An increasing number of curricula define educational aims and objectives in these terms. A competence 'involves the ability to meet complex demands, by drawing on and mobilising psychosocial resources (including skills and attitudes) in a particular context' (OECD 2005, p. 4). They are generally defined as *outcomes* of the education process and therefore form part of the conceptual shift 'from a content-based input approach to a competence-based output approach' (Malan 2000, p. 27).

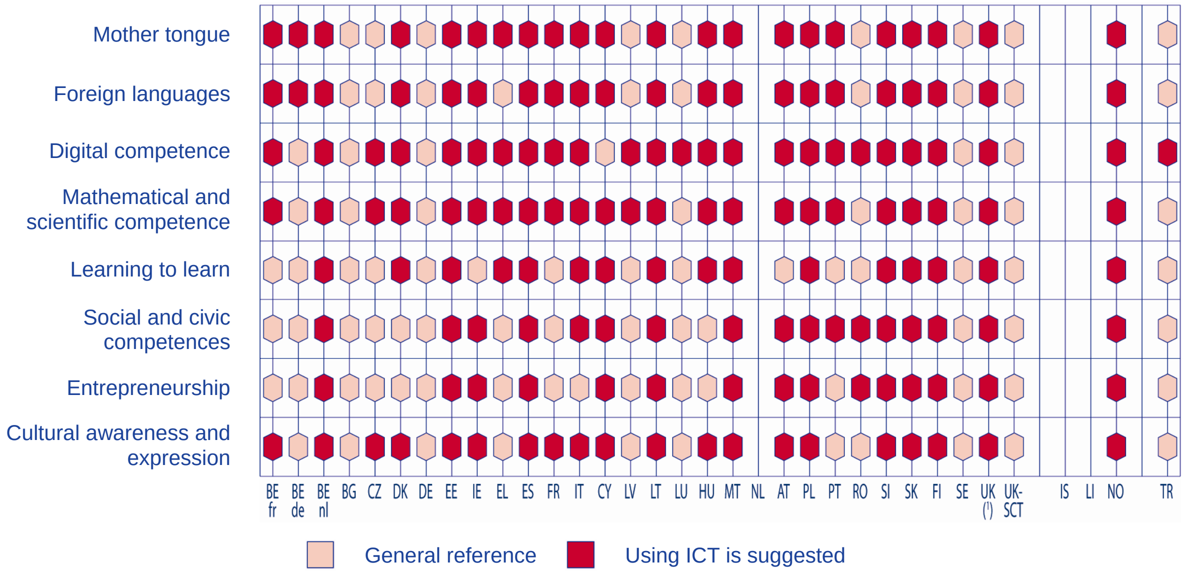
The Recommendation adopted by the European Parliament and the Council in 2006 on key competences for lifelong learning defines the European reference framework for this field. It includes competences that 'all individuals need for personal fulfilment and development, active citizenship, social inclusion and employment' ([1]).

Almost all European countries include the EU key competences in their central steering documents for compulsory education. Germany and Liechtenstein include them in their national curricula without making specific reference to the EU key competences framework. In the Netherlands and Iceland no central regulations on these matters exist. Most countries have introduced these concepts during the last decade; only a few have been applying this or a similar competence-based approach since the mid 1990s (e.g. Belgium – French Community), Finland, Sweden and the United Kingdom (England and Wales). Where countries mention key competences in their curricula, they include all those in the EU framework.

Almost all countries applying this competence framework suggest using information and communication technology (ICT) as a means to help pupils acquire at least some of these competences. The exceptions are Bulgaria, Germany, Sweden and the United Kingdom (Scotland). Eleven countries even recommend the use of ICT for all EU key competences. Not surprisingly, ICT use is the most frequently recommended in relation to digital competence, followed by mathematical competence and basic competences in science and technology. The use of ICT is least frequently recommended for the competences of learning to learn and entrepreneurship.

([1]) Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning, OJ L 394, 30.12.2006, p. 13.

Figure B1: EU key competences and the use of ICT in central steering documents for primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

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

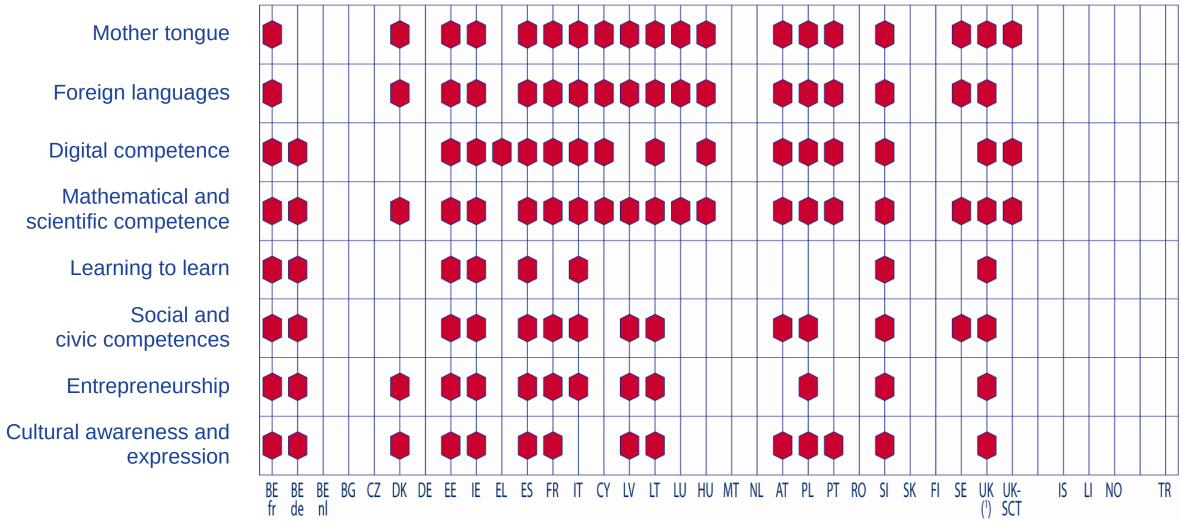
FEW COUNTRIES CENTRALLY RECOMMEND ASSESSMENT OF ALL KEY COMPETENCIES

According to the European Commission ICT cluster, assessment strategies are essential for the implementation of a competence-based framework. Since new learning outcomes are likely to be assessed using new assessment methods (European Commission/ICT Cluster, 2010), it is important to look at whether steering documents include any recommendations for assessing key competences.

Most of the countries recommend the assessment of one or more of the EU key competences included in their central steering documents. Where the assessment of key competences is recommended, it often applies to only part of them. In particular, there are six countries/rgions that recommend assessing all key competencies: Belgium (French Community), Estonia, Ireland, Spain, Slovenia and the United Kingdom (England, Wales and Northern Ireland). The competences for which assessment is usually recommended are mathematical competence, communicating in the mother tongue, digital competence and communicating in foreign languages. Norway is currently developing an assessment framework for basic skills.

Looking more specifically at 'digital competence', which is most closely related to ICT, seventeen countries report that they have recommendations for its assessment. Competences in mother tongue, mathematics and foreign langue are the only areas which are recommended for assessment in more countries.

Figure B2: Centrally recommended/required assessment of EU key competences in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

UK (¹) = UK-ENG/WLS/NIR

Country specific note

Ireland: No centralised recommendations exist at primary level.

MOST CENTRAL STEERING DOCUMENTS SPECIFY A RANGE OF CROSS-CURRICULAR SKILLS AS DESIRED OUTCOMES OF EDUCATION

Besides incorporating the European reference framework for key competences, European countries also include other general or cross-curricular skills in their steering documents. Many international organisations have compiled lists of skills or competences that pupils must learn in school so they are properly prepared to deal with complex social and work environments. A good example is the Partnership for 21st Century Skills (P21), which lists the knowledge skills and expertise considered essential to ‘ensure 21st century readiness for every student’ (Partnership for 21st Century Skills, 2010). Figure B3 includes a selection of the skills mentioned in this framework from the categories ‘learning and innovation skills’ and ‘life and career skills’. It shows which European education systems include them in their steering documents as desired educational outcomes and, more specifically, the figure shows where ICT is recommended as tool to be used in developing these skills (see the Glossary for definitions).

All steering documents for compulsory education include at least six of these skills as desired outcomes of the education process. As with the EU key competences (see Figure B1), most countries have introduced these skills during the last decade, with the exception of Belgium (French Community), Spain, Austria, Sweden and the United Kingdom (England and Wales), which already had skills-based frameworks in place in the 1990s.

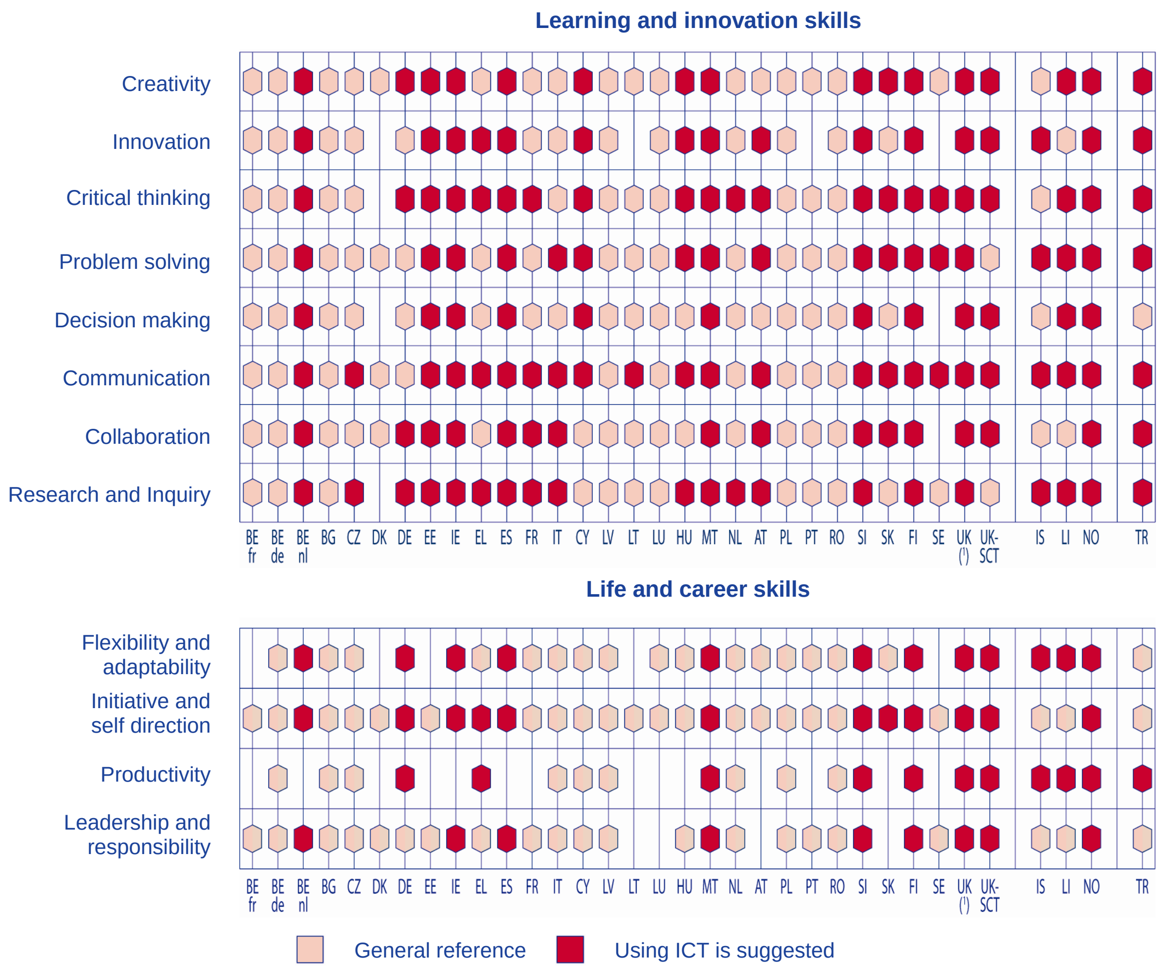
An analysis of the steering documents shows that from the learning and innovation skills group, all countries include creativity, problem solving and communication. However, other skills from this category are not embraced by all countries, for example:

- critical thinking and research and inquiry are not included in Denmark;
- collaboration is not included in Sweden;
- decision-making does not appear in the steering documents of either Sweden or Denmark;
- innovation is not incorporated in the documents of Denmark, Lithuania, Portugal or Sweden.

From the life and career skills category, initiative and self-direction are included in all steering documents analysed but:

- flexibility and adaptability are not covered in the steering documents of Belgium (French Community), Denmark, Estonia, Lithuania and Sweden;
- Lithuania, Luxembourg, Austria and Slovakia do not include leadership and responsibility;
- productivity is the ‘skill’ included least in steering documents and is mentioned in only twenty countries.

Figure B3: Central recommendations on the inclusion of cross-curricular skills and using ICT as a tool for skills teaching in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

UK (¹) = UK-ENG/WLS/NIR

The use of ICT as a tool for encouraging pupils to develop these general and cross-curricular skills is most often recommended in steering documents with respect to teaching communication and critical thinking skills. However, the use of ICT is less frequently recommended for encouraging the development of leadership and responsibility skills, and for productivity.

Countries referring to ICT use for all the cross-curricular skills included in their steering documents are Belgium (Flemish Community), Ireland, Spain, Malta, Slovenia, Finland, the United Kingdom (England, Wales and Northern Ireland) and Norway. The steering documents of Estonia suggest ICT use for all learning and innovation skills.

ASSESSMENT OF CROSS-CURRICULAR SKILLS IS RECOMMENDED IN FEW COUNTRIES

Recommendations for the assessment of cross-curricular skills are not so present comparing with the assessment of EU key competences (see Figure B2). Only 17 countries report that their steering documents include recommendations to assess at least some of the cross-curricular skills. The skills most commonly recommended for assessment are problem solving and communication. In general, learning and innovation skills are recommended for assessment more often than life and career skills. The number of skills which are recommended for assessment varies from only one (in Bulgaria, where only creativity is recommended for assessment) to all (in Slovenia and the United Kingdom – England, Wales and Northern Ireland).

Figure B4: Centrally recommended/required assessment of cross-curricular skills in primary and general secondary education (ISCED 1, 2, and 3), 2009/10

Learning and innovation skills

	BE fr	BE de	BE nl	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK (1)	UK-SCT	IS	LI	NO	TR
Creativity	●	●		●							●				●							●			●				●					
Innovation		●									●											●			●				●					
Critical thinking	●	●						●			●	●			●	●						●			●			●	●					●
Problem solving		●						●			●	●	●	●	●	●					●	●			●			●	●	●				●
Decision making		●						●			●	●													●				●					●
Communication		●						●			●	●	●	●	●	●					●	●			●			●	●					
Collaboration		●						●			●	●	●	●							●	●			●				●					●
Research and inquiry		●						●			●	●			●	●					●				●				●	●				●

Life and career skills

	BE fr	BE de	BE nl	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK (1)	UK-SCT	IS	LI	NO	TR
Flexibility and adaptability		●									●														●				●					
Initiative and self direction											●	●										●			●				●					●
Productivity																									●				●					●
Leadership and responsibility		●									●				●							●			●				●					

Source: Eurydice.

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

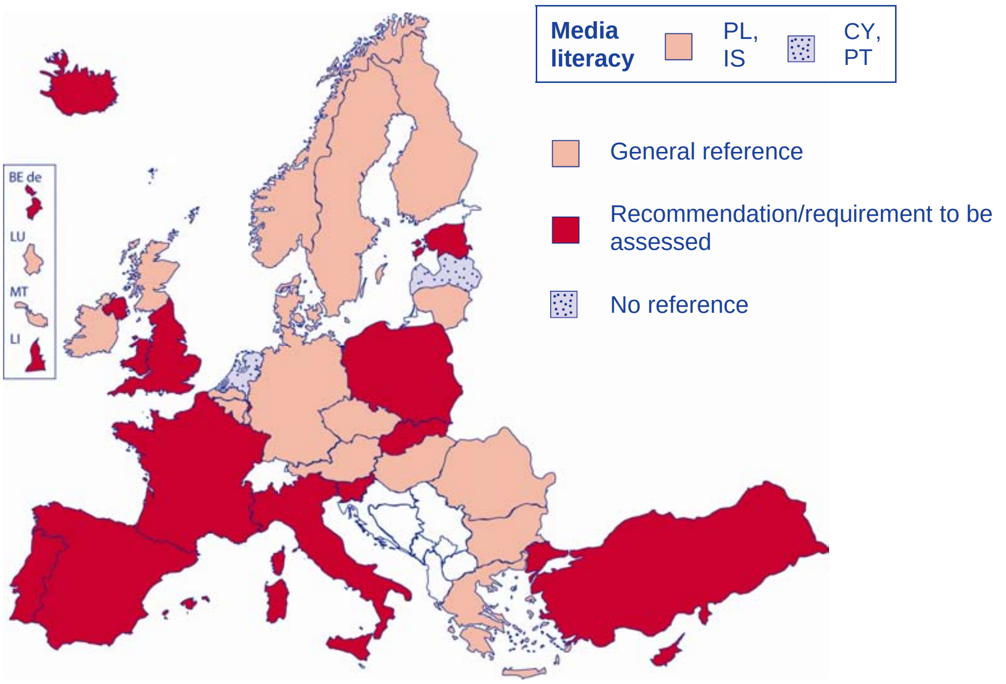
INFORMATION AND MEDIA LITERACY ARE INCLUDED IN ALMOST ALL STEERING DOCUMENTS BUT THEIR ASSESSMENT IS NOT AS WIDESPREAD

The Partnership for 21st Century Skills framework includes two explicitly ICT-related skills: information and media literacy (2009). Information literacy is defined as the skill to 'access, evaluate and use information properly, to manage the information flow coming from a variety of sources', and to 'apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information' (Ibid, p. 5). Media literacy is also an important concept in an EU context, shown for example by the 2007 Communication (European Commission, 2007) and the 2009 Council conclusions on media literacy in the digital environment ([2]). In these documents, media literacy is defined as 'the ability to access the media, to understand and to critically evaluate different aspects of the media and media contents and to create communications in a variety of contexts' (European Commission 2007, p. 3).

Almost all countries include information and media literacy in their steering documents as desired outcomes of the education process. However, in Latvia and the Netherlands, neither of these competences is mentioned. Furthermore, media literacy is not included in the steering documents of Cyprus, but is implicit in Scottish documents.

The steering documents of less than half of the countries include recommendations on assessing pupils in information and media literacy. For information literacy, the steering documents of 16 education systems include recommendations for its assessment. With respect to media literacy, there are recommendations for its assessment in 14 education systems. Poland and Iceland only have assessment recommendations for information literacy.

Figure B5: Information and media literacy included in steering documents for primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

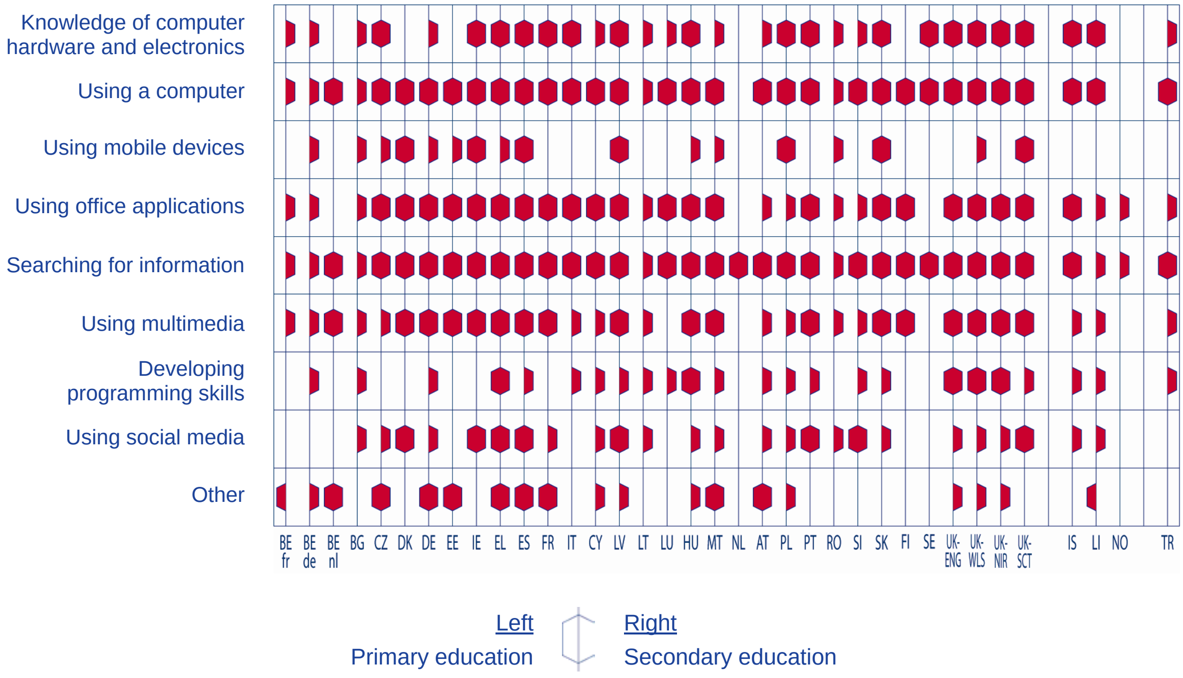
([2]) Council conclusions of 27 November 2009 on media literacy in the digital environment, OJ C 301, 11.12.2009.

ICT LEARNING OBJECTIVES ARE INCLUDED IN CURRICULA ESPECIALLY AT SECONDARY LEVEL

Digital literacy, the knowledge and skills required to participate in essential ICT user activities, is regarded today as the prerequisite for acquiring basic skills, both subject-specific and cross-curricular (ICT Cluster, 2010). The European Commission has also put digital literacy as a learning outcome high on its agenda for the next decade (European Commission, 2010b). Therefore, Figure B6 looks at specific learning objectives related to ICT use.

All countries include at least some of the listed ICT learning objectives in their steering documents for compulsory education. The learning objectives 'using a computer' and 'searching for information' have been adopted by all those countries where their steering documents cite specific objectives. 'Using office applications' is also a widespread goal of curricula which has been adopted by almost all countries. The learning objective least adopted is the 'use of mobile devices', which is included in the steering documents of only about half of the education systems. The countries which have all the listed objectives in their steering documents for either primary or secondary education are Bulgaria, Germany, Greece, Spain, Latvia, Hungary, Malta, Poland, Slovakia and the United Kingdom (Wales and Scotland).

Figure B6: ICT learning objectives in central steering documents for primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

Country specific notes

Belgium (BE nl): The defined learning objectives only applies to primary education and the first stage of secondary education.

Belgium (BE nl), Spain and **Poland**: 'How to use social media' includes the ability to communicate with others using ICT. The use of office applications encompasses word processing, spreadsheet and presentations skills. This includes presenting information and ideas creatively for Belgium (Flemish Community) and Poland.

The ICT learning objectives listed above are usually included in steering documents for secondary education, though most countries have them at both compulsory levels. It is relatively rare for countries to incorporate these learning objectives only into primary education, although ‘using mobile devices’ is only included at primary level in Poland. The learning objectives more usually included in steering documents for secondary rather than for primary education are ‘using mobile devices’, ‘developing programming skills’ and ‘using social media’.

Several countries include additional ICT learning objectives in their curricula. These cover a wide range of issues. Estonia further emphasises playing computer games and data base analysis. The latter is also important for Latvia and the United Kingdom. Finally, the societal impact of ICT is a learning objective in Spain, France, Hungary, the United Kingdom and Liechtenstein.

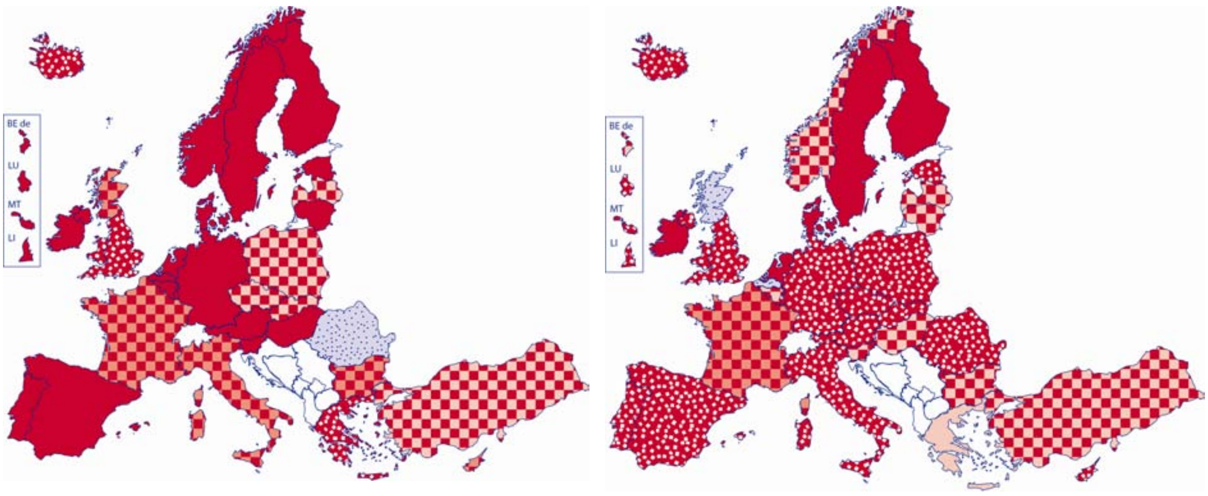
IN THE MAJORITY OF EUROPEAN COUNTRIES SCHOOLS APPLY ICT ACROSS THE CURRICULUM

The Handbook on *Digital Strategies for Educational Transformation* recommends embedding the use of ICT and digital media across the whole curriculum through specific tasks in all subjects in order to develop digital fluency (European Commission/ICT Cluster 2010, p. 29). Empirical research has highlighted that there is indeed a shift from teaching ICT skills in isolation towards more horizontal approaches, ‘crossing the traditional boundaries of academic subjects’ and forming part of other complex skills such as collaboration and communication (Voogt and Pelgrum 2005, p. 172).

Eurydice information on curricula and steering documents shows that education policy reflects these findings. ICT is used as a general tool and/or for specific tasks across the different subjects of the curriculum in the large majority of countries.

Figure B7: Delivery of ICT learning objectives as recommended by central steering documents in primary and general secondary education (ISCED 1, 2 and 3), 2009/10

Primary level | **Secondary level**



- **A –** ICT as separate subject
- **B –** ICT included in technology subject
- **C –** ICT as general tool for other subjects and/or as tool for specific tasks in other subjects
- **A + B + C**
- Not included

Source: Eurydice.

Country specific note

Norway: ICT as separate subject is only applicable to upper secondary education (ISCED 3).

In addition to being used as a general tool, ICT is taught as a separate subject in eight countries/regions (Czech Republic, Latvia, Poland, Slovakia, the United Kingdom (England and Wales), Iceland and Turkey) at primary level. Also at this level, ICT is included in a technology subject in Bulgaria, France, Italy, Cyprus, the United Kingdom and Iceland. At secondary level, ICT is taught as a separate subject and/or is part of a technology subject in almost every education system. The exceptions are Denmark, Ireland, the Netherlands, Finland and Sweden where ICT is used as a general tool for all subjects.

A WIDE VARIETY OF ONLINE SAFETY ISSUES ARE INCLUDED IN THE SCHOOL CURRICULUM

Online Safety (OS) may include a large variety of topics. In the present report, six main elements were analysed: *Safe online behaviour, Privacy issues, Cyberbullying, Downloading and copyright issues, Safe use of mobile phones and Contact with strangers* (for more details see EACEA/Eurydice, 2010).

'Safe online behaviour' and 'privacy issues' are present as themes in all of the countries that have OS included in some form in the school curriculum. In the safe online behaviour topic, students are taught not to reveal any personal information, including their address, name of their school, telephone numbers, etc. In more advanced courses, pupils also learn how companies and agencies gather information about individuals and how this information might be used in ways people might not expect or agree to.

'Downloading and copyright issues' constitute the second element of OS present in the curricula of almost all countries. Children learn about the existence of copyright for some online materials, and what this means in terms of authors' rights to distribute, reproduce and make their works available to the public. The intention is to help children understand the issues surrounding illegal file sharing, particularly with respect to services offering peer-to-peer sharing.

Learning about how to handle 'contact with strangers' on the Internet is also a very important topic in almost all national curricula that include some elements of OS. To avoid any kind of physical injury, children are recommended never to arrange to meet someone that they have got to know online without telling an adult and they are also taught that any such meetings must always be in a public place.

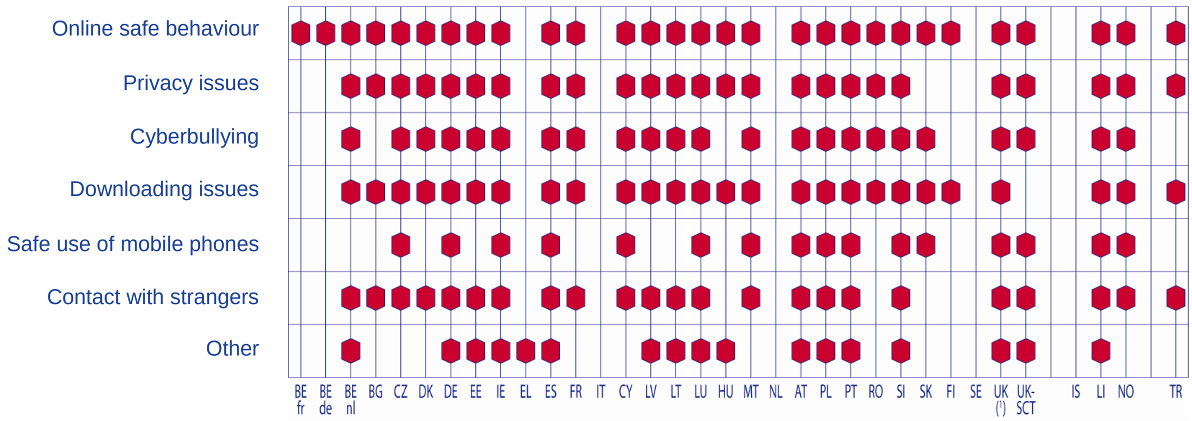
Bullying in schools has become a subject of growing importance within the last few years and, as more and more children are using the Internet and mobile phones to communicate, 'cyberbullying' has become an issue. Children are always advised to tell their parents and teachers about cyberbullying and not to remain silent about any incident. In some countries, this topic is also addressed in collaboration with the associations or other public bodies operating in the schools.

Finally, the 'safe use of mobile phones' is less apparent as an OS subject in the curricula but some complementary initiatives exist in many European countries. Increasingly mobile phones have full Internet access and children and young people use both stationary connections and mobile phones to browse the Internet. Therefore, the same safety measures as for using the Internet become important for using mobile phones (protection of personal data, avoiding harmful content, consumer protection, gaming addiction, etc.).

In many countries, other topics are also covered by the OS curriculum. These may include some of the issues surrounding cybercrime or computer games addiction as in Latvia, or some of the legal issues relating to Internet shopping or banking, as in Germany, Hungary, or Austria. In Belgium (Flemish Community), Greece, Spain and the United Kingdom, online safety classes (mainly in upper secondary education) include issues such as the reliability of information, the prevention of and recovery from spam, viruses and other malware and technical solutions for e-safety (firewalls, back-ups, secure password policies, etc.).

Although some countries/regions do not report the inclusion of OS in the curriculum, this does not mean that the related issues are not covered at school. In Belgium (German-speaking Community) elements such as 'safe online behaviour', 'privacy issues', 'downloading and copyright issues' as well as 'contact with strangers' are included in various subjects. In the Netherlands and Sweden, school authorities or local municipalities may decide to include such topics in the curriculum even where there are no central recommendations to do so.

Figure B8: Online safety issues included in education programmes for primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

UK (¹) = UK-ENG/WLS/NIR

Country specific notes

Spain: At primary level, only 'safe online behaviour' is covered by education programmes.
Italy: Online safety is not included in the school curriculum, but the Ministry of Education, Universities and Research disseminates information to all schools according to bilateral agreements with the police, telecommunication companies and consumer's associations.
Malta: In upper secondary education (ISCED 3), this applies to students up to the age of 16.
Netherlands: Online safety is taught in Dutch schools at both primary and secondary levels as part of *Mediawijsheid* (media literacy) and information competencies. Neither subject is strictly tied to the curriculum in terms of competences and (exit) qualifications.
Sweden: Online safety issues may be integrated within subjects that form part of the curriculum if decided by the local school authority or school head.
Iceland: Online safety is taught in some schools both at primary and secondary levels, but there is no centralised information on the topic

C

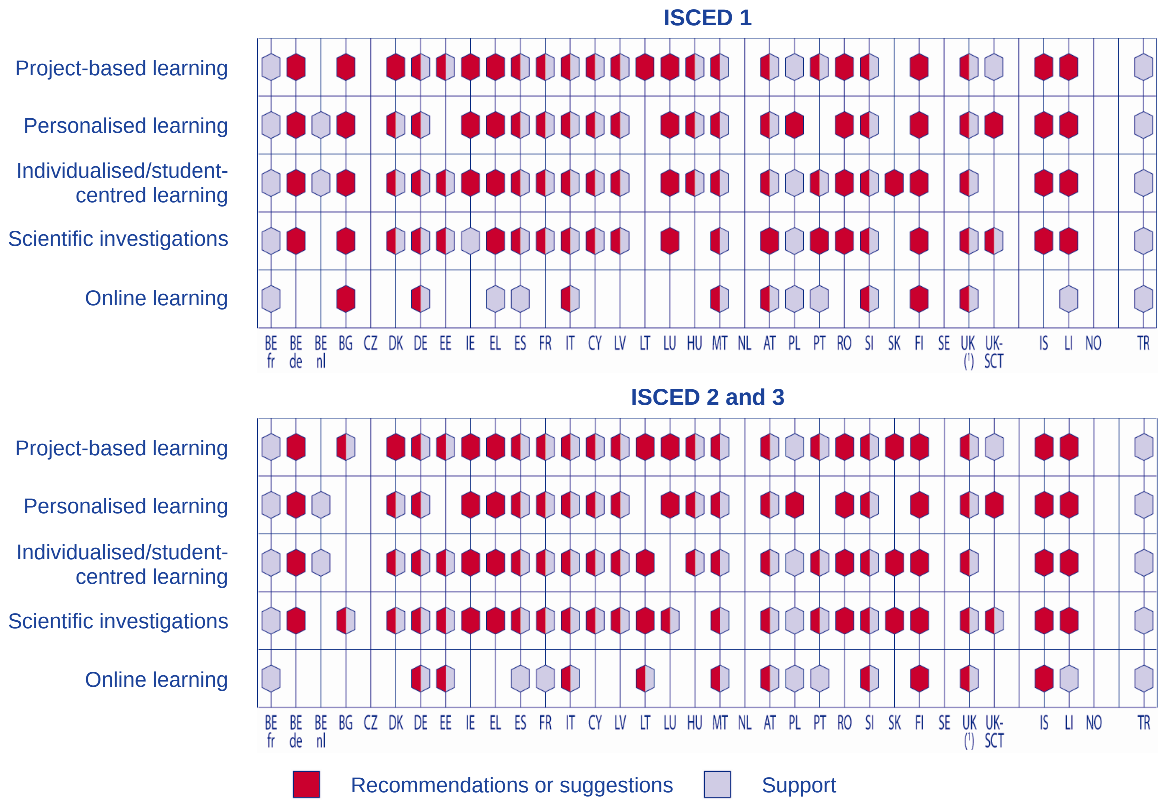
EDUCATIONAL PROCESSES

SECTION I – TEACHING METHODS

EUROPEAN COUNTRIES PROMOTE A WIDE RANGE OF INNOVATIVE TEACHING METHODS AT PRIMARY AND SECONDARY LEVEL

Innovative teaching methods that are based on active and experiential learning and may be enhanced through the use of ICT can increase student engagement and improve their results. At both primary and secondary level, the great majority of European countries recommend or suggest several innovative pedagogical approaches. These may include project-based learning activities that engage students in open-ended, long term (one week or more) questions or problems; personalised learning, whereby students learn in ways relevant to their own background, experiences, and interests; individualised learning, by which teachers make it possible for individual students to work at their own pace, or they adapt their teaching to individual students' skill levels and learning needs; and scientific investigations, based on observation, hypotheses, experimentation and conclusions.

Figure C1: Recommendations/suggestions/support for the use of innovative pedagogical approaches in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

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

Explanatory note

Recommendations and suggestions are put forward in official documents proposing the use of specific tools, methods and/or strategies for teaching and learning. Support given to schools and teachers refers to practical advice and help for lesson planning, effective teaching, classroom management, use of various resources, etc.

Country specific note

Turkey: No recommendations/suggestions/support at ISCED 3.

Less than half of European countries promote the use of online learning where the teacher and learner are separated by distance and/or time, and interactions between the two are conducted through online technology.

In most countries where innovative pedagogical approaches are recommended or suggested in official documents, support is also available to schools and teachers in the form of advice or help to implement these new teaching methods. Few countries focus mainly or entirely on providing practical support at both levels of education such as Belgium (French and Flemish Communities), Poland and Turkey.

In the Czech Republic, the Netherlands, Sweden and Norway, none of the innovative pedagogical approaches mentioned above are recommended, suggested or supported by the central level of the education administration, either at primary or at secondary level. In the Netherlands, Sweden and Norway this is because schools and teachers have a high level of autonomy in their choice of teaching methods. In the Czech Republic, it is because the Framework Educational Programme for Basic Education (FEB BE) only mentions teaching practices generally and there are no specific recommendations or suggestions for the use of innovative practices.

TEACHERS' USE OF ICT HARDWARE AND SOFTWARE IN THE CLASSROOM IS WIDELY PROMOTED

ICT is generally assumed to have a positive impact on learning. The benefits derived from ICT extend beyond the use of computers and the Internet to embrace the use of other technologies such as digital cameras and mobile phones which can support pupils' learning and personal development.

In the majority of countries in Europe, the use of a large range of ICT tools for teaching and learning is currently promoted. Most countries recommend or suggest that teachers use a range of hardware including computers, projectors or beamers; DVD, video, TV, camera; smartboards; and virtual learning environments which integrate a range of ICT infrastructure to create a personalised online learning space. Relatively few countries recommend or suggest the use of mobile devices and e-book readers.

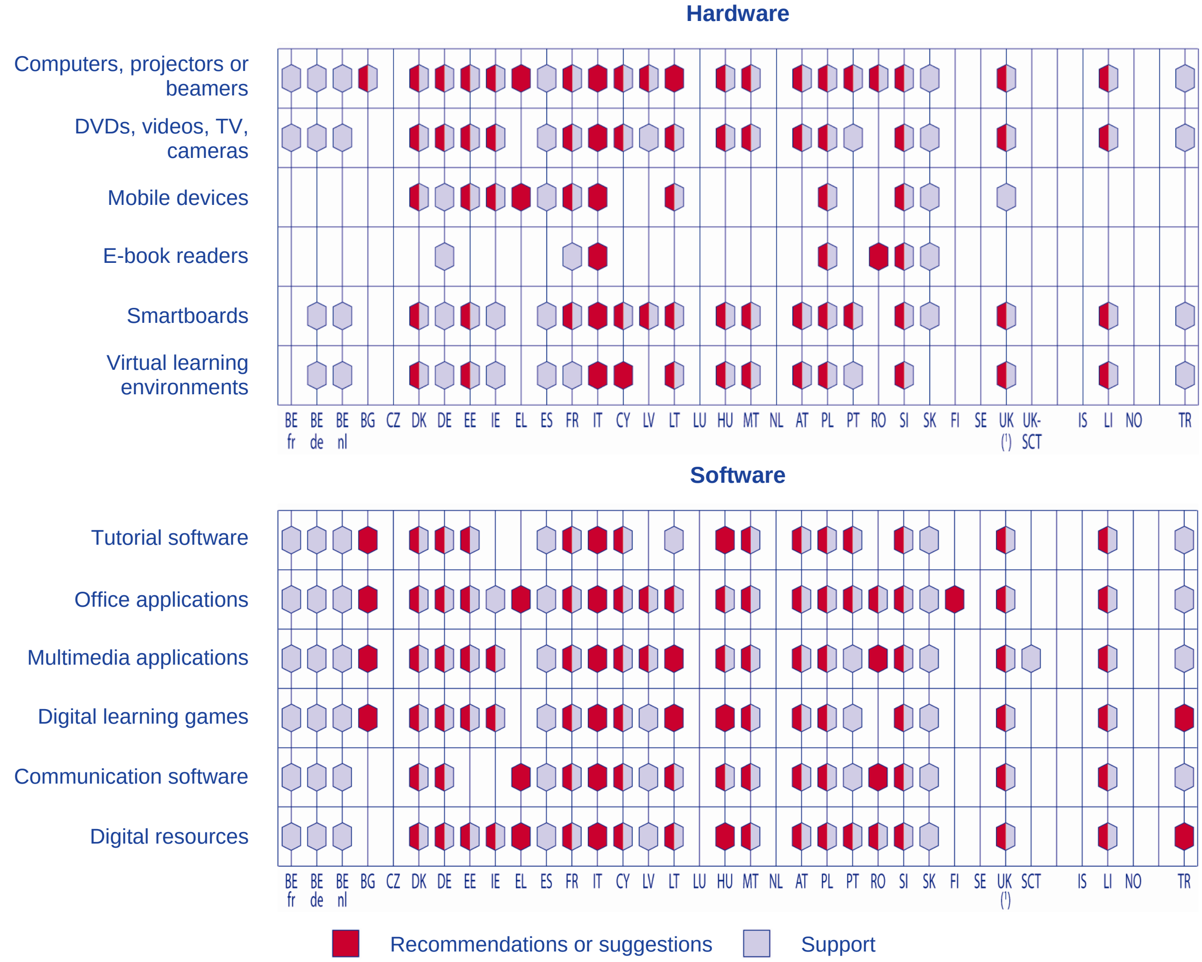
Most countries which recommend or suggest, in their official documents, the use of ICT tools in the classroom also offer support and advice for schools and teachers in employing these tools. However, in Belgium, Spain, Slovakia and Turkey there are no official recommendations or suggestions, but support is nevertheless provided to schools and teachers for using a range of ICT tools.

In the Czech Republic, Luxembourg, the Netherlands, Finland, Sweden, Iceland and Norway none of the above ICT tools are specifically recommended, suggested or supported at central level. As with innovative teaching practices (see Figure C1), this is due to school and teacher autonomy in teaching methods in most of these countries.

More countries recommend the use of particular ICT software than hardware for teaching and learning in the classroom. The types of software which almost all countries promote include tutorial software; general office applications such as word processing and spreadsheet programmes; multimedia applications; digital learning games; communication software such as email, chat or discussion forums; and digital resources e.g. encyclopaedias and dictionaries.

In the majority of countries where various types of software are recommended or suggested for use in the classroom, support for implementation is also offered. In Belgium, Spain, Slovakia and the United Kingdom (Scotland), although there are no official recommendations or suggestions on this matter, support is made available to schools and teachers.

Figure C2: Recommendations/suggestions/support for the use of ICT hardware and software in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice. UK (¹) = UK-ENG/WLS/NIR

Explanatory note

Recommendations and suggestions are made in official documents for the use of specific tools, methods and/or strategies for teaching and learning. Support given to schools and teachers refers to practical advice and help for lesson planning, effective teaching, classroom management, use of various resources, etc.

THE USE OF ICT FOR BOTH IN-CLASS LEARNING AND COMPLEMENTARY ACTIVITIES IS RECOMMENDED FOR STUDENTS

If digital competence, as defined in the 2006 Recommendation on Key Competences ([1]) involves the confident and critical use of ICT that forms the basis for learning, then it is important to look at whether ICT use is integrated into specific subjects in the curriculum. Steering documents make recommendations or suggestions not only for the use of ICT by students (see Figure C3) but also by teachers (see Figure C4).

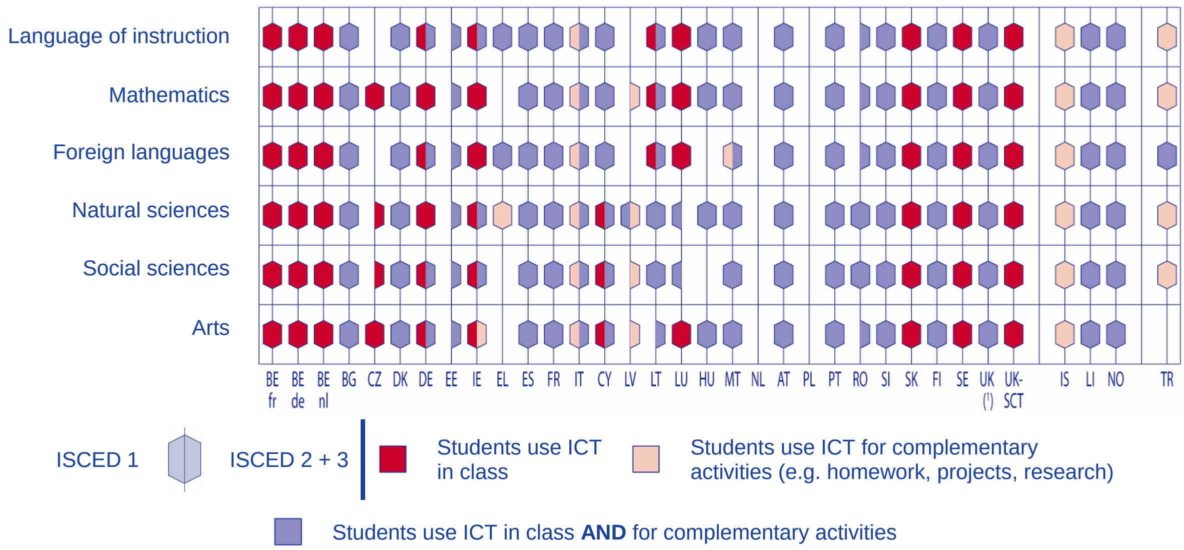
Across Europe, official steering documents suggest that students should use ICT for learning in class and/or for complementary activities, e.g. for homework or project work. Recommendations/ suggestions are very similar for both primary and secondary levels of education, although complementary activities are perhaps promoted more at lower and upper secondary than at primary level.

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

With the exception of the Netherlands and Poland, all other countries' steering documents suggest that students use ICT in relation to specific subjects. However, in some cases, there are no or only few central recommendations/suggestions on student use of ICT or support for schools at primary level, for example in the Czech Republic, Estonia, Latvia and Romania.

Where official documents include recommendations or suggestions for the use of ICT, they usually apply to all, or almost all, listed subjects. Generally, students are encouraged to use ICT in schools both in class as well as for complementary activities. However, Latvia, Iceland and Turkey suggest that students use ICT largely for complementary activities.

Figure C3: Student use of ICT by subject area according to official steering documents in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

UK (¹) = UK-ENG/WLS/NIR

TEACHERS' USE OF ICT IS RECOMMENDED FOR A VARIETY OF SUBJECTS

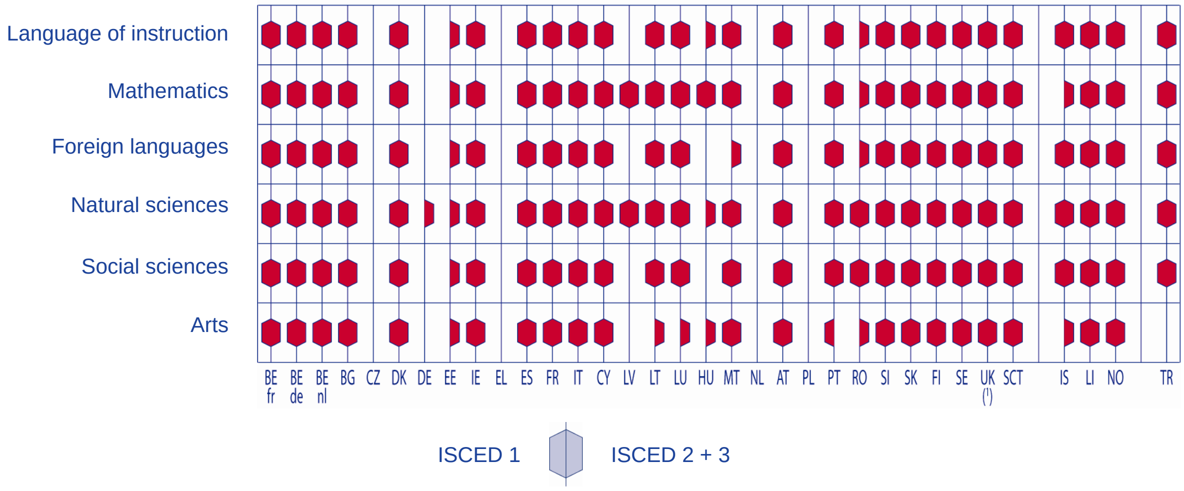
Teachers' use of ICT in the classroom depends on several factors such as school and national policies, availability and access to resources, support in school, ICT training, or teachers' own beliefs about teaching and learning (Mumtaz, 2000). Effectively applied, ICT can play an important role in transforming and supporting teaching.

Recommendations or suggestions for the use of ICT by teachers at different levels of education are similar to that for students (see Figure C3). Official steering documents do not generally differentiate between primary and secondary levels, but where there are differences, it is more common for ICT to be recommended for use by teachers at lower and upper secondary than at primary level.

There is also little difference between subjects. However, it is slightly more common for ICT to be recommended or suggested for use in the natural sciences than for social sciences or the arts at primary level.

Teachers' use of ICT is not suggested in relation to specific subjects in the Czech Republic, Greece, the Netherlands and Poland. Furthermore, teachers' use of ICT is encouraged less than students' use in Germany, where it is only mentioned for natural sciences, and in Latvia where it is only mentioned for mathematics and natural sciences.

Figure C4: Teacher use of ICT by subject area according to official steering documents in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

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

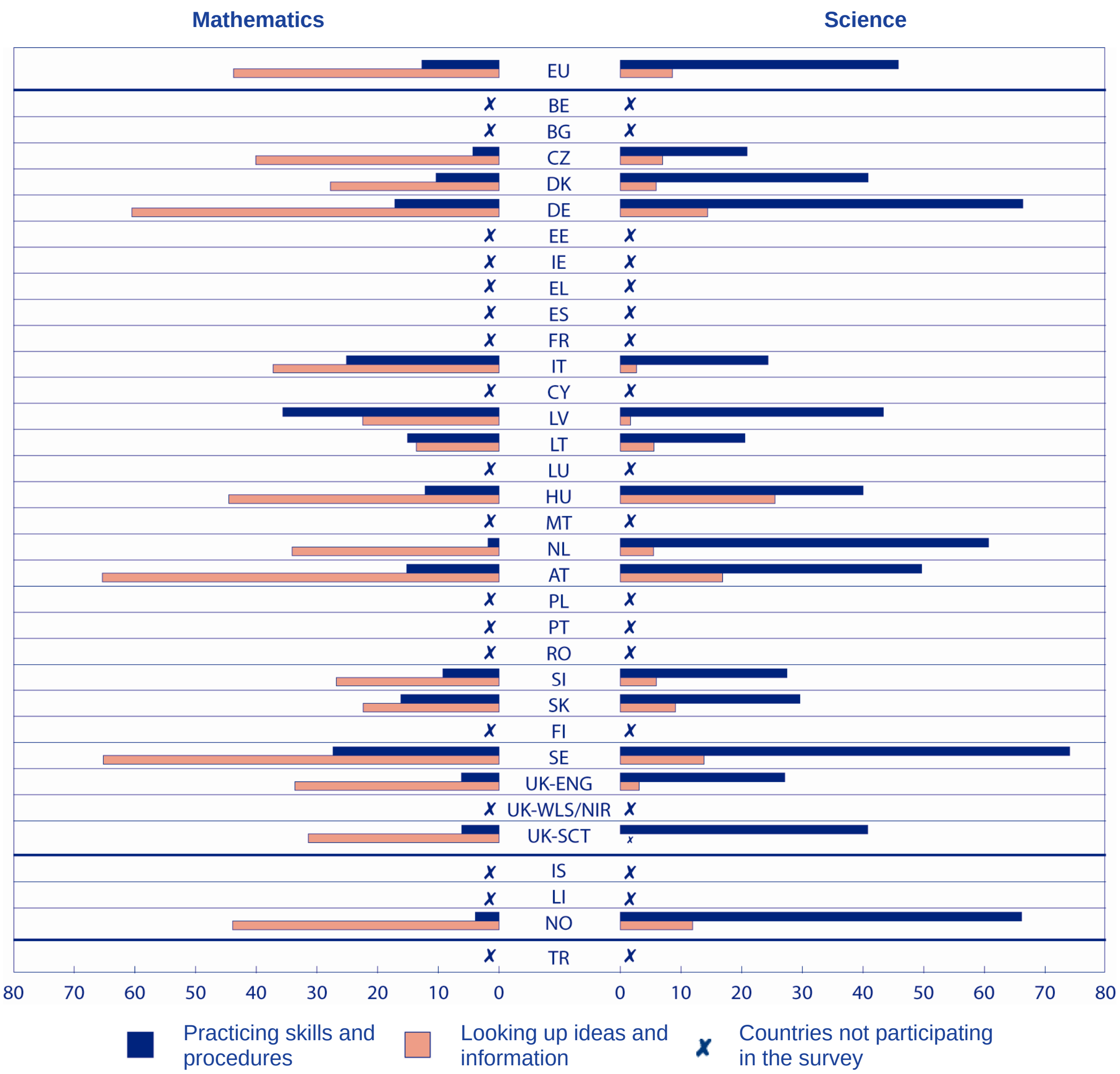
IN MATHEMATICS, COMPUTERS ARE USED MORE FOR SKILLS PRACTICE, WHILE IN SCIENCE, THEY ARE USED MORE OFTEN FOR LOOKING UP INFORMATION

Although ICT use is commonly promoted for use by students (see Figure C3) and teachers (see Figure C4), research evidence suggests that successful implementation of ICT in teaching is not necessarily as widespread. The European Schoolnet 'ICT Impact Report' (2006) has found, based on a review of national, European and international studies and surveys, that teachers recognise the value of ICT in education. However, they experience problems with the process of adopting these technologies and therefore only a minority of teachers has so far embedded ICT into lessons.

The TIMSS 2007 international survey data reveals large variations in teachers' ICT use. The most striking differences can be found in the types of activities for which teachers had their students use computers. A relatively large share of students (44 %) in the participating European countries had teachers who never required them use a computer for looking up ideas and information in mathematics class, compared to using a computer for practicing skills and procedures. In science class, on the other hand, a larger proportion of students (46 %) had teachers that never required them to use a computer for practicing skills and procedures than for looking up ideas and information.

Countries tend to have similar proportions of students whose teachers never had them use a computer for either of the two activities across the two subjects. In other words, in Germany, Austria, Sweden and Norway, for example, very high proportions of students had teachers who never required them to use a computer for looking up ideas and information in mathematics, or for practicing skills and procedures in science. On the other hand, in countries such as the Czech Republic, the Netherlands, the United Kingdom (England) and Norway, the proportion of students whose teachers never required them to use a computer for practicing skills and procedures in mathematics class was very low as was the proportion of students who used them for looking up ideas and information in science class.

Figure C5: Percentage of students in the fourth grade who had NEVER used a computer in their mathematics or science class, even where they were available in the classroom, as reported by their teacher, 2007



Source: IEA, TIMSS 2007 database.

Mathematics

	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
■ (Practicing skills and procedures)	12.7	x	4.3	10.4	17.2	25.1	x	35.6	15.1	12.2	x	1.8	15.2	x	9.2	16.1	27.3	6.2	6.1	3.9	x
■ (Looking up ideas and information)	43.7	x	40.1	27.8	60.5	37.2	x	22.4	13.6	44.5	x	34.1	65.3	x	26.8	22.4	65.2	33.6	31.4	43.9	x

Science

	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
■ (Practicing skills and procedures)	45.8	x	20.9	40.8	66.3	24.3	x	43.3	20.5	40.0	x	60.7	49.7	x	27.4	29.6	74.0	27.1	40.7	66.1	x
■ (Looking up ideas and information)	8.6	x	7.0	5.9	14.4	2.7	x	1.7	5.5	25.5	x	5.5	16.9	x	5.9	9.1	13.8	3.1	x	11.9	x

Source: IEA, TIMSS 2007 database.

Explanatory note

The questionnaire asked teachers to indicate if computers were available for use when they were teaching mathematics and science. If computers were available, teachers were asked to specify if they required students to use a computer during lessons for the following activities: a) Discover mathematical principles and concepts; b) Practice skills and procedures; c) Look up ideas and information; d) Do scientific procedures or experiments; e) Study natural phenomena through simulations. The possible replies were (i) Every or almost every lesson, (ii) About half the lessons, (iii) Some lessons, (iv) Never.

The figure presents only the percentage of students whose teachers report that they never required their students to use a computer in their mathematics or science class – **even when one was available** – for practicing skills and procedures or looking up ideas and information.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

STUDENTS RARELY USE COMPUTERS FOR CONDUCTING EXPERIMENTS OR SIMULATIONS OF NATURAL PHENOMENA IN SCIENCE LESSONS

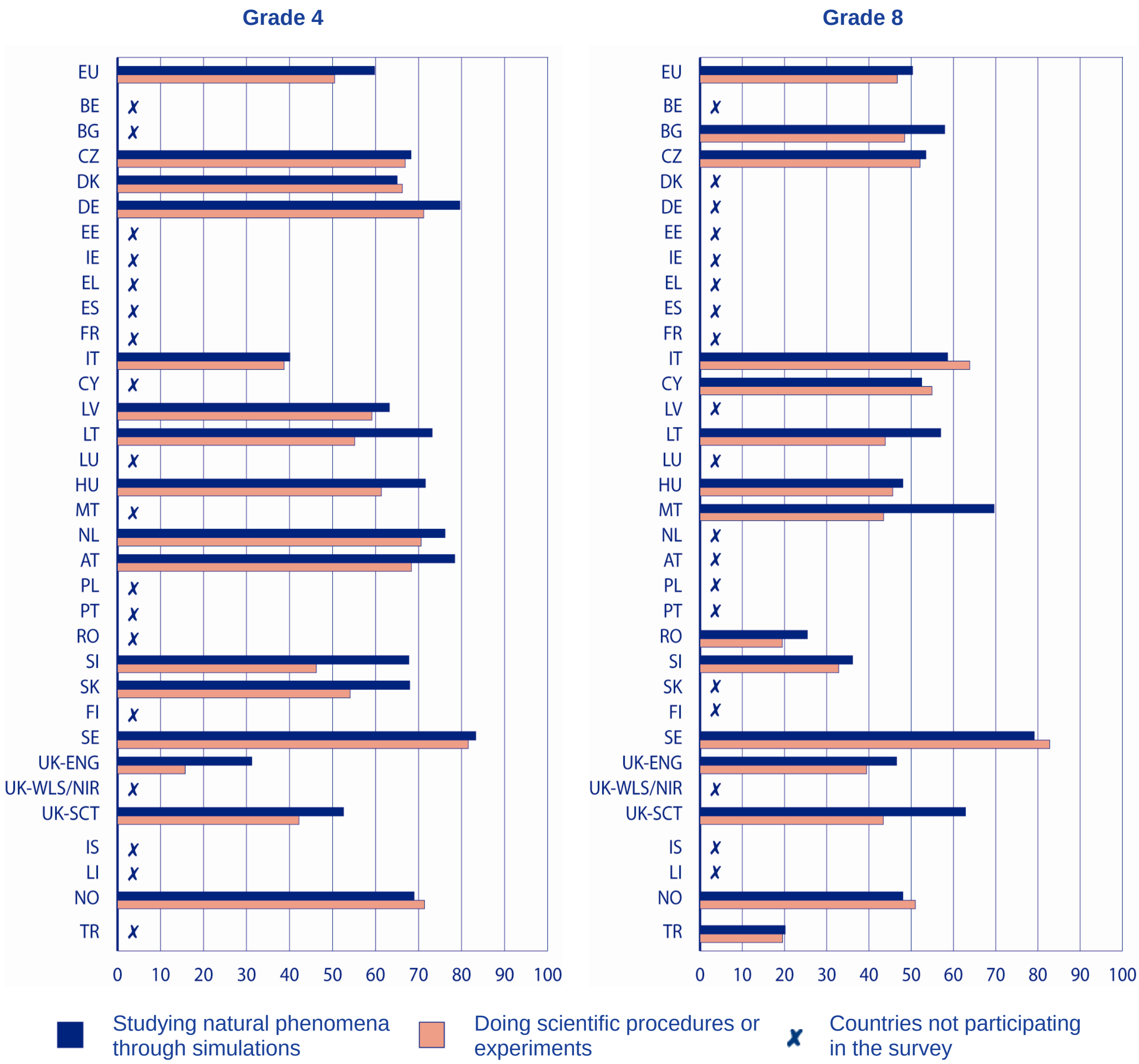
With respect to science teaching, the TIMSS 2007 international survey analysed the use of computers for carrying out scientific procedures and experiments as well as for studying natural phenomena through simulations. Computers were used by students for both types of activities as rarely as for practicing skills and procedures (see Figure C5). Moreover, students used computers even less frequently for both types of activities at primary than at lower secondary level.

In the fourth grade, there were around 60 % of students on average, in European countries that responded to this part of the survey, who had teachers who never required them to use a computer for studying natural phenomena through simulations. In comparison, the proportion of students in the fourth grade with teachers who never required them to use a computer for carrying out scientific procedures or experiments is slightly lower with 51 % on average in Europe.

Almost all countries had relatively high proportions of students who had teachers that never required them to use a computer in science classes for studying experiments or for studying natural phenomena through simulations. Lower percentages can be found only in the United Kingdom (England) in the fourth grade and in Romania, Slovenia and Turkey in the eighth grade. Another commonality between countries is that, in the fourth grade, the proportion of students using a computer for studying experiments was higher than for those studying natural phenomena through simulations. The only exception was Norway where the opposite occurred.

In the eighth grade, a similar proportion of students had teachers who never required them to use a computer for doing scientific procedures and experiments as for studying national phenomena through simulations. The percentages are again higher in most countries for doing scientific procedures and experiments than for studying natural phenomena through simulations, except in Italy, Cyprus, Sweden and Norway where the opposite is the case.

Figure C6: Percentage of students in the fourth and eighth grades who NEVER USED A COMPUTER IN THEIR SCIENCE CLASS, even where they were available in the classroom, as reported by their teacher, 2007



Grade 4

	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
■	59.8	X	68.3	65.0	79.6	40.1	X	63.2	73.2	71.6	X	76.2	78.4	X	67.8	67.9	83.3	31.2	52.6	69.0	X
□	50.5	X	66.9	66.2	71.2	38.8	X	59.1	55.2	61.4	X	70.6	68.3	X	46.2	54.1	81.6	15.7	42.2	71.4	X

Grade 8

	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
■	50.3	57.9	53.5	X	X	58.6	52.5	X	57.0	48.0	69.6	X	X	25.4	36.1	X	79.1	46.5	62.9	48.0	20.2
□	46.7	48.5	52.1	X	X	63.9	54.9	X	43.9	45.7	43.5	X	X	19.5	32.8	X	82.8	39.4	43.4	51.0	19.5

Source: IEA, TIMSS 2007 database.

Explanatory note

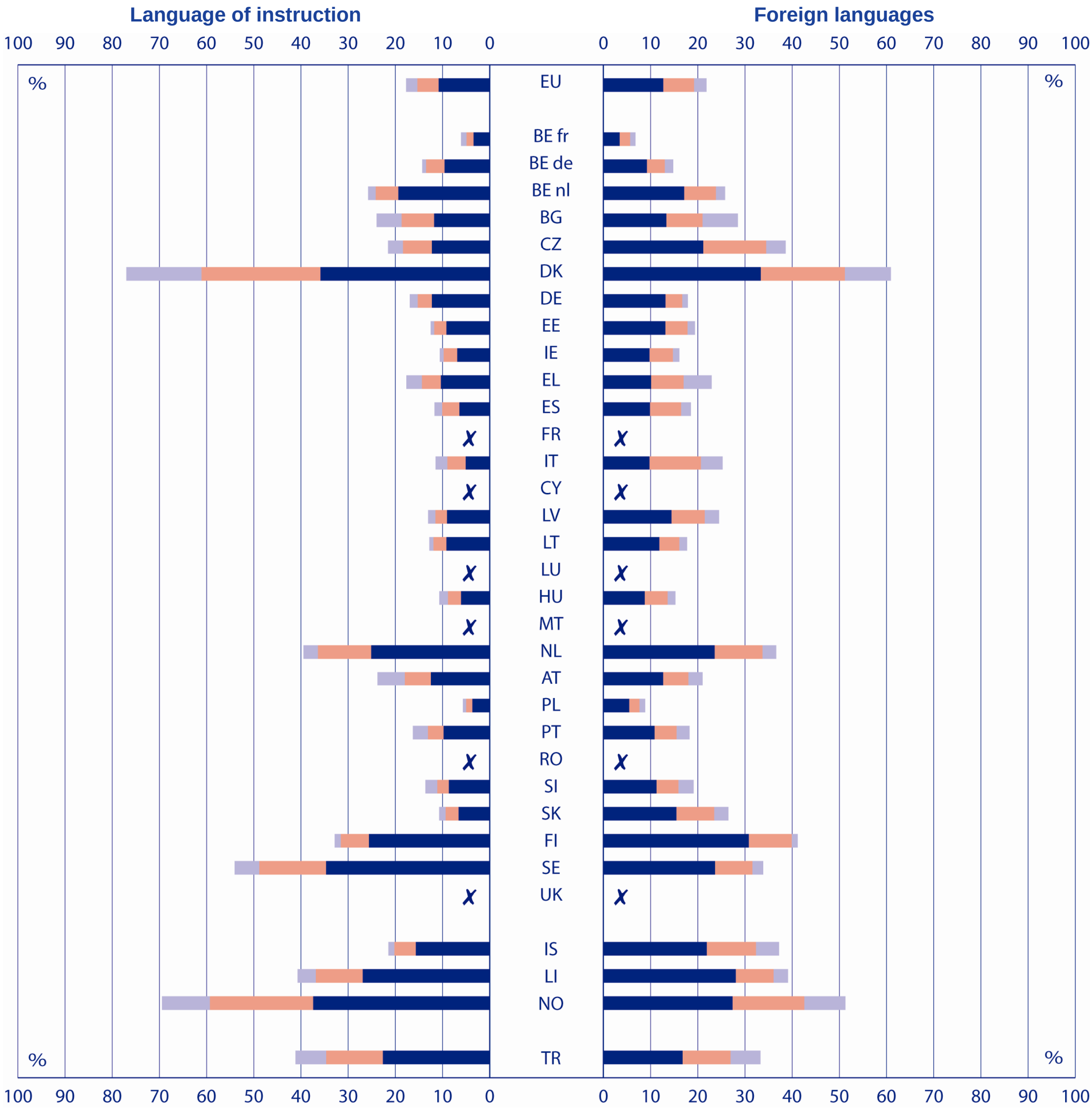
The figure presents only the percentage of students whose teachers report that they never required their students to use a computer in their mathematics or science class – even where one was available – for doing scientific procedures or experiments, or studying natural phenomena through simulations. For more information on all the items and answer options in this question, see Figure C5.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

COMPUTER USE IN LANGUAGE OF INSTRUCTION AND FOREIGN LANGUAGES IS MORE THE EXCEPTION THAN THE RULE

Similar to the data on the use of computers in mathematics and science class (see Figures C5 and C6), in PISA 2009 information has been collected on its use in language of instruction and foreign languages classes. The data shows that in these subjects too computer use to support the teaching and learning process is rather limited.

Figure C7: Use of computers by 15 years-old students per week, during language of instruction and foreign language classes, 2009



Source: OECD, PISA 2009 database.

Language of instruction (%)					Foreign languages (%)			
NEVER	≥ 60 minutes	31-60 minutes	0-30 minutes		0-30 minutes	31-60 minutes	≥ 60 minutes	NEVER
82.3	2.4	4.5	10.8	**EU**	12.7	6.5	2.6	78.2
93.9	1.2	1.5	3.4	**BE fr**	3.4	2.2	1.2	93.2
85.7	0.8	3.9	9.6	**BE de**	9.2	3.8	1.8	85.2
74.2	1.6	4.8	19.4	**BE nl**	17.1	6.7	1.9	74.2
76.0	5.3	6.9	11.8	**BG**	13.3	7.7	7.5	71.5
78.5	3.2	6.1	12.3	**CZ**	21.2	13.3	4.2	61.4
23.0	15.9	25.2	35.9	**DK**	33.3	17.8	9.7	39.1
83.1	1.7	3.0	12.3	**DE**	13.2	3.5	1.2	82.1
87.5	0.7	2.6	9.2	**EE**	13.1	4.7	1.6	80.6
89.4	0.8	2.9	6.9	**IE**	9.8	4.9	1.4	83.9
82.3	3.3	4.0	10.4	**EL**	10.1	6.9	6.0	77.1
88.3	1.6	3.7	6.4	**ES**	9.9	6.6	2.1	81.5
88.6	2.5	3.9	5.1	**IT**	9.8	10.9	4.6	74.7
89.3	1.8	2.8	6.1	**HU**	8.7	4.8	1.7	84.7
87.0	1.5	2.4	9.1	**LV**	14.4	7.0	3.1	75.5
87.2	0.9	2.7	9.2	**LT**	11.8	4.2	1.7	82.3
60.5	3.1	11.3	25.1	**NL**	23.6	10.1	2.9	63.4
76.2	5.8	5.5	12.5	**AT**	12.7	5.3	3.0	79.0
94.3	0.7	1.3	3.7	**PL**	5.5	2.1	1.2	91.2
83.7	3.2	3.3	9.8	**PT**	10.8	4.7	2.8	81.7
86.4	2.5	2.4	8.7	**SI**	11.2	4.7	3.2	80.9
89.3	1.4	2.7	6.6	**SK**	15.5	8.0	3.0	73.5
67.2	1.3	6.0	25.6	**FI**	30.8	9.1	1.3	58.8
45.9	5.2	14.2	34.7	**SE**	23.7	7.9	2.3	66.1
78.5	1.2	4.5	15.7	**IS**	21.9	10.4	4.9	62.8
59.3	3.9	9.9	26.9	**LI**	28.1	8.0	3.1	60.9
30.6	10.1	21.9	37.4	**NO**	27.4	15.2	8.7	48.7
58.8	6.5	12.0	22.7	**TR**	16.8	10.2	6.4	66.7

Source: PISA 2009 database.

Explanatory note

The figure presents the percentage of students that report the time they use computers during classroom lessons in a typical school week

For further information on the PISA international survey sampling procedures, see the Glossary and Statistical Tools section.

On average in the participating European countries, around 80 % of students reported never using computers in neither of the two subject areas. However, there are some variations between countries; the disparities are more marked in languages of instruction than in foreign language classes.

In six countries – Denmark, the Netherlands, Sweden, Liechtenstein, Norway and Turkey – around 40 % or more students reported using computers in language of instruction classes on a weekly basis for up to 60 minutes or even more. The figures are particularly high in Denmark and Norway where around 60 % of student reported using computers less than one hour per week, and another 10-16 % stated that they use them for more than 60 minutes per week. In the majority of other countries, the rates are comparatively low with less than 20 % of all students who reported that they use computers in language of instruction lessons for up to 60 minutes per week or more.

The rates are more equally distributed among countries with regard to foreign language classes. Denmark and Norway stand out again with around 60 % and 50 % of students, respectively, who reported that they use computers in foreign language lessons up to 60 minutes per week or more. However, in most other countries, the percentage of students ranges between 20-40 %. There are some exceptions such as Belgium (French Community) and Poland where even less than 10 % of students reported using computers in foreign languages class for more than one hour per week or more, but in both countries similar rates applied also to language of instruction lessons.

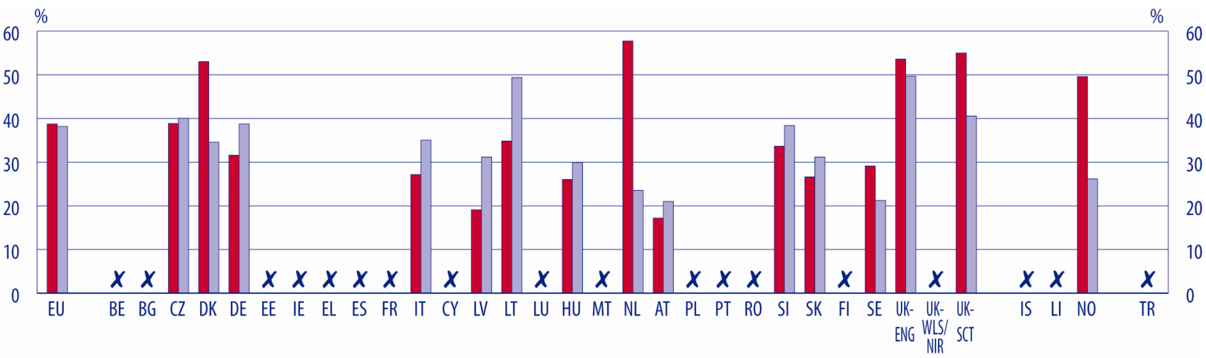
ON AVERAGE, MORE THAN ONE THIRD OF STUDENTS USE COMPUTERS FOR MATHEMATICS AND SCIENCE SCHOOLWORK AT LEAST ONCE A MONTH

Official steering documents in the majority of European countries suggest the use of computers not only for teachers teaching different subjects in school, but also to help students with their learning activities in and out of school (see Figures C3 and C4).

The TIMSS 2007 international survey investigated, in particular, students' use of a computer for their mathematics and science schoolwork. The results show that across the European countries that participated in this part of the survey, the average percentage of fourth grade students using a computer at least once a month for this purpose was similar for mathematics and science.

In most countries, the general pattern is the same: the proportions of students using a computer for mathematics and science schoolwork, respectively, are similar. Larger differences can be found only in Denmark, the Netherlands and Norway where more students used a computer at least once a month for mathematics schoolwork; whereas in Latvia and Lithuania a proportionately larger share of students used a computer for science schoolwork.

Figure C8: Percentage of students in the fourth grade who use a computer for their mathematics and science schoolwork (in and out of school) at least once a month, 2007



Use computers for mathematics schoolwork at least once a month
Use computers for science schoolwork at least once a month
✗ Countries not participating in the survey

	EU	CZ	DK	DE	IT	LV	LT	HU	NL	AT	SI	SK	SE	UK-ENG	UK-SCT	NO
Mathematics	38.7	38.9	53.0	31.6	27.2	19.1	34.8	26.0	57.7	17.2	33.6	26.6	29.1	53.6	55.0	49.6
Science	38.2	40.1	34.6	38.8	35.1	31.2	49.4	29.9	23.5	21.0	38.4	31.2	21.2	49.7	40.5	26.2

Source: IEA, TIMSS 2007 database.

Explanatory note

The questionnaire asked students to indicate how often they used a computer for their mathematics and science schoolwork (in and out of school). The possible replies were (i) Every day, (ii) At least once a week, (iii) Once or twice a month, (iv) A few times a year, (v) Never.

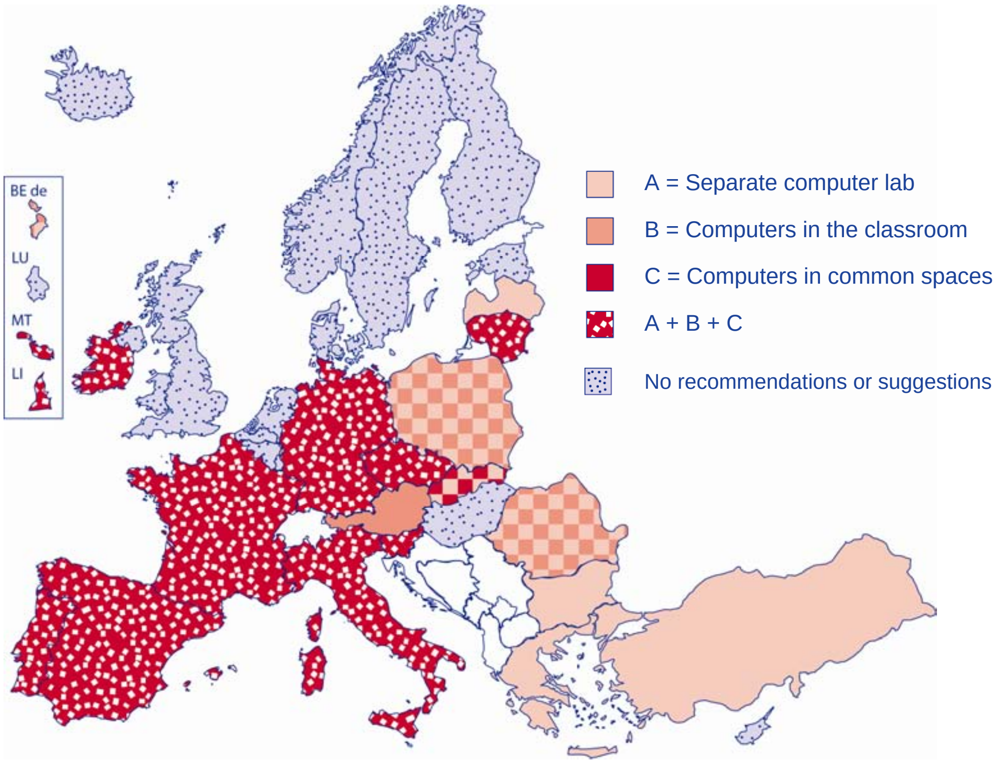
Results are aggregated to present: 'Every day', 'At least once a week' and 'Once or twice a month'.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

MOST EUROPEAN COUNTRIES RECOMMEND PLACING ICT EQUIPMENT IN A VARIETY OF PLACES IN SCHOOL

When computers are used in school, different choices are made as to where they are situated. Computer labs allow ICT to be established as part of the taught curriculum in a cost-effective way. However, this solution may contribute to learning about ICT rather than through ICT. On the other hand, computers that are readily available in the classroom can be used more routinely throughout the day and for a variety of everyday activities. Computers in the classroom can be particularly useful in personalising teaching and learning, whether the aim is to respond to special needs, individual interests or to implement individualised learning programmes or activities (Condie and Munro, 2007).

Figure C9: Recommendations/suggestions on the location of ICT equipment in schools in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Different recommendations/suggestions at ISCED 2 and 3

	Separate computer lab	Computers in the classroom	Computers in common spaces
CY	x	-	-
LV	x	x	x
AT	x	-	x

Source: Eurydice.

Country specific note

Portugal: During the first cycle of education (first four years of schooling), it is recommended or suggested to use ICT only within the classroom.

The most common solution in European countries is to take a combined approach: in Belgium (German-speaking Community), Poland and Romania, schools are encouraged to use ICT in separate computer labs as well as in the classroom. In eleven countries – the Czech Republic, Germany, Ireland, Spain, France, Italy, Lithuania, Malta, Portugal, Slovenia and Liechtenstein, three spaces are recommended or suggested – separate computer labs, classrooms, and common spaces. The situation is the same in Latvia but only at secondary level.

In Bulgaria, Greece and Turkey the recommendation or suggestion is to use ICT only in separate computer labs at both primary and secondary level; while the same is the case in Cyprus at secondary level. In Austria, it is recommended or suggested to use ICT only within the classroom during primary education and in separate computer labs as well as common spaces during lower and upper secondary education.

Thirteen European countries or regions do not have any central recommendations or suggestions for locating ICT equipment in schools.

In general, where ICT equipment is located in separate computer labs or in the classroom, recommendations or suggestions envisage that students may use them only under the supervision of a teacher and during specific hours. Free use of ICT by students can only be found only in a minority of cases, especially where computers are located in schools' common spaces and at lower and upper secondary levels.

MOST COUNTRIES ENCOURAGE THE USE OF ICT AS A TOOL FOR PROMOTING EQUITY

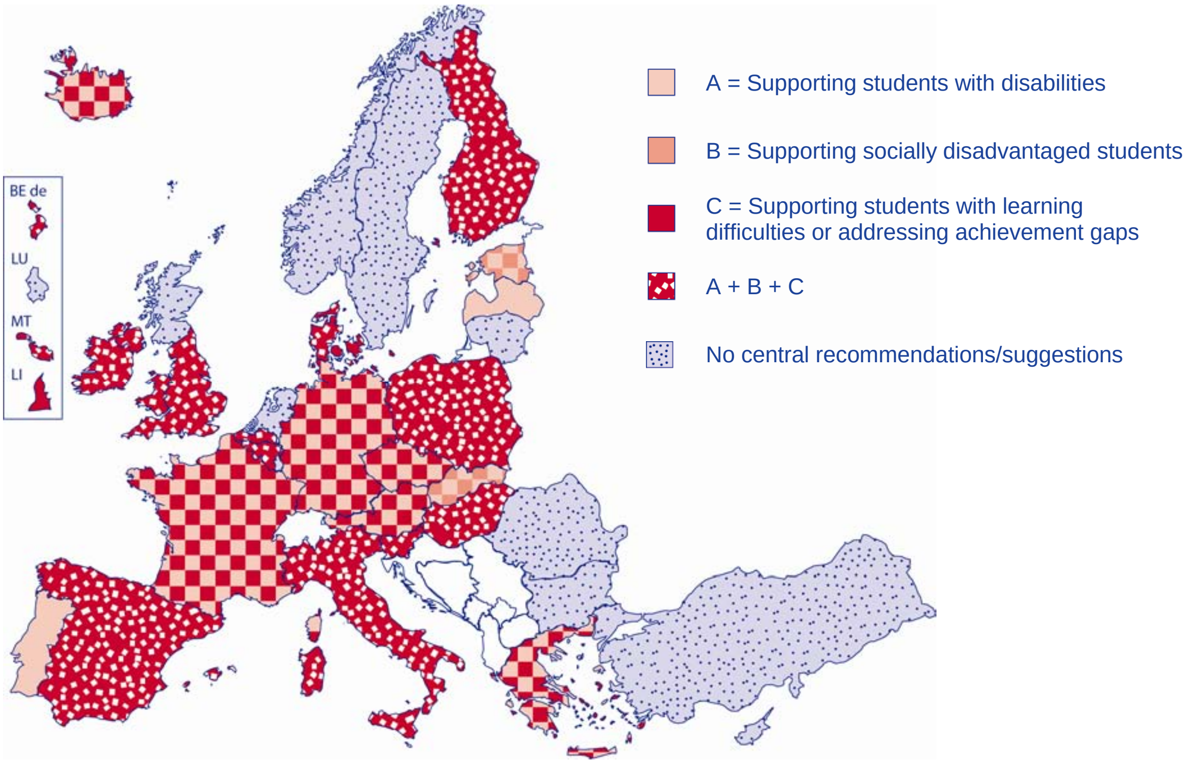
ICT can be used as a tool for personalising learning and for promoting equity in education. The European Commission (2008b) highlights the role of ICT in helping students with special educational needs gain greater autonomy. It can also enable hospitalised children keep in contact with their classroom. By allowing users to learn at their own pace, it can also encourage less able students and enhance their self-esteem.

In most European countries, there are central recommendations or suggestions for promoting the use of ICT to address equity issues. The exceptions are Bulgaria, Cyprus, Lithuania, Luxembourg, the Netherlands, Romania, Sweden, the United Kingdom (Scotland), Norway and Turkey.

In a large number of countries, ICT use is recommended or supported with a view to achieving several different objectives. In the Czech Republic, Germany, Greece, France, Austria and Iceland, the aim is to support students with disabilities as well as those with learning difficulties. In Estonia and Slovakia, the two aims of promoting ICT as tool for promoting equity are to support students with disabilities and those who are socially disadvantaged. Finally, in Belgium, Denmark, Ireland, Spain, Italy, Hungary, Malta, Poland, Slovenia, Finland and the United Kingdom (England, Wales and Northern Ireland), the use of ICT is promoted in mainstream education to address all three target groups, students with disabilities, socially disadvantaged students and students with learning difficulties.

In Latvia and Portugal, ICT tools are promoted to support mainly students with disabilities while in Liechtenstein, it is encouraged to support only students with learning difficulties or for addressing achievement gaps.

Figure C10: Recommendations/suggestions on the use of ICT for promoting equity in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

E-PORTFOLIOS ARE NOT YET WIDELY USED FOR PUPIL ASSESSMENT

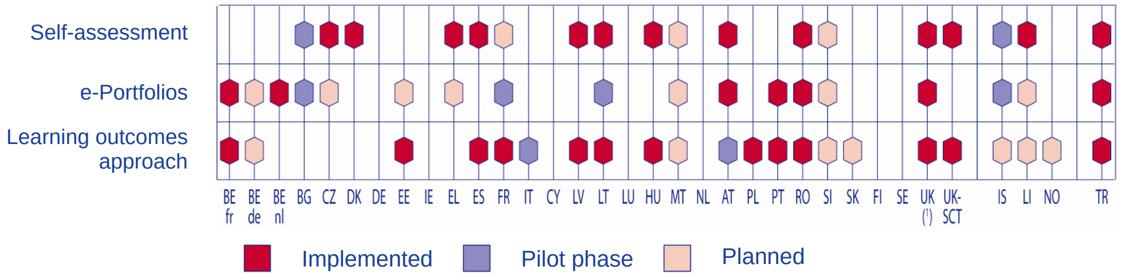
The following indicator looks at the way three approaches to pupil assessment, which can benefit from or genuinely build on ICT, are used in European countries. The first approach, self-assessment, is a type of formative assessment where students make judgements about their own work. ICT can help students to self-assess by providing them with immediate feedback on their performance and by allowing the sharing of information. The second approach, which is based on learning outcomes, is a paradigm that has recently taken hold in education discourse. Here the focus lies on what the pupil ought to be able to do at the end of a cycle or stage of education rather than on teaching objectives. Assessment of these competences, which may include, for example, digital literacy, can be facilitated through ICT and can be carried out by the teacher or other students. Finally, e-Portfolios are a genuinely ICT-based assessment mechanism. They are electronic collections of users' achievements which permit an assessment of their competences.

A wide variation exists between countries with respect to central recommendations on the use of these new approaches to pupil assessment. In Romania, the United Kingdom (England, Wales and Northern Ireland) and Turkey, there are central recommendations on all three, while six other countries have embraced two of these forms of assessment. Spain, Latvia, Hungary and the United Kingdom (Scotland) have implemented self-assessment and learning outcomes while Austria and Portugal have implemented e-Portfolios and/or self-assessment or learning outcomes.

Self-assessment and assessment based on learning outcomes have been most widely adopted (eleven countries). Liechtenstein uses ICT tools for self-assessment in secondary education. Bulgaria, Lithuania and Iceland have pilot projects, while France, Malta and Slovenia plan the use of self-assessment. For assessment based on learning outcomes, only Italy and Austria have pilot projects, while seven more countries plan its use. e-Portfolios have been implemented by six countries, while Bulgaria, Germany, France and Iceland are in the pilot phase and eight countries report planning to use them. Finally, nine countries report not having central recommendations for the use of any of the new approaches to pupil assessment.

There is, thus, a variety of ways in which approaches to assessment are recommended. In addition, the stages countries have reached in the implementation of these recommendations vary. Estonia is at the planning stage in the use of e-Portfolios, while in Portugal and the United Kingdom they are already available to students throughout their entire educational career and are assessed by awarding bodies in England, Wales and Northern Ireland. In contrast, Poland and Liechtenstein are focusing more on providing teachers with ICT tools to monitor pupil progress.

Figure C11: Central recommendations on using new approaches to pupil assessment in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice. UK (1) = UK-ENG/WLS/NIR

Explanatory note

Pilot phase: experimental project, limited in time, and – for the purpose of this study – at least in part established and financed by the relevant education authorities. Such experiments are subject to systematic assessment.

Country specific notes

Belgium (BE nl): The learning outcomes approach is only applicable to secondary education (ISCED 2-3).
Hungary: Self-assessment and peer assessment are usual practices in the teaching-learning process, but are not based on formal central recommendations.
Portugal: The use of e-Portfolios is explicitly suggested only in 8th grade; however, some other projects exist that aim to promote the use of e-Portfolios in schools.
Sweden: The decision on how to approach to pupil assessment is the responsibility of the school.

ONLY A FEW COUNTRIES MAKE RECOMMENDATIONS AT CENTRAL LEVEL ON THE USE OF ICT FOR GENERAL PUPIL ASSESSMENT

Although the use of these new approaches to pupil assessment is becoming increasingly widespread (see Figure C11), the question arises whether and how ICT (largely in the form of computers) is used in this context. Seven countries centrally recommend the use of ICT in pupil assessment in compulsory education. This supports the earlier finding that eleven countries use ICT in national testing, and either for marking tests or for on-screen testing (EACEA/Eurydice 2009, p. 36-37).

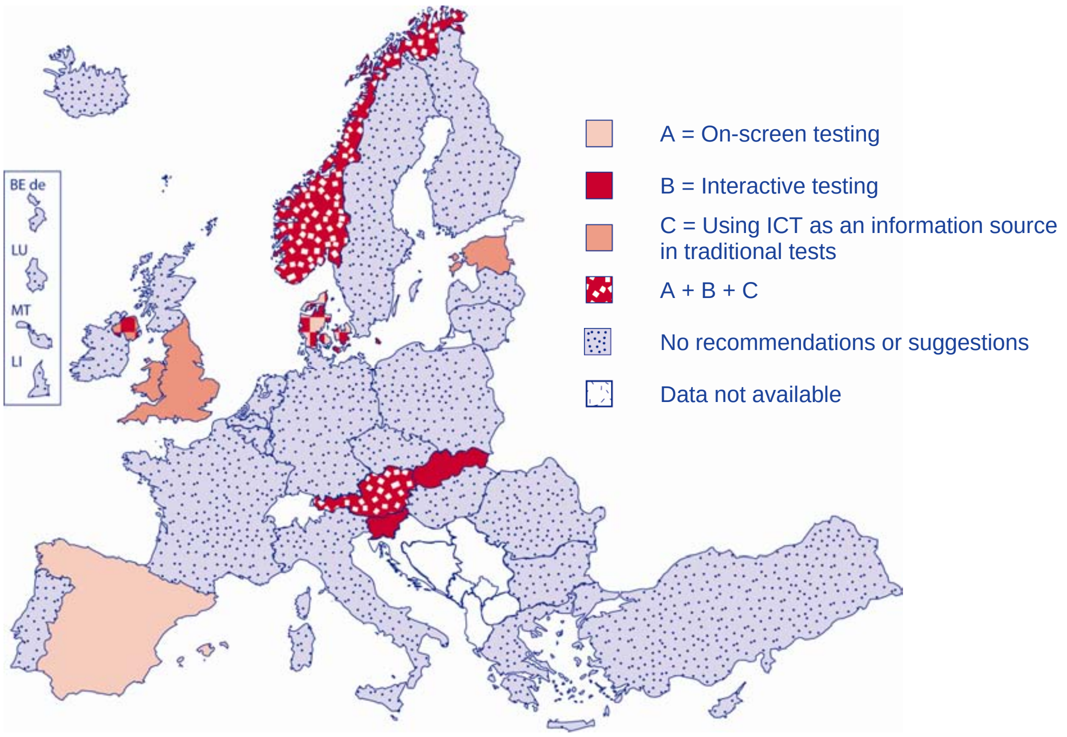
Only eight countries, in different areas of Europe, recommend the use of ICT in pupil assessment. However, the nature of these recommendations varies considerably. Estonia, Austria, the United Kingdom and Norway recommend the use of ICT as an information source for use in traditional tests. In other words, while ICT may be used as an additional tool in these countries, this does not change the basic nature of the test.

The other two options, on-screen testing and interactive testing, rely much more fundamentally on the use of new technologies. Where on-screen testing is mainly a replication of a traditional 'static' test on a computer, interactive tests, for example, adapt questions automatically to the capabilities of students depending on the result of preceding answers. Denmark (for primary education), Spain, Austria and Norway have central recommendations for on-screen testing while four countries have them for interactive testing. Denmark (for primary education), Austria and Norway also recommend the use of interactive testing.

Besides central recommendations, some countries report on other innovations. For example, Romania reports a project on using ICT for student assessment, while Estonia is in the process of developing a digital testing system. Hungary states that all forms of testing are employed by innovative teachers.

Where testing using ICT is recommended, it should be used at all levels. However, there are some exceptions. Austria, for example, has recommendations exclusively for secondary education, while Denmark has only recommendations for primary education.

Figure C12: Central recommendations on the use of ICT in pupil assessment in compulsory education in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

Country specific notes

Denmark: Central recommendations are applicable to primary and lower secondary education (ISCED 1 and 2).
Austria and **United Kingdom (ENG/WLS/NIR)**: Central recommendations on using ICT as an information source in traditional tests only apply to secondary education (ISCED 2 and 3).
United Kingdom (NIR): Central recommendations on using interactive testing only apply to primary education (ISCED 1).

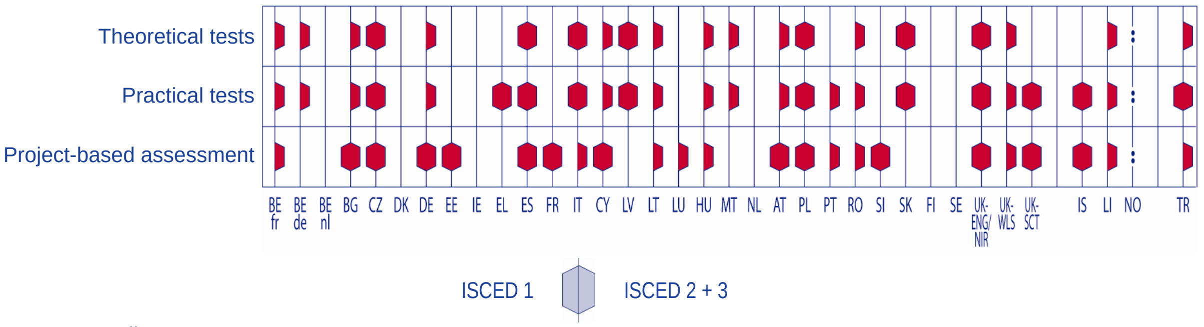
ICT COMPETENCES ARE ASSESSED DURING SECONDARY EDUCATION THROUGH DIFFERENT TYPES OF TEST

Countries were asked to report on how ICT competences (see Figure B6) were assessed: through theoretical tests, practical tests or through project-based assessment. A number of striking features emerge from the analysis. Twenty seven countries test ICT competences in some manner in school, whereas only seven do not. But within those 27 countries clear differences exist. Testing is much more widespread in secondary than in primary education and the forms of assessment are also much more diverse.

Nine countries assess ICT competences only during secondary education. In Bulgaria, Germany and Cyprus, project-based assessment is additionally used in primary education and practical tests in Turkey. The Czech Republic, Spain, Poland and the United Kingdom (England and Northern Ireland) use all three forms of tests at all levels. Latvia, Slovakia, the United Kingdom (Scotland) and Iceland use two types of test at all levels. Greece, Luxembourg and Slovenia use only one form of test at secondary level and Greece also does this in primary education.

Project-based and practical assessments of ICT competences are equally widespread across European countries. Eight countries only use these two forms of test to assess ICT competences. Across different levels of education, project-based assessment is slightly more common in primary education. Theoretical tests are, overall, slightly less common, and much more so in primary education. Twelve countries use all three types of test at secondary level.

Figure C13: Assessment of ICT competences in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

Explanatory note

Project-based assessment: an assessment method based on project-based learning activities.

Country specific notes

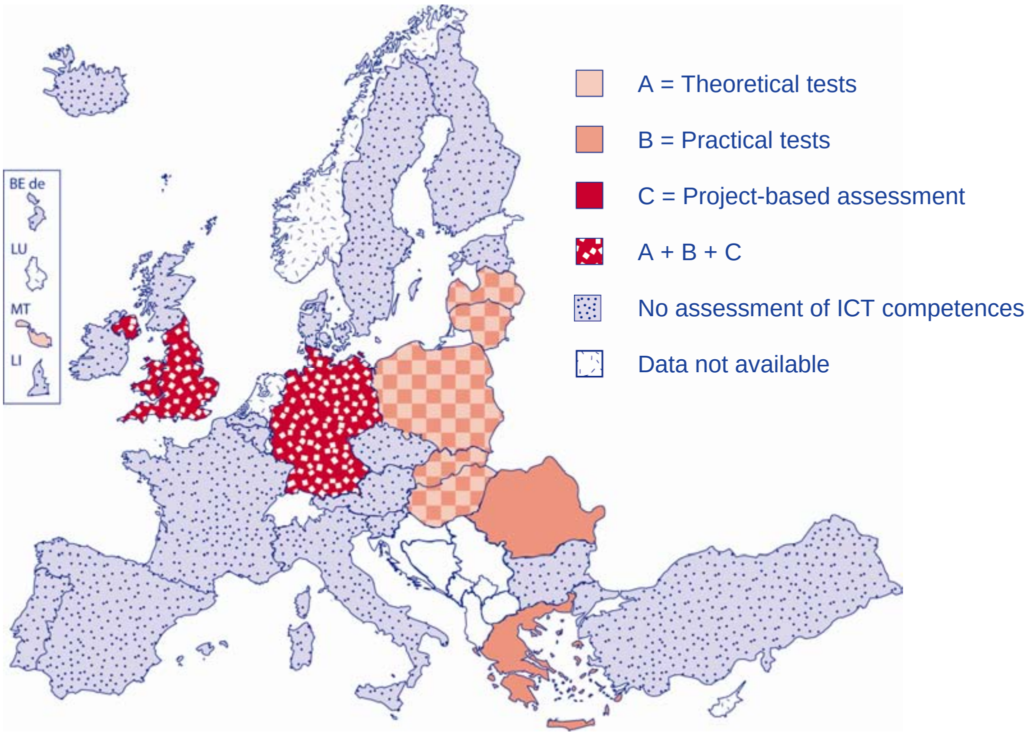
Belgium (BE fr): The data only apply to lower secondary education (ISCED 2).
Malta: Theoretical tests are used only at upper secondary education (ISCED 3).
United Kingdom (WLS): The data only apply to upper secondary education (ISCED 3).

ICT COMPETENCES ARE ASSESSED IN SCHOOL LEAVING EXAMINATIONS IN SOME COUNTRIES

In addition to assessing ICT competences during compulsory education (see Figure C12), in ten countries they also form part of the school leaving examination. Germany and the United Kingdom (England, Wales and Northern Ireland) show the greatest diversity of assessment forms, as they combine theoretical, practical and project-based tests. Five countries combine theoretical and practical tests while three countries have their students take either theoretical or practical tests. This also means that when ICT competences are tested in school-leaving examinations, with the exception of Malta, it always involves a practical test.

In addition to assessing ICT competences, some countries also use ICT tools in other subjects as part of school-leaving examinations. There is only data available for a limited number of countries, so the numbers should be treated with care. The assessment tools used are the same as those discussed in Figure C12, namely on-screen testing, interactive testing and ICT as an information tool used during traditional tests. The examination system in the United Kingdom (England, Wales and Northern Ireland) offers a wide choice of exams within a centrally regulated system. There are standardised examinations using all three types of assessment at the end of upper secondary education, although only a small minority are offered online. In addition, Slovakia recommends on-screen testing and ICT as an information tool and Denmark only recommends on-screen testing.

Figure C14: Assessment of ICT competences in school-leaving examinations at the end of compulsory education, 2009/10



Source: Eurydice.

Explanatory note

Portugal: Students must achieve a certain level of knowledge in the ICT area in all educational levels in order to meet the transversal competencies defined as 'learning goals' *(metas de aprendizagem)*.

ICT CERTIFICATES ARE WIDELY USED BUT THEY DO NOT ALWAYS FOLLOW THE ECDL STANDARD

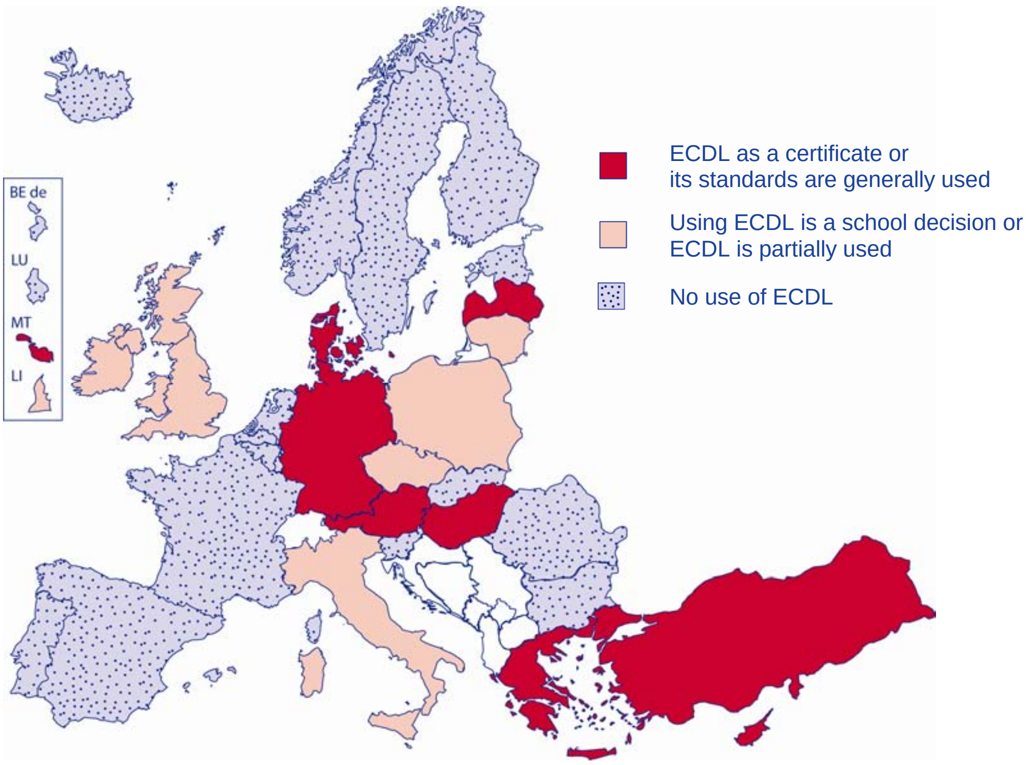
The European Computer Driving Licence (ECDL Foundation, 2010) is a computer literacy certification system provided by the ECDL Foundation. Obtaining the ECDL shows mastery of seven groups of computer skills and competences. Seven countries regularly use this widely-supported and -accepted certificate of competence. In another seven countries, the decision to certify against ECDL standards lies with schools or the qualification is available to some of the pupil population. It is mostly used in upper secondary education. Cyprus and Turkey do not use the ECDL itself, but assess the necessary competences through the general curriculum. Malta has used the ECDL as a basis to develop assessment procedures for ISCED 2 and 3 (see figures C12 and C13).

Another group of countries issue publicly recognised ICT certificates at different levels. These generally cover a similar set of competences as the ECDL. The French Community of Belgium has a non-compulsory ICT passport for primary and secondary education. France offers ministry certification at different levels while Germany, Lithuania, Romania and the United Kingdom offer additional recognised qualifications in ICT skills. The Scottish Qualifications Agency also offers ICT certificates. Slovenia has certificates for students as well as teachers.

In those countries, where neither ECDL nor other certificates are used, it does not mean that ICT competences are not assessed (see Figure C13). Portugal and Slovakia, for example, emphasise that ICT competences are regularly assessed. In these countries, the competences assessed in the course of general ICT education are considered to be equivalent to a certificate, but no special certificate is issued.

Finally, a number of countries highlight the widespread use of certificates in cooperation with IT companies, such as Novell, Oracle and Microsoft, and are subject to a fee. In Greece, private certificates are issued but supervision lies with the ministry of education.

Figure C15: ECDL certificates awarded for ICT competences, 2009/10

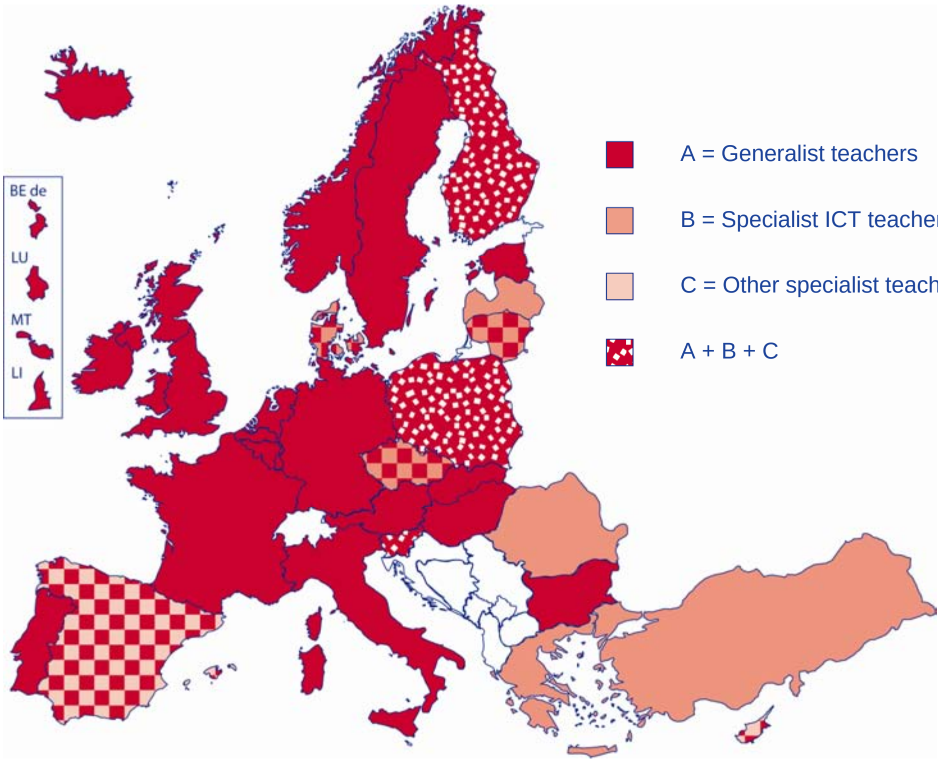


Source: Eurydice.

AT PRIMARY LEVEL, ICT IS TAUGHT MAINLY BY GENERALIST TEACHERS

School teachers play an essential part in helping students to acquire and develop the ICT knowledge and skills they will need in later life. At primary level, teachers usually teach all subjects to one class of pupils, while secondary school teachers normally only teach one or two subjects to different classes. The difference in training, therefore, is that primary teachers are trained as generalists and secondary teachers as subject specialists (see Figure D2).

Figure D1: Types of teachers teaching ICT in primary education (ISCED 1), 2009/10



Source: Eurydice.

In the great majority of European countries, as might be expected, ICT is taught at primary level by generalist teachers. However, in most of the countries where ICT is taught as a separate subject (see Figure B7), it is delivered by specialist ICT teachers. This is for example the case in Greece, Latvia and Turkey. Although ICT is not included in the compulsory curriculum in primary education in Romania, it may be included in extra-curricular activities and, where this is the case, teachers must be specialist ICT teachers.

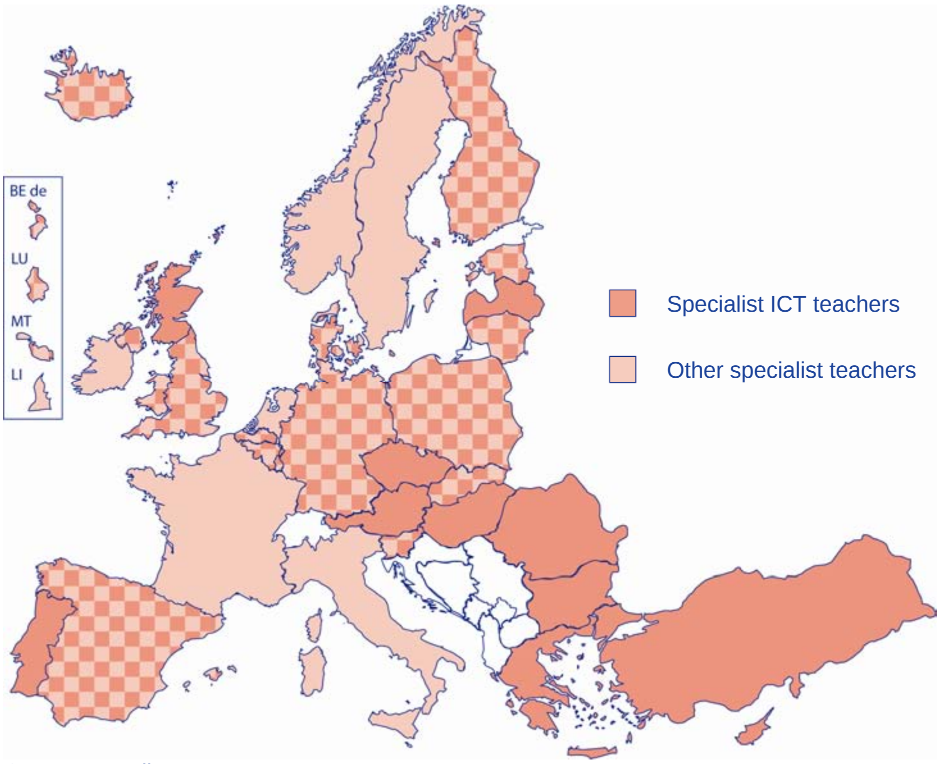
The situation is slightly mixed in the Czech Republic, Denmark and Lithuania where ICT may be taught at primary level by either generalist or specialist ICT teachers. In Malta, ICT is taught by the class teacher with the support of peripatetic teachers who promote e-learning. In Spain and Cyprus, generalist and other specialist teachers share the responsibility of teaching ICT. Finally, at primary level in Poland, Slovenia and Finland, ICT may be taught by generalist, specialist ICT or other specialist teachers.

AT SECONDARY LEVEL, SPECIALIST ICT TEACHERS ARE MOSTLY RESPONSIBLE FOR TEACHING ICT

At lower and upper secondary level, the teachers who teach ICT are different to those who teach it at primary level (see Figure D1). At this stage, in most countries, it is the responsibility of specialist ICT teachers to teach this subject; and moreover, in around half of the countries, it is only specialist ICT teachers who may teach ICT skills.

ICT is not taught by specialist ICT teachers in only a few countries – Ireland, France, Italy, the Netherlands, Sweden, Liechtenstein and Norway. In these countries it is taught by specialist teachers of other subjects.

Figure D2: Types of teachers teaching ICT in general secondary education (ISCED 2 and 3), 2009/10



Source: Eurydice.

SCHOOLS FACE DIFFICULTIES IN RECRUITING ICT TEACHERS

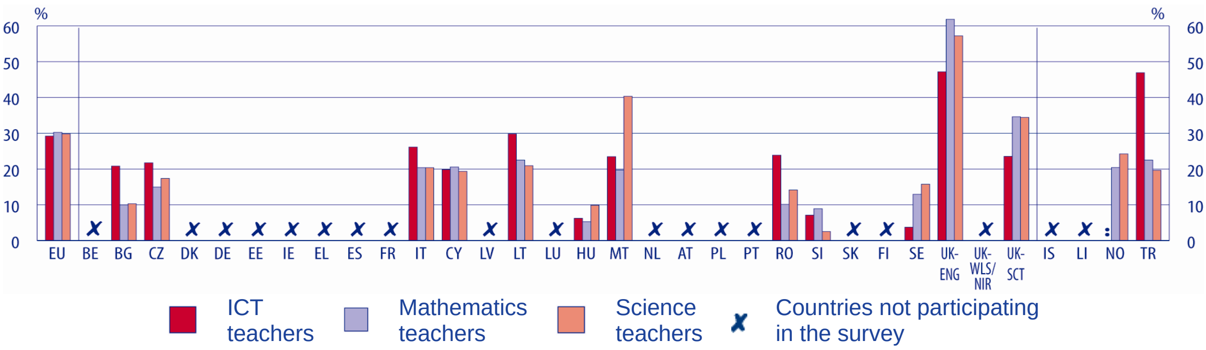
The availability of qualified teaching staff depends on the dynamics of teacher supply and demand. A number of external factors, e.g. pertaining to the labour market, and internal school factors such as work conditions and career prospects impact on the recruitment of specially qualified teaching staff. A study on the use of ICT in upper secondary schools (OECD, 2004) shows that all countries face difficulties in recruiting teachers, and that school heads find it more difficult to recruit ICT teachers than those for other subjects.

The results of the TIMSS 2007 international survey confirm this finding to some extent. In the European countries responding to a question on this subject in the survey, on average 29 % of students had school heads who reported finding it difficult or very difficult to fill teaching vacancies for ICT teachers.

The figure is significantly higher in United Kingdom (England) and Turkey with around 47 %. In Hungary, Slovenia and Sweden, on the other hand, less than 10 % of students had school heads who reported having difficulties in recruiting ICT teachers.

Mathematics and science teachers may in many cases also teach ICT (see Figure D2). However, comparatively, in most countries, the highest shares of students have school heads who stated that they have difficulties filling vacancies in particular for ICT teachers. This is followed by four countries – Hungary, Malta, Sweden and Norway – where the highest share of students have school heads who report finding it difficult to recruit science teachers; and another four countries or regions – Cyprus, Slovenia, United Kingdom (England and Scotland) – where the highest share of students have school heads who report difficulties in recruiting mathematics teachers.

Figure D3: Percentage of students in the eighth grade attending a school which had difficulty filling vacancies for specialist teachers, as reported by school heads, 2007



	EU	BG	CZ	IT	CY	LT	HU	MT	RO	SI	SE	UK-ENG	UK-SCT	NO	TR
	29.2	20.8	21.7	26.2	19.8	29.8	6.2	23.5	23.9	7.1	3.7	47.2	23.5	:	46.9
	30.3	10.0	15.0	20.4	20.6	22.5	5.3	19.7	10.1	8.9	13.0	61.8	34.6	20.4	22.5
	29.8	10.3	17.4	20.4	19.4	20.9	9.9	40.3	14.2	2.5	15.8	57.2	34.4	24.2	19.7

Source: IEA, TIMSS 2007 database.

Explanatory note

The questionnaire asked school heads to indicate how difficult it was to fill teaching vacancies during the school year for the subjects: mathematics, science, computer science/information technology. The possible replies were (i) No vacancies in this subject, (ii) Easy to fill vacancies, (iii) Somewhat difficult, (iv) Very difficult.

The data has been aggregated to include the responses: 'Somewhat difficult' and 'Very difficult' to fill the teaching vacancies in each subject.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

Country specific note

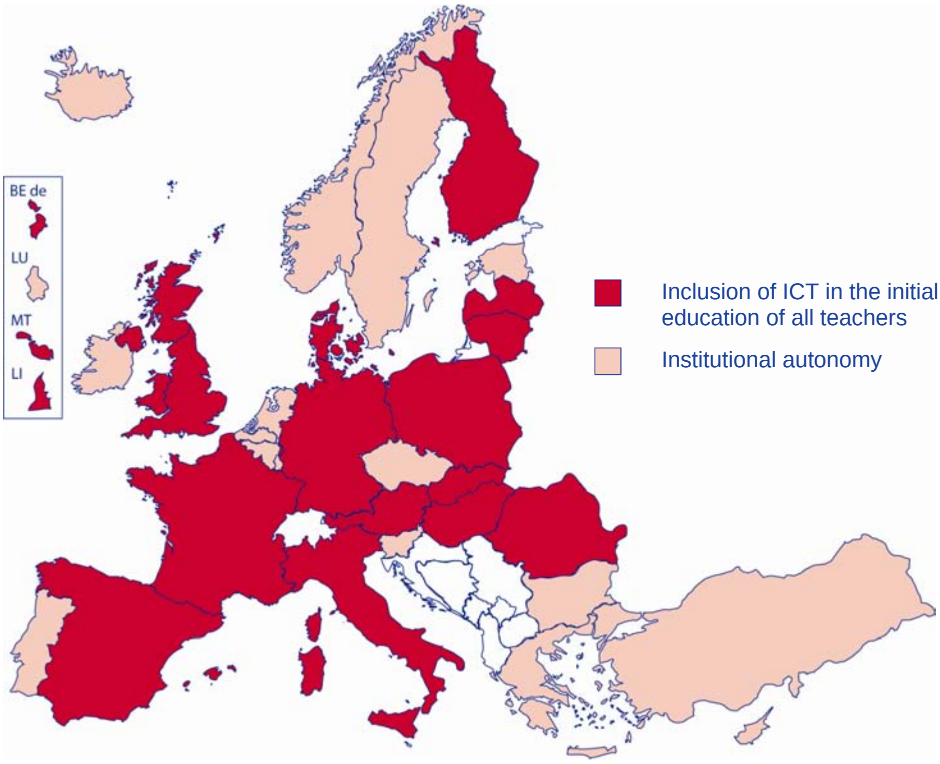
Norway: The option on ICT teachers was not included.

MANY TEACHERS ACQUIRE ICT KNOWLEDGE AND SKILLS DURING INITIAL TEACHER EDUCATION PROGRAMMES

In addition to having specially trained ICT teachers, it is important that all subject teachers have the knowledge and skills to integrate ICT into their daily teaching practice. According to a policy brief on ICT for Learning, Innovation and Creativity prepared by the Institute for Prospective Technological Studies (Ala-Mutka, Punie and Redecker, 2008), ICT can in fact improve the effectiveness of learning and learning outcomes, but the results depend on the approaches used. Therefore, it is crucial that initial teacher education provides teachers with knowledge of new and innovative approaches as well as encourages them to experiment with digital and media technologies and to reflect on the impact their teaching practices may have.

An analysis of the regulations on the initial education of teachers throughout Europe shows that ICT is included in their basic studies in over half the countries. Nevertheless, implementation may vary in practice at some higher education institutions. The other countries report that there is institutional autonomy in this area; in other words, institutions are free to decide whether or not to include ICT in initial teacher education.

Figure D4: Regulations on the inclusion of ICT in initial education for teachers in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

Explanatory note

The figure covers initial teacher education for all teachers except specialist ICT teachers.

TEACHERS ARE REQUIRED TO LEARN A VARIETY OF ICT SKILLS DURING INITIAL TEACHER EDUCATION, ESPECIALLY THOSE RELATED TO THE PEDAGOGICAL USE OF ICT

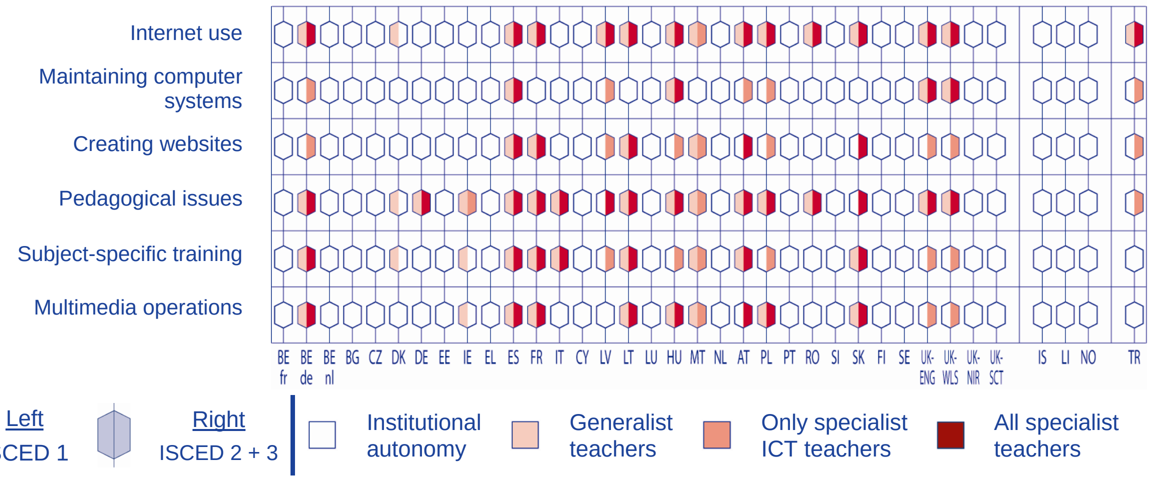
The key individual in helping students develop ICT skills is the classroom teacher. S/he is responsible for providing the learning opportunities that help students use ICT to learn and communicate. Therefore, it is critical that all teachers receive the training they need to create these opportunities for students.

In many European countries, ICT is included in regulations on the initial education of teachers (see Figure D3). However, countries allow a great deal of autonomy to institutions to determine the types of ICT skills student teachers should learn during initial teacher education. In contrast, six countries or regions specify that all the principal ICT skills should be acquired by teachers.

Where regulations concerning the curriculum for initial teacher education exist, they usually require teachers to develop the ICT skills related to the pedagogical aspects of integrating ICT into teaching and learning, as well as use of the Internet, and the application of ICT to specific subjects. The other ICT-related skills are covered in a few countries but in most cases these skills are not mandatory requirements and usually there is institutional autonomy.

At primary level, existing regulations on the specific ICT skills to be developed during initial teacher education target only generalist teachers. At secondary level, few countries target only specialist ICT teachers but where this is the case, the regulations usually cover more technical ICT skills such as maintaining computer systems or creating websites. In the other countries where regulations exist, they are directed at all specialist teachers at secondary level, including specialist ICT teachers and specialist teachers of other subjects.

Figure D5: ICT-related skills defined in the core curriculum for initial education for teachers in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

TEACHERS PARTICIPATE MORE FREQUENTLY IN CPD ON INTEGRATING ICT INTO MATHEMATICS AND SCIENCE TEACHING AT SECONDARY LEVEL THAN AT PRIMARY LEVEL

Following initial teacher education, it is crucial that teachers continue to develop and refresh their ICT knowledge and skills through continuing professional development (CPD). They should have the opportunity to engage in training to deepen their understanding and mastery of ICT as a tool for innovating teaching and learning approaches (European Commission, 2008a).

Across Europe, all countries, except Denmark and Iceland, report that the development of teachers' ICT skills is currently included in centrally promoted CPD programmes. Moreover, all countries, except Iceland, also report the inclusion of skills related to the pedagogical use of ICT in these programmes.

With regard to particular subject areas, the TIMSS 2007 international survey has investigated the participation of fourth and eighth grade teachers in professional development on integrating ICT into mathematics and science teaching. While the results show a high level of participation overall, the rates are higher at secondary level than at primary level, and slightly higher for mathematics than for science.

For mathematics teaching, participating European countries indicate, on average, that 25 % of fourth grade students have teachers who participated in CPD for using ICT in mathematics in the last two years. In contrast, there are, on average, only 16 % of fourth grade students who have teachers who participated in CPD over the same period for using ICT in science teaching.

At the eighth grade, CPD participation is higher for both subjects. In the participating European countries, on average, 51 % percent of students have teachers who report having participated in CPD related to mathematics teaching. The equivalent figure for science teaching is 41 %.

Overall, countries with a high proportion of students who have teachers who participated in these kinds of CPD activities tend to be the same regardless of subject. In other words, countries with high participation rates in ICT training for mathematics also tend to have high rates for science, as it is the case in Bulgaria, the Czech Republic, Cyprus, Lithuania, Romania, Slovenia, and the United Kingdom (England and Scotland). Similarly, countries with low participation rates in ICT training for mathematics also tend to have low rates for science, such as in Denmark, Germany, Hungary, the Netherlands, Austria, Sweden and Norway.

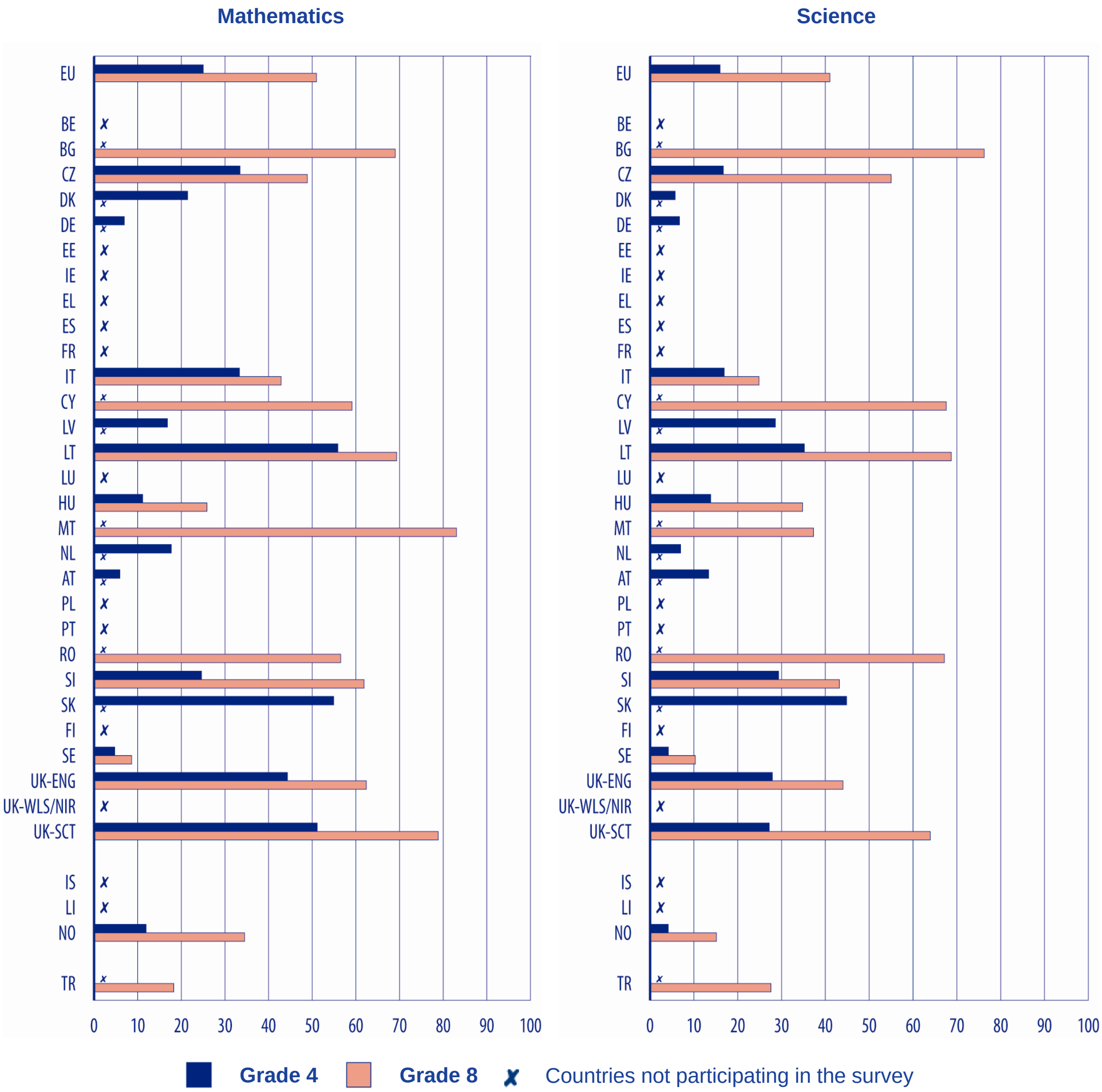
Explanatory note (Figure D6)

Teachers were asked in the questionnaire to indicate if, in the past two years, they had participated in professional development (CPD) on issues related to mathematics and science teaching, such as curriculum and content; pedagogy/instruction; integrating information technology into teaching; improving students' critical thinking or inquiry skills, and assessment.

The figure presents only the results on participation in CPD on integrating information technology into mathematics and science teaching.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

Figure D6: Percentage of students in the fourth and eighth grades whose teachers report having participated in CPD on integrating ICT in mathematics and science teaching in the past two years, 2007



Mathematics

	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
Grade 4	25.0	x	33.5	21.5	6.9	33.3	x	16.8	55.9	11.2	x	17.7	5.9	x	24.6	54.9	4.8	44.3	51.2	11.9	x
Grade 8	51.0	69.0	48.9	x	x	42.9	59.1	x	69.4	25.9	83.1	x	x	56.5	61.9	x	8.6	62.4	78.9	34.5	18.3

Science

	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
Grade 4	16.0	x	16.7	5.7	6.7	16.9	x	28.6	35.2	13.9	x	7.0	13.4	x	29.3	44.8	4.2	27.9	27.2	4.2	x
Grade 8	41.0	76.3	55.0	x	x	24.9	67.6	x	68.7	34.8	37.3	x	x	67.2	43.2	x	10.3	44.0	63.9	15.2	27.6

Source: IEA, TIMSS 2007 database.

WHERE TEACHERS' ICT SKILLS ARE ASSESSED, IT IS OFTEN BASED ON BOTH EXTERNAL AND INTERNAL EVALUATION

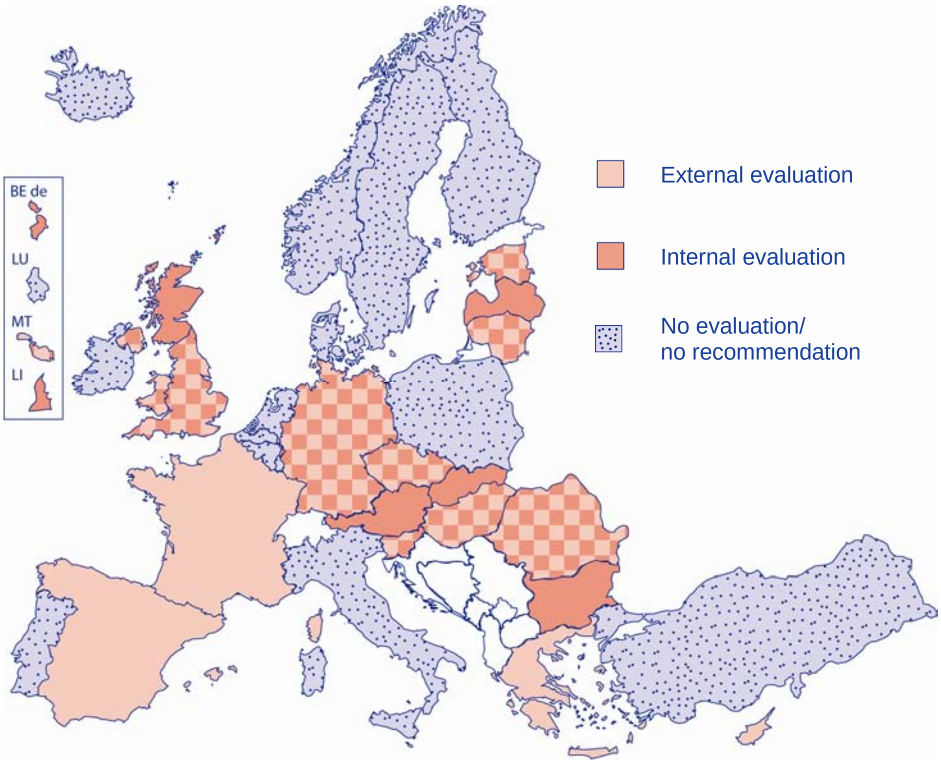
An integral part of teachers' professional development and career is that they are periodically evaluated in their work in order to guide them and help them to improve. This evaluation may be external, e.g. by an inspectorate, or it may be carried out internally by school staff, particularly by the school head. In both cases, teacher evaluation may be based on standardised or non-standardised criteria which will provide the basis for giving feedback to teachers on both their performance in class and on their knowledge and skills.

With regard to evaluating teachers' ICT skills, in Belgium (German-speaking Community), Bulgaria, Latvia, Austria, Slovakia, the United Kingdom (Scotland) and Liechtenstein only internal assessment is used for this purpose. In contrast, in Greece, Spain, France and Cyprus only external assessment is used. In nine other countries, a combination of internal and external assessment methods is used.

Standardised criteria are applied in the external teacher evaluation process in Estonia, Cyprus, Lithuania, Hungary and the United Kingdom (England, Wales and Northern Ireland); while in internal teacher evaluation, standardised criteria may be applied only in Bulgaria and the United Kingdom (England, Wales and Northern Ireland).

Finally, fourteen countries or regions report that they do not evaluate teachers' ICT skills or have no regulations concerning the evaluation of teachers' ICT skills.

Figure D7: Regulations on evaluating teachers' ICT skills in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



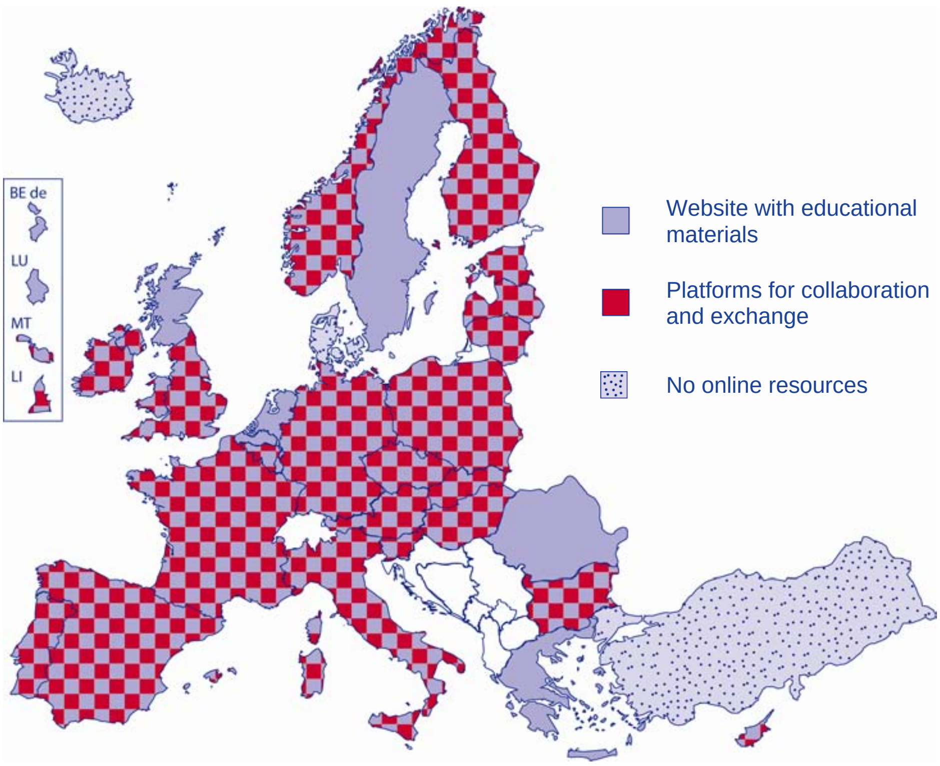
Source: Eurydice.

MOST EUROPEAN COUNTRIES HAVE ONLINE PLATFORMS FOR TEACHERS TO SHARE IDEAS AND INFORMATION ON USING ICT FOR INNOVATIVE TEACHING AND LEARNING

In addition to teachers' education, training and professional evaluation, collaboration between teachers is also generally assumed to have positive effects on their professional learning and classroom practices. An analysis of teachers' professional development in the 15 EU Member States that participated in the OECD's Teaching and Learning International Survey – TALIS (European Commission, 2010d) confirms the importance of professional collaboration. As teachers find that collaboration and feedback leads to changes in aspects of their work, the more they recognise their own development needs and the more they participate in different professional development activities – consequently, they experience greater impacts on their professional development.

In Europe, centrally promoted online resources are widely available to teachers to support them using ICT for innovative teaching and learning in the classroom. In the majority of the countries, there are online platforms, forums, blogs or similar social networking sites that facilitate collaboration, the sharing of experience and the exchange of material between teachers. In addition, there may be centrally provided gateways linking to other sites of interest to teachers, such as those providing educational materials, including teaching resources and software; information about new technologies; or to commercial sites providing news and information on current affairs. In eight countries, only websites with educational resources for teachers' individual use are centrally promoted. Finally, Denmark, Iceland and Turkey do not report having any of these kinds of online resources that are promoted at central level.

Figure D8: Websites and platforms for teacher collaboration on ICT use for teaching and learning in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

ICT PEDAGOGICAL SUPPORT STAFF ARE WIDELY AVAILABLE

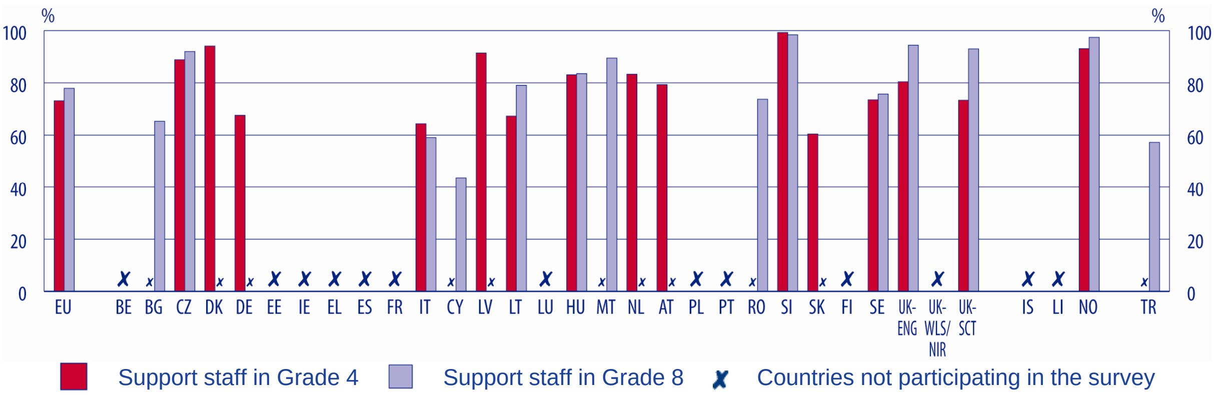
In addition to interaction with other teachers on general teaching methods and materials, teachers may require some specialised support for using ICT in the classroom. This may be for technical support, e.g. by staff who can assist teachers to solve hardware and software problems, or for pedagogical support which may be needed by teachers to integrate ICT into their teaching and learning.

A study carried out on behalf of the European Commission on indicators of ICT in primary and secondary education (Pelgrum, 2009) has analysed current policy issues regarding ICT in education in EU countries. The review shows that teachers often have difficulties in implementing ICT in the teaching-learning process and that they need support to accomplish this task.

The TIMSS 2007 international survey analysed the availability of support staff to help teachers in the use of ICT for teaching and learning. The results reveal that this type of staff is widely available in European schools. Across the EU countries who responded to this question, on average 73.1 % of students in fourth grade have a school head who reports that ICT pedagogical support staff are available at their school; in the eighth grade, the figure is slightly higher with 77.9 %.

The highest levels of ICT support staff available for both fourth and eighth grades can be found in Slovenia and Norway, with nearly 100 % of students having a school head who reports that support staff is available to help teachers use ICT for teaching and learning. In contrast, the rates are the lowest in Cyprus and Turkey at the eighth grade, with around 50 % of students having a school head who reports the availability of ICT pedagogical support staff.

Figure D9: Percentage of students in the fourth and eighth grades attending a school with staff available to help teachers using ICT for teaching and learning as reported by the school head, 2007



	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
	73.1	x	88.9	94.1	67.6	64.3	x	91.4	67.2	83.1	x	83.3	79.3	x	99.3	60.4	73.5	80.4	73.4	93.1	x
	77.9	65.3	92.0	x	x	59.0	43.6	x	79.1	83.5	89.5	x	x	73.7	98.4	x	75.7	94.4	93.0	97.4	57.2

Source: IEA, TIMSS 2007 database.

Explanatory note

School heads were asked in the questionnaire to indicate if anyone was available to help teachers use information and communication technology for teaching and learning.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

A COMBINATION OF NATIONAL OBJECTIVES AND INDICATORS ARE USED TO ENSURE THE AVAILABILITY OF ICT INFRASTRUCTURE

All educational establishments must have access to appropriate networks, equipment and software in order to promote ICT in all subjects and for all students. This infrastructure must be efficient and effective, available for use by all students and teachers and not limited to specific fields of study or subjects.

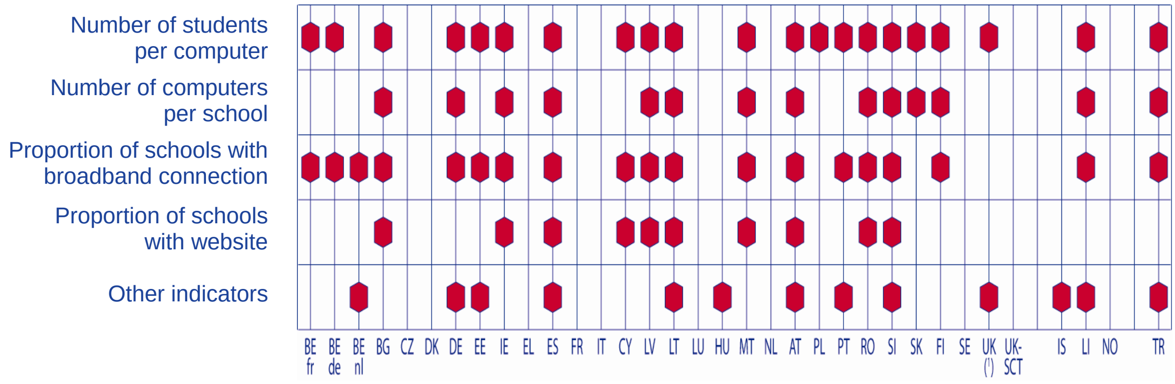
For these reasons, in almost all European countries where objectives on ICT availability are stated in central level steering documents (see Figure A7), they are accompanied by a range of indicators to measure progress. In 21 of the education systems, ensuring a sufficient 'number of computers per school' is a key objective for decision-makers. In the majority of these countries/regions, this objective is used in conjunction with an indicator for the 'number of students per computer'. This combination in national policies guarantees not only a total reasonable number of students per computer, but also an even distribution between schools.

In parallel, seventeen countries include in their steering documents an objective relating to the establishment of a broadband connection in a certain proportion of schools. This is clearly linked to the application of new teaching approaches such as eLearning, use of audiovisual and multimedia content or access to interactive didactic software and software for simulations. Education authorities are very ambitious in this area, with some countries including a target for almost complete broadband coverage for schools by 2012-2015.

Additionally, in a third of countries, the existence of a school website is set as an indicator of ICT infrastructure availability. The diversity of information posted on such websites varies considerably between different countries (as shown in Figures E11 and E12), but in all countries schools provide general information as well as information on the pedagogy plans and extra-curricular activities on their websites.

A diverse range of other indicators related to the provision of ICT equipment is used by the central authorities in some countries. Germany, Slovenia and Iceland monitor the amount of available digital educational materials or the percentage of different types of software used in class. In Spain the national ICT plan *Escuela 2.0* aims to provide each fifth-grade pupil with a notebook computer and their classrooms with an interactive whiteboard as well as a wireless connection. Primary and secondary schools in Portugal must have, by the end of 2010, one video projector in each classroom, one interactive whiteboard per 3 classrooms and a broadband connection. Hungary defines in its national Social Infrastructure Operative Program 2007-2013 public education indicators, including an increased number of classrooms with an interactive whiteboard and the related workstations; increases in the proportion of students using a computer in school; increases in the number of classrooms with Internet and ICT tools per 1 000 students, and a decrease in the inequalities between regions. In Turkey, compulsory and upper secondary schools with eight or more classes must have at least one computer lab comprising 20 computers, one printer and one projector. In Estonia and Lithuania, the ratio of teachers per computer and workstations available in class has been set as an objective.

Figure E1: Objectives defined in central level steering documents on the availability of ICT infrastructure in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

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

Country specific note

United Kingdom: The indicator 'Number of students per computer' is only applicable for England and Northern Ireland.

As presented in Figure A7, a majority of European countries have mechanisms to monitor the development of their ICT policies in education. This task of collecting information from schools may be carried out by the ministry with responsibility for education, or the work may be delegated to the national statistics office or to a specific agency dealing with ICT in education.

In countries such as the Czech Republic, France and Italy, which do not have centrally defined targets for ICT infrastructure in schools, still regularly monitor progress. In the Czech Republic the monitoring of ICT equipment is a part of the annual report of the Czech School Inspectorate. In addition to its annual report, a thematic report entitled the 'Level of ICT in basic schools in the Czech Republic' was published in 2009 with a representative sample of schools. In France, the ETIC survey (*Enquête sur les technologies de l'information et de la communication* / National survey on information and communication technology for school) is carried out by the *Sous-direction des technologies de l'information et de la communication pour l'éducation* (SDTICE) and the *Direction de l'évaluation, de la prospective et de la performance* (DEPP). This survey aims to collect the data on ICT in schools which is necessary for monitoring the implementation of ICT policies and to support the dialogue between central government and the local authorities responsible for school infrastructure. (More information is available on http://www.educnet.education.fr/plan/etic/). In Hungary, the data on the availability of ICT in schools is collected through the Public Education Information System (KIR – http://www.kir.hu) and all education establishments are obliged to provide information. Finally, in Italy, a specialised centre for technological equipment called *Osservatorio delle dotazioni tecnologiche* resumed its activities in 2010.

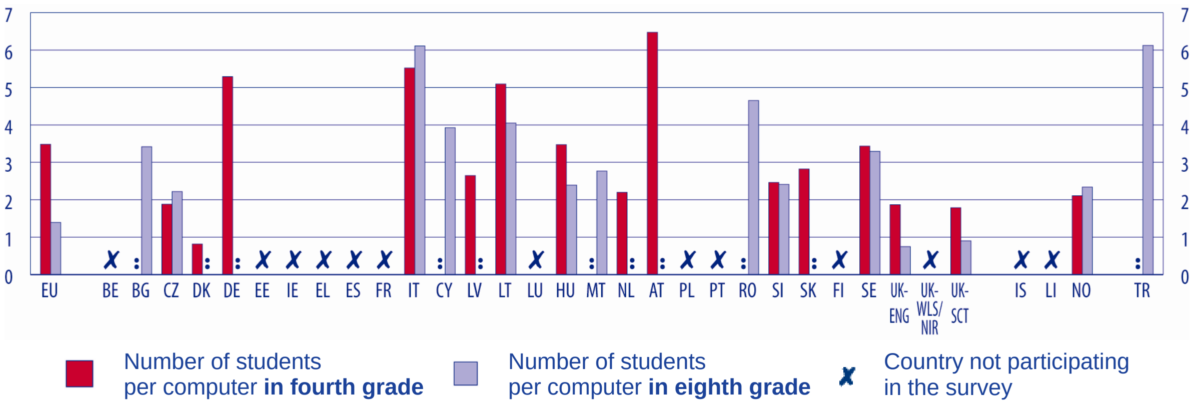
IN 2007, THERE WERE BETWEEN TWO AND FOUR STUDENTS PER COMPUTER IN MOST EUROPEAN COUNTRIES

In many European countries in 2007, students in the fourth grade attended a school that had on average one computer for 4 students. At secondary level, in schools with students in the eighth grade there was on average one computer for two students. In Denmark at primary level and in the United Kingdom (England and Scotland) at secondary level, at least one computer was available for each student. In contrast, only three countries (Italy – eighth grade, Austria and Turkey) have more than 6 students per computer.

This shows a significant increase in computer availability in schools compared with the year 2000 (see Eurydice, 2004). In that year, on average, 20 students aged around 15 years shared one computer, with Greece, Portugal and Romania at the extreme end of the range with over 50 students sharing a single computer.

Although the number of students per computer is one of the main indicators used by countries in monitoring their progress in developing the ICT infrastructure (see Figure E1), it must be stressed that the existence of computers alone is not a guarantee that students actively use them for learning as can be seen in the Figure E4.

Figure E2: Average number of fourth and eighth grade students per computer, as reported by the school head, 2007



	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
	3.5	:	1.9	0.8	5.3	5.5	:	2.6	5.1	3.5	:	2.2	6.5	:	2.5	2.8	3.4	1.9	1.8	2.1	:
	1.4	3.4	2.2	:	:	6.1	3.9	:	4.0	2.4	2.8	:	:	4.7	2.4	:	3.3	0.7	0.9	2.3	6.1

Source: IEA, TIMSS 2007 database.

Explanatory note

School heads were asked in the questionnaire to indicate the total number of students enrolled in their school in the fourth and eighth grades and the total number of computers that could be used by them for educational purposes. The average number of students per computer is calculated by dividing the students in each grade by the total number of computers available for educational purposes.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

FEW DISPARITIES BETWEEN SCHOOLS IN THEIR LEVEL OF COMPUTERISATION IN MOST COUNTRIES IN 2009

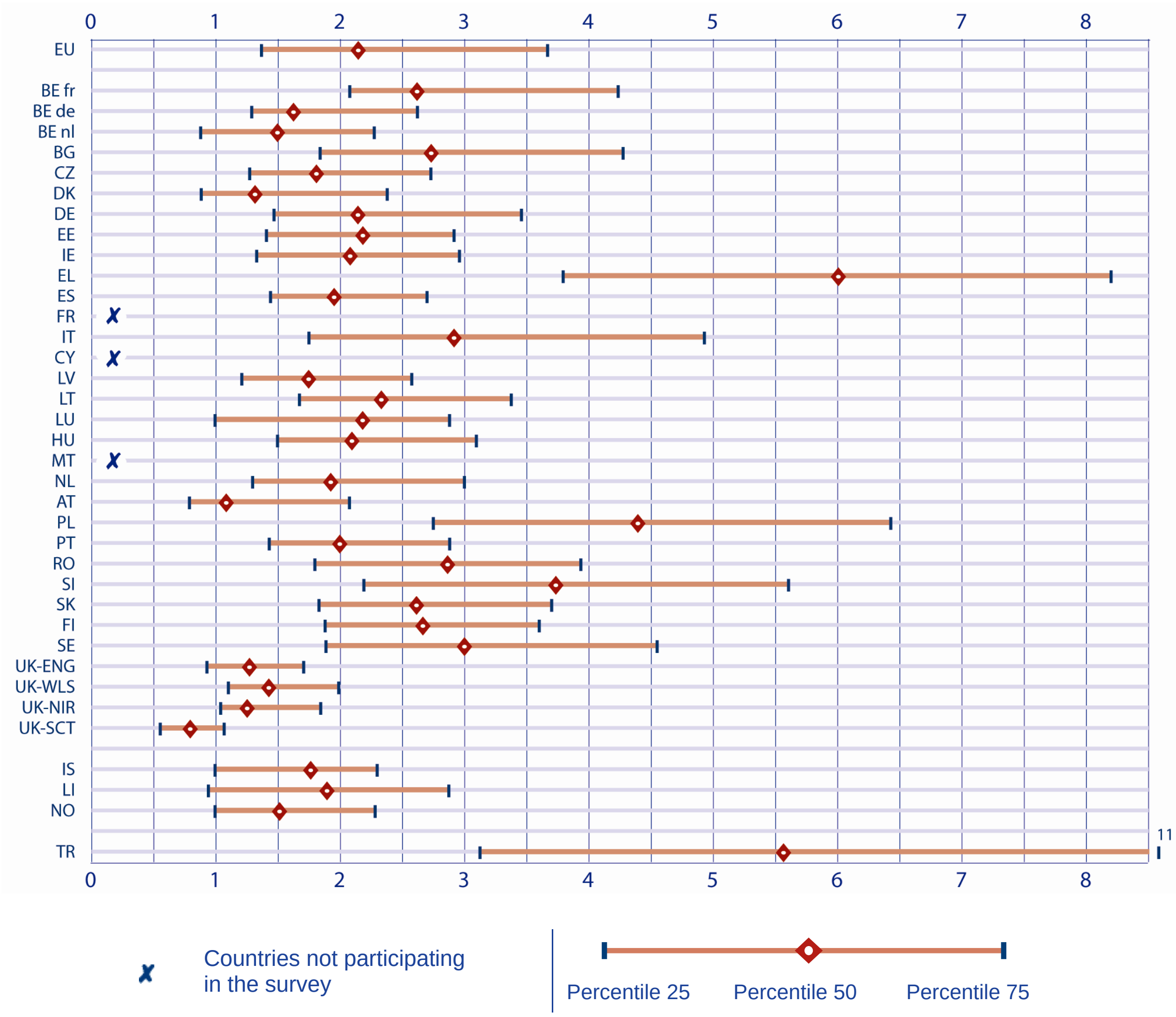
The distribution of computers between schools within each country is an important indicator that enables policy-makers to monitor access to electronic equipment and therefore to new teaching approaches. To represent this variation, the distribution of the pupil/computer ratios between schools attended by pupils aged 15 from PISA 2009 is used.

In most European countries, at least 50 % of students are in schools where one computer is available for every two students. Nevertheless in Greece, Italy, Poland and Slovenia and to a lesser extent Belgium (French Community), Bulgaria and Sweden, larger disparities exist in computer availability. In these countries, one computer is available for four to eight students. In Turkey, the gap is even greater as there are fewer than 4 pupils per computer in some schools and more than 11 in others. These data reveal a significant reduction in the disparity between schools in the last 10 years as in 2000 there were between 25 and 90 students per computer in the different countries (see Eurydice, 2004). In

2009, in almost all countries, at least 75 % of students were studying in schools where they were sharing a computer with no more than four other classmates.

The highly concentrated distributions and the highest availability of computers which reflect a genuinely uniform school computer environment for 15 year-old students can be found in Spain, Austria, Iceland, Norway and, above all, the United Kingdom where the variation is less than one student per computer.

Figure E3: Distribution of student/computer ratio in schools attended by pupils aged 15, 2009



Source: OECD, PISA 2009 database.

(P) = Percentile.

(P)	EU		BE fr	BE de	BE nl	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU
25	1.37		2.08	1.29	0.88	1.84	1.28	0.89	1.47	1.41	1.33	3.79	1.44	✗	1.75	✗	1.21	1.68	1.00
50	2.15		2.62	1.63	1.50	2.73	1.81	1.32	2.15	2.19	2.08	6.00	1.95	✗	2.92	✗	1.75	2.33	2.18
75	3.67		4.23	2.62	2.28	4.27	2.73	2.38	3.46	2.92	2.96	8.19	2.70	✗	4.93	✗	2.58	3.38	2.88

(P)	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK-ENG	UK-WLS	UK-NIR	UK-SCT	IS	LI	NO	TR
25	1.50	✗	1.30	0.79	2.75	1.43	1.80	2.19	1.83	1.88	1.89	0.93	1.11	1.04	0.56	1.00	0.95	1.00	3.13
50	2.10	✗	1.93	1.09	4.39	2.00	2.86	3.73	2.62	2.67	3.00	1.28	1.43	1.26	0.80	1.77	1.90	1.52	5.56
75	3.10	✗	3.00	2.08	6.42	2.88	3.93	5.60	3.70	3.60	4.55	1.71	1.99	1.85	1.07	2.30	2.88	2.28	11.04

Source: OECD, PISA 2009 database.

Explanatory note

School heads were asked in the questionnaire to indicate the total number of 15-year-olds students in their school, and approximately how many computers were available for these students for educational purposes. In the figure, the percentiles 25th, 50th and 75th are presented. A percentile is a value on a scale of one hundred that indicates the percentage of a distribution that is equal to or below this value. The median is defined conveniently as the 50 percentile.

For further information on the PISA international survey sampling procedures, see the Glossary and Statistical Tools section.

Country specific note

France: The country took part in PISA 2009 but didn't administer the school questionnaire. In France, 15 year-old students are distributed between two different types of school and therefore an analysis at school level might be not consistent.

OVER HALF OF STUDENTS HAVE COMPUTERS AVAILABLE DURING THEIR MATHEMATICS LESSONS

On average, almost 55 % of students in the fourth grade and 45 % of students in the eighth grade have computers available during their mathematics lessons. However, this availability is not equally distributed between countries and it varies between almost 95 % in Denmark at fourth grade to only around 10 % in Cyprus at eighth grade.

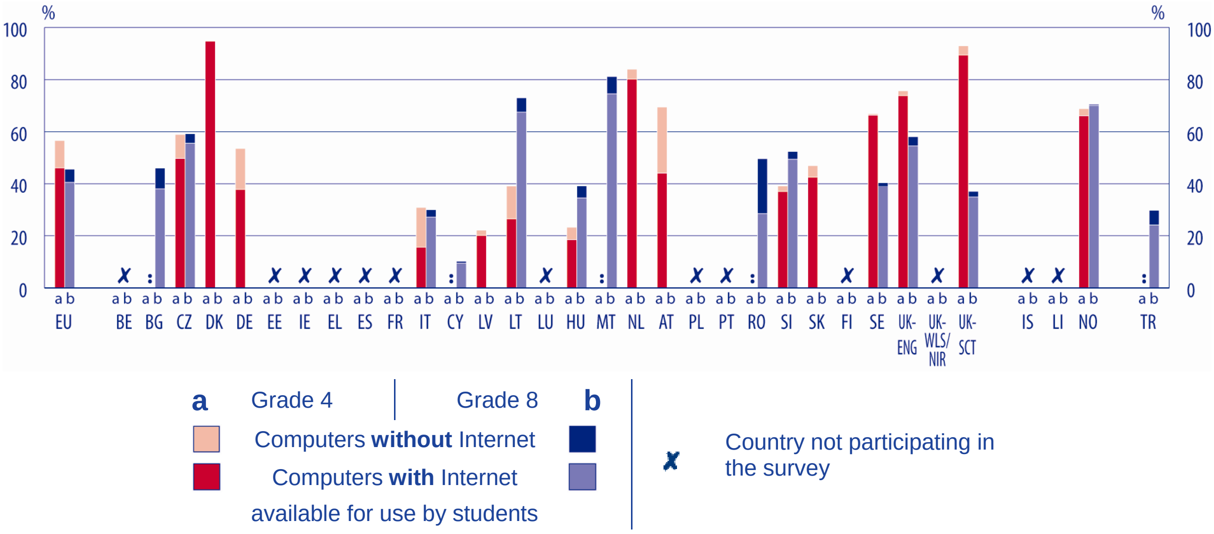
The availability of computers during mathematics lessons must be analysed in parallel with their regular usage (see Figure C5) and any rules for their location within schools as presented in Figure C9.

Having in mind these two caveats, in the TIMSS 2007 international survey, teachers in Denmark Netherlands, Austria, Sweden, United Kingdom (England and Scotland) and Norway reported that more than 60 % of students in the fourth grade had computers available. In Malta, around 81 % of all students in the eighth grade had computers available during their mathematics class, followed by Lithuania and Norway with around 70 %.

In general, the overall accessibility to computers in mathematics classes is higher in fourth grade with more than 10 percentage points difference. Considerable disparities between fourth and eighth grades are registered in Sweden and the United Kingdom (Scotland) where in the fourth grade considerably more students had computers available during their mathematics lessons. The opposite tendency is registered in Lithuania where almost twice as many students in the eighth grade had computers available during these lessons. The existence of specific computer labs in some schools may explain the lower percentage of students in the eighth grade with direct access to computers during ordinary mathematics lessons. Nevertheless, the overall access of eighth grade students is still relatively low (less than 30 %) in Italy, Cyprus and Turkey.

On average, between 80 % in the fourth grade and almost 90 % in the eighth grade of the available computers for mathematics have Internet access. Only Italy and Austria for fourth grade and Romania for eighth grade have lower Internet availability, reaching no more than 60 % of the total number of computers.

Figure E4: Percentage of students in the fourth and eighth grades with computers and Internet access available during their mathematics lessons, as reported by their teacher, 2007



		EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU
Grade 4	**Total computers**	56.6	X	58.9	94.8	53.6	30.8	X	22.1	39.0	23.2
	with Internet	46.2	X	49.7	94.8	37.7	15.6	X	20.1	26.4	18.5
	without Internet	10.5	X	9.2	0.0	15.9	15.2	X	2.0	12.6	4.7
Grade 8	**Total computers**	45.7	46.1	59.3	:	0.0	29.9	10.2	X	73.0	39.2
	with Internet	40.6	37.9	55.6	:	0.0	27.1	9.5	X	67.5	34.4
	without Internet	5.1	8.2	3.7	:	0.0	2.8	0.7	X	5.5	4.8

		MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
Grade 4	**Total computers**	:	84.0	69.5	:	39.1	47.0	66.9	75.7	93.0	68.9	X
	with Internet	:	80.2	44.1	:	36.9	42.6	66.4	73.9	89.5	66.1	X
	without Internet	:	3.8	25.3	:	2.2	4.4	0.5	1.9	3.5	2.7	X
Grade 8	**Total computers**	81.2	X	X	49.7	52.4	X	40.5	58.1	37.0	70.6	29.7
	with Internet	74.6	X	X	28.4	49.4	X	39.0	54.6	34.8	70.1	24.1
	without Internet	6.7	X	X	21.3	3.0	X	1.5	3.5	2.2	0.5	5.7

Source: IEA, TIMSS 2007 database.

Explanatory note

Teachers were asked in the questionnaire to indicate if fourth/eighth grade students had computer(s) available for use during mathematics lessons and if they were connected to the Internet. In the figure, the number of computers without Internet has been calculated by subtracting the number of computers with Internet from the total number of computers available.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

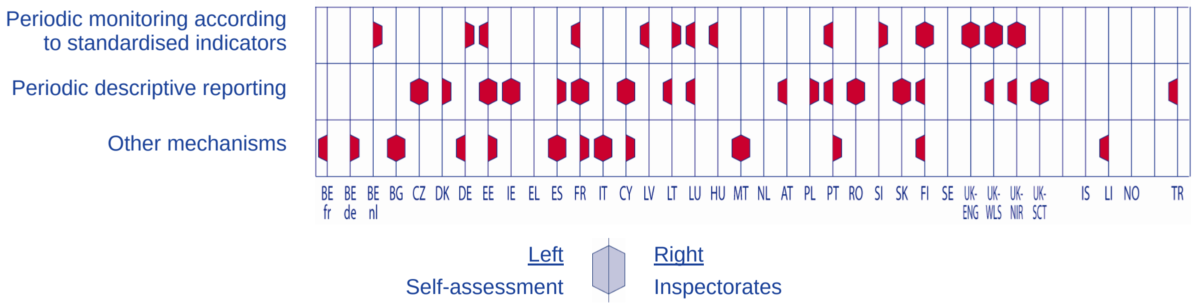
MAJORITY OF COUNTRIES MONITOR THE AVAILABILITY AND USE OF ICT EQUIPMENT IN SCHOOLS WITH PERIODIC DESCRIPTIVE REPORTING

The existence of up to date ICT equipment is a preliminary condition for the implementation of innovative teaching methods and the use of interactive software and online materials. For this reason, different types of monitoring activities are carried out in European countries.

In eighteen education systems, the availability of computers and other ICT resources is monitored periodically and descriptive reports are issued. In eight of these countries, reports are drafted by schools as part of their self-evaluation processes and also by educational inspectorates. In Lithuania, Luxembourg, Austria, Finland, the United Kingdom (Wales and Northern Ireland) and Turkey, such descriptive reporting is used only for school self-assessment.

In Belgium (Flemish Community), Germany, Lithuania, Slovenia, Finland and the United Kingdom (England, Wales and Northern Ireland), the monitoring by inspectorates follows standard lists of criteria which are mainly based on the national indicators related to the development of ICT in schools or, in some cases, criteria linked to technological infrastructure projects.

Figure E5: Monitoring of the availability and use of ICT in schools in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

Country specific note

France: Each 'académie' and some of the local authorities have their own information systems for monitoring ICT equipment in schools. General information is provided in the ETIC (*Enquête nationale sur les technologies de l'information et de la communication pour l'enseignement scolaire* / National survey on information and communication technology for school).
Norway: Schools and local education authorities are autonomous in determining the type of monitoring activities.

In some countries, other forms of monitoring have been developed either using questionnaires submitted to schools as in Italy, or carried out by independent external agencies as in Malta where the monitoring of leased equipment (teachers' laptops and classrooms computers) is done by Malta's Information Technology Agency through its own network. In Belgium (German-speaking Community) there is a practice of dual monitoring: firstly, ICT experts check that schools are benefiting from the specific budget dedicated to investment in 'cyber classes', and secondly, monitoring takes place within the framework of schools' external evaluation. This evaluation takes place every 5 years and covers the number of computers in the school and in the classroom, and assesses how computer use is integrated into the school curriculum.

In many Autonomous Communities in Spain, a teacher, nominated by the school, is appointed by the education authority as 'ICT Coordinator'. The steering documents adopted by each Autonomous Community define the functions of the ICT Coordinator as planning, organising and managing the school's media and technology resources, ensuring their compliance with standards and recommendations, supervising their installation and configuring educational software. In parallel, the school inspectorates of the Autonomous Communities evaluate the ICT coordinator's Working Plan as part of the annual school plan to ensure that it complies with standards and recommendations.

RESPONSIBILITY FOR UPDATING ICT EQUIPMENT IS SHARED BETWEEN SCHOOLS AND EDUCATION AUTHORITIES

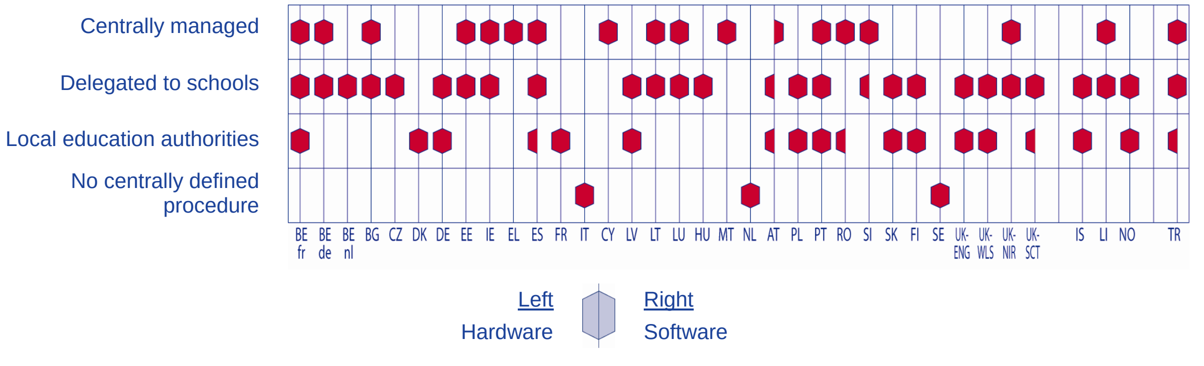
In the majority of European countries, updating computer equipment and procuring educational software is a responsibility delegated to schools. However, in many countries, central or local education authorities may also provide additional resources.

In almost all countries, the same authority is responsible for updating both hardware and software. However, in Austria, the distribution of educational software is centrally managed and the responsibility for renewing ICT equipment is shared between schools and local authorities. In Greece, Cyprus, Malta and Liechtenstein, all school computers and accompanying software are centrally managed but schools can integrate other technological resources into the learning process.

Finally, in Italy, the Netherlands and Sweden, there are no specific procedures defined at central level and schools have the autonomy to develop their own ICT policies.

Schools are generally accountable for the technical maintenance of existing ICT equipment and they usually depend on their own resources to do this. Nevertheless, in seventeen countries, the central or local education authorities provide access to a certified external contractors that schools may use to deliver these services. In Bulgaria, Estonia, Ireland, Spain, Lithuania, Austria and Slovenia, schools use their own budgets to maintain school computers and networks, and call on the centrally-appointed contractor or, in some cases, choose an external contractor, depending on their needs.

Figure E6: Levels of decision-making for updating ICT equipment and software in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

Country specific notes

Hungary: Local governments as 'maintainers' of schools make the formal decision on purchases since they procure ICT equipment. However, all purchases are made at the request of schools to meet their specific needs.
Liechtenstein: Responsibility for renewing ICT equipment at primary level is shared between the central authority and the local authorities *(Gemeindeschulräte)*.

SHORTAGE OF ICT RESOURCES AFFECTS MATHEMATICS AND SCIENCE INSTRUCTION OF AROUND ONE THIRD OF STUDENTS

ICT provide many ways to improve teaching and learning but their integration into the school curriculum is a complex process as many different factors are involved (Balanskat, Blamire and Kefala, 2006). In the research literature, the barriers that make it difficult to achieve the effective integration of ICT tools in education have been classified in various ways (Pelgrum, 2008; Bingimlas, 2009). Nevertheless, a strong consensus supports the idea that there are two main sets of barriers, one of which relates to teacher behaviour and knowledge (see Chapters C and D) and the other to school level barriers including inadequate technological infrastructure, software, Internet connectivity and technical support (see Figure E7 and E8).

To examine these potential obstacles further, the TIMSS 2007 international survey considered four types of ICT resources, the shortage of which might affect the 'instruction capacity' of a school (i.e. its ability to teach effectively): computers, software, audio-visual resources and technical support staff.

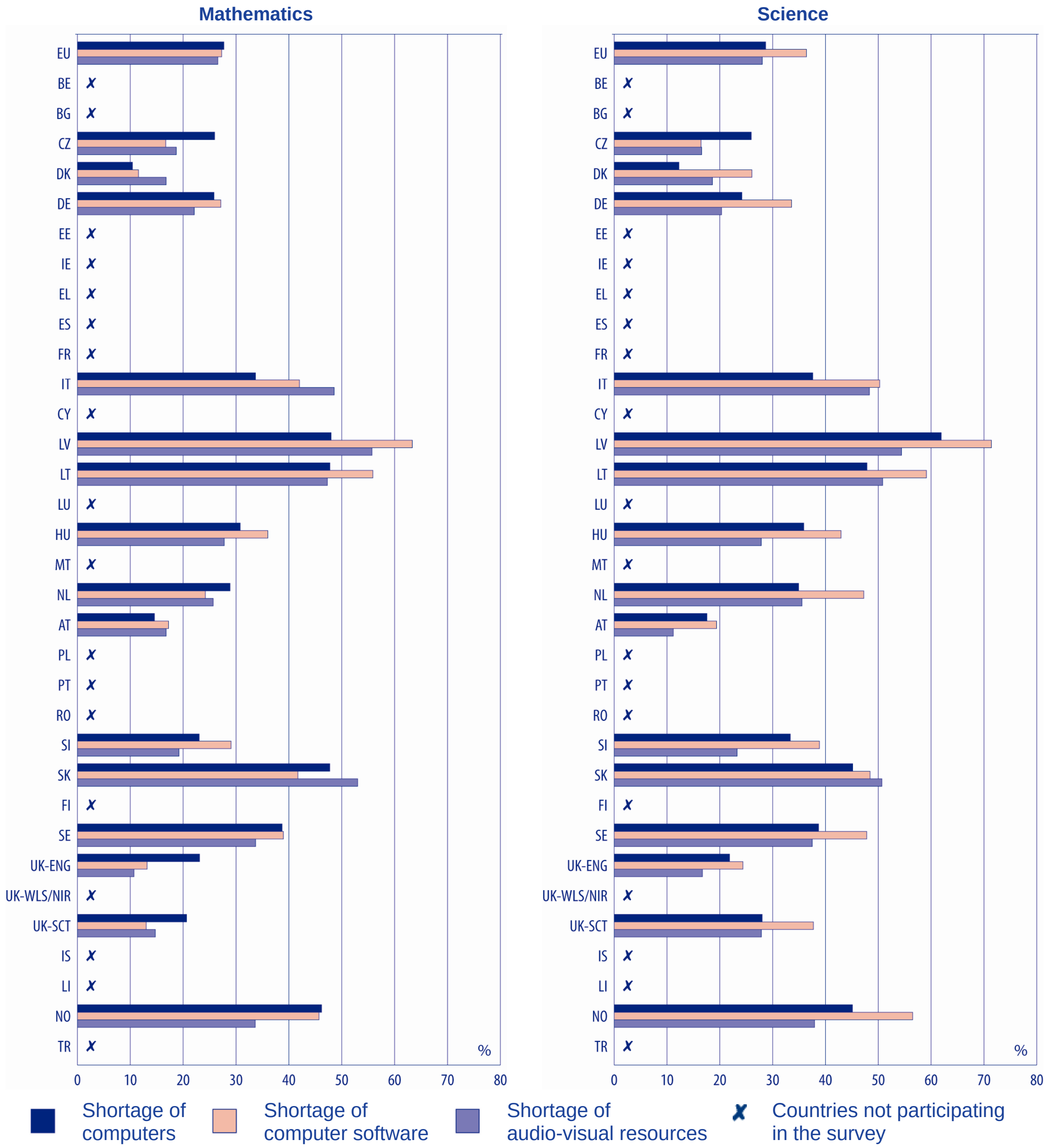
School heads, representing schools attended by approximately one third of students, reported that the 'instruction capacity' of their school was considerably affected by a shortage or inadequacy of ICT resources. Among the countries that took part in the TIMSS 2007 international survey, the percentage of schools whose capacity to provide effective instruction was affected by insufficient ICT resources at a similar level for both mathematics and science classes.

The lowest percentage of fourth grade students affected by inadequate or insufficient computers is registered in Denmark (10.43 % for mathematics and 12.25 % for science) and in Austria (14.58 % for mathematics and 17.57 % for science). In contrast in Latvia, Lithuania, Slovakia and Norway, almost half of students in the fourth grade were affected to some degree by a lack of computers. When discussing the inadequacy or non-availability of computers, one must bear in mind that school organisation may play a part. The procedures in place to book a computer room, the ways computers are shared between teachers/disciplines or the location of computers within the school may all affect teaching even if there is relatively high number of computers overall per school (Figures E2 and E3).

Both in Mathematics and Science the shortage or inadequacy of computer software was claimed as greater problem than computer hardware. This is especially the case in Latvia where mathematics teaching for the fourth grade was reported to be considerably affected by a lack of educational software for 63.34 % of students (15.37 percentage points more than those affected by the lack of computers). With a lower but still significant impact, the inadequacy of specific software affected the teaching of around 12 percentage points more students in Denmark, Italy and the Netherlands, than did the shortage of computers.

Finally, most school heads reported that their schools were better equipped with audio-visual equipment than computers or computer software and therefore teaching was less affected by a lack of these resources. Only Denmark, Italy and Slovakia registered the opposite tendency both for mathematics and science with more students affected by the shortage of audiovisual resources than computers. Nevertheless, in the case of Denmark, the overall percentage of students affected was less than 20 %. A similar trend, but with less impact on the teaching process (a difference of less than 10 percentage points) was also registered in Latvia and Austria for mathematics and in Lithuania for science.

Figure E7a: Percentage of pupils in the FOURTH GRADE attending schools in which the 'instruction capacity' was considerably affected by a lack of ICT resources as reported by the school head, 2007



Mathematics

	EU	CZ	DK	DE	IT	LV	LT	HU	NL	AT	SI	SK	SE	UK-ENG	UK-SCT	NO
■ (Shortage of computers)	27.7	26.0	10.4	25.8	33.7	48.0	47.8	30.8	28.9	14.6	23.0	47.7	38.7	23.1	20.7	46.2
■ (Shortage of computer software)	27.3	16.7	11.6	27.1	42.0	63.3	55.9	36.0	24.2	17.3	29.1	41.7	39.0	13.2	13.0	45.7
■ (Shortage of audio-visual resources)	26.6	18.7	16.8	22.1	48.6	55.7	47.3	27.8	25.7	16.8	19.2	53.0	33.7	10.7	14.7	33.6

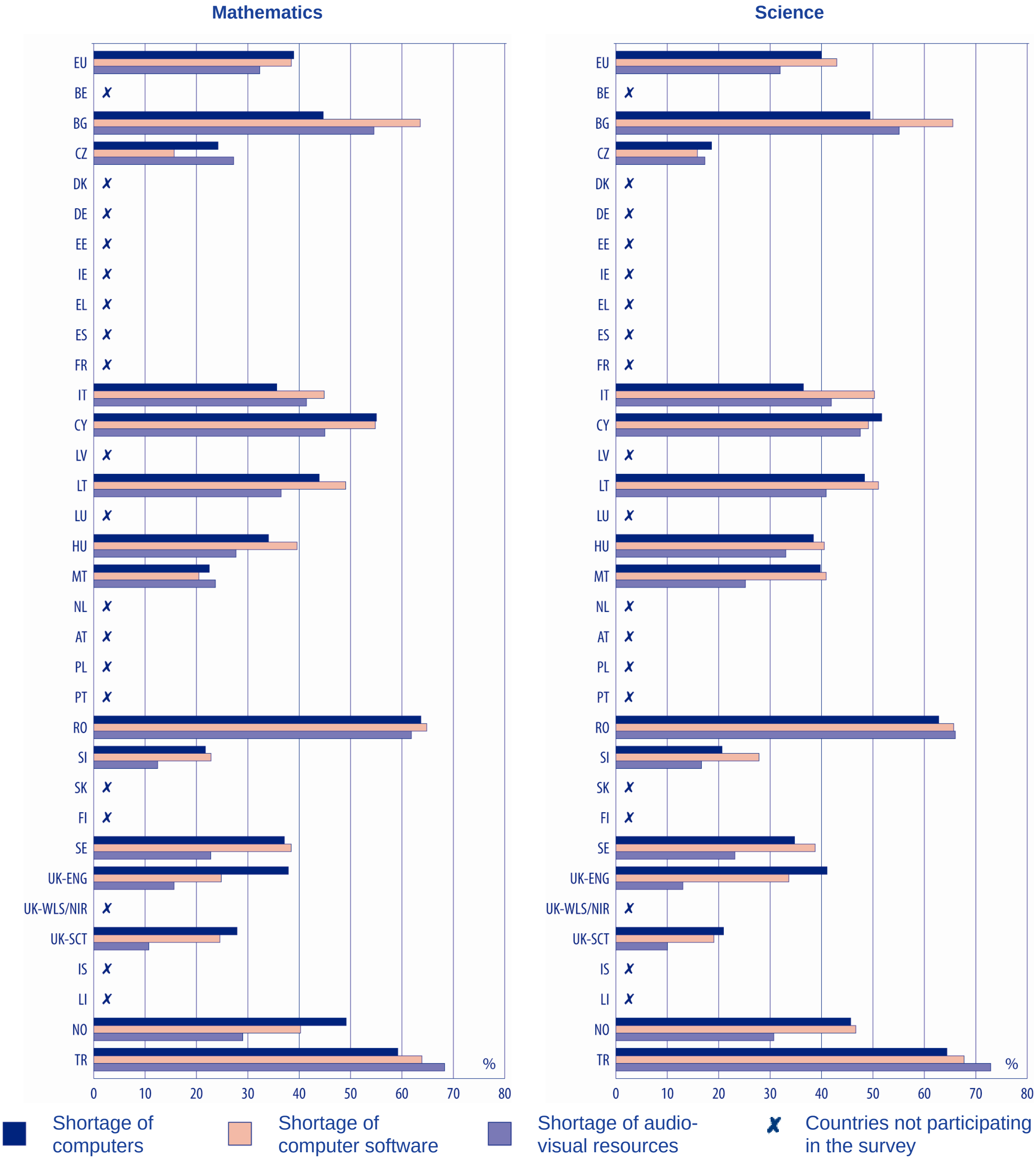
Science

	EU	CZ	DK	DE	IT	LV	LT	HU	NL	AT	SI	SK	SE	UK-ENG	UK-SCT	NO
■ (Shortage of computers)	28.7	25.9	12.3	24.2	37.6	61.9	47.9	35.9	34.9	17.6	33.3	45.2	38.7	21.8	28.0	45.1
■ (Shortage of computer software)	36.4	16.5	26.1	33.6	50.3	71.4	59.1	43.0	47.3	19.4	38.9	48.4	47.8	24.4	37.7	56.5
■ (Shortage of audio-visual resources)	28.0	16.6	18.6	20.3	48.3	54.4	50.8	27.8	35.5	11.2	23.3	50.7	37.5	16.7	27.9	37.9

Source: IEA, TIMSS 2007 database.

In the eighth grade, on average, teaching seems to have been affected to a greater extent (around 10 percentage points higher) by the inadequacy of ICT resources, but large variations between countries remain. The Czech Republic, Malta, Slovenia and the United Kingdom – Scotland (for science) had less than 25 % of their eighth grade students whose instruction had been affected by a shortage of ICT equipment. On the other hand, more than 50 % of eighth grade students were in schools with a shortage of ICT resources in Bulgaria, Cyprus, Romania and Turkey. For countries which took part in the TIMSS 2007 international survey at both fourth and eighth grades, approximately the same percentage of students was affected by a lack of, or inadequate ICT resources.

Figure E7b: Percentage of pupils in the EIGHTH GRADE attending schools where the 'instruction capacity' was considerably affected by a lack of ICT resources as reported by the school head, 2007



Source: IEA, TIMSS 2007 database.

Mathematics

	EU	BG	CZ	IT	CY	LT	HU	MT	RO	SI	SE	UK-ENG	UK-SCT	NO	TR
■	38.9	44.7	24.2	35.6	55.0	43.9	34.0	22.5	63.7	21.7	37.1	37.9	27.9	49.1	59.2
□	38.5	63.6	15.7	44.9	54.8	49.1	39.6	20.5	64.8	22.8	38.5	24.8	24.6	40.3	63.9
▪	32.3	54.5	27.2	41.4	45.0	36.5	27.7	23.7	61.8	12.5	22.8	15.6	10.7	29.0	68.3

Science

	EU	BG	CZ	IT	CY	LT	HU	MT	RO	SI	SE	UK-ENG	UK-SCT	NO	TR
■	40.0	49.4	18.6	36.5	51.7	48.4	38.4	39.8	62.8	20.6	34.7	41.1	21.0	45.7	64.4
□	43.0	65.5	15.9	50.3	49.1	51.1	40.5	40.9	65.7	27.9	38.8	33.6	19.1	46.7	67.7
▪	32.0	55.1	17.3	41.9	47.5	40.9	33.0	25.2	66.0	16.7	23.1	13.0	10.1	30.7	72.9

Source: IEA, TIMSS 2007 database.

Explanatory note

School heads were asked in the questionnaire to indicate to what degree their school's capacity to provide instruction was affected by a shortage or inadequacy of (a) Computers for mathematics instruction, (b) Computer software for mathematics instruction, (c) Audio-visual resources for mathematics instruction, (d) Computers for science instruction, (e) Computer software for science instruction, (f) Audio-visual resources for science instruction, and (vii) Computer support staff. The possible replies were (i) None, (ii) A little, (iii) Some, (iv) A lot.

The figure presents aggregated data for the responses 'Some' and 'A lot'.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

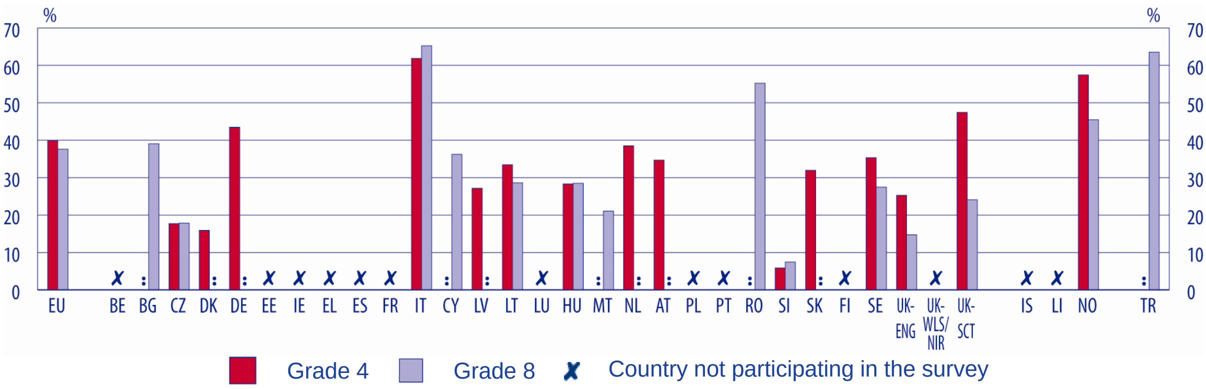
LACK OF ICT SUPPORT STAFF CONSIDERABLY AFFECTS THE INSTRUCTION OF UP TO 50 % OF STUDENTS IN SOME COUNTRIES

Studies carried out in the last decade have revealed that teachers regard one of the main barriers to the active introduction of the ICT resources in daily teaching to be the lack of technical support (Pelgrum, 2001; Korte and Husing, 2007). The absence or ineffectiveness of technical assistance means that teachers have to deal frequently with equipment-related problems that might discourage them from using these tools in their teaching.

School heads participating in the TIMSS 2007 international survey were asked to report how a shortage of technical support staff had affected the general instruction process in the fourth and eighth grades (see also Figure E7). At European level, on average 40 % of students were considerably affected by a lack of ICT support staff. This situation was even more problematic in Italy, Romania, Turkey and Norway (for primary education) where at least 50 % of students attended a school where the instruction capacity was believed to be considerably affected by insufficient technical support staff. In contrast, in Slovenia, school heads reported that at both education levels there were technical staff in almost all schools and only 10 % of students were considerably affected by a lack of technical support. The analysis of the effects of a shortage/inadequacy of technical support staff must be considered in combination with the general availability of these staff, as presented in Figure D9, which reveals that they are widely available in schools.

When countries took part in the TIMSS 2007 survey at both primary and secondary levels, school heads indicated that the shortage/inadequacy of computer support staff had either the same or less impact on eighth grade than on fourth grade students. In the United Kingdom (Scotland), the percentage of students affected in the eighth grade was half the figure of those affected in the fourth grade.

Figure E8: Percentage of pupils in the fourth and eighth grades attending a school where the 'instruction capacity' was considerably affected by a lack of computer support staff, as reported by the school head, 2007



	EU	BG	CZ	DK	DE	IT	CY	LV	LT	HU	MT	NL	AT	RO	SI	SK	SE	UK-ENG	UK-SCT	NO	TR
Grade 4	39.9	:	17.7	15.9	43.5	61.8	:	27.2	33.5	28.3	:	38.5	34.7	:	5.9	32.0	35.4	25.3	47.4	57.4	:
Grade 8	37.6	39.0	17.8	:	:	65.3	36.2	:	28.6	28.5	21.1	:	:	55.2	7.5	:	27.5	14.7	24.1	45.5	63.5

Source: IEA, TIMSS 2007 database.

Explanatory note

The figure presents aggregated data on students attending schools where the school head reported that the shortage or inadequacy of computer support staff (item vii) was having 'Some' or 'A lot' of impact on the provision of instruction. For more information on all the items and answer options in this question, see Figure E7.

For further information on the TIMSS international survey sampling procedures, see the Glossary and Statistical Tools section.

NATIONAL INFORMATION SYSTEMS FOR EDUCATION MANAGEMENT ARE IMPLEMENTED OR UNDER DEVELOPMENT IN MAJORITY OF COUNTRIES

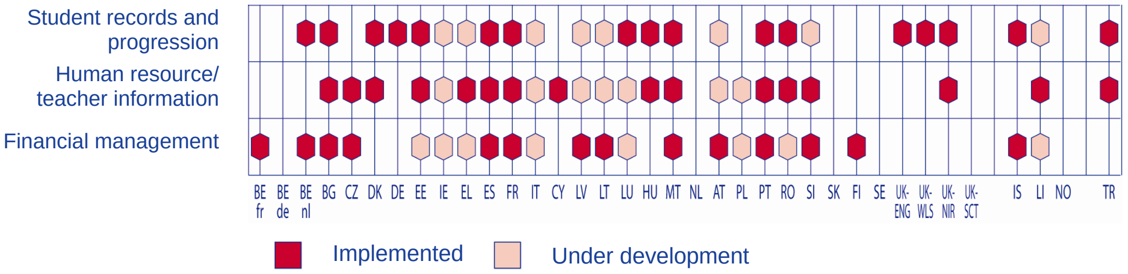
ICT technologies are a crucial element in providing innovative learning and teaching but they also play a substantial role in ensuring effective school management. In a recent progress report on the use of ICT to support innovation and lifelong learning for all, the European Commission stated that in order to effectively embed ICT in education, education systems require further changes related to their working environment in terms of technology and organisation (European Commission, 2008c).

The development of integrated information systems for monitoring student progression, managing teacher information or financial management are some of the ways in which more efficient school administration can be achieved. In twenty-five countries, national information systems for the registration of student records and progression have been implemented or are currently being developed. These systems are widely used when students need to be transferred from one school to another and in some countries to record student diplomas/certificates.

Information systems for the management of teacher information are the second most widely used ICT tool in education administration. Such applications are already in place in a total of sixteen countries and they are currently being developed in a further seven education systems. In some cases, these applications only cover the management of human resource information but, in many other countries, specific applications for recording continuing professional development also exist.

Closely linked to the management of teacher information, twenty-two countries have developed or are finalising the implementation of integrated systems for school financial management. When schools have a high degree of autonomy to manage their own financial resources, these integrated management systems act as central repositories/registers of the operations carried out at institutional level. In countries where schools have limited or no autonomy in managing their own spending on specific goods, ICT systems also play a key role in central or local education authority approval procedures. Finally, in a third set of countries, similar systems are implemented and used for reporting spending at local level or for the allocation of the annual, delegated budget or general subsidy.

Figure E9: National information systems/databases for education management and administration in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

PUBLIC-PRIVATE PARTNERSHIPS ARE USED TO IMPROVE THE PROVISION OF ICT EQUIPMENT AND TRAINING STUDENTS AND TEACHERS

With the general aim of extending the cooperation between education and business, the European Commission held the first School-business forum in Brussels on the 24-25 March 2010 (European Commission, 2010e). The participants in the forum agreed that co-operating with outside partners, including businesses, could help to improve education processes. School-business co-operation can also help students to develop wider skills, raise their motivation to learn and help them take the initiative in creating their own learning plans.

In the summary report on ‘Education on Online Safety in Schools in Europe’ (EACEA/Eurydice, 2010), the Eurydice Network analysed in detail the collaboration between education authorities and external partners in order to promote Online Safety in schools. This analysis extended to a wider range of areas where public-private partnerships are involved in promoting the use of ICT in education.

In twenty European countries, there are partnerships of some kind for the provision of hardware and software for educational purposes. The donation of resources or equipment is also backed up in many cases with training courses for teachers. This is the case in thirteen countries where companies or non-governmental organisations provide specific training for teachers on the use of educational software or using ICT resources in lessons.

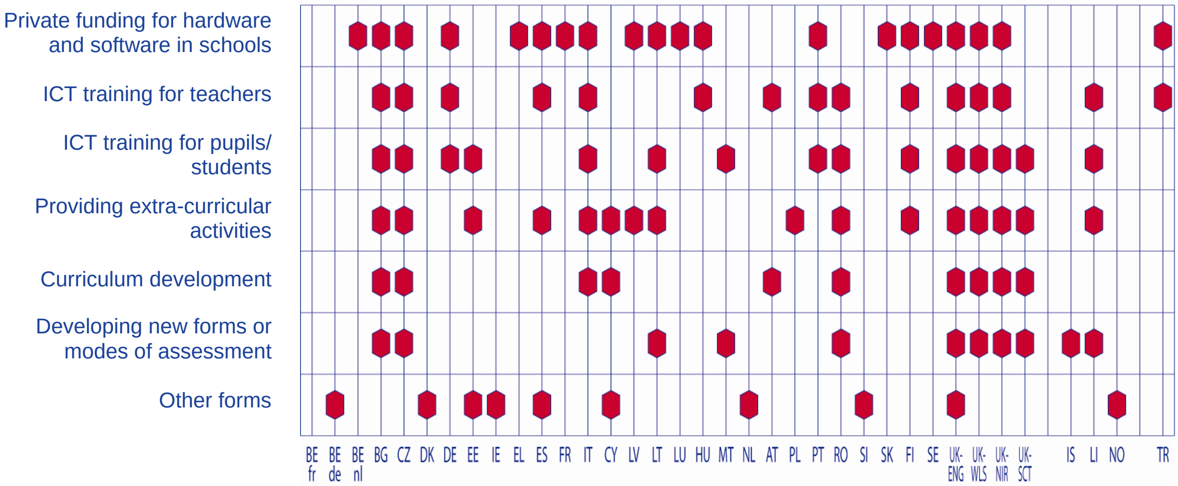
Providing extra-curricular activities as well as specific courses for students is the second main area where active public-private collaboration is in place. In twelve countries, companies offer 'out-of-school activities' such as classes and workshops or are involved in long-term actions such as the organisation of awareness campaigns and activities for parents and children.

In up to one third of countries, external partners are participating in discussions on curriculum development or on the introduction of new forms of assessment linked to, for example, cross-curricular skills or e-portfolios. For these activities, businesses and other partners are invited to contribute ideas for new ways of delivering the curriculum or assessment, and especially ways to help students to apply their newly gained knowledge and skills.

Finally, in some countries other specific forms of collaboration exist. For example, in Ireland, a joint steering group, comprising a broad cross-section of public and private sector stakeholders, advises on policy-making for ICT in Irish schools, taking account of new technology applications, curriculum development and pedagogy. Similarly, in Norway, the newly created Norwegian Centre for ICT in Education established in January 2010 has an objective to bring together various participants and resources and to facilitate cooperation on ICT in and for the education sector. The target groups for the Centre are teacher training institutions, including pre-school teacher training; local school authorities; school leaders; school and pre-school teachers. Elsewhere, in Slovenia and the United Kingdom (England), companies finance the organisation of competitions for schools with the aim of showing how ICT can develop students' knowledge and also help people in their community.

From the available data, it can be seen that when public-private collaborations are in place they generally cover a combination of issues. Three countries (Bulgaria, the Czech Republic and the United Kingdom) have carried out analyses of the nature of these partnerships.

Figure E10: Public-private partnerships for promoting the use of ICT in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

Country specific note

Malta: Developing new forms or modes of assessment is only applicable for ISCED 2 and 3 as Malta introduced the automated testing for ECDL for these levels.

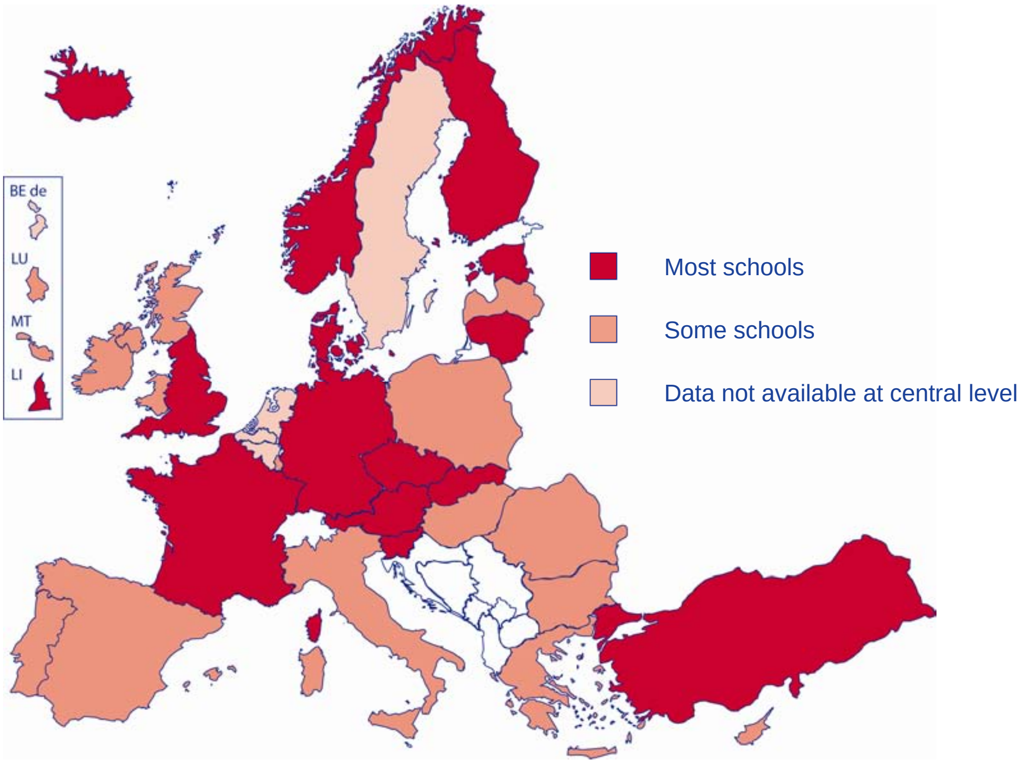
ICT TOOLS ARE COMMONLY USED BY SCHOOLS TO COMMUNICATE WITH PARENTS

Communication between schools and parents is an important element of everyday school management. With the widespread availability of computers and Internet access in the home (see Figures A1 and A3), schools are trying increasingly to communicate with parents using ICT. This communication can either be limited to the dissemination of information via the school website or be more interactive (e.g. using emails to inform parents about disciplinary matters or via structured information systems or school portals). In the United Kingdom, parent engagement is perceived as not only limited to technology, but technology offers practical, effective ways to engage families, keeping them in touch with their children's progress and encouraging learning beyond the classroom (Becta, 2009a).

In half the countries/regions, most schools use ICT to communicate with parents. In some of these countries, education authorities or private partners have developed school portals where parents can access different types of information related to school life. In the remaining countries/regions, some schools use ICT to exchange information with parents but there is no information centrally available about the nature of these exchanges.

Even though schools in many countries use ICT tools to communicate with parents to some extent, the type of information that is communicated or the level of detail varies considerably, as can be seen from Figure E12.

Figure E11: Communication with parents using ICT in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Source: Eurydice.

Country specific note

Czech Republic: At ISCED level 3, all schools have websites and 63 % of schools use ICT for communicating with parents according to the 2009/10 annual report of the Czech School Inspectorate. The thematic report of the school inspectorate for ISCED 1 and 2 ‘Level of ICT in basic schools in the Czech Republic’ found that 85.5 % of schools (for large schools the figure is 98 %) have their own website, 23.7 % of schools communicate directly with parents through these information systems.

MOST SCHOOLS USE THEIR WEBSITES TO COMMUNICATE GENERAL INFORMATION AND EXTRA-CURRICULAR ACTIVITIES

School websites are today the most common source of information about education institutions. In all countries, websites would appear to be the first method of communication using ICT to be developed by schools or education authorities. Some central level education authorities have even included the existence of a school website as one of the key indicators for the availability of ICT infrastructure in schools in their steering documents (see Figure E1).

Schools broadly use their websites to communicate general information such as its location, facilities, contacts, structure, etc. The list of extra-curricular activities is also widely disseminated via school websites, in many cases parents are also invited to take part in such activities and assist the school in their organisation. In many schools, an internal newsletter is available which parents can access or even participate in its drafting. In addition, in some countries parents can also get information from the school website on teaching methods, timetables and canteen menus. Finally, some administrative information such as ministerial circular letters or announcements is also available on the school websites.

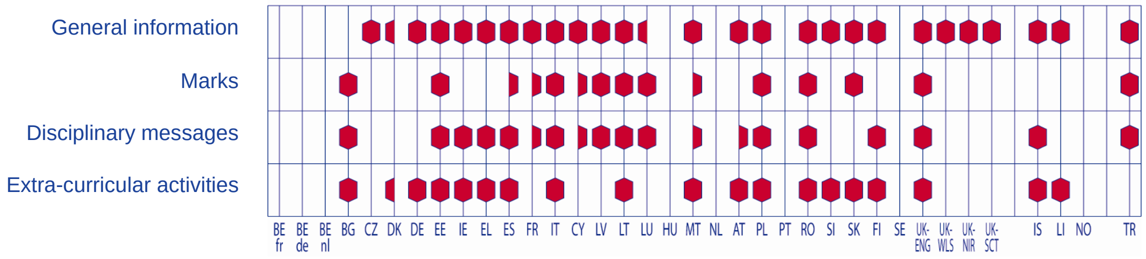
In almost half the countries/regions, information about students' marks, attendance or disciplinary messages are transmitted to parents using ICT tools (e.g. *e-registers, online school reports or e-diaries*). When such information is communicated, as for example in Estonia, Spain (secondary education), France (secondary education), Latvia, Lithuania, Slovakia, Finland, the United Kingdom (England) and Turkey, specific information systems with username and password protection are established to guarantee privacy. Additionally, in many countries, teachers commonly use email to send information to parents about their child's behaviour, marks or attendance.

In Italy, a nationwide project called My School *(Scuolamia)* started in the school year 2009/10. The Italian Ministry of Education, University and Research has also launched a related website that can serve as meeting place for schools and families. The system offers a range of services such as booking interviews with teachers or the printing of individual certificates and reports. This virtual office is expected to simplify administrative procedures and allow greater participation by families in the life of the school and in their children’s education.

A recent study from United Kingdom – England (Becta, 2009b) revealed that 65 % of the surveyed parents declared that the introduction of online reporting offered either a ‘great improvement’ or ‘some improvement’ with respect to their engagement in the education of their children.

In Poland, changes to school regulations in 2009 permitted the use of electronic registers with the consent of the school management body. Despite a lack of network infrastructure and sufficient equipment in some schools, some of the more innovative institutions have already put in place electronic class registers. School heads and teachers have said that electronic registers have considerably improved school management, reduced bureaucracy and saved time which can be devoted to working with students. Furthermore, the training accompanying the introduction of these registers has upgraded the ICT skills of all teachers working in these schools.

Figure E12: Information commonly transmitted to parents via ICT in primary and general secondary education (ISCED 1, 2 and 3), 2009/10



Left: ISCED 1 | Right: ISCED 2 and 3

Source: Eurydice.

Explanatory note

This indicator aims to present the actual situation in schools, for this reason, many countries do not provide data for the figure. However, in those countries, schools may use ICT to communicate with parents to provide general information about developments in the school, students' marks, disciplinary messages, promote extracurricular activities etc., but these practices are not part of a nationwide project and the central authorities do not monitor the process.

Country specific notes

Czech Republic: In many schools, other types of information are also communicated to parents on a periodic basis.
Cyprus: The Cyprus School Net (DIA.S.) portal is currently being implemented on a pilot basis for seven upper secondary general, technical and vocational schools and the Ministry of Education is planning the expansion of the School Net project to all schools (primary, secondary, technical and vocational).

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GLOSSARY AND STATISTICAL TOOLS

Terms and Definitions

Broadband connection: High data rate, or high speed, internet access. Generally, any connection of 256 kbit/s or greater is considered broadband internet access.

e-Portfolio: Demonstrations of the user's abilities and platforms for self-expression. An e-portfolio can be seen as a type of learning record that provides actual evidence of achievement. There are three main types of e-portfolios, although they may be referred to using different terms: developmental (e.g. working), reflective (e.g. learning), and representational (e.g. showcase) (Wikipedia, 2010a).

EU Key Competences: A combination of knowledge, skills and attitudes appropriate to the context. Key competences are those which all individuals need for personal fulfilment and development, active citizenship, social inclusion and employment ([1]). Definitions of each EU Key competence can be found at: http://europa.eu/legislation_summaries/education_training_youth/lifelong_learning/c11090_en.htm

European Computer Driving Licence (ECDL): An internationally-recognised certification that provides verification of pupils' and teachers' skills and demonstrates the achievement of a recognised standard (ECDL Foundation, 2010).

Expenditure on ICT in schools: The level of investment in ICT in compulsory education. The indicators of investment used in this study include: the amount of money spent on hardware, software, internet connection and networks, staff for technological support, professional development related to ICT.

Gross domestic product (GDP): At market prices is the result of the production activity of resident producer units.

Guideline: Any document (governmental or private) that aims to streamline particular processes, and to improve their quality. By definition, following a guideline is never mandatory (Wikipedia, 2010b).

Hardware: For the purpose of this study, refers to technological tools for information and communication such as computer, handheld devices, interactive white boards, etc.

ICT: ICT stands for information and communication technology and is defined – for the purposes of this study – as a 'diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information' (Blurton, 1999). These technologies include hardware, such as computers, handheld devices, interactive whiteboards; systemic basics, such as the Internet or intranets; software, such as word processing, spreadsheet, database applications and graphical software; and broadcasting technologies (radio, television dvd) (Tinio, 2003).

ICT as a general tool for other subjects: Refers to the use of ICT in all or some aspects of teaching, but without a clearly assigned purpose. This can include the use of ICT as a tool for instruction by the teacher and/or for problem-solving or learning by pupils.

ICT as a tool for specific tasks (in other subjects): Refers to the use of ICT in the teaching process for specific tasks. Examples are the use of map software to learn about geography, the use of word processing in language training or the use of ICT to solve mathematical problems.

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

ICT infrastructure: Umbrella term for all the ICT hardware and software as well as broadband connection and websites.

ICT learning objectives: Objectives defined in steering documents related to learning about and with ICT. When they are reached, pupils have acquired certain ICT skills.

ICT skills: The ability to use ICT for a specific purpose in an effective, critical and efficient manner.

Information literacy: Access information efficiently (time) and effectively (sources) and evaluate information critically and competently. Use and manage information accurately and creatively for the issue or problem at hand, manage the flow of information from a wide variety of sources and apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information (Partnership for 21st Century Skills, 2010).

Innovative pedagogical approaches: Teaching approaches that are characterised by being tailored to pupils needs, thereby increasing their interest and engagement in learning activities and improving their results (Langworthy et al. 2009, p. 30). These innovative pedagogical approaches include:

- **Project-based learning**: Project-based learning activities engage pupils in open-ended, long term (1 week or more) questions or problems, usually one with no known answer or no previously learned solution.
- **Personalised learning**: Pupils learn in ways that are relevant to their own background, experiences, and interests. They can choose the topics they will learn about, the tools or strategies they will use, and the types of work products they will create.
- **Individualised student-centred learning**: Teachers make it possible for individual pupils to work at their own pace, or they adjust instruction based on individual pupils' skill levels and learning needs.
- **Scientific investigations**: Mostly applied to science of nature and technology. By definition, inquiry is the intentional process of diagnosing problems, critiquing experiments, and distinguishing alternatives, planning investigations, researching conjectures, searching for information, constructing models, debating with peers, and forming coherent arguments (Linn et al. 2004, p. 4).
- **Online learning**: Refers to an education process and system in which all or a significant proportion of the teaching is characterised by (a) separation/distance of place and/or time between instructor and learner, amongst learners, and/or between learners and learning resources; and (b) interaction between the learner and the instructor, among learners and/or between learners and learning resources conducted through one or more media (UNESCO Institute for Statistics 2009, p. 19).

Interactive ICT assessment: Assessment which involves onscreen testing methods, is possibly done online, and is self-marking. It gives the pupils a clear indication of their current learning levels and training needs. In the case of 'computer adaptive testing', the assessment is geared to individual pupils' level of ability. Following a correct answer, pupils are asked more difficult questions and vice versa (EACEA/Eurydice, 2009b).

Learning outcomes: What an individual knows, is able to do and/or understands after having completed a learning process (described in terms of skills and competences) (European Commission 2010, p. 23).

Learning outcomes approach: Is a pupil-centered learning philosophy that focuses on measuring pupil performance in terms of outcomes. A learning outcomes approach does not specify or require any particular style of teaching or learning. Instead, it requires that students demonstrate that they have learned the required skills and content (European Commission 2010, p. 23).

Media literacy: Skills, knowledge and understanding that allow consumers to use media effectively and safely. Media-literate people are able to exercise informed choices, understand the nature of content and services and take advantage of the full range of opportunities offered by new communications technologies ([2]).

National information system/database for educational management: For the purpose of this study, refers to central databases or other forms of centralised information systems used for keeping pupils' and/or teachers' records as well as maintaining data related to the planning and control of public education finances.

Online safety: Includes information on the potential risks that pupils may face online, and empowerment to use the internet and mobile phones responsibly (EACEA/Eurydice, 2010).

Onscreen testing: Is an alternative to the traditional paper-based tests and exams. In onscreen testing ICT is used at the time of testing, and usually software marks each test and provides instant results (EACEA/Eurydice, 2009b).

Pedagogical ICT skills: The ability of teachers to use ICT within the classroom to support teaching and learning. Also the ability of teachers to realise the pedagogical potential of ICT.

Project-based assessment: Assessment method based on project-based learning activities.

Recommendation: An official document proposing the use of specific tools, methods and/or strategies for teaching and learning. A recommendation is stronger in its bindingness than a suggestion.

Regulation: A law, rule or other order prescribed by public authority to regulate conduct.

School autonomy: Refers to several different aspects of school management. Schools may be autonomous to varying degrees regarding these aspects. They are considered to be fully autonomous, or to have a high degree of autonomy, if they are fully responsible for their decisions subject to legal constraints or the general framework of education legislation. This does not preclude consultation with other education authorities. Schools are partly autonomous if they take decisions within a set of predetermined options or require approval for decisions from their education authority. Autonomy may also be implied where there is an absence of rules or regulations in a given area (Eurydice, 2007).

Self-assessment (pupils): Pupils are required to take responsibility for their own learning. They must plan and monitor their own tasks. They know the criteria that define 'success' for this task, and they must revise their work based on feedback from teachers or peers or based on self-reflection (Langworthy et al. 2009, p. 30).

Self-assessment (schools): Is carried out by members of the school community who are directly involved in school activities (such as school head, teaching and administrative staff and pupils) or who have a direct stake in them (such as parents or local community representatives) (EACEA/Eurydice, 2009a).

([2]) Directive 2007/65/EC of the European Parliament and of the Council of 11 December 2007 amending Council Directive 89/552/EEC on the coordination of certain provisions laid down by law, regulation or administrative action in Member States concerning the pursuit of television broadcasting activities, Official Journal L 332 of 18.12.2007.

Self-assessment (teachers): Reflexive and reflective thinking about one's own practices aiming to identify the kinds of changes in practice that are needed to better serve the learning needs of pupils.

Software: Computer applications, such as word processing, spreadsheet, database applications and graphical software.

Specialist ICT teacher: Teachers trained to teach ICT as a subject. The area of specialisation is already reflected in teacher education.

Steering documents: Different kinds of official documents containing guidelines for teaching, such as programmes of study including activities, learning objectives, attainment targets etc., and any official guidelines defining criteria for pupils' assessment. Several types of steering documents can exist for the same level of education.

Suggestion: An idea or plan put forward for consideration in teaching and learning. A suggestion is the weakest type of official document and is often used in trying out new approaches.

Support: Advice and help for teachers concerning lesson plans, motivating and teaching pupils effectively, classroom management, resources, talking to parents, etc.

Technical support: A range of services providing assistance with ICT infrastructure. In general, technical support services attempt to help the user solve specific problems with a product rather than providing training, customisation, or other support services.

Transversal competences: Horizontal, cross-disciplinary, not subject-based competences. The Partnership for 21st Century Skills (2010) defines transversal competences such as the following:

- **Creativity**: Thinking creatively about new and worthwhile ideas and to work creatively with others, i.e. being open and responsive to new and diverse perspectives
- **Innovation**: Acting on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur.
- **Critical thinking**: Using various types of reasoning (inductive, deductive, etc.) as appropriate to the situation and analyse how parts of a whole interact with each other to produce overall outcomes in complex systems.
- **Problem solving**: Solving different kinds of non-familiar problems in both conventional and innovative ways.
- **Decision making**: Effectively analysing and evaluate evidence, arguments, claims and beliefs; interpret information and drawing conclusions based on the best analysis.
- **Communication**: Articulating thoughts and ideas effectively using oral, written and non-verbal communication skills in a variety of forms and contexts.
- **Collaboration**: Demonstrating the ability to work effectively and respectfully with diverse teams to accomplish a common goal.
- **Research and inquiry**: Defining information needs, knowing how to identify relevant information sources and how to look up for and select the information required.
- **Flexibility and adaptability**: Working effectively in a climate of ambiguity and changing priorities.
- **Initiative and self-direction:** demonstrating initiative to set goals, and defining, prioritising and completing the tasks without direct oversight.

- **Productivity**: Managing work to achieve the intended results, even in the face of obstacles and competing pressures.
- **Leadership and responsibility**: Using interpersonal and problem-solving skills to influence and guide others toward a goal, keeping the interests of the group/community in mind.

Virtual learning platforms: describes a broad range of ICT infrastructure brought together to enable more effective ways of working within and outside the classroom. At the heart of any virtual learning platform is the concept of a personalised online learning space. This space should offer teachers access to stored work, e-learning resources, communication and collaboration with peers, and the facility to track progress (Wikipedia, 2010c).

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 distinguishes seven levels of education.

ISCED 97 levels used in the study

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 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.

For more information and other education levels: http://unescostat.unesco.org/en/pub/pub0.htm

PISA and TIMSS data

PISA (**Programme for International Student Assessment**): An international survey conducted under the auspices of the OECD in 65 countries worldwide, including 29 countries involved in the EU LLP Programme. The aim of the survey is to measure the performance level of pupils aged 15 in reading literacy, mathematical literacy and scientific literacy. Data used in the present report are from PISA 2009 data collection.

Besides measurements of outcome (tests in reading, mathematics and science), the survey includes questionnaires for pupils and school heads, which are intended to identify variables linked to family and school circumstances that may help explain the findings. It is these questionnaires that have been used to prepare the indicators in the present publication.

The survey is based on representative samples of 15-year-old pupils in secondary education, who were selected by their school. Education at each school may last a greater or lesser number of years corresponding to curricula at ISCED levels 2 and/or 3, or in some cases even ISCED level 1. This explains why the titles to Figures in the present publication refer to schools attended by pupils aged 15 and not secondary education in general.

TIMSS (**Trends in International Mathematics and Science Study**): An international survey conducted since 1995 under the auspices of the International Association for the Evaluation of Educational Achievement (IEA). In the last edition of TIMSS (2007) took part 59 countries and regions worldwide, including 18 involved in the EU LLP Programme. The aim of this survey is to provide data about trends in mathematics and science achievement over time, in the fourth and eighth years of education.

In addition to measurements of outcomes of education, the survey includes questionnaires for pupils, their parents, teachers and school heads, which are intended to identify variables linked to family and school circumstances that may help explain the findings among pupils. It is these questionnaires that have been used to prepare the indicators in the present publication.

The survey is based on representative samples of fourth and eighth year classes. These classes are given in schools able to offer provision lasting a greater or lesser number of years

The sampling procedure involved selecting schools and then students from a class in the fourth and eighth grades. It sought to offer each student the same probability of being selected irrespective of the size of the school he or she attended. For this purpose, schools were weighted in such a way that the probability that they would be selected was inversely proportional to their size. This explains why the figures does not directly show the proportions of teachers or school heads who gave a particular reply, but the proportions of pupils whose teacher or students in the school whose school head gave this reply.

The EU average presented in the PISA and TIMSS figures is an average estimate taking into account the absolute size of the population in each EU-27 country participating in each survey. The EU average was constructed in the same way as the OECD total (i.e., the average across OECD countries, taking absolute sample size into account).

The indicators derived from the OECD/PISA and IEA/TIMSS databases have to be interpreted in context. For example, the percentage of pupils aged 15 who said they had a computer at home cannot be interpreted as the percentage of families with a computer. Neither can the percentage of pupils in the fourth year of primary school who said they had a computer at home.

Definition of statistical tools and notes on the calculations

Correlation coefficient: The correlation coefficient indicates the degree of association between two variables, of which the values may vary within the limits from -1 to +1. Negative values of the correlation coefficient reflect an inverse relationship between the two variables: the values of one variable decrease as the values of the other variable increase. For instance, the coefficient of variation between the age of an individual and his remaining life expectancy tends to -1. When the values of two variables increase or decrease more or less simultaneously, the correlation coefficient is positive. For instance, there is a positive correlation between the size of an individual and the size of his feet. The closer a correlation approaches -1 or +1, the stronger the relationship between the two variables. A correlation coefficient with a value of 0 reflects the absence of any relationship between the two variables.

Percentile: A percentile is a value on a scale of one hundred that indicates the percent of a distribution that is equal to or below this value. The median is defined conveniently as the 50^{th} percentile. For example, the smallest test score which is, greater than 90 % of the scores of the people taking the test, is said to be at the 90th percentile. In short, percentiles are the 99 values that divide a set of statistical data or a frequency distribution into 100 sub-divisions, each containing the same (or approximately the same) number of individuals.

Purchasing Power Standard: Purchasing Power Standard (PPS) shall mean the artificial common reference currency unit used in the European Union to express the volume of economic aggregates for the purpose of spatial comparisons in such a way that price level differences between countries are eliminated. Economic volume aggregates in PPS are obtained by dividing their original value in national currency units by the respective PPP. PPS thus buys the same given volume of goods and services in all countries, whereas different amounts of national currency units are needed to buy this same volume of goods and services in individual countries, depending on the price level.

Standard error: The standard error corresponds to the standard deviation of the sampling distribution of a population parameter. It is a measure of the degree of uncertainty associated with the estimate of a population parameter inferred from a sample. Indeed, due to the randomness of the sampling procedure, one could have obtained a different sample from which a more or less different results could have been inferred. Suppose that, based on a given sample, the estimated population average were 10 and the standard error associated with this sample estimate were two units. One could then infer with 95 % confidence that the population average must lie between 10 plus and 10 minus two standard deviations, i.e. between 6 and 14.

TABLE OF FIGURES

ANNEX

Tables of data by Figure with Percentage of students and standard error (se)

Students in the fourth and eighth grades using computers at home and in school, (Figure A4)

	Fourth grade				Eighth grade			
	Home		Schools		Home		Schools	
	Percentage	se	Percentage	se	Percentage	se	Percentage	se
EU	92.7	0.20	60.7	0.71	37.5	0.69	5.4	0.20
BG	x	x	x	x	73.3	1.29	40.5	2.04
CZ	90.8	0.77	51.1	2.53	91.2	0.63	84.4	0.97
DK	95.9	0.46	78.8	1.34	x	x	x	x
DE	94.7	0.38	37.5	1.74	x	x	x	x
IT	90.6	0.60	63.2	1.99	97.8	0.31	60.3	2.04
CY	x	x	x	x	92.9	0.36	82.2	0.65
LV	79.7	1.25	23.2	1.65	x	x	x	x
LT	82.8	1.14	21.9	1.82	85.3	0.81	43.9	2.04
HU	88.0	0.89	42.9	2.52	88.9	0.71	77.6	0.97
MT	x	x	x	x	96.9	0.28	87.4	0.53
NL	97.2	0.35	83.2	1.37	x	x	x	x
AT	94.0	0.41	37.4	1.81	x	x	x	x
RO	x	x	x	x	72.5	1.54	51.0	2.86
SI	95.8	0.30	33.3	1.63	97.6	0.29	53.8	1.49
SK	81.4	0.98	46.7	2.16	x	x	x	x
SE	96.5	0.35	58.5	2.10	98.6	0.20	68.5	1.39
UK-ENG	92.3	0.59	85.8	0.92	96.1	0.46	79.5	0.97
UK-SCT	92.7	0.54	87.0	0.73	95.8	0.47	73.7	1.10
NO	95.6	0.36	64.6	1.84	98.3	0.20	69.4	1.25
TR	x	x	x	x	39.5	1.48	73.8	1.93

x = Country that did not take part in the survey

Source: IEA, TIMSS 2007 database.

NB: Countries not participating in the survey for grade 4 and grade 8: BE, EE, IE, EL, ES, FR, LU, PL, PT, FI, UK-WLS/NIR, IS and LI.

Use of computers at home by 15 years old students for entertainment and school related work, 2009 (Figure A5)

Home											School									
Browse the Internet for fun					Use email						Browse the Internet for schoolwork					Use email for communication with other students about schoolwork				
Once a week		Every day		≥1 / week	Once a week		Every day		≥1 / week		Once a week		Every day		≥1 / week	Once a week		Every day		≥1 / week
%	se	%	se	%	%	se	%	se	%		%	se	%	se	%	%	se	%	se	%
24.0	0.19	60.0	0.22	84.0	28.9	0.22	38.9	0.22	67.8	EU	33.3	0.19	13.3	0.18	46.7	21.7	0.18	15.1	0.15	36.8
28.6	0.79	57.3	0.94	85.9	32.0	0.91	37.4	1.00	69.4	BE fr	24.7	0.99	7.9	0.62	32.6	20.7	1.02	10.0	0.58	30.7
32.0	1.73	51.6	1.94	83.6	31.7	1.59	38.6	1.73	70.3	BE de	19.8	1.46	2.7	0.60	22.5	18.8	1.32	11.3	1.16	30.1
28.2	0.76	60.6	0.84	88.8	31.9	0.83	51.6	0.95	83.5	BE nl	39.5	0.91	12.3	0.68	51.9	25.5	0.76	13.2	0.67	38.7
15.5	0.61	65.6	1.35	81.1	26.5	0.88	34.0	0.94	60.4	BG	26.6	0.96	25.0	0.95	51.6	20.6	0.56	25.3	0.93	45.9
19.6	0.68	68.5	0.75	88.1	29.5	0.61	53.2	0.83	82.8	CZ	28.6	0.66	17.3	0.64	45.9	20.2	0.61	17.4	0.57	37.7
24.9	0.72	67.9	0.81	92.8	32.5	0.83	45.6	0.92	78.1	DK	47.0	0.90	14.1	0.79	61.1	22.5	0.66	6.0	0.39	28.5
23.7	0.73	63.4	0.78	87.1	29.6	0.76	42.5	0.87	72.2	DE	32.6	0.74	7.3	0.50	40.0	22.6	0.61	14.2	0.57	36.8
21.3	0.61	71.9	0.71	93.2	33.2	0.74	46.8	0.81	80.1	EE	39.4	0.79	11.1	0.56	50.5	25.1	0.82	15.5	0.50	40.6
33.7	0.78	46.2	0.99	79.9	26.6	1.00	26.8	0.93	53.4	IE	23.0	0.81	5.8	0.34	28.8	12.2	0.64	5.8	0.42	18.0
22.7	0.70	50.6	1.07	73.3	20.7	0.61	38.7	0.75	59.4	EL	21.4	0.69	20.2	0.67	41.6	17.6	0.64	23.9	0.68	41.5
26.0	0.49	56.9	0.59	83.0	29.6	0.57	38.6	0.65	68.1	ES	33.3	0.52	15.3	0.47	48.5	24.6	0.56	20.1	0.48	44.7
22.2	0.37	58.6	0.50	80.8	23.8	0.36	41.9	0.47	65.6	IT	31.9	0.43	14.3	0.28	46.2	19.2	0.33	15.8	0.29	35.0
25.5	1.07	54.4	1.48	79.9	31.8	0.70	41.5	0.89	73.3	LV	31.8	1.10	9.3	0.66	41.2	26.0	0.65	20.6	0.75	46.6
22.3	0.64	61.0	0.83	83.3	27.7	0.68	45.2	0.88	72.9	LT	32.2	0.69	12.1	0.55	44.3	27.5	0.75	20.8	0.66	48.2
24.5	0.84	60.2	1.12	84.7	34.6	0.79	34.9	0.90	69.4	HU	37.5	0.82	13.0	0.56	50.5	27.0	0.68	18.6	0.78	45.6
:	:	:	:	:	:	:	:	:	:	NL	37.7	1.01	15.4	0.63	53.2	29.9	0.86	12.9	0.58	42.8
26.9	0.72	61.2	0.79	88.1	31.5	0.82	43.9	1.07	75.3	AT	34.4	0.78	8.4	0.50	42.7	23.0	0.67	12.4	0.62	35.4
24.6	0.70	54.3	0.98	78.9	29.5	0.75	22.3	0.66	51.8	PL	38.0	0.71	18.8	0.74	56.7	18.1	0.64	10.5	0.51	28.6
31.1	0.69	52.5	0.81	83.6	30.7	0.69	47.7	0.81	78.4	PT	42.6	0.84	18.1	0.60	60.7	31.1	0.77	23.1	0.71	54.2
22.7	0.73	67.5	0.81	90.2	30.7	0.79	51.8	0.82	82.5	SI	35.1	0.80	9.3	0.47	44.4	28.2	0.73	21.5	0.61	49.7
20.8	0.76	61.2	0.94	82.0	27.3	0.76	39.7	0.69	67.0	SK	24.3	0.69	15.2	0.89	39.4	23.9	0.67	26.4	0.78	50.3
18.6	0.55	75.1	0.64	93.7	34.2	0.67	42.1	0.76	76.2	FI	14.5	0.59	3.3	0.44	17.8	7.5	0.42	3.2	0.32	10.7
21.0	0.64	72.8	0.70	93.9	34.1	0.69	38.0	0.80	72.0	SE	37.6	0.94	9.9	0.47	47.5	14.6	0.65	7.5	0.45	22.1
23.1	0.80	70.2	0.83	93.3	35.0	0.95	30.7	0.73	65.8	IS	26.2	0.76	5.5	0.44	31.7	15.2	0.60	5.2	0.41	20.4
31.3	2.26	60.9	2.43	92.2	40.2	2.45	43.2	2.58	83.4	LI	30.8	2.56	3.4	0.92	34.2	22.4	2.02	9.3	1.42	31.7
18.6	0.68	75.9	0.83	94.5	33.7	0.65	39.9	0.80	73.6	NO	48.8	0.94	14.8	0.72	63.7	11.1	0.60	4.0	0.35	15.1
26.7	0.66	27.9	0.79	54.7	26.2	0.72	29.6	0.79	55.8	TR	35.1	0.75	18.0	0.68	53.1	27.7	0.69	17.6	0.74	45.3

Source: OECD, PISA 2009 database.

NB: Countries not participating in the ICT survey: FR, CY, LU, MT, RO and UK.

Students in the fourth grade who never use a computer in their mathematics or science class, even where they are available in the classroom, for looking up ideas and information or practicing skills and procedures, as reported by their teacher, 2007 (Figure C5)

	Mathematics				Science			
	Never used for practice skills and procedures		Never used for looking up ideas and information		Never used for practice skills and procedures		Never used for looking up ideas and information	
	Percentage	se	Percentage	se	Percentage	se	Percentage	se
EU	12.7	1.50	43.7	2.15	45.8	2.25	8.6	1.19
CZ	4.3	1.91	40.1	5.10	20.9	4.05	7.0	2.72
DK	10.4	2.68	27.8	4.23	40.8	5.09	5.9	2.47
DE	17.2	3.36	60.5	5.14	66.3	4.15	14.4	3.03
IT	25.1	5.63	37.2	6.02	24.3	4.88	2.7	1.59
LV	35.6	6.22	22.4	7.13	43.3	7.47	1.7	1.69
LT	15.1	3.22	13.6	4.57	20.5	4.64	5.5	3.17
HU	12.2	4.86	44.5	8.81	40.0	9.25	25.5	7.81
NL	1.8	0.94	34.1	4.65	60.7	5.58	5.5	2.57
AT	15.2	2.58	65.3	4.00	49.7	3.27	16.9	2.79
SI	9.2	2.92	26.8	3.85	27.4	4.14	5.9	2.31
SK	16.1	3.97	22.4	4.10	29.6	4.62	9.1	2.87
SE	27.3	4.09	65.2	4.89	74.0	3.41	13.8	2.85
UK-ENG	6.2	2.41	33.6	3.45	27.1	4.18	3.1	1.78
UK-SCT	6.1	1.89	31.4	3.79	40.7	4.10	0.0	0.00
NO	3.9	1.48	43.9	4.10	66.1	5.11	11.9	3.24

Source: IEA, TIMSS 2007 database.

NB: Countries not participating in the survey: BE, BG, EE, IE, EL, ES, FR, CY, LU, MT, PL, PT, RO, FI, UK-WLS/NIR, IS, LI and TR.

Students in the fourth and eighth grades who NEVER used a computer in their science class, even where they were available in the classroom, as reported by their teacher, 2007 (Figure C6)

	Fourth grade				Eighth grade			
	Never used for studying natural phenomena through simulations		Never used for doing scientific procedures or experiments		Never used for studying natural phenomena through simulations		Never used for doing scientific procedures or experiments	
	Percentage	se	Percentage	se	Percentage	se	Percentage	se
EU	59.8	1.95	50.5	2.02	50.3	1.74	46.7	1.92
BG	x	x	x	x	57.9	4.09	48.5	4.70
CZ	68.3	5.19	66.9	5.47	53.5	3.38	52.1	3.29
DK	65.0	4.64	66.2	5.21	x	x	x	x
DE	79.6	2.92	71.2	3.63	x	x	x	x
IT	40.1	6.25	38.8	5.62	58.6	5.86	63.9	5.26
CY	x	x	x	x	52.5	2.27	54.9	2.47
LV	63.2	7.36	59.1	7.68	x	x	x	x
LT	73.2	5.40	55.2	6.41	57.0	2.43	43.9	2.62
HU	71.6	7.03	61.4	7.77	48.0	3.81	45.7	3.79
MT	x	x	x	x	69.6	0.34	43.5	0.44
NL	76.2	4.89	70.6	4.84	x	x	x	x
AT	78.4	3.25	68.3	3.68	x	x	x	x
RO	x	x	x	x	25.4	2.76	19.5	2.80
SI	67.8	3.98	46.2	4.22	36.1	3.84	32.8	2.81
SK	67.9	4.68	54.1	5.40	x	x	x	x
SE	83.3	3.19	81.6	3.20	79.1	3.37	82.8	3.16
UK-ENG	31.2	4.34	15.7	3.71	46.5	4.21	39.4	3.91
UK-SCT	52.6	3.77	42.2	4.52	62.9	2.96	43.4	3.26
NO	69.0	4.78	71.4	4.42	48.0	3.91	51.0	4.17
TR	x	x	x	x	20.2	5.81	19.5	4.43

Source: IEA, TIMSS 2007 database. x = Country that did not take part in the survey

NB: Countries not participating in the survey for the fourth and eighth grades: BE, EE, IE, EL, ES, FR, LU, PL, PT, FI, UK-WLS/NIR, IS and LI.

Use of computers by 15 years-old students per week, during language of instruction and foreign language classes, 2009 (Figure C7)

Language of instruction									Foreign languages							
Never		0-30 minutes		31-60 minutes		≥ 60 minutes			Never		0-30 minutes		31-60 minutes		≥ 60 minutes	
%	se	%	se	%	se	%	se	pays	%	se	%	se	%	se	%	se
82.3	0.30	10.8	0.22	4.5	0.13	2.4	0.09	EU	78.2	0.29	12.7	0.20	6.5	0.14	2.6	0.07
93.9	0.74	3.4	0.54	1.5	0.29	1.2	0.22	BE fr	93.2	1.02	3.4	0.49	2.2	0.62	1.2	0.20
85.7	1.17	9.6	0.95	3.9	0.70	0.8	0.32	BE de	85.2	1.21	9.2	1.04	3.8	0.56	1.8	0.44
74.2	1.56	19.4	1.22	4.8	0.64	1.6	0.23	BE nl	74.2	1.28	17.1	1.02	6.7	0.44	1.9	0.23
76.0	1.18	11.8	0.77	6.9	0.49	5.3	0.55	BG	71.5	1.29	13.3	0.77	7.7	0.58	7.5	0.56
78.5	1.41	12.3	1.00	6.1	0.65	3.2	0.36	CZ	61.4	1.80	21.2	0.97	13.3	1.03	4.2	0.40
23.0	1.18	35.9	0.91	25.2	1.02	15.9	1.01	DK	39.1	1.36	33.3	1.01	17.8	0.88	9.7	0.77
83.1	0.99	12.3	0.78	3.0	0.28	1.7	0.35	DE	82.1	0.95	13.2	0.75	3.5	0.38	1.2	0.17
87.5	1.13	9.2	0.86	2.6	0.43	0.7	0.11	EE	80.6	1.08	13.1	0.78	4.7	0.51	1.6	0.23
89.4	0.82	6.9	0.59	2.9	0.35	0.8	0.17	IE	83.9	1.27	9.8	0.84	4.9	0.57	1.4	0.27
82.3	0.78	10.4	0.66	4.0	0.33	3.3	0.28	EL	77.1	0.91	10.1	0.58	6.9	0.50	6.0	0.47
88.3	0.90	6.4	0.51	3.7	0.42	1.6	0.22	ES	81.5	1.19	9.9	0.63	6.6	0.59	2.1	0.21
88.6	0.49	5.1	0.21	3.9	0.25	2.5	0.18	IT	74.7	0.87	9.8	0.36	10.9	0.52	4.6	0.24
89.3	0.62	6.1	0.51	2.8	0.28	1.8	0.23	HU	84.7	1.14	8.7	0.65	4.8	0.62	1.7	0.22
87.0	0.67	9.1	0.46	2.4	0.35	1.5	0.28	LV	75.5	1.20	14.4	0.81	7.0	0.53	3.1	0.27
87.2	0.87	9.2	0.67	2.7	0.31	0.9	0.15	LT	82.3	0.96	11.8	0.68	4.2	0.40	1.7	0.19
60.5	2.40	25.1	1.57	11.3	0.97	3.1	0.46	NL	63.4	1.85	23.6	1.29	10.1	0.83	2.9	0.43
76.2	1.19	12.5	0.72	5.5	0.54	5.8	0.66	AT	79.0	1.25	12.7	0.79	5.3	0.48	3.0	0.57
94.3	0.48	3.7	0.37	1.3	0.17	0.7	0.11	PL	91.2	0.67	5.5	0.52	2.1	0.23	1.2	0.18
83.7	0.88	9.8	0.61	3.3	0.26	3.2	0.38	PT	81.7	0.98	10.8	0.64	4.7	0.32	2.8	0.39
86.4	0.62	8.7	0.50	2.4	0.23	2.5	0.29	SI	80.9	0.78	11.2	0.59	4.7	0.33	3.2	0.29
89.3	0.78	6.6	0.56	2.7	0.34	1.4	0.23	SK	73.5	1.90	15.5	1.01	8.0	0.84	3.0	0.61
67.2	1.85	25.6	1.40	6.0	0.70	1.3	0.25	FI	58.8	1.99	30.8	1.49	9.1	0.81	1.3	0.24
45.9	1.70	34.7	1.04	14.2	0.91	5.2	0.54	SE	66.1	1.21	23.7	1.03	7.9	0.57	2.3	0.26
78.5	0.66	15.7	0.58	4.5	0.26	1.2	0.18	IS	62.8	0.74	21.9	0.70	10.4	0.47	4.9	0.35
59.3	2.33	26.9	2.28	9.9	1.67	3.9	0.98	LI	60.9	2.70	28.1	2.51	8.0	1.51	3.1	0.94
30.6	1.35	37.4	1.08	21.9	1.02	10.1	0.85	NO	48.7	1.31	27.4	0.97	15.2	0.69	8.7	0.60
58.8	1.21	22.7	0.83	12.0	0.60	6.5	0.45	TR	66.7	1.23	16.8	0.75	10.2	0.53	6.4	0.45

Source: OECD, PISA 2009 database.

Students in the fourth grade who use a computer for their mathematics and science schoolwork (in and out of school) at least once a month, 2007 (Figure C8)

	Mathematics				Science			
	Day + at least once a week		Once or twice a month		Day + at least once a week		Once or twice a month	
	Percentage	se	Percentage	se	Percentage	se	Percentage	se
EU	22.5	0.49	16.2	0.37	18.3	0.40	19.8	0.42
CZ	24.6	1.20	14.2	1.03	22.2	1.03	17.8	1.00
DK	16.5	1.38	36.5	2.20	10.2	1.12	24.3	1.29
DE	16.1	0.81	15.6	0.85	17.5	0.85	21.2	0.94
IT	18.3	1.00	8.9	0.75	20.3	1.20	14.8	1.09
LV	10.9	1.15	8.2	0.80	13.4	0.91	17.8	0.85
LT	21.7	0.93	13.2	0.76	28.0	1.26	21.4	1.02
HU	16.7	1.01	9.3	0.56	16.9	0.71	13.0	0.66
NL	40.4	2.21	17.3	1.09	11.6	1.62	12.0	1.02
AT	10.4	0.59	6.7	0.45	11.5	0.65	9.5	0.60
SI	19.1	0.83	14.5	0.78	20.0	0.86	18.4	0.74
SK	16.9	1.01	9.8	0.72	18.0	1.10	13.2	0.78
SE	13.1	1.16	16.0	1.11	8.0	0.75	13.3	0.85
UK-ENG	31.0	1.50	22.6	1.02	22.2	1.07	27.5	1.02
UK-SCT	35.3	1.78	19.7	1.00	19.3	1.33	21.3	1.06
NO	26.6	1.52	22.9	1.16	10.9	0.85	15.3	0.92

Source: IEA, TIMSS 2007 database.

NB: Countries not participating in the survey: BE, BG, EE, IE, EL, ES, FR, CY, LU, MT, PL, PT, RO, FI, UK-WLS/NIR, IS, LI and TR.

Students in the eighth grade attending a school which had difficulties filling vacancies for specialist teachers, as reported by school heads, 2007 (Figure D3)

	Mathematics				Science				ICT			
	Difficult vacancies		Very vacancies		Difficult vacancies		Very vacancies		Difficult vacancies		Very vacancies	
	%	se	%	se	%	se	%	se	%	se	%	se
EU-27	18.7	1.55	11.6	1.25	20.6	1.58	9.2	1.17	18.1	1.35	11.2	1.28
BG	7.0	1.91	3.0	1.38	7.3	2.15	3.1	1.39	13.4	2.49	7.4	2.23
CZ	7.1	2.16	7.9	2.78	14.3	3.41	3.0	1.51	12.0	2.91	9.8	3.09
IT	16.2	2.71	4.2	1.60	16.2	2.71	4.2	1.60	19.5	2.96	6.7	2.03
CY	18.8	0.20	1.8	0.07	17.5	0.23	1.9	0.08	15.6	0.20	4.3	0.09
LT	14.2	2.79	8.3	2.45	16.8	3.30	4.1	1.63	13.1	2.91	16.7	3.31
HU	4.6	2.05	0.7	0.02	7.8	2.36	2.1	1.23	5.6	1.70	0.7	0.02
MT	17.9	0.15	1.8	0.06	31.7	0.22	8.6	0.11	16.5	0.19	7.0	0.12
RO	9.2	2.86	0.9	0.91	14.2	3.42			10.9	2.88	13.0	3.25
SI	7.4	2.32	1.5	1.09	1.5	1.09	1.0	1.01	5.5	2.07	1.6	1.12
SE	11.9	2.65	1.0	0.40	14.7	3.02	1.1	0.41	2.5	1.42	1.3	0.82
UK-ENG	32.9	3.77	29.0	3.83	34.3	4.36	22.9	3.54	27.3	3.45	19.9	3.41
UK-SCT	20.5	3.82	14.1	3.08	22.6	4.25	11.8	3.40	16.7	3.31	6.8	2.66
NO	16.9	3.68	3.6	1.61	19.1	3.74	5.1	1.95				
TR	13.2	3.20	9.3	2.15	11.7	2.75	7.9	2.35	26.7	4.37	20.3	3.63

Source: IEA, TIMSS 2007 database.

NB: Countries not participating in the survey for the fourth and eighth grades: BE, EE, IE, EL, ES, FR, LU, PL, PT, FI, UK-WLS/NIR, IS and LI.

Students in the fourth and eighth grades whose teachers report having participated in CPD on integrating ICT in mathematics and science teaching in the past two years, 2007 (Figure D6)

	Fourth grade				Eighth grade			
	Mathematics		Science		Mathematics		Science	
	Percentage	se	Percentage	se	Percentage	se	Percentage	se
EU-27	25.0	1.17	16.0	1.01	51.0	1.79	41.0	1.46
BG	x	x	x	x	69.0	3.55	76.3	2.67
CZ	33.5	3.55	16.7	3.07	48.9	4.58	55.0	2.73
DK	21.5	3.02	5.7	1.99	x	x	x	x
DE	6.9	1.53	6.7	1.56	x	x	x	x
IT	33.3	3.18	16.9	2.33	42.9	3.09	24.9	2.90
CY	x	x	x	x	59.1	3.36	67.6	1.00
LV	16.8	3.01	28.6	3.67	x	x	x	x
LT	55.9	3.55	35.2	3.18	69.4	3.47	68.7	2.19
HU	11.2	2.75	13.9	2.49	25.9	3.63	34.8	2.74
MT	x	x	x	x	83.1	0.18	37.3	0.29
NL	17.7	2.92	7.0	2.29	x	x	x	x
AT	5.9	1.72	13.4	1.91	x	x	x	x
RO	x	x	x	x	56.5	3.93	67.2	2.60
SI	24.6	2.77	29.3	2.85	61.9	3.04	43.2	2.21
SK	54.9	3.20	44.8	3.64	x	x	x	x
SE	4.8	0.91	4.2	1.33	8.6	1.83	10.3	1.85
UK-ENG	44.3	4.05	27.9	3.47	62.4	4.24	44.0	3.03
UK-SCT	51.2	4.68	27.2	3.63	78.9	2.96	63.9	2.10
NO	11.9	2.76	4.2	1.50	34.5	3.71	15.2	2.69
TR	x	x	x	x	18.3	3.29	27.6	3.63

Source: IEA, TIMSS 2007 database.

NB: Countries not participating in the survey for the fourth and eighth grades: BE, EE, IE, EL, ES, FR, LU, PL, PT, FI, UK-WLS/NIR, IS and LI.

Students in the fourth and eighth grades attending a school with staff available to help teachers using ICT for teaching and learning as reported by the school head, 2007 (Figure E2)

	Fourth grade				Eighth grade			
	Mean number of computers per school		Mean number of students per school		Mean number of computers per school		Mean number of students per school	
	Percentage	se	Percentage	se	Percentage	se	Percentage	se
EU	18.2	0.39	63.4	0.78	96.3	3.95	134.1	1.95
BG	x	x	x	x	19.7	1.27	67.3	1.32
CZ	22.2	0.99	41.7	1.24	26.1	1.09	58.0	2.33
DK	53.1	3.11	43.3	1.14	x	x	x	x
DE	11.9	0.41	63.0	1.59	x	x	x	x
IT	19.0	0.96	104.9	2.21	24.0	0.98	146.9	4.42
CY	x	x	x	x	42.4	0.13	166.5	0.21
LV	15.7	0.89	41.7	1.13	x	x	x	x
LT	11.4	0.69	58.1	2.38	23.3	0.97	94.2	3.48
HU	14.8	1.00	51.4	1.50	22.8	1.00	54.4	1.55
MT	x	x	x	x	44.4	0.07	122.9	0.27
NL	15.3	1.47	33.6	0.92	x	x	x	x
AT	7.0	0.48	45.2	1.71	x	x	x	x
RO	x	x	x	x	13.6	0.86	63.4	2.49
SI	20.4	0.84	50.3	1.31	22.4	1.15	54.1	0.95
SK	16.2	0.62	45.7	1.42	x	x	x	x
SE	11.6	1.45	39.7	0.91	32.4	1.83	106.5	1.94
UK-ENG	26.4	1.42	49.3	1.61	254.8	12.66	190.6	4.02
UK-SCT	23.0	1.10	41.1	1.58	203.1	7.53	182.9	4.14
NO	19.7	1.06	41.4	1.13	40.3	2.06	94.3	2.36
TR	x	x	x	x	21.9	0.78	134.2	5.83

Source: IEA, TIMSS 2007 database. x = Country that did not take part in the survey

NB: Countries not participating in the survey for the fourth and eighth grades: BE, EE, IE, EL, ES, FR, LU, PL, PT, FI, UK-WLS/NIR, IS and LI.

Distribution of the student/computer ratio between schools attended by pupils aged 15, 2009 (Figure E3)

	P25	se	P75	se	P50	se
EU	1.37	0.02	3.67	0.06	2.15	0.04
BE fr	2.08	0.19	4.23	0.28	2.62	0.50
BE de	1.29	0.00	2.62	0.26	1.63	0.00
BE nl	0.88	0.10	2.28	0.17	1.50	0.21
BG	1.84	0.04	4.27	0.34	2.73	0.25
CZ	1.28	0.06	2.73	0.17	1.81	0.09
DK	0.89	0.07	2.38	0.15	1.32	0.12
DE	1.47	0.16	3.46	0.26	2.15	0.13
EE	1.41	0.10	2.92	0.15	2.19	0.14
IE	1.33	0.12	2.96	0.22	2.08	0.18
EL	3.79	0.34	8.19	0.35	6.00	0.33
ES	1.44	0.07	2.70	0.12	1.95	0.04
FR	:	:	:	:	:	:
IT	1.75	0.06	4.93	0.17	2.92	0.14
CY	x	x	x	x	x	x
LV	1.21	0.10	2.58	0.16	1.75	0.09
LT	1.68	0.06	3.38	0.28	2.33	0.07
LU	1.00	0.00	2.88	0.00	2.18	0.00

	P25	se	P75	se	P50	se
HU	1.50	0.21	3.10	0.21	2.10	0.13
MT	x	x	x	x	x	x
NL	1.30	0.14	3.00	0.23	1.93	0.11
AT	0.79	0.06	2.08	0.32	1.09	0.11
PL	2.75	0.11	6.42	0.25	4.39	0.20
PT	1.43	0.09	2.88	0.15	2.00	0.11
RO	1.80	0.11	3.93	0.34	2.86	0.14
SI	2.19	0.00	5.60	0.00	3.73	0.01
SK	1.83	0.13	3.70	0.25	2.62	0.15
FI	1.88	0.15	3.60	0.17	2.67	0.12
SE	1.89	0.07	4.55	0.25	3.00	0.17
UK-ENG	0.93	0.05	1.71	0.10	1.28	0.09
UK-WLS	1.11	0.04	1.99	0.12	1.43	0.06
UK-NIR	1.04	0.08	1.85	0.10	1.26	0.05
UK-SCT	0.56	0.04	1.07	0.05	0.80	0.07
IS	1.00	0.01	2.30	0.00	1.77	0.00
NO	1.00	0.00	2.28	0.14	1.52	0.06
LI	0.95	0.00	2.88	0.00	1.90	0.00
TR	3.13	0.34	11.04	1.46	5.56	0.52

Source: OECD, PISA 2009 database.

France: The country took part in PISA 2009 but didn't administrate the school questionnaire. In France, 15-year students are distributed among two different types of schools and therefore analysis on school level might be not coherent.

Students in the fourth and eighth grades with computers and Internet access during their mathematics lessons, as reported by their teacher, 2007 (Figure E4)

	Fourth Grade				Eighth grade			
	Computers		Internet		Computers		Internet	
	Percentage	se	Percentage	se	Percentage	se	Percentage	se
EU	56.6	1.38	81.5	1.61	45.7	1.68	88.8	1.58
BG	x	x	x	x	46.1	3.51	82.3	4.13
CZ	58.9	3.55	84.4	3.78	59.3	4.47	93.8	2.95
DK	94.8	1.44	100.0	0.00	x	x	x	x
DE	53.6	3.51	70.3	4.15	x	x	x	x
IT	30.8	2.72	50.6	5.35	29.9	3.24	90.5	2.81
CY	x	x	x	x	10.2	1.91	92.7	7.51
LV	22.1	2.78	91.0	4.27	0.0	0.00	0.0	0.00
LT	39.0	3.68	67.8	5.91	73.0	3.24	92.5	2.69
HU	23.2	3.52	79.6	8.81	39.2	3.85	87.7	5.89
MT	x	x	x	x	81.2	0.21	91.8	0.21
NL	84.0	2.89	95.5	2.49	x	x	x	x
AT	69.5	2.83	63.6	3.96	x	x	x	x
RO	x	x	x	x	49.7	3.90	57.2	6.37
SI	39.1	3.06	94.5	2.04	52.4	2.64	94.3	2.00
SK	47.0	3.87	90.6	3.60	x	x	x	x
SE	66.9	3.36	99.2	0.80	40.5	3.25	96.3	1.75
UK-ENG	75.7	3.45	97.5	1.75	58.1	3.96	94.0	2.74
UK-SCT	93.0	2.44	96.2	1.47	37.0	3.59	94.0	2.35
NO	68.9	3.34	96.0	1.40	70.6	3.28	99.3	0.66
TR	x	x	x	x	29.7	4.14	81.0	6.92

x = Country that did not take part in the survey

Source: IEA, TIMSS 2007 database.

NB: Countries not participating in the survey for the fourth and eighth grades: BE, EE, IE, EL, ES, FR, LU, PL, PT, FI, UK-WLS/NIR, IS and LI.

Pupils in the fourth and eighth grades attending a school where the instruction capacity was considerably affected by a lack of computer support staff, as reported by the school head, 2007 (Figure E8)

	Fourth grade				Eighth grade			
	Some		A lot		Some		A lot	
	Percentage	se	Percentage	se	Percentage	se	Percentage	se
EU	21.6	1.10	18.3	1.11	15.9	1.51	21.7	1.44
BG	x	x	x	x	16.1	3.24	22.9	3.82
CZ	14.2	3.42	3.5	1.60	12.6	3.12	5.2	1.77
DK	13.4	3.77	2.5	1.46	x	x	x	x
DE	26.3	2.36	17.2	2.59	x	x	x	x
IT	22.0	3.36	39.8	3.75	20.6	3.05	44.6	3.62
CY	x	x	x	x	20.4	0.19	15.9	0.17
LV	14.9	2.98	12.3	2.60	x	x	x	x
LT	12.8	2.57	20.7	3.57	14.9	3.17	13.7	3.24
HU	13.5	3.10	14.8	3.61	13.5	3.23	15.0	3.10
MT	x	x	x	x	15.9	0.17	5.2	0.09
NL	24.6	3.44	13.9	3.63	x	x	x	x
AT	20.6	3.32	14.1	2.65	x	x	x	x
RO	x	x	x	x	18.6	4.11	36.6	4.28
SI	3.0	1.49	2.9	1.46	6.2	1.96	1.3	0.89
SK	15.6	2.82	16.3	3.02	x	x	x	x
SE	25.8	3.91	9.6	2.61	23.1	3.88	4.4	1.87
UK-ENG	18.5	3.67	6.8	1.88	10.2	2.76	4.6	1.91
UK-SCT	24.9	3.97	22.5	3.88	18.3	3.72	5.8	2.38
NO	46.9	4.38	10.6	2.39	39.3	4.48	6.2	2.24
TR	x	x	x	x	23.3	3.60	40.2	4.07

x = Country that did not take part in the survey

Source: IEA, TIMSS 2007 database.

NB: Countries not participating in the survey for the fourth and eighth grades: BE, EE, IE, EL, ES, FR, LU, PL, PT, FI, UK-WLS/NIR, IS and LI.

ACKNOWLEDGEMENTS

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EACEA; Eurydice

Key Data on Learning and Innovation through ICT at School in Europe

2011 Edition

Brussels: Eurydice

2011 – 120 p.

ISBN 978-92-9201-184-0

doi:10.2797/61068

Descriptors: ICT, ICT equipment, computer-assisted learning, basic skills, cross-curricular competences, computer literacy, curriculum, curriculum subject, timetable, teaching method, teacher education, specialist teacher, internet usage, evaluation method, educational innovation, creativity, information to parents, educational software, statistical data, PISA, TIMSS, primary education, secondary education, EFTA, European Union

EN

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