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Status quo report on DGS usage

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[1] OJ L 79, 24.3.2005, p. 1.

Appendices

1 Introduction

The following report is based on information coming from 24 European countries. It must be pointed out that it is difficult to obtain information and in particular reliable information about the quantitative and qualitative use of DGS[1]. However from the information that we could gather, some trends emerge.

At the beginning of year 2008, there are **few countries referring in an explicit way** to DGS (one quarter of the 24 countries) in their national curriculum or guidelines. Among the other countries not mentioning DGS, half of them refer to ICT[2] in general, while the other half does not even mention ICT at all. However in some of these latter countries there may be some recommendations to use DGS by educational inspectors like in Cyprus, or in Denmark for experimental schools.

The availability of DGS in schools **varies greatly** from very few schools (Cyprus, Bulgaria) to 25% of schools (Czech Republic and Slovakia) or even to all schools, as in Greece, for countries that have a national licence of a specific DGS software.

But the **availability** of DGS in schools **does not automatically imply their use**. For example in Lithuania, while there is a national licence, it seems that only one fourth of schools regularly use DGS. Furthermore one must distinguish between using DGS regularly from using it exceptionally. For example, 40% of 250 Austrian geometry teachers asked about whether they used some DGS, answered that they used at least one time in their career such software, but only one sixth of them declared to use it regularly. At the time being there is no reliable precise information on the frequency of real use in classrooms.

From all the above criteria (explicit reference in national curricula, availability in schools, regular and frequent use for only a smaller proportion of teachers) it can be concluded that, currently, DGS are not used on a large scale in Europe.

Finally it must also be stressed that the use of a DGS in classrooms may also cover various types of use: from a mere demonstration in front of passive students, to active students involved in problem solving tasks through some DGS. No large-scale study of the different types of uses was carried out but qualitative studies within specific countries seem to show the prevalence of demonstration and illustration uses over open-ended activities for students.

This report consists of a main section and three appendices. The main section summarizes the answers we have collected, among the different contact persons in each country, to the following questions:

1- Does a reference to DGS appears in the national curriculum?
2- Data on the usage of DGS.

One of the appendices includes the complete set of received answers of these questions.

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[1] DGS: Dynamic Geometry Systems.

[2] ICT: Information and Communication Technology.

Moreover there is one appendix collecting all the answers from a survey that was conducted by Intergeo in 2006, contacting relevant education officers and personalities in all the European countries. Finally, the appendices include the references and further bibliography used during the preparation of the report.

2 Report by country

2.1 Austria

There is a reference to the use of calculators and computers in the mathematics national curriculum for schools called “Hauptschule” (10-14 year old students not continuing to higher school levels) but not to DGS.

There is a reference to the use of appropriate geometry 2D and 3D software in the program of the subject matter entitled “Geometric drawing” for the lower level of schools called “Allgemeinbildende höhere Schulen” (10-14 year old students who will continue to higher school levels). We can consider this reference as implicit, but it does not explicitly refer to DGS.

There is an explicit reference to DGS with a strong recommendation for their use which is “unavoidable” (unverzichtbar) in the program of the upper level of “Allgemeinbildende höhere Schulen” (15-18 year students).

A thesis [MULLER] is available on the use of new media in teaching geometric drawing and descriptive geometry. This thesis, based on answers by 250 teachers, shows that 40% of teachers said that they have used at least one time a DGS but not even one sixth of the teachers declared to regularly use them.

2.2 Belgium

In Flanders, there is no reference to DGS in the curriculum, and we did not succeed obtaining information from the French speaking community.

No data is available on the DGS usage.

2.3 Bulgaria

There is no reference to DGS in the curriculum, there are no official guidelines regarding the usage of geometry software.

The use of DGS is limited to a small number (30) of schools, the so-called mathematical or science-oriented schools (on a total of 800 such schools). The main argument for this situation is the lack of hardware resources. When they are used, DGS are used by teachers with a certain degree of programming knowledge, mostly for illustrative tasks in elementary geometry and specifically in the field of teacher education.

2.4 Cyprus

DGS are not mentioned in the curriculum. However their usage is strongly recommended by the inspectors of mathematics. The Ministry of Education has made a call for tenders for software development covering the gymnasium content (12-15) and expects to acquire some ready-made software, including DGS.

Very few teachers actually use the DGS in the classroom.

2.5 Czech Republic

DGS are not mentioned in curriculum, usage of ICT is only recommended.

In Czech Republic teachers are free to use the instrument they want to improve their teaching. Such instruments are not subject to any approval from any authority and the Ministry of Education doesn't provide access to them.

Within 1998-2007 the main seller of Cabri sold 460 licences of Cabri II, Cabri II plus, Cabri 3D. This number increases by 10% every year. On the base of sold DGS softwares we estimate that approximately 20% schools use DGS. The main software they use is Cabri II, Cabri II plus, Cabri 3D (Czech translation). Some schools use other software like GEONExT (Czech translation), Cinderella, Geogebra (Czech translation) etc. There is also special software e.g. for cube sections, descriptive geometry etc. which is used.

2.6 Denmark

DGS are not officially required in the curricula for neither the lower nor the upper secondary school. On the contrary, use of ICT is mandatory. But DGS are recommended as one possible way of using experimental methods.

In many schools such programs are not used at all or only rarely used. But there is a growing consensus about their importance and specially in the upper secondary school it is customary for many students to know about such programs.

2.7 Estonia

DGS are not mentioned in the curriculum, ICT in general is not mentioned neither.

No data is available concerning the DGS usage in school. Two DGS programs have been translated in Estonian.

2.8 Finland

DGS are not mentioned in the curriculum but ICT is recommended in general. There is a project in development to teach geometry in secondary level using DGS.

There is no data available concerning the usage of DGS but it seems not to be particularly spread.

2.9 France

In France, two documents describe the programme of studies: The curriculum itself and the accompanying documents. DGS are not explicitly mentioned in the curriculum, even if some sentences can indirectly refer to them. However the accompanying documents do explicitly mention DGS.

At the Collège level, the curriculum shows DGS as an alternative to paper and pencil environment, but no explicit or specific potentialities are mentioned. The accompanying documents go further by providing a lot of examples with their explanations.

At the Lycée level, the situation is equivalent: DGS are not explicitly mentioned in the curriculum but are in the accompanying document. The accompanying document reports on some advantages of the DGS usage: e.g. visualizing geometric invariants and properties that the students have to prove, experimenting with geometric figures, inspecting geometric constructions through the drag mode and, thus, motivating the need to do constructions based on geometric properties.

There is no quantitative data available concerning DGS usage in France. However a paper [E-CD] have studied the different subjects of dissertation chosen by the students following the standard teacher-training masters. These dissertations are viewed as a trace of teacher practice for, at least, young teachers. On a total of 582 dissertations, 59 concern the use of ICT in the classroom (10%). And on those 59 dissertations, 23 concern DGS (4% of the total).

2.10 Germany

In Germany, where the states are responsible for all school-related tasks, there is a reference to DGS only in few, but important, states. However, other regions have started to add a DGS reference to their curriculum and it is expected that all others will follow.

No data is available concerning DGS usage in classroom, but there is evidence that half of the teachers use computers regularly, or at least sometime, in teaching, with no precision on the software used. Some surveys show that DGS represent 30% of the computer usage in classroom.

2.11 Greece

There is no direct reference to DGS in the mathematic curriculum in Greece.

There are no official reports concerning the usage of DGS in Greek schools. However, thanks to a European framework project[1], most of schools in Greece are equipped with computers and software as well as some activities to use them. Thanks to the Kirki project, two DGS programs were translated into Greek and sent to 350 schools, back in 2002. Until the end of 2003, the Ministry of Education was training professors on how to use this software. After that the Ministry of Education decided to send the software to all public schools. Currently all the second grade schools (age 12 to 18) are provided with DGS programs.

2.12 Hungary

DGS are not mentioned in the curriculum and no data is available concerning their usage in classroom. Hungary has a very traditional vision of mathematic teaching and it is mainly hands-on (ruler, compass, …).

[1] Few projects have helped Greek school to be equipped with hardware, software and activities. One of them is "Odysseia – Hellenic Schools in the Information Society Programme", with a particular sub-project called Kirki: Adaptation of international educational software for use in the Greek school system. Another project is "Pleiades – develops and diffuses e-learning solutions in primary and secondary education schools", with two sub-projects: Amaltheia, procurement of existing educational software packages, and Niriides, development of integrated educational activity packages.

2.13 Ireland

No data available yet for Ireland.

2.14 Italy

Since September 2007, there is a new curriculum that provides some reference to geometry software. These references mainly state that geometry software should be uses to construct figures, the potential of the interaction with the figure is not mentioned.

No quantitative data is available concerning the usage in classroom. However, in the opinion of many consulted experts, DGS (and Cabri, in particular) are the most widely used mathematical programs at school. DGS are mainly used for exploration.

2.15 Latvia

No data available yet for Latvia.

2.16 Lithuania

DGS are not mentioned in curriculum, usage of ICT is only recommended.

A Geometer's Sketchpad licence was bought by the state and translated into Lithuanian language in 2003. It was provided to all the schools as a package, including some content (constructions, animations, etc.) to be used in the classroom.

The estimation is that approximately 25% schools use Geometer's Sketchpad.

2.17 Luxembourg

Luxembourg is probably the country where DGS are given the greatest importance in the curriculum. It appears explicitly mentioned for pupils age 13 to 18 and is referred not only as a way to built geometric figures, but also as an exploratory tool.

The didactical potential of DGS is precisely listed and explained in the official curriculum. The exploration capabilities are listed and their benefit on the pupil's learning process is emphasized. DGS are also mentioned as a way to connect all the mathematical fields together (algebra, geometry, calculus, …).

There are no precise data concerning the usage done in each school, but country licences exist for Cabri and Geometer's Sketchpad.

2.18 Malta

DGS are explicitly mentioned in the curriculum as a way to explore, practice and consolidate concepts.

All secondary students are exposed to DGS on a regular basis.

2.19 Netherlands

There is no mention to DGS in the curriculum.

There are no data available concerning DGS usage, however a country licence exists for Cabri and all schools and teachers have access to DGS.

2.20 Poland

DGS are not mentioned in the curriculum.

2.21 Portugal

The official curriculum for the Basic School (grades 1 to 9) in Portugal mentions the use of calculators and computers but is not explicit about DGS (this syllabus dates back to 1991). But lots of teachers (not the majority) use regularly DGS like Cabri and Sketchpad.

There is going to be a new syllabus (it was approved recently) that says explicitly that "DGS and applets favour also the understanding of concepts and geometric relations, so they should also be used." and DGS should be used "in exploratory tasks and investigations". The bibliography for this new official syllabus mentions the software Geogebra and the book on DG by J. King and D. Schattschneider.

In Secondary School (grades 10 to 12) the use of graphing calculators and computers is compulsory since 1997 and the official curriculum mentions frequently the importance of using DGS. Quite a few teachers use DGS like Cabri, Sketchpad and Cinderella. It should be mentioned that version 1 of Cinderella was translated into Portuguese and distributed to all Secondary Schools in 2001.

2.22 Romania

No data available yet for Romania.

2.23 Slovakia

DGS are not mentioned in curriculum, usage of ICT is only recommended. The country has bought a country licence for DGS.

The estimation is that approximately 25% schools use Cabri.

2.24 Slovenia

Usage of DGS in the Slovenian curriculum is recommended only.

DGS usage is occasional in Slovenia. Based on estimation from teachers interested in DGS, it is used from 5 to 10% of the teachers. It is thus reasonable to think that the usage is less than that.

2.25 Spain

The State-level secondary education curriculum, enacted in 2007, explicitly indicates,

in the area of Mathematics, the special interest in the use of DGS, allowing students to interact with figures, and to obtain from this interaction properties and relations, as well as to formulate and validate conjectures. In addition, the curriculum includes a variety of basic geometric notions and a reference to using computers and calculators in diverse math contexts. To a large extent the same applies to the different regional curricula (which complement State-level curriculum, with content ratio about 65/35 for State and regional curricula).

DGS are popular in the Spanish education community. But are much less popular using them in the classroom. There are no concrete data available at this moment. According to a 2006 report [PEREZ] about the use of computers and software by mathematics teachers at Madrid schools, DGS are about 61% of the software used by teachers. The results of this Madrid survey can be extrapolated to the whole of Spain.

Some of the Spanish textbooks, which are the principal guide to the classroom activities, include sections with Derive, Wiris, GeoGebra and/or Cabri activities.

2.26 Sweden

There is no reference to dynamic geometry in the mathematical curriculum in Sweden. No data are available on the DGS usage in classrooms.

2.27 United Kingdom

The UK has a good access to ICT in general, however DGS are not completely part of this. As mentioned by the Office for Standards in Education on its 2004 report [OSE]: *The availability of software to support the teaching of mathematics has improved since 2002. It was satisfactory in the majority of schools and good in almost half of the schools visited. In most schools there was a mixture of generic software and subject-specific packages. Most departments have good access to spreadsheets, databases, graph plotting software, LOGO and to specific items of software to support skills learning. An increasing number of teachers are making more use of the Internet but use of the powerful dynamic geometry or algebra software available remains more limited*.

Appendices

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- classes 8TE/8PO and 9TE/9PO: http://content.myschool.lu/sites/horaires/2007-2008/pdf/9TE/MATHE/MATHE_9TE_2_0.pdf
- classes 5 and 4: http://content.myschool.lu/sites/horaires/2007-2008/pdf/5C/MATHE/MATHE_5C_1_0.pdf
- classes 3B/3C/3D, 2B/2C/2D and 1B/1C/1D : http://content.myschool.lu/sites/horaires/2007-2008/pdf/3CB/MATHE/MATHE_3CB_1_0.pdf

□ Austrian curriculum : http://www.bmukk.gv.at/schulen/unterricht/index.xml

II Answers from education officers

The following tables provide, literally copied, the answers from a survey that was conducted in 2006 in all the European countries. In that survey was asked the following questions:

- □ Is the use of geometry software recommended or required by the curriculum?
- □ Are there user groups or teachers' associations who provide electronic content to be used with geometry software in teaching?

Austria	• Sabine Kroissenbrunner, sabine.kroissenbrunner@bmaa.gv.at • Ambassador (Austrian Embassy, Berlin) • "Danke für Ihr Schreiben vom 15. September d.J. und Ihr Interesse an der österreichischen Situation...." Einen direkten Link zu den Mathemathik-Lehrpläne n in Österreich finden Sie auf der Homepage des österreichischen Bundesministerium für Bildung, Wissenschaft und Kultur. Die Internetadresse lautet www.bmbwk.gv.at. Dort finden Sie unter Bildung/Schulen > Unterricht und Schule > Lehrpläne die die österreichischen Lehrpläne des Faches Mathematik.
	• Michaela Kraker, michaela.kraker@chello.at • Position: "Forum für Geometrie" (http://www.brg22.ac.at/ffg/) • Einige österreichische Mathematiklehrer/innen, aber nicht alle, nutzen dynamische Geometrie software. Besonders verbreitet ist Euklid Dynageo, Cabri, Geogebra, Cinderella und noch einiges mehr. Im Mathematiklehrplan bei der Bildungs- und Lehraufgabe steht: verschiedene Technologien (zb. Computer) einsetzen können.
	• Research on the official website of the Ministry of Education • Address: http://www.bmbwk.gv.at • Datei: lp_neu_hs_07.pdf • Lernen mit technologischer Unterstützung Mathematiknahe Technologien wie Computeralgebra-Systeme, dynamische Geometrie-Software oder Tabellenkalkulationsprogramme sind im heutigen Mathematikunterricht unverzichtbar. Sachgerechtes und sinnvolles Nutzen der Programme durch geplantes Vorgehen ist sicherzustellen. Die minimale Realisierung besteht im Kennenlernen derartiger Technologien, das über exemplarische Einblicke hinausgeht und zumindest gelegentlich eine wesentliche Rolle beim Erarbeiten und Anwenden von Inhalten spielt. Bei der maximalen Realisierung ist der sinnvolle Einsatz derartiger Technologien ein ständiger und integraler Bestandteil des Unterrichts.

Belgium	• Karina Nestler, walbru.berlin@snafu.de • Position: Trainee at the Belgian Embassy, Berlin • "Das Bildungssystem in Belgien wird durch die drei Gemeinschaften verwaltet, daher existieren leider keine nationalen Informationen über das Bildungswesen in ganz Belgien - mit Ausnahme der Europäischen Schulen; jede Gemeinschaft hat ihre eigene Unterrichtspolitik. Die Unterschiede zwischen Flamen, Wallonen und Deutschsprachigen sind deshalb relativ groß." Rahmenpläne zum Mathematikunterricht in der Französischen Gemeinschaft finden Sie (leider nur in französischer Sprache) unter den folgenden Adressen: http://www.restode.cfwb.be/pgres/programmes/secd1_1A2C.htm http://www.restode.cfwb.be/pgres/programmes/secd2_TT1.htm
Cyprus	• George Hajisavva hajisg@cytanet.com.cy • Position: Inspector of Secondary Education for Mathematics • Ministry of Education and Culture, Cyprus Dear Dr. Kortenkamp, a) the use of software for teaching geometry is not required by the curriculum, and is not even mentioned in the curriculum. However, the inspectors of Mathematics strongly recommend its use and such use is foreseen in the newly planned special rooms for maths. Also, the ministry of education has made a call of tenders for software development to cover most of the curriculum in maths for the three classes of the gymnasium (ages 12-15) and the first such software has been already delivered. It covers some chapters on geometry. All gymnasia have access to this software, and it is available on the internet. However, its use is only recommended, and very few teachers actually use this software. Also, the ministry has called for tenders to buy ready made software for educational use in several subjects, including mathematics. We expect to acquire gabri, among others, and then the use of this software will be strongly recommended. When all the secondary teachers of mathematics pass through the necessary education on computerawareness and educational use of computers (in about 3 years time) then such use will be required in the curriculum. b)content for the software acquired was developed by a team of teachers and was based on specifications drawn by the inspectors of mathematics. these teachers were employed by the firm that won the tender. When in full application of the program for the ducational use of software, there will be a team of educators screening material that is developed by individual teachers and then passed on to other teachers, and in addition, they will develop some content they deem necessary. The plan is to have them on ducational visits to schools to check the needs, show teachers how best to use the material and support the teachers who need such support.

Czech Republic	• Pavel Pech, pavel_pech@post.cz • Excerpts from Czech curricula: Stage 1: Age 6-15 „ Pupils realize changes and dependences of known facts These changes and dependences are analyzed from tables, diagrams and graphs, in simple cases pupils construct and express them by a mathematical formula or model them with the use of an appropriate computer software or graphical calculators.” ” Pupils learn to use computer technique tools (mainly calculators, an appropriate computer software, some kinds of teaching programs) and another tools, which enable to approach mathematics even those pupils with drawback in numerical computation and drawing techniques. They also improve their individual and critical work with source of information.“ " Education in mathematics tends to forming end developing key competences since it leads a pupil to developing his/her experience with mathematical modelling.” Stage 2: Age 15 – 18 “ During the study pupils realize that mathematics is applied in many branches of human activity (e.g. in economy, technique, sociology, etc.), is influenced by outer reasons (for instance in natural sciences) and that modern technologies are useful helpers of mathematics.” ”Education in mathematics tends to forming end developing key competences since it leads a pupil to developing of ability to work with various representations, using calculators and modern technologies to effective solutions of problems and presentation of results, developing experience with mathematical modelling.”
	• Katerina Honzikova, Katerina.Honzikova@msmt.cz • Czech Ministry of Education, Youth and Sports • "... the use of geometry software is not the part of the Czech curricula." "... The curriculas contain only the content of educational programmes but not the way how to teach. In the Czech Republic is possible to use different software during the education which is only the educational instrument improving lessons. Using of such an instrument does not have to be accepted by any authority."
Denmark	• botschaft@daenemark.org • Request for information sent, no answer received yet
	• Answer from Jakob.Wandall@uvm.dk, from the Danish Ministy of Education • 1.)Is the use of geometry software recommended or required by the curriculum? No - the curriculum is a local governmets responsability. 2.)Are there user groups or teachers’ associations who provide electronic content to be used with geometry software in

	teaching? We do not collect that kind of information in the ministry - and personally I dont know. But it is very possible.
Estonia	• Anti Teepere, anti.teepere@ekk.edu.ee • Position: Chief Expert of Mathematics and Informatics National Examination and Qualification Centre • Dear Mr Welle, We use two Geometry teaching computer programs in Estonia. One of them is GeomeTricks (made by Viggo Sadolin from Denmark). If you search by This program has been translated into Estonian. The second one is GeologWin (made in Germany). It has also been translated into Estonian, but is not as popular as GeomeTricks. We have a special foundation which is in charge of ICT integration at schools. It is called the Tiger Leap Foundation (www.tiigrihype.ee). Actually, teaching Geometry with the help of computer programs is not listed in our curriculum. There is an overall requirement of using ICT in learning and teaching process in general. With the help of the Tiger Leap Foundation a lot of teacher training is carried out on using different teaching software in math lessons.
	• Rein Prank, rein.prank@ut.ee • Hello, Ulrich! In 1997 Estonian School Computerization Foundation "Tiger Leap" was established. In area of software Tiger Leap finances our own projects and tries to buy country-wide licences of foreign programs with reasonable price. I attached a paper (written for a local conference) about situation with Mathematics software (Mathematics Courseware in Estonian Schools and Teacher Training). Our software set contains two interactive geometry programs. 1. Small dynamic geometry program GeomeTricks is written by Danish author Viggo Sadolin. 2. Geolog is intelligent environment for proofs in congruence geometry I know the author from 1992 and he gave us the possibility to translate it to Estonian. But the avilability of software does not mean that Estonian curriculum contains the use of software. Our teachers have freedom to use (many schools have appropriate computer classrooms) or not to use computers. The universities have organized some couses for inservice teachers but the numbers of participants are not too big.
Finland	• Leo Pahkin, Leo.Pahkin@oph.fi • Position: Councellor of Education • Dear Philipp Welle, You were asking about if we have some recommentations in our

	curriculum for using geometry software. Exactly we don't. But we have some sentence about using ICT in general in all subjects. Anyway we have one development project for teaching geometry in lower secondary level and upper secondary level (7-9 grades in comprehensive school and upper secondary general school). In that project we have supported our teachers to use software in teaching geometry (we use Geometers' sketchpad). We have made some content too, that is not so much but anyway. There is also some teachers out of this project who uses software like C.a.R, Cinderella, GSP, GeomeTricks and Capri in Finland.
France	• Christian Mercat, mercat@math.univ-montp2.fr • 2te Mail: France is a pioneer in interactive geometry. The French ministry has supported developpment of Cabri and Geoplan/Geospace. The basis of users is therefore quite large, even though geometry is not the king subject in curriculum. Sesamath with its platform MathEnPoche, where TracEnPoche belongs, boasts a huge basis of really dedicated users, that use dynamic geometry since a short time but very actively. 1te Mail: 1) Software for geometric constructions is more or less mentionned in the French curricula for all 4 classes in our "Collège"... « Recent enhancements in computers - software quality, ease of use, cost reduction, ..) are greatly in favor of their use in middle schools. While more and more people practice computer assisted pedagogy, its richness of application becomes more obvious. At the same time, coordinated with other educational subjects, mathematics bring a specific contribution to the use of computers. » In: http://www.cndp.fr/textes_officiels/college/programmes/acc_prg3/acc_prg3... [That´s the official comment for the official French curriculum for la classe de troisième (~ 9. Klasse in Gernany)] 2) In the same document: « Geometry construction software allow bringing to the fore relationships between the elements of a figure. The students need to explicit those relationships in order to be able to do the construction. Geometry construction software notably allow to observe a figure without having to reconstruct it, for example when you move one of its points, in order to make clear which properties remain valid and to state some conjectures. These software constitute a powerful mean for exploring geometrical figures... They allow settling situations that otherwise could seem complex but for the dynamics of the figure that allow giving them a meaning.» 3) As long as I understand and translate well, the main goals of working with geometry software are the following (in order of

	importance as perceived by me in the official curricula). [Yet the words between brackets reflect my own classification.] * to visualize the figures, volumes and abstract geometric objects [illustration for lessons and more] * to establish and verify conjectures [research activities, exploration] * to understand the meaning of deductive reasoning [understand the concepts and methods] * to analyze mutual relationships between quantities [leading to other parts of maths and science] 4) in many school books, you will find constructions to be done with geometry software, in the courses or exercises. For example : Hachette collection Cinq sur Cinq
Germany	Inter2Geo Eintrag: DGS play an important role in the curricula of most of the German federal states. Specially at high school education in Brandenbug, Saxony, North Rhine-Westfalia and Bavaria the use of DGS is obligatory. In most of the curricula of secondary schools in Germany DGS complete the mathematical education.
Greece	• George Hajisavva, hajisg@cytanet.com.cy • Position: Inspector of Secondary Education for Mathematics Ministry of Education and Culture, Cyprus • Dear Mr Welle, ... here are a few things I know about the Greek education system. We do have a similar curriculum as far as geometry is concerned and we do use the same book for geometry in the Lyceum. However, the Cypriot curriculum has a different sequence on the subjects covered. The Greek curriculum for mathematics (from year 2002) mentions the software Cabri II and the Geometer's Sketchpad and there are strong suggestions for teachers to use them in several points while teaching geometry. Also, there is a group of researchers/curriculum developers working at the Greek Pedagogical Institute which develops subject material to support the teaching of the various subjects. I imagine there is such a group for the use of software in geometry too.
Hungary	• Holger Wendlandt, holger.wendlandt@t-online.hu • Position: German advisor in Hungary • "Ich kenne keine Schule, an der Geometriesoftware eingesetzt wird. Der ungarische Unterricht ist sehr traditionell lehrer- und stoffzentriert."

Ireland	• Ann Comac, acomac@ccea.org.uk • Position: Principal Officer, Mathematics, Council for the Curriculum, Examinations and Assessment • In Northern Ireland software has been provided by the government to assist teachers deliver aspects of geometry within the N.I. programme of study for mathematics. This software is called Geometry Inventor produced by Logal and is one of a series called 'tangible maths'. The software is very powerful and rather complex so it requires a good grasp ICT on the teachers' behalf. It can also be used by pupils to develop independent learning. Within the SEELB area (one of the five Education and Library Board areas in Northern Ireland) I am not aware of any user groups or teachers associations who would be collaboratively working with this particular piece of software, however the Mathematics unit have developed some 'applets' which have been demonstrated to a number of schools to show the power of the programme. I am aware that some schools have invested in Autograph (another software package), also quite complex which addresses aspects of data handling and geometry on the Northern Ireland Programme of Study for Mathematics.
Italy	
Latvia	
Lithuania	• Valentina Dagiene, dagiene@ktl.mii.lt • In Lithuania, we bought the Geometer's Sketchpad (GSP) licence and translated to Lithuanian language 4 years ago. We named this packed 'Dinamine geometrija' (Dynamic Geometry). Two years ago it was made study on using educational software in schools. GSP was used about 25 proc. of schools. We prepared special additional material to mathematical textbooks with CD. It is very interesting and good material. We do not mention any software in curriculum. There are only recommendation. Also we have course for math teachers with GSP.
Luxembourg	• Yves Kreis • Structure of the Luxembourgish School System: http://www.men.public.lu/sys_edu/organigrammee.pdf Interactive Geometry Software usage mentioned in the curriculum of 5e (children aged 14 or older): "(...) La géométrie telle qu'elle est prévue au programme de la classe de 5e avec entre autres l'étude des transformations du plan et des isométries en général, se prête particulièrement bien pour l'intégration de l'outil informatique en ce sens qu'avec un logiciel de construction "dynamique" tel que Cabri Géomètre II ou The

	Geometer's Sketchpad, l'élève aura la possibilité de réaliser une figure précise, rectifiable et dynamique, ce qui lui permettra de passer rapidement du cas général aux cas particuliers et inversement. Cela facilitera un processus d'essais et erreurs propices au développement des capacités visées. De plus, l'outil informatique avec sa puissance de calcul et sa polyvalence permettra à l'élève d'explorer les liens qui existent entre la géométrie, l'algèbre et les premières notions de l'analyse telles les fonctions, les variations des fonctions et les premiers pas intuitifs vers la notion d'optimisation. (...) Le prolongement en classe de 4e avec le logiciel de géométrie se fera par exemple avec le théorème de Thalès, les angles inscrits, les débuts de la géométrie analytique (droites, vecteurs) et l'approfondissement de la notion de fonction, quelques sujets pouvant se traiter de manière complémentaire avec les deux types de logiciels; la puissance de calcul d'un tableur trouvera son application dans le chapitre sur les statistiques et les fonctions. (...)" http://content.myschool.lu/sites/horaires/2006-2007/pdf/5C/MATHE/MATHE_5... Interactive Geometry Software usage mentioned in the curriculum of 3eB/C/D (children aged 16 or older): "A partir de l'année scolaire 2003-2004 l'emploi de la calculatrice fait partie intégrante de l'enseignement des mathématiques des classes de la division supérieure, de la 3e à la 1ère. (...) Pour des raisons de compatibilité avec les logiciels utilisés dans les classes de 5e et 4e la calculatrice devra être équipée des logiciels suivants: (...) - logiciel de construction géométrique dynamique Cabri Géomètre, (...) En conséquence la Commission Nationale pour les programmes de mathématiques recommande pour les sections B, C et D la Voyage 200 (V200) de Texas Instruments. (...)" http://content.myschool.lu/sites/horaires/2006-2007/pdf/3CB/MATHE/MATHE_... Interactive Geometry Software usage mentioned in the curriculum of 9eTE (théorique) (children aged 14 or older): "(...) Pour l'élaboration et l'illustration de propriétés géométriques, il est vivement recommandé de prévoir des séances en salle informatique avec le logiciel « Cabri Géomètre ». (...)" http://content.myschool.lu/sites/horaires/2006-2007/pdf/9TE/MATHE/MATHE_...

	• Jos Bertemes, jos.bertemes@men.lu • Position: professeur chargé de mission, Ministère de l'Education nationale • The use of Geometry Software is in the Cirruculum. Jos Bertemes schrieb: Der Einsatz von DGS war in den alten Lehrplänen auch schon vorgegeben, deshalb waren schon Unterichtseinheiten exemplarisch ausgearbeitet worden. Zusätzlich wird der Einsatz von CAS-Rechner in der gymnasialen Oberstufe verpflichtend für alle Lehrer und auch im Abitur vorgeschrieben
Malta	• Anna Gilson, anna-maria.gilson@gov.mt • Position: Department for Curriculum Management • Dear Philipp Welle, In Malta, students sit for a selective examination at age ten. Then depending on what result they achieve, they will either attend a Junior Lyceum or else the Secondary School in their vicinity. The students attending both Junior lyceums as well as secondary schools go to the computer labs on a regular basis. Normally Form 1, 2, 3 go with their mathematics teacher once a week and Form 4 and 5 go less often because of constraints imposed by the quantity of topics that they have to cover during the academic year. The students are exposed to Cabri Geometre which is a geometry software that enables students to explore, discover and establish geometrical results with diagrams that they themselves have constructed. Students also work with the software Microworlds LOGO. This software allows students to write a programme and then when they run it, it will draw a particular geometric design. Logo helps students develop mathematical concepts and skills; it enhances problem solving skills by encouraging them to think both algorithmically and procedurally; it gives rise to new learning and teaching styles. The students are also introduced to an algebra software, namely Derive and they also apply mathematical recording and data handling through the use of a spreadsheet, namely Excel. If you go through the Malta education website at http://skola.gov.mt/maths/resources.htm you will also find worksheets and notes that help both teachers and students to become better acquainted with the software that is used in our schools. As regards user groups or teachers' associations as such we do not have. However, we have a very hardworking group of subject coordinators or you might call them heads of department, and they hold INSET training for teachers of mathematics ona regular basis.
Poland	• Bronek Pabich, bronek.pabich@gmail.com • Dear Ulli!

	"Of course.The dynamic geometry is use in many lesson like: geometry, calcullus, logic, 3D geometry. For example: definition of derive, discoveing of simple theorems, tranformation of polyhedrons, visualisation propetries of curves, solving math problems, etc." Geometry in official curriculum in Poland is'nt! Only teachers similar like me work with geometry dynamic. WEITERE ANFRAGEN AN: 15 Kuratoren der einzelnen "Bezirke", 4 Deutsche Schulen, 1 Polnische Botschaft, 1 deutsche Botschaft in Polen und 1 an das Polnische Bildungsministerium (Ministerstwo Edukacji Narodowej), ergaben bisher keine Antwort.
Portugal	
Slovakia	• Beáta Holubecová, beata.holubecova@diplo.de • Position: German ambassy in Pressburg (graduate mathematician) • Sehr geehrter Herr Welle, auf der Internetseite des Staatlichen Pädagogischen Instituts (Štátny pedagogický ústav, www.statpedu.sk) habe ich die gewünschten Studienpläne gefunden. Diese sind allerdings nur in Slowakisch. Dennoch der Pfad: 1. www.statpedu.sk anklicken 2. Základné školy (Grundschulen) anklicken 3. Ucebné osnovy (Lehrpläne) anklicken 4. Ucebné osnovy pre základné školy – 2.stupen (Lehrpläne für Grundschulen – 2.Stufe, 5.-9.Klasse) anklicken oder 5. www.statpedu.sk anklicken 6. Gymnáziá (Gymnasien) anklicken 7. Ucebné osnovy (Lehrpläne) anklicken 8. Osemrocné štúdium (8 J Schulbesuch) oder Štvorrocné štúdium (4 J Schulbesuch) Ich vermute, dass die interaktive Geometriesoftware – wenn überhaupt – nur an den mathematischen Gymnasien angewendet wird.
	• Beata Menzlova, beata.menzlova@statpedu.sk • Position: State Pedagogical Institut Guten Tag, entschuldigen Sie, dass ich mich erst jetzt melde, aber ich war verreist. Ich werde diese Woche die zutreffenden Personen kontaktieren. Schöne Grüße aus der Slowakei Beata Menzlova Datum: 04.10.2006
Slovenia	
Spain	• Tomás Recio, tomas.recio@unican.es • Position: Chair of the Spanish ICMI subcommission (Internation

	Commission on Mathematical Instruction) The official curriculum includes a variety of basic geometric notions and a reference to using computers and calculators in diverse math contexts. Yet, no specific reference appears to dynamic geometry software. Secondary education in Spain has two periods. Compulsory education goes up to age 16. Post-compulsory extends to age 18. Again the official curriculum includes many geometric concepts and references to the use of computers and calculators (mostly in relation to estimation, approximation, graphing, algebra). No specific reference is included to dynamic geometry software. Yet, we can say talking about dynamic geometry software is popular in the Spanish education community. But it is much less popular using it in the classroom (due to a variety of reasons, mostly related to classroom management hardships). See the recet report http://rsme.es/gacetadigital/abrir.php?id=571 concerning the use of computers in math education at Madrid schools (clearly the same conclusions apply to the rest of Spain). A personal and very rough estimation could be that two thirds of Spanish secondary education teachers have ever heard of dynamic geometry software, one third have even had the opportunity of using it occasionally for personal purposes, and very very few have incorporated this software (even occasionally) as a tool for teaching. Still we can say that, the situation in Spain of the different dynamic geometry software programs is as follows: Cabri (Spanish version), most used (no stats available) The Geometer's Sketchpad (Spanish version) (second most used) Cinderella (Spanish version of Jesus de Loera, UC Davis) Geogebra (Spanish version by Liliana Saidon) Geup2 (full Spanish software, see http://www.geup.net/index_esp.htm) GDI: an academic dynamic geometry soft prototype,made in Spain, that uses CoCoA for performing automatic proof and discovery. The same team, leaded by F. Botana, is responsible of a)Some applets for translating Cabri and GSP constructions to OpenMath (using the experimental Content Dictionaries plangeo, from TU Eindhoven). They are located athttp://nash.sip.ucm.es/appletsOM/ b)webDiscovery, a server for performing remote geometric proof and discovery Geomouse (an earlier bird, I ignore if still updated, see http://boj.pntic.mec.es/~jcastine/default.htm) • There is also a variety of software tools, created by different Spanish teachers, related to the teaching and manipulation of some specific geometry situations (I apologize for involuntary omissions): -(a huge collection of java applets for teaching most mathematical topics, including a lot devoted to geometry, a project by the Ministry of Education)http://descartes.cnice.mecd.es/ -(triangles) http://garciacapitan.auna.com/

	-(applets java Cabri for primary education) http://platea.pntic.mec.es/%7Ejmigue1/index.htm -(interactive material for geometry, among other topics) http://www.edu365.com/ -(geometry calculators) http://www.iesadpereda.net/thales/ -(java applets for most geometry secondary education items) http://mimosa.cnice.mecd.es/%7Eclobo/index.htm -(applets for primary education and kindergarten) http://clic.xtec.net/db/act_es.jsp?id=1308 -(a collection of geometry interactive resources) http://www.pnte.cfnavarra.es/%7Eiesozizu/departamentos/matematicas/recur... -(a collection of programs for various parts of mathematics curriculum in secondary education, including geometry, by M. Diaz-Regueiro, member of this project team):http://www.allegue.com/ -Three URL's by the same author (J. A. Mora, member of this project team and one of the Spanish top experts on dynamic geometry software in secondary education), on Cabri resources: http://www.divulgamat.net/weborriak/RecursosInternet/RecInternet/Cabri/C... http://www.divulgamat.net/weborriak/RecursosInternet/RecInternet/Cabri/C... http://www.divulgamat.net/weborriak/RecursosInternet/RecInternet/Cabri/C... -Two URL's by Jose Manuel Arranz, a classic on Cabri use for Spanish education: http://mimosa.cnice.mecd.es/%7Eclobo/index.htm http://roble.pntic.mec.es/~jarran2/index.htm Finally I would like to mention that there is a group devoted to the studay of the didactics of geometry, including didactical consequences of the use of dynamic geometry tools: http://www.uv.es/aprengeom/learngeom.html
Sweden	• Waltraud FRANK, Waltraut.Frank@tyskaskolan.se • Position: Teacher in the German school of Stockholm • Lieber Herr Welle, Sie haben um Informationen über den Einsatz "interaktiver Geometriesoftware" an schwedischen Schulen gebeten. Ähnlich wie in Deutschland ist der Einsatz eines solchen Computerprogramms empfohlen, aber nicht vorgeschrieben. Gewöhnlich wird ggf. das Programm Capri eingesetzt. Es gibt einen Mathematiklehrerverband (für bis Klassen 9): Sveriges MatematikLärarförening SMaL. Homepage: www.smal-matte.com

	• Jan Sydhoff, jan.sydhoff@skolverket.se • Position: The Swedish National Agency for Education (Skolverket) • Answer from: Upplysningstjansten@skolverket.se (Henrik Fredriksson) • Dear Philipp! The Swedish school system is not regulated on such a detailed level, but the education act states that the pupils shall without cost have access to books, writing material, tools and other aid that are needed for a modern education. We have a institution called “Myndigheten för skolutveckling” The Swedish National Agency for school improvement that might have a better insight in your second question. Apart from what they produce software produced comes mainly from private initiatives and publishing firms. See: http://www.skolutveckling.se/in_english/
The Netherlands	• S. Garst, garst@planet.nl • Position: mathematics teacher, member of the CTWO commity • Dear dr. Welle, Here you find the answer on your question. They are formulated by dr. Drijvers. [dr. P.H.M. Drijvers is a researcher of technology in mathematics education at the Freudenthal Institute] He can be regarded as one of the specialists on the area of ICT and geometry in the Netherlands. For advanced geometry at upper secondary level (the German SII) the use of a dynamic geometry software package is recommended (e.g. Cabri).
United Kingdom	• Research on the official website of the Ministry of Education • National Curriculum Online: http://www.nc.uk.net/webdav/harmonise?Page/@id=6004&Subject/@id=22 • Stage 1 During the key stage, pupils should be taught the Knowledge, skills and understanding through: 1. practical activity, exploration and discussion 2. using mathematical ideas in practical activities, then recording these using objects, pictures, diagrams, words, numbers and symbols 3. using mental images of numbers and their relationships to support the development of mental calculation strategies 4. estimating, drawing and measuring in a range of practical contexts 5. drawing inferences from data in practical activities 6. exploring and using a variety of resources and materials, including ICT 7. activities that encourage them to make connections between

	number work and other aspects of their work in mathematics. Stage 3 During the key stage, pupils should be taught the Knowledge, skills and understanding through: 1. activities that ensure they become familiar with and confident using standard procedures for a range of problems, including ratio and proportion 2. activities that enable them to understand that algebra is an extension of number 3. solving familiar and unfamiliar problems, including multi-step problems, in a range of numerical, algebraic and graphical contexts and in open-ended and closed form 4. activities that develop short chains of deductive reasoning and concepts of proof in algebra and geometry 5. activities focused on geometrical definitions in which they do practical work with geometrical objects to develop their ability to visualise these objects and work with them mentally 6. practical work in which they draw inferences from data and consider how statistics are used in real life to make informed decisions 7. a sequence of activities that address increasingly demanding statistical problems 8. tasks focused on using appropriate ICT [for example, spreadsheets, databases, geometry or graphic packages], using calculators correctly and efficiently, and knowing when it is not appropriate to use a particular form of technology. Stage 4 higher During the key stage, students should be taught the Knowledge, skills and understanding through: 1. activities that ensure they become familiar with and confident using standard procedures for the range of calculations appropriate to this level of study 2. solving familiar and unfamiliar problems in a range of numerical, algebraic and graphical contexts and in open-ended and closed form 3. using standard notations for decimals, fractions, percentages, ratio and indices 4. activities that show how algebra, as an extension of number using symbols, gives precise form to mathematical relationships and calculations 5. activities in which they progress from using definitions and short chains of reasoning to understanding and formulating proofs in algebra and geometry 6. a sequence of practical activities that address increasingly demanding statistical problems in which they draw inferences from data and consider the uses of statistics in society 7. choosing appropriate ICT tools and using these to solve numerical and graphical problems, to represent and manipulate geometrical configurations and to present and analyse data.

III Collected raw data

This appendix lists more raw data we have been able to obtain, but which was omitted from the official report due to the need to normalize the presentation.

Austria	Dissertation by Thomas Müller, c.f. bibliography
Belgium	
Bulgaria	• From: Alfred Wassermann, Alfred.wassermann@uni-bayreuth.de School coverage estimation: There is not much information available. The data I could find is available here: http://intern.inter2geo.eu/system/files/bulgaria_response.pdf DGS are not referred in the curriculum. Official or political guidelines regarding the usage of geometrical software do not exist in Bulgaria. The use of DGS is limited to a small number (30) of (private) so-called mathematical schools. As the limiting factor in Bulgaria is the hardware, the use of mathematical software in general is not as widespread as in the western european countries., simply because of a lack of resources. European GEONExT usage: http://intern.inter2geo.eu/system/files/geonext_usage.pdf
Cyprus	
Czech Republic	• From: Pavel Pech, pavel_pech@post.cz DGS are not refered in the curriculum. Usage of ICT is only recommended. No free DGS software is available at schools. Within 1998-2007 the main seller of Cabri sold 460 licences of Cabri II, Cabri II+ and Cabri 3D. This number increases by 10% every year. On the base of sold DGS software we estimate that approximately 20% of schools use DGS. The main software they use is Cabri II, Cabri II+ and Cabri 3D (Czech translation). Some schools use another software like Geonext (Czech translation), Cincerella, GeoGebra (Czech translation) etc. There is also special software e.g. cube section, descriptive geometry etc. which is used.
Denmark	• From: Bjoern Felsager, fe@haslev-gym.dk The situation in Denmark is as follows:

	Dynamic Geometry Software are not officially required in the curricula for neither the lower or the upper secondary scool. On the contrary, use of IT is mandatory - it is only that dynamic Geometry software as such is not. But dynamic Geometry software is recommended as one possible way of using experimental methods. So in many schools such programs are not used or only rarely used. But there is a growing consensus of their importance and especially in the upper secondary school it is customary for many students to know about such programs. There are no official statistics as far as I am aware. There are a number of different software programs being used. From my experience at meeting Geoemters SketchPad and GeoGebra are the most used programs in the upper secondary schools, but of course other programs, especially Cabri 2D, are certainlyused as well. In the lower secondary school a Danish program called Geometrix has been used quite a lot in the lower secondary school - it is part of a software package called the INFA programs. But the use of GeoMeters SketchPad is growing as well in the lower secondary school. Despite lack of statistics it is thus generally accepted that the three most important Dynamic Geometry programs are Geometer's Sketchpad, GeoGebra and Cabri 2D.
Estonia	
Finland	
France	• From: Caliskan-Dedeoglu dissertation (c.f. Bibliography) The curriculum doesn't mention the dynamic geometry. It only mentions "geometrical construction software". Two official documents are distinguished: the curriculum by itself and the accompanying document. The curriculum mention the possibility to use DGS without giving any tips. The curriculum only presents DGS (and more generally the usage of the computer) as an alternative way, that seems to be conceded to the social pressure. The curriculum doesn't mentioned anything concerning the potentials of the DGS, except for the visualisation of 3D image, but this exception is meaningful since 3D visualisation at the college level is considered as less important than plane geometry. The accompanying documents give more details on how to use DGS, and which activities to do with it. It explains also which are the potentialities of the DGS. But still the curriculum is "the law" and the accompanying documents provide recommendations. • Teaching manual analysis Between 1996 and 2004, the study of the manuals shows an integration of the DGS year after year. Dynamic Geometry is proposed in more topics than what suggest the curriculum. However,

	nothing is proposed for 3D. We can assume that the teachers dissertation gives us an approximation of what can be the practice of (at east the young) teachers. The following gives a summary of what Erdogan and Caliskan-Dedeoglu (c.f. Bibliography) have found: On 582 dissertation studied, 59 concerns the use of ICT, which is 10%. On those 59 dissertations, 23 concerns DGS, which is 39%
Germany	• Digitale Medien in der Schule. Standortbestimmung 2005. (Quelle: Studie Herzig) Almost half of Teachers use Computers regularly or at least sometime in teaching. Internet is used by a third of teachers at public schools regularly or at least sometimes. However, teachers say that they will use media in the future more often. 72% want to use the Internet more, 68% want to use the PC more often. On the other hand the share of teachers not using digital media in topic specific teaching is almost 50%. You have to observe that this data contains no information about what "regularly or at least sometimes" means, and also that there is a lot of difference between different schools and the different (German) states. As a tendency it might be stated that a core group of ca. 10 to 30% of teachers use digital media regularly. These groups are also the main users of online services for teachers. Over 90% of them use the computer daily or several times a week for preparation and post-paration of teaching, and more than 50% use it also daily or several times a week in their teaching. • Information from Country Representative (Elschenbroich) o No official data is available o Ranking of DGS in schools: Dynageo > Geonext > Geogebra o personal estimate: <50% schools have licenses, but probably >25% (but that does not say anything about whether it is really used) o guess: 50% of schools having a license use it. o Countries that require DGS in curriculum (examples: NRW, Rh-Pfalz): usage increases! o Sales of exercise material by Elschenbroich: 4-digit number, but schools that use it could be 3-digit. Altogether ~10% school coverage, estimated, at least half of it use it regularly o DynaGeo and Geonext are represented in school books / add-on material by publishers o Cabri not an important player, ratio Dynageo : Cabri is 10:1 with respect to the exercise material sold by E. o DGS on TI handhelds: not used at all, quote: "no fun to use". • Information from CASIO (Tim Bebensee) from a telephone survey conducted in 2005/2006 o 627 Gymnasia in NRW were called o 529 schools use software, 38 do not, 60 no answer

	○ 44% (233 Schools) use Excel/Derive/MuPad ○ 33% (176 Schools) use "other software". It was not asked which software. But further investigation showed, that most of these indeed use geometry software (for example Dynageo). ○ 120 schools could not remember which software they use • Sales information from Dynageo (Roland Mechling, Associate Partner) ○ total number of sold licenses for schools in 2006: ~3500 ○ total number of sold licenses for schools in 2007: ~4000
Greece	• From: Georgios Agathos, gaga@kastaniotis.com Thanks to a quite big project called Odysseia, most of international famous educational software have now reached the greek scools. Odysseia had more than 20 chapters (sub-projects): there were sub-projects aimed to introduce informatics and computers to public education; other sub-projects had as an aim to educate the "educators", so as to know how to teach these new tools in schools; others had as an aim the creation of new software from various companies, so that they play the role of a pilot for the future to come; others had as an aim, to start the cooperation of public school professors with the Greek companies, through creation of books and activities for all courses in public schools; the goal of the biggest sub-project was the localization in Greek of the most famous international tools (it was the biggest because of the royalties). One of the major subprojects of Odysseia was Kirki. Through Kirki two major DGS were localized in Greek: Cabri Geometry II and The Geometer's Sketchpad 3.1. These two DGS were sent to 350 public schools each one, back in 2002. Till the end of 2003, the Ministry of Education was teaching the professors how to use the software, and I may say that after 2004 we saw the first good results. This summer Cabri II Plus localization has finished, and the software was sent in 4.000 copies for 2-10 users to the Ministry of Education. With this quantity all second grade education public schools are covered (by saying second grade I mean students of age 12-18; the num of such schools is around 3.100), plus all relating services of the Ministry, plus the two main organizations of the Ministry: Pedagogical Institute (PI) and Research and Academic Computer Technology Institute (RACTI). Sketchpad is still under development. After Sketchpad finishes, the ministry shall find the way to continue with DGS implementation in all public shools. There are no direct reports of DG in the geometry curriculum. There are only a few reports concerning dynamic geometry software; this answer was given by Mr Kostas GAVRILIS, a math teacher and

	former Pedagogical Institute tutor. There are no official surveys indicating any numbers. The only thing we know for sure as Kastaniotis Editions: CGII and TGS were sent to 700 high schools (20% of all second-grade public schools). We had almost 100 phone calls, during the last three years from math professors, asking for more info and a few of them ordered CGII. Apart from them, there exist another num of educators that have already used DGS in the past, without having tried contacting us (a probable number of 50 people; these are estimates by Mr Gavrilis). As a probable estimate, we may say that only in 5% of all public schools DGS is taught.
Hungary	
Ireland	
Italy	• From: Aurelia Orlandoni, Aurelia.orlandoni@libero.it, President of ADT, Associazione per la Didattica con le Tecnologie • From: Domingo Paola, domingo.paola@tin.it, Vice-president of CIEAEM, International Commission for the Improvement of Mathematical Teaching • From: Mariolina Bartolini Bussi, mariagiuseppina.bartolini@unimore.it, Executive Committee ICMI, International Commission on Mathematical Instruction • Collected and summarized by Tomás Recio, tomas.recio@unican.es **Does the DGS appears in the curriculum?** Since September 2007 there is a new curriculum of the Ministry of Education, Giuseppe Fioroni, *(Indication for a curriculum for the students aged from 3 to 14 years old* [Curr3-14]) and there are three references to geometry software for "ciclo primario" (children from 6 to 14 years old): 1) In the introduction to Mathematics it is stated that teachers have to encourage pupils from first years to conveniently use pocket calculators and PC's, for instance, to verify mental and written calculations, and to explore the world of numbers and geometry. 2) In the final objectives for 5th grade it is mentioned: "Riproduce una figura in base ad una descrizione, utilizzando gli strumenti opportuni (carta a quadretti, riga e compasso, squadre, software di geometria)" (Pupils should reproduce a geometric shape according to a given description by using proper tools like squared paper, drawing ruler, compass, square, geometry software). 3) In the final objectives for 8th grade it is mentioned: "Riproduce figure e disegni geometrici in base ad una descrizione, utilizzando in

	modo appropriato e con accuratezza strumenti opportuni (riga, squadra, compasso, software di geometria)" (Pupils should reproduce geometric shapes and drawings according to a given description by using accurately proper tools like drawing ruler, compass, square, geometry software.) On the other hand, in the document for the cultural guidelines for compulsory school (that is more recent) the word "geometric software" does not appear. In the official programs that word does not appear. **Data on the usage of DGS** No quantitative data available yet. But in the opinions of Domingo Paola, current vice-president of the CIEAEM (Commission Internationale pour l'Étude et l'Amélioration de l'Enseignement des Mathématiques, see http://www.cieaem.net/), teacher-researcher and member of several official committees) and of Aurelia Orlandoni, president of ADT (Associazione per la Didattica con le Tecnologie), DGS is among the most used mathematics software in italian schools. An indirect proof shows up in recent textbooks of secondary school [TXB] (form 14 to 18 years old) which often contain some pages or some section about Cabri-géomètre; another clear indicator is that the local and national meetings in mathematics education do occur a lot of presentations by teachers using DGS. In the opinion of these professors, Cabri IIplus is largely used in Italy. Italy is clearly the first country in Europe for the number of licences of Cabri IIplus and Cabri 3D. It is specially used in the secondary school (ages from 14 to 19 years old). Most teachers use Cabri for geometric explorations, but some teachers use it only for drawing. There is a forum called Cabrinews (http://www.fardiconto.it/cabrinews/) launched by IRRE-ER (Instituto Regionale di Ricerca Educativa- Emilia Romagna, see http://www.irreer.org/) in 1996, within a project for the revitalization of the teaching of geometry at different school levels, whose aim is to be a site for exchange of experiences, questions and information about the use of Cabri-géomètre. Cabrinews has became a space for discussion on problems related to the teaching and learning of mathematics, particularly with the use of TIC, and at the same time, is a center of information and spread of events, articles and books on mathematics education. The Cabriworld Conference was held in Rome in 2004, and about 1500 teachers participated in courses and seminars. In the last years some teachers began to use Geogebra. [Curr3-14] http://www.pubblica.istruzione.it/news/2007/indicazioni_nazionali.shtml .

	[TXB] Boieri P., Dané C. CABRI - Laboratorio informatico per la Matematica Loescher (specific about the use of Cabri)
Latvia	
Lithuania	There is no reference to DGS in the curriculum. Geometer's Sketchpad is used in Lithuania.
Luxembourg	• From: Yves Kreis, yves.kreis@uni.lu Structure of the Luxembourgish School System: http://www.men.public.lu/sys_edu/organigrammee.pdf Interactive Geometry Software usage mentioned in the curriculum of 5e (children aged 14 or older): "(...) La géométrie telle qu'elle est prévue au programme de la classe de 5e avec entre autres l'étude des transformations du plan et des isométries en général, se prête particulièrement bien pour l'intégration de l'outil informatique en ce sens qu'avec un logiciel de construction "dynamique" tel que Cabri Géomètre II ou The Geometer's Sketchpad, l'élève aura la possibilité de réaliser une figure précise, rectifiable et dynamique, ce qui lui permettra de passer rapidement du cas général aux cas particuliers et inversement. Cela facilitera un processus d'essais et erreurs propices au développement des capacités visées. De plus, l'outil informatique avec sa puissance de calcul et sa polyvalence permettra à l'élève d'explorer les liens qui existent entre la géométrie, l'algèbre et les premières notions de l'analyse telles les fonctions, les variations des fonctions et les premiers pas intuitifs vers la notion d'optimisation. (...) Le prolongement en classe de 4e avec le logiciel de géométrie se fera par exemple avec le théorème de Thalès, les angles inscrits, les débuts de la géométrie analytique (droites, vecteurs) et l'approfondissement de la notion de fonction, quelques sujets pouvant se traiter de manière complémentaire avec les deux types de logiciels; la puissance de calcul d'un tableur trouvera son application dans le chapitre sur les statistiques et les fonctions. (...)" http://content.myschool.lu/sites/horaires/2006-2007/pdf/5C/MATHE/MATHE_5... Interactive Geometry Software usage mentioned in the curriculum of 3eB/C/D (children aged 16 or older): "A partir de l'année scolaire 2003-2004 l'emploi de la calculatrice fait partie intégrante de l'enseignement des mathématiques des classes de la division supérieure, de la 3e à la 1ère. (...) Pour des raisons de compatibilité avec les logiciels utilisés dans les classes de 5e et 4e la calculatrice devra être équipée des logiciels

	suivants: (...) - logiciel de construction géométrique dynamique Cabri Géomètre, (...) En conséquence la Commission Nationale pour les programmes de mathématiques recommande pour les sections B, C et D la Voyage 200 (V200) de Texas Instruments. (...)" http://content.myschool.lu/sites/horaires/2006-2007/pdf/3CB/MATHE/MATHE_... Interactive Geometry Software usage mentioned in the curriculum of 9eTE (théorique) (children aged 14 or older): "(...) Pour l'élaboration et l'illustration de propriétés géométriques, il est vivement recommandé de prévoir des séances en salle informatique avec le logiciel « Cabri Géomètre ». (...)" http://content.myschool.lu/sites/horaires/2006-2007/pdf/9TE/MATHE/MATHE_...
Malta	
Poland	
Portugal	• From: Jaime Carvalho, jaimecs@mat.uc.pt, U. Coimbra, ICMI Executive Committee, International Commission on Mathematical Instruction The official syllabus for the Basic School (grades 1 to 9) in Portugal mentions the use of calculators and computers but is not explicit about DGS (this syllabus dates back to 1991). But lots of teachers (not the majority) use regularly DGS like Cabri and Sketchpad. There is going to be a new syllabus (it was approved recently) that says explicitly that "DGS and applets favor also the understanding of concepts and geometric relations, so they should also be used." and DGS should be used "in exploratory tasks and investigations". The bibliography for this new official syllabus mentions the software Geogebra and the book on DG by J. King and D. Schattchneider. In Secondary School (grades 10 to 12) the use of graphing calculators and computers is compulsory since 1997 and the official syllabus mentions frequently the importance of using DGS. Quite a few teachers use DGS like Cabri, Sketchpad and Cinderella. It should be mentioned that version 1 of Cinderella was translated into Portuguese and distributed to all Secondary Schools.
Romania	
Slovakia	

Slovenia	The state has a licence of Cabri and Derive for all high schools. • From: Vlasta Kokol-Voljc, vlasta-kokol@uni-mb.si The use of DGS is recommended in the curriculum. In reality, an estimated 5-10% of teachers use DGS. This estimation is based on the number of participants for teacher training.
Spain	• From: Tomas Recio, tomas.recio@unican.es 1- Does the DGS appears in the curriculum? In Spain, there is a basic curriculum (covering about half of the whole curriculum) that is built up by the Ministry of Education and that holds all over the country. On the other hand, the second half of the curriculum is designed and approved by the different regions. The Ministry of Education's Primary School curriculum (enacted in 2006) explicitly proposes the use of DGS as a mean for the construction of concepts from real models. Secondary education in Spain has two periods. Compulsory education goes up to age 16. Post-compulsory extends to age 18. Again, the current official curriculum enacted in 2007, explicitly indicates, in the area of Mathematics, the special interest in the use of DGS, allowing students to interact with figures, and to obtain from this interaction properties and relations, as well as to formulate and validate conjectures. In addition, the curriculum includes a variety of basic geometric notions and a reference to using computers and calculators in diverse math contexts. To a large extent the same applies to the different regional curricula. 2- Data on the usage of DGS DGS is popular in the Spanish education community. But it is much less popular using it in the classroom (due to a variety of reasons, mostly related to classroom management hardships). There are no concrete data available at this moment. What follows are some indirect evidencies. According to a 2006 report [PEREZ] about the use of computers and software by mathematics professors at Madrid schools, the most used software is: Spreadsheet 58% Derive 50% Cabri 38% Descartes 23% Cinderella 8%

	Geogebra 0% The professors use mainly the computer to: Prepare class materials 81% Write reports or letters 62% Find materials for class 54% Class management 27% The results of this Madrid survey can be extrapolated to the whole of Spain. Some of the Spanish textbooks, which are the principal guide to the classroom activities, include sections with Derive, Wiris, Geogebra and/or Cabri activities. In two important journals on mathematics teaching, the percentages of articles on dynamic geometry are the following: SUMA 1.2% UNO 1.8% There is large amount of figures, explanations, classroom materials and tutorials for Cabri, Geometer's Sketchpad, Cinderella and Geogebra, in Spanish, available on internet. Many of them have been done by Spanish school or university professors. A recent article in the Gaceta of RSME (the magazine of the Spanish Mathematical Society) by R. Losada, praises the features and possibilities of Geogebra [LOSADA]. In JAEM 2007 (by far the largest mathematics teachers congress, taking place every two years in Spain), 5% of the talks were about studies of different uses of DGS in the classroom. Within SEIEM (a Spanish society for research on mathematics education) there is a group called Aprengeom devoted to the study of teaching and learning of geometry, including didactical aspects of the use of DGS tools [APG]. [PEREZ] A. Pérez Sanz, El profesorado de matemáticas ante las Tecnologías de la Información y la Comunicación, La Gaceta De La RSME, Vol. 9.2 (2006), 521-544. http://rsme.es/gacetadigital/abrir.php?id=571 [LOSADA] R. Losada Liste, Geogebra: la eficiencia de la intuición, La Gaceta De La RSME, Vol. 10.1 (2007), 223–239. http://www.rsme.es/gacetadigital/abrir.php?id=619 [APG] http://www.uv.es/aprengeom/learngeom.html
Sweden	• From: Jonas Hall, jonas.hall@personal.danderyd.se I have not seen any curricular materials in Sweden at all that refers to

	DGS apart from some of Texas Instruments own materials. I was then in contact with one publisher trying to make the case for graphical calculators and DGS but they weren't interested. Their disinterest originally stems from the disinterest of many teachers - In Sweden many teachers of mathematics are more interested in their primary subject such as biology, chemistry or physics - and the lack of a tradition using DGS. • From: David Sjöstrand, david@ydsa.se You have received a mail from Jonas Hall, where he describes the situation in Sweden very well. I agree completely.
The Netherlands	• DGS is in the curriculum: the list of final demands on students does not mention (having used) a DGS, for any school type. • From: A. Goddijn, a.goddijn@fi.uu.nl • Position: researcher of technology in mathematics education at the Freudenthal Institute There are no statistics concerning the usage of DGSs in The Netherlands. All students and teachers have access to geometrical software, mostly Cabri. An estimate that 50% of the teachers use this might be reasonable, but it is guessing. Update from Paul Drijvers (also from the Freudenthal Institute): GeoGebra is also downloaded regularly. But is Cabri still licensed to and shipped with the two main Dutch school books for math?
United Kingdom	• From: Kenneth Ruthven, kr18@cam.ac.uk Le Royaume-Uni a quatre systèmes d'enseignement secondaire dont celui de l'Angleterre est nettement le plus grand. (Les autres sont ceux de l'Ecosse, le Pays de Galles, et l'Irlande du Nord). Je me concentre sur l'Angleterre dans cette réponse. Je commence avec le 'National Curriculum' actuel. (Certains changements sont prévus pour l'année prochaine dont je parlerai plus tard). Le 'Key Stage 3' (Years 7-9) concerne les jeunes de 11-14 ans. Le programme de mathématiques est à: http://www.nc.uk.net/nc/contents/Ma-3-3-POS.html. Le 'Key Stage 4' (Years 10-11) concerne les jeunes de 14-16 ans. Le programme de mathématiques est à http://www.nc.uk.net/nc/contents/Ma-4+-3-POS.html. Là on trouve des références très génerales à 'using ICT', comme: “Pupils should be taught to: select problemsolving strategies and resources, including ICT, to use in geometrical work, and monitor their effectiveness." Et certaines références plus particulières, comme: "Pupils should be taught to find loci, both by reasoning and by using ICT to produce shapes and paths (for example, equilateral triangles).”

	Pour 'Key Stage 3' il y a un document d'accompagnement qui propose des traitements plus explicites: http://www.standards.dfes.gov.uk/secondary/keystage3/respub/mathsframework/ma_fmkdl/. Les documents télechargeables sur la géometrie sont: Section 4 Examples - Geometrical reasoning, lines, angles, shapes Section 4 Examples - Transformations Section 4 Examples - Coordinates, construction, loci Là on trouve certains images de figures SDG, et certaines recommendations particulieres du type “Use dynamic geometry software to?”, mais sans élaboration du processus. Pour Years 12-13 (16-18 ans) la situation est plus complexe, mais ce qu'on peut dire avec confiance est que très peu de géometrie est exigé, et que les SDG sont inconnus. Les nouveaux documents sont en cours de préparation. Leur implémentation est prévu pour l'année scolaire prochaine avec les classes qui commencent 'Key Stage 3'. Les documents de base pour le 'National Curriculum' sont à: http://curriculum.qca.org.uk/uploads/QCA-07-3338-p_Maths_3_tcm6-403.pdf?return=http%3A//curriculum.qca.org.uk/subjects/mathematics/keystage3/index.aspx http://curriculum.qca.org.uk/uploads/QCA-07-3339-p_Maths_4_tcm6-404.pdf?return=http%3A//curriculum.qca.org.uk/subjects/mathematics/keystage4/index.aspx Ils font une recommendation générale que “Students should be familiar with a range of resources and tools, including graphical calculators, dynamic geometry and spreadsheets, which can be used to work on mathematics.” Il reste à voir s'il y aura des élaborations dans d'autres documents d'accompagnement.