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Intergeo

Final Report on Usage Increase of DGS

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

1 Table of Contents

2 Summary

This report deals with the situation of DGS usage in Europe, almost three years after the publication of deliverable D.5.1). Section 3 refers to the data collected by different Intergeo deliverables. Section 4 discusses some methodological difficulties and proposes a concrete procedure to obtain some data on DGS use.

Section 5 displays the results collected on 7 European countries about the following three questions:

a) the evolution of Dynamic Geometry presence along the years 2007, 2008 and 2009 in some journals of reference for teachers in different European countries

b) the evolution of Dynamic Geometry activities and contributions along the same years, at some popular national Conferences for teachers

c) the evolution, in these years, of the references to Dynamic Geometry in the national curriculum or guidelines, for some European countries

We must gratefully acknowledge the help provided by our colleagues of WP5 in collecting the results.

Section 6 analyzes the data and proposes some conclusions and recommendations. In particular, it shows the need to establish future analysis and the relevance, for increasing DGS usage, of projects such as Intergeo, aiming to develop tools for communities of practice. The need to establish some kind of structure that could allow users to continue profiting from Intergeo's platfom, is also commented.

Section 7 (a kind of Appendix) describes the collected data with further detail.

3 DGS usage indicators through Intergeo deliverables

Intergeo's Description of Work (DoW) establishes the need to collect statistical data regarding the usage of interactive geometry at the beginning, during, and at the end of the project.

In fact, one of the first deliverables for the project (D.5.1: *Status quo Report on the Usage of DGS*, January 2008) was devoted to present the results of a survey that was conducted by some Intergeo partners along 2006-2007, contacting relevant education officers and personalities in most European countries. It analyzes the received answers to the following questions:

- Does a reference to DGS appears in the national curriculum? Is the use of geometry software recommended or required by the curriculum?
- Data on the usage of DGS. In particular: availability in schools, use at the classroom.

It must be said that information about these issues was provided, in most cases, through a variety of indirect means (some dissertations or national reports on the use of ICT[2] in schools, existence of user groups or teachers' associations providing electronic content to be used with geometry software in teaching, declared sales figures for some commercial software, etc.).

[2] ICT: Information and Communication Technology.

We believe that D.5.1., a document that includes, as well as a summary for each country, the original answers provided by the experts to the different posed questions, deserves further study by researchers in mathematics education. Yet, we can summarize its findings stating that at the beginning of year 2008, there were **few countries referring in an explicit way** to DGS (one quarter of the 19 consulted countries) in their national curriculum or guidelines. Among the other countries not mentioning DGS, half of them referred to ICT in general, while the other half did not even mention ICT at all. However in some of these latter countries there were some recommendations to use DGS by educational inspectors like in Cyprus, or in Denmark for experimental schools.

The availability of DGS in schools **varied 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 license of a specific DGS software.

But the **availability** of DGS in schools **did not automatically imply their use**. For example in Lithuania, while there was a national license, it seemed that only one fourth of schools regularly used DGS. Furthermore it must be distinguished 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. There was 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 was concluded in D.5.1, that is, as of January 2008, DGS **was not used on a large scale** in Europe. Moreover, although there was not at that point a detailed study of the incidence of the different types of DGS use at the classroom (from a mere demonstration in front of passive students, to active students involved in problem solving tasks through some DGS), some qualitative studies within specific countries seemed to show **the prevalence of demonstration and illustration uses over open-ended activities for students**.

Along the past three years, Intergeo has collected, in different deliverables, indirect data concerning the usage of DGS. For instance, at D. 5.2 (*Report on Local User Meetings*, October 2008), D. 6.2 and 6.3 (*Best practises for DGS content*, November 2009 and *Guidelines for external testing*, February 2010), D. 4.7 (*Usage analysis report and platform adjustments*, November 2009).

All these documents contain relevant data concerning the impact of some specific Intergeo action (geographic coverage and number of participants at Intergeo-related local user meetings, statistics about best practices and external testing for the Intergeo resources, Intergeo platform usage data, etc.). Actually, it is data concerning Intergeo impact and not, with all generality, about DGS usage, but we think data about Intergeo impact could be a relevant source of information for DGS usage in Europe. On the one hand it is true that no every European country is involved in Intergeo, but, on the other, all major DGS providers are members of the Intergeo consortium and, moreover, Intergeo is the only European-wide project, specifically concerning DGS, during this period (2007-2010).

A very rough summary, extracted from this large collection of data in the four deliverables mentioned above, points out to an initial period of early interest (from external visitors) in the use of Intergeo tools, followed by a period with less activity (due to the platform adjustments) and then a period of high activity (number of involved teachers and number of performed actions). Although it is even more difficult to present a precise timeline for this development, we could dare to say that the three periods could be described as occurring at October 2007-Summer 2008, Fall 2008-Spring 2009, Summer

2009-Summer 2010, respectively. For instance, the Internal Evaluation report for Y2 (October 2008-October 2009), states:

"The i2geo platform was officially registered on17th of December, 2008.

The monthly trends show

- *a significant increase of visits in March and April 2009 which has to be attributed to the amount of visits caused by members of the project itself during the resource-migration process. Due to these effects the numbers given for this period cannot be interpreted as representative user behaviour.*
- *a significant decrease of visits during the summer period. We assume that the number of visits for the period May to September reflects the real visits generated by active users of the platform.*
- *a significant increase of visits in September 2009."*

This implies, in our opinion, that obtaining relevant data concerning DGS usage, interpolated from Intergeo platform statistics, will have to wait till the Year 3 report, since the data from previous years is too dependent on the shaping up of the platform. Yet, at D. 6.3, there are indications that the usage is rapidly increasing, doubling some figures (for instance, number of evaluations or number of external members involved in this task) in just three months (November 2009-February 2010).

4. Measuring DGS usage: a methodological proposal

Although it established the need to collect statistical data regarding the usage of interactive geometry *at the beginning, during, and at the end of the project*, Intergeo's DoW did not prescribe a concrete method to obtain such data. Deliverables D.8.1 and D.8.2 (*Evaluation Plan* and *Methodology for measuring Intergeo impact*), both presented at the first trimester of the project, contained some hints about measuring DGS usage (and not only Intergeo success):

*"**School Coverage***

[Abstract from DoW, p. 13] *Today, only a small percentage (less than 25% in all countries) of schools are working with geometry software, though it is required in many curricula, or will be required in the next revision. We try to increase this rate to 90% within three years. WP5 will collect this data, in particular by conducting surveys among representative schools and using the data available from the national governmental bodies for education issues, or the EC, if there are working groups established that are similar to those in the Education & Training 2010 programme.*

WP5 collects statistical data regarding the usage of interactive geometry at the beginning, during, and at the end of the project. The status quo report on the usage of DGS is to be delivered by the end of January 2008 and shall describe how DGS are used in Europe. This collection contains country-specific data concerning:

- numbers on DGS usage

- the presence of DGS in the curriculum

- sales numbers if possible"

As stated above, the *Status Quo* report was delivered on time, but could not include, for lack of appropriate data, such figures. It was, rather, a qualitative report, based on survey responses from relevant educational agents in different countries.

Indeed, we believe that establishing and applying a serious method, statistically reliable, that could provide a reasonable coverage on the current use of DGS at the European schools, is a task

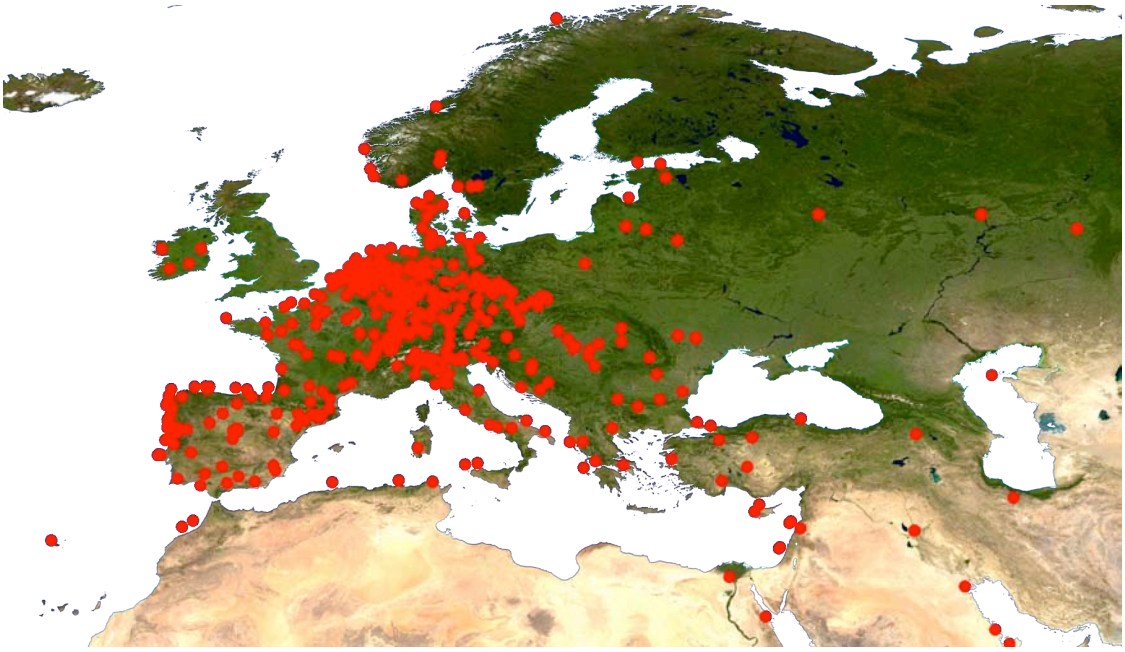
a) too demanding, in particular, regarding its secondary role inside the project Intergeo (it is just one out of seven or eight impact parameters considered by Intergeo in its *Methodology for measuring impact*, D.8.2). In fact, we know of no European country having ever established such accountability.

b) irrelevant (regarding the possible detection of trends in DGS usage and, in particular, trends related to Intergeo success), if the obtained data are to cover just the three years of duration of the project.

In this respect, D.8.4 (the internal report we have elaborated for the second year of the project but, for different reasons, written in March 2010), states that

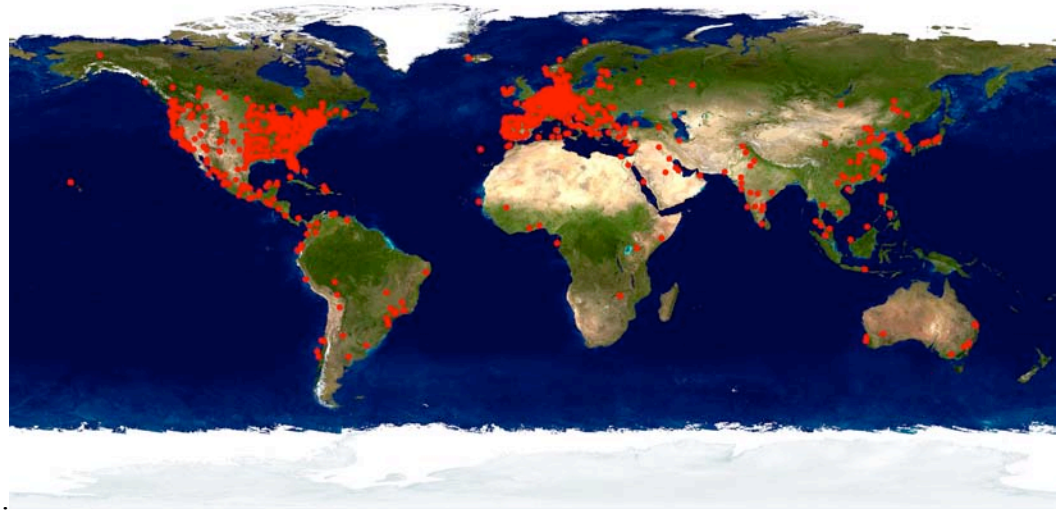
> *"This (School coverage) performance indicator has been discussed in D5.1 Status Quo Report in detail. We did not expect that school coverage could be increased a lot yet due to the activities so far, so we did not deem it important to do another detailed analysis for this report.*
>
> *All further current activities (LUMs, conference attendances, publications) besides the platform may also contribute to school coverage, but it does not seem to be easy to measure these effects separately (see the following chapter).*
>
> *Nevertheless, this indicator attempts to measure the amount of schools aware of interactive geometry in Europe. None of the indicators above tackle this problem; basically, IP's are used to put accesses on a map. The platform development team (WP4) is currently investigating usage of ippages.com, which we could actually leverage for other services (e.g. distribution of points for a given educational level, or a given set of topics).*
>
> *At the moment we are using this in order to show the visits. The preprocessor sends the IP to ippages and we get from them the values of lattidude and longitude depending on the IP. With this informations we can draw the place to a linear worldmap from NASA (http://visibleearth.nasa.gov/view_rec. php?id=2430). The result can be contemplated at http://stat.i2geo.net/worldmap_big.png (access restricted to i2geo editors). It will accumulate each day; and at the moment it includes visits since 27th of November".*

Below we display a map of Europe (and a World map) with the accumulated visits to the Intergeo platform (showing, in some sense, DGS usage) up to date (June 14, 2010). We can say that it gives some positive indicators: if there is a red dot, surely there is a DGS user, but not conversely.



It should be remarked that most Central Europe is practically covered by users. The case of Italy is also remarkable (North versus South), a country not participating in the Intergeo consortium. UK, East Europe, Greece, Nordic and Balkan countries (none of them in Intergeo) show very few users (but then, one can not extract information about DGS use).

The case of Spain and Portugal should be analyzed bearing in mind the distribution of population: most of the empty spots in Spain actually correspond to areas with very few inhabitants.



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In view of this situation, a concrete step forward, to measure DGS usage, was adopted in March 2010, by the teams involved in the WP5 . Thus, the D.8.4 stated that

> *"This new deliverable (D.5.5) will regard other impact indicators, such as those regarding*
>
> *a) the evolution of Dynamic Geometry presence along the years 2007, 2008 and 2009 in some journals of reference for teachers in different European countries*
>
> *b) the evolution of Dynamic Geometry activities and contributions along the same years, at some popular national Conferences for teachers*

c) the evolution, in these years, of the references to Dynamic Geometry in the national curriculum or guidelines, for some European countries"

In fact, D.5.1 had already reflected, in some countries, the status of these same parameters, so it could useful to learn about its evolution.

Next Section presents the result of our findings concerning these three parameters in Austria, Czech Republic, France, Germany, Italy, Slovakia and Spain. The data have been obtained by WP5 members or closely related persons. One should bear in mind that there is a lot of subjectivity in the interpretation of what a Dynamic Geometry occurrenbce in a journal should be considered (a large article mostly devoted to DGS? Even if it deals with DGS just collaterally? A short notice?), what a "journal of reference" is to be considered, etc.

5. DGS usage: some data analysis

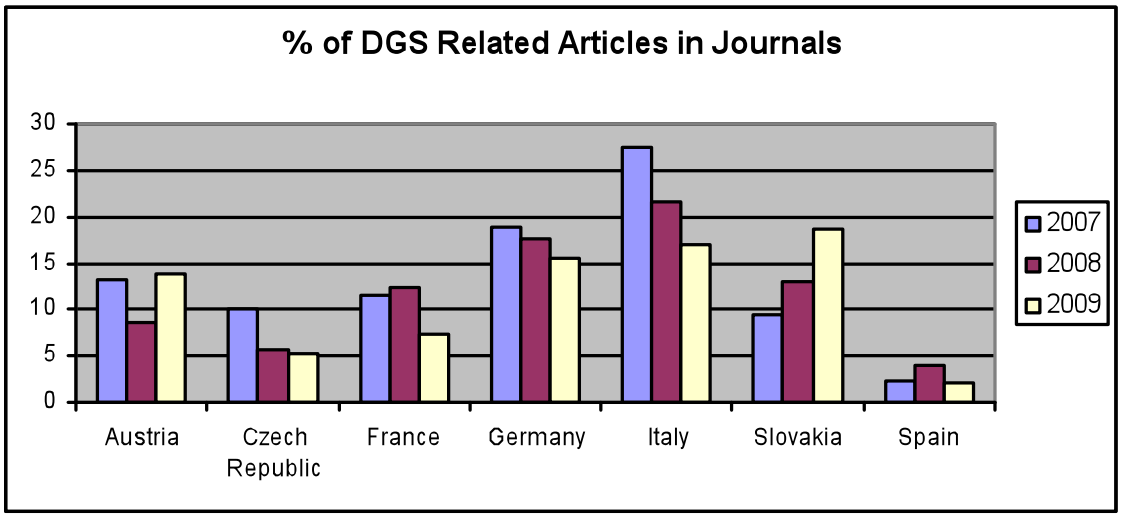
The data collected comes from seven countries: Austria, Czech Republic, France, Germany, Italy, Slovakia and Spain.

5.1 Ratio of DGS papers in journals

This item reflects information about the number of papers on DGS or closely related themes, compared to the total number of papers, in well known journals that are widely distributed among teachers, for the years 2007, 2008 and 2009. More than 700 papers where surveyed, from 22 journals.
The following table is a summary of the data in Annex 7.1, and collects the total percentages for the seven countries:

Table 5.1. Percentage of DGS related papers in journals

Country	Number of journals	2007 (%)	2008 (%)	2009 (%)
Austria	2	13.2	8.6	13.8
Czech Republic	3	10.0	5.6	5.2
France	1	11.6	12.4	7.4
Germany	4	18.8	17.7	15.5
Italy	3	27.5	21.7	17.0
Slovakia	2	9.5	13.0	18.7
Spain	7	2.4	4.0	2.1
Mean		13.3	11.9	11.4



Austria: There is no indication of a tendency. There is 34.8% drop from 2007 to 2008, but a level similar to 2007 is obtained in 2009.
Czech Republic: There is a 44% drop from 2007 to 2008, and then remains stable.
France: There are some fluctuations that do not seem to be significant.
Germany: There is a very moderate decreasing tendency from 2007 to 2009.
Italy: The data shows an approximate drop of 5 points, each year in the percentage.
Slovakia: There is a moderate tendency to increase.
Spain: The percentage is quite steady, and it is low compared with the other countries.

5.2 Percentage of DGS talks in conferences

The data considered in this point is obtained from one, two or three mathematics teachers meetings or conferences of reference (for instance, the largest mathematics teachers conference in the country). It is the percentage of activities, such as talks, panel discussions, or tutorial courses, devoted to DGS in those meetings, on the years 2007, 2008 and 2009.

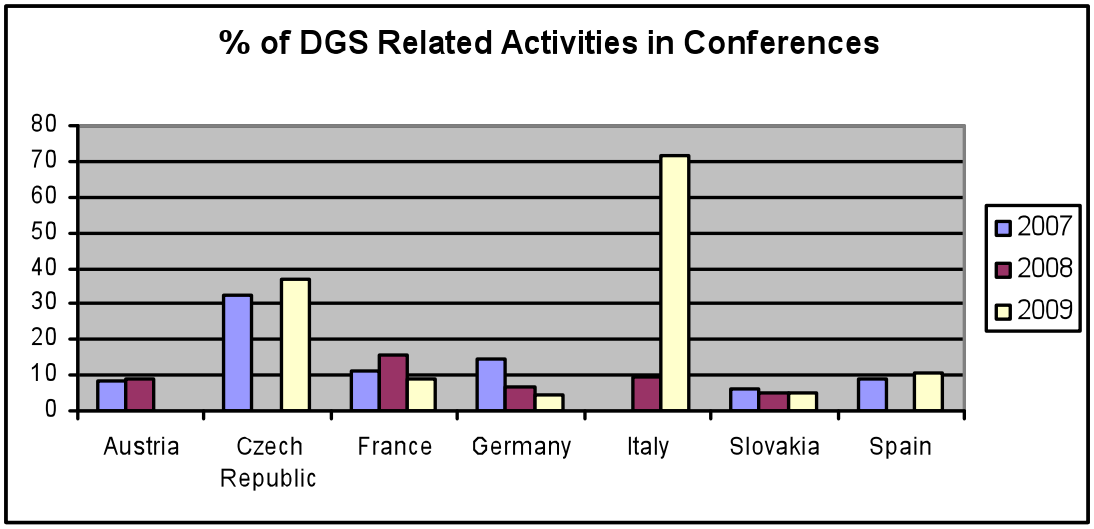
The following table is a summary of the data in annex 7.2, and collects the total percentages for the seven countries:

Table 5.2. Percentage of DGS activities in conferences

Country	Number of conferences	2007 (%)	2008 (%)	2009 (%)
Austria	1	8.3	9.1	0.0
Czech Republic	1	32.3	(1)	36.8
France	1	11.3	15.4	9.1
Germany	1	14.4	6.6	4.2
Italy	3	(2)	9.5	71.4
Slovakia	1	6	4.8	5.2
Spain	2	9	(1)	10.9
Mean		13.6	9.1	19.7

(1) These conferences take place on odd years.

(2) It was organized jointly with the National Congress of Mathematicians. Therefore it is not comparable with 2008 and 2009.



For all countries, there are no significant variations in the percentage of DGS related activities from one conference to the next, with the exception of Italy, where an impressive 71% took place in 2009.

5.3 Changes in the mathematics curricula

The question in this paragraph is whether there have been any changes with respect to DGS in the mathematics curricula, on the years 2007, 2008 or 2009. These changes might be, for instance, "DGS appears in the curriculum for the first time", or "DGS is mentioned in the curriculum in a different way than before". In this case, the information is not quantitative.

The countries that present such kind of changes in the mathematics curricula are France, Germany and Italy. In the other four countries, there have been no changes in the curricula, or the changes do not contain any reference to DGS.

France

First part of secondary school
Some very slight changes have been introduced in the curricula in September 2009. Concerning DGS, an additional reference to DGS has been done systematically for each level (6ème, 5ème, 4ème, 3ème) at the beginning of the Geometry section :
Solving problems in geometry involves the practice of geometrical constructions by means of instruments and dynamic geometry software (for the class of 6ème, grade 6, « dynamic » is not mentioned)
In the curriculum of the class of 4ème (grade 8) for 3D geometry, a new formulation is used :
« Ces activités doivent être complétées par l'observation et la manipulation d'images dynamiques données par des logiciels de géométrie. »
(These activities must be completed by observing and manipulating dynamic images provided by geometry software)

instead of the former one which was:
« Les élèves sont amenés à observer et manipuler y compris sur un écran d'ordinateur des

pyramides et des cônes. »
(Students are led to observe and manipulate pyramids and cones, including on a computer screen).

Second part of secondary school
A new curriculum was adopted for the class of Seconde (grade 10) starting in September 2009. The reference to dynamic geometry software is stronger than in the previous one.
For the study of functions dynamic geometry is explicit (it was not the case before)
In geometry, a new sentence is added about the contribution of dynamic geometry to students autonomy
« Dans le cadre de la résolution de problèmes, l'utilisation d'un logiciel de géométrie dynamique par les élèves leur donne une plus grande autonomie et encourage leur prise d'initiative. »
(In the frame of problem solving, the use of dynamic geometry software by students gives them a greater autonomy and supports them in having initiative).

The use of software is stressed for space geometry:
« L'utilisation d'un logiciel de visualisation et de construction est un élément déterminant dans « l'apprentissage de l'espace ».
(The use of a visualization and construction software is a decisive element of the learning of space).
« On entraîne les élèves à l'utilisation autonome d'un logiciel de géométrie dans l'espace »
(Students are trained to use on their own a software for space geometry).

Conclusion about the curricula
The emphasis on DGS seems to be stronger than before.

Germany

In the 16 different mathematics curricula, 64 of 516 topics comprised DGS. That is 12.4%.

Italy

There is a new Curriculum for Primary School since 2007. Computers appear for the first time:
"L'uso consapevole e motivato di calcolatrici e del computer deve essere incoraggiato opportunamente fin dai primi anni della scuola primaria, ad esempio per verificare la correttezza di calcoli mentali e scritti e per esplorare i fenomeni del mondo dei numeri e delle forme." (page 95)
(The conscious and justified use of the calculator and the computer must be conveniently encouraged from the first years of primary school, for example for checking mental or written arithmetic, and for the exploration of the properties of numbers and forms).

There were no changes in the curriculum of the other types of school.

6. Conclusions and recommendations

The above data show clearly, in our opinion, a few conclusions:

• Three years is not enough time to derive consistent trends about DGS usage.

• For instance, concerning ratio of DGS papers in popular teachers' journals, inter-annual variations, happening almost in every country, are too large. Yet, it is clear that DGS is

more popular (among those contributing in teachers' journals) in Italy or Germany. Austria, Czech Republic, France, Slovakia, come to a second position in this ranking, hoding percentages around 12%. Spain is, distinctly, the last (less than 3%). But there is no way to detect whether there has been (in any of the considered countries) an increase of the considered ratio along the period 2007-2009.

• Regarding activities on DGS at teachers' conferences, the annual data present, in general, less variations. Most countries are in a similar interval (around 10%), with the exception of the Czech Republic, clearly over this average. The case of Italy does not allow to extract sound conclusions. Again, there is no way to detect whether there has been (in any of the considered countries) an increase of the considered ratio along the period 2007-2009.

• Official curricular changes go always in the direction of including and recommending the use of DGS at the school. The number of countries explicitly referring to DGS in the curriculum has increased (c.f. D.5.1 for comparisons). We could say that DGS is *politically correct.* But it does not seem to exist a relation between

curricular presence of DGS/higher ratio on items 1 or 2

See, for instance, the cases of Slovakia, Czech Republic (without DGS reference) and Spain (with quite a few references). .

• DGS role in mathematics education seems to be confined, at best, to, say, a mere 10% in terms of the *worries* and resources (of all kinds) used by teachers. This figure, by itself, is neither good nor bad. What seems amazing is that

a) the presence of DGS in the official curriculum does not affect such figure (case of Spain, for instance)

b) it does not evolve clearly with the years

c) it seems to depend more on the existence of strong "communities of practice" (case of Czech Republic, Italy, Slovakia).

Bearing all this in mind, we believe that the outcome of a project such as Intergeo, directly concerned with providing these communities with resources, ready for classroom use, and favoring the gathering of DGS practitioners, would do much more for DGS usage than curricular changes (at least if they go in the positive direction, or at least not forbidding the use of DGS).

But some more time would have to elapse before we can perceive the Intergeo effect… Therefore, the main recommendation of this report should necessarily go in the direction of supporting the continuation, by whatever means, of the Intergeo goals and the maintenance of the Intergeo platform.

7. Data Annexes

Question 1. Papers related to DGS in journals

Austria

	2007		%	2008		%	2009		%
Journal TI-News	4	22	18.2	2	20	10.0	3	19	15.8
IBDG	1	16	6.3	1	15	6.7	1	10	10.0
	5	**38**	**13.2**	**3**	**35**	**8.6**	**4**	**29**	**13.8**

Czech Republic

	2007		%	2008		%	2009		%
Matematika-fyzika–informatika	7	44	15.9	2	42	4.8	4	55	7.3
Učitel matematiky	1	25	4.0	2	27	7.4	1	25	4.0
Rozhledy matematicko - fyzikální	1	21	4.8	1	21	4.8	0	16	0.0
	9	**90**	**10.0**	**5**	**90**	**5.6**	**5**	**96**	**5.2**

France

	2007		%	2008		%	2009		%
Bulletin APMEP	13	112	11.6	12	97	12.4	8	108	7.4
	13	**112**	**11.6**	**12**	**97**	**12.4**	**8**	**108**	**7.4**

Germany

	2007		%	2008		%	2009		%
Mathematik lehren			16.7			37.5			16.7
MatheWelt			16.7			16.7			16.7
Praxis der Mathematik			16.7			16.7			16.7
Grundschule Mathematik			25.0			0.0			0.0
			18.8			**17.7**			**15.5**

Italy

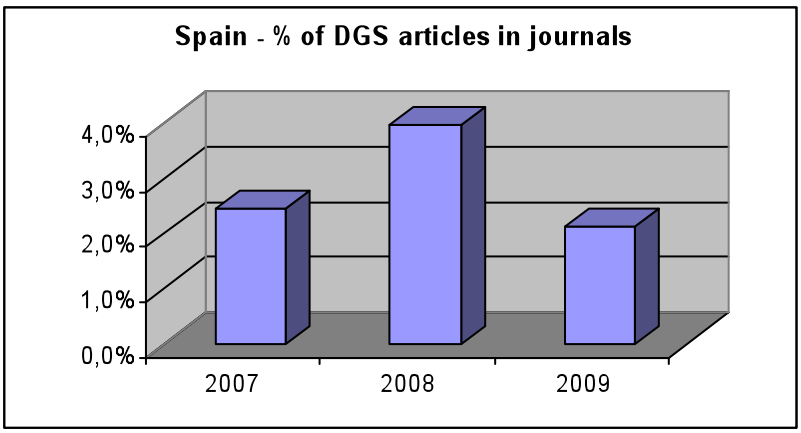
	2007		%	2008		%	2009		%
Archimede	1	18	5.6	0	19	0.0	0	17	0.0
Progetto Alice	9	21	42.8	10	21	47.6	5	21	23.8
Didattica della Matematica e delle Scienze Integrate	15	52	28.9	10	52	19.2	10	50	20.0
	25	**91**	**27.5**	**20**	**92**	**21.7**	**15**	**88**	**17.0**

Slovakia

	2007		%	2008		%	2009		%
Slovenský časopis pre geometriu a grafiku	1	10	10.0	1	10	10.0	2	10	20.0
Matematika, Informatika, Fyzika	1	11	9.1	2	13	15.4	1	6	16.7
	2	**21**	**9.5**	**3**	**23**	**13.0**	**3**	**16**	**18.7**

Spain

	2007		%	2008		%	2009		%
UNION	1	57	1.8	1	71	1.4	3	59	5.1
Números	0	24	0.0	0	6	0.0	2	33	6.1
Suma	0	36	0.0	2	30	6.7	0	29	0.0
UNO	1	27	3.7	2	27	7.4	0	29	0.0
Gamma	1	19	5.3	2	19	10.5	0	15	0.0
La Gaceta RSME	3	39	7.7	0	29	0.0	0	25	0.0
Matematicalia	0	44	0.0	2	44	4.5	0	44	0.0
	6	**246**	**2.4**	**9**	**226**	**4.0**	**5**	**234**	**2.1**



Question 2. Contributions in conferences related to DGS

Austria

	2007		**%**	**2008**		**%**	**2009**		**%**
Teachers Days	1	12	8.3	1	11	9.1	0	10	0.0
	1	**12**	**8.3**	**1**	**11**	**9.1**	**0**	**10**	**0.0**

Czech Republic

	2007		**%**	**2008**		**%**	**2009**		**%**
Užití počítačů ve výuce matematiky	20	62	32.3				14	38	36.8
	20	**62**	**32.3**				**14**	**38**	**36.8**

France

	2007		**%**	**2008**		**%**	**2009**		**%**
Annual National Meeting of APMEP	11	97	11.3	18	117	15.4	8	88	9.1
	11	**97**	**11.3**	**18**	**117**	**15.4**	**8**	**88**	**9.1**

Germany

	2007		**%**	**2008**		**%**	**2009**		**%**
GDM			10.0			6.5			9.5
MUED			0.0			13.3			3.0
AMI			33.3			0.0			0.0
			14.4			**6.6**			**4.2**

Italy

	2007		**%**	**2008**		**%**	**2009**		**%**
UMI-CIIM	(1)			2	21	9.5	10	14	71.4
				2	**21**	**9.5**	**10**	**14**	**71.4**

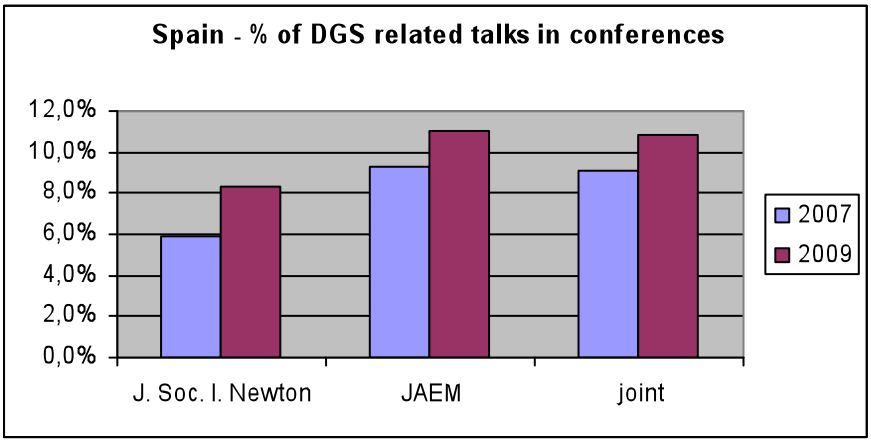
(1) It was organized jointly with the National Congress of Mathematicians. Therefore it is not comparable with 2008 and 2009.

Slovakia

	2007		**%**	**2008**		**%**	**2009**		**%**
DIDZA – national conference	3	50	6.0	3	63	4.8	3	58	5.2
	3	**50**	**6.0**	**3**	**63**	**4.8**	**3**	**58**	**5.2**

Spain

	2007		%	2008		%	2009		%
Jornadas Socidead I. Newton	1	17	5.9				1	12	8.3
JAEM	19	204	9.3				20	181	11.0
	20	**221**	**9.0**				**21**	**193**	**10.9**



Question 3. Changes in curricula

Austria

No changes.

Czech Republic

No changes.

France

First part of secondary school

Some very slight changes have been introduced in the curricula in September 2009.
Concerning DGS, an additional reference to DGS has been done systematically for each level (6ème, 5ème, 4ème, 3ème) at the beginning of the Geometry section :
Solving problems in geometry involves the practice of geometrical constructions by means of instruments and dynamic geometry software (for the class of 6ème, grade 6, « dynamic » is not mentioned)
In the curriculum of the class of 4ème (grade 8) for 3D geometry, a new formulation is used :
« Ces activités doivent être complétées par l'observation et la manipulation d'images dynamiques données par des logiciels de géométrie. »
(These activities must be completed by observing and manipulating dynamic images provided by geometry software)
instead of the former one which was:
« Les élèves sont amenés à observer et manipuler y compris sur un écran d'ordinateur des pyramides et des cônes. »
Students are led to observe and manipulate pyramids and cônes, including on a computer screen

Second part of secondary school

A new curriculum was adopted for the class of Seconde (grade 10) starting in September 2009. The reference to dynamic geometry software is stronger than in the previous one.
For the study of functions dynamic geometry is explicit (it was not the case before)
In geometry, a new sentence is added about the contribution of dynamic geometry to students autonomy
« Dans le cadre de la résolution de problèmes, l'utilisation d'un logiciel de géométrie dynamique par les élèves leur donne une plus grande autonomie et encourage leur prise d'initiative. »
In the frame of problem solving, the use of dynamic geometry software by students gives them a greater autonomy and supports them in having initiative.
The use of software is stressed for space geometry :
« L'utilisation d'un logiciel de visualisation et de construction est un élément déterminant dans « l'apprentissage de l'espace ».
The use of a visualization and construction software is a decisive element of the learning of space
« On entraîne les élèves à l'utilisation autonome d'un logiciel de géométrie dans l'espace »
Students are trained to use on their own a software for space geometry

Conclusion about the curricula
The emphasis on DGS seems to be stronger than before.

Germany

In the 16 different curricula, 64 of 516 topics comprised DGS. That is 12.4%.

Italy

2007- New Curriculum for Primary school.
Computer (DGS?) appears for the first time:
"L'uso consapevole e motivato di calcolatrici e del computer deve essere incoraggiato opportunamente fin dai primi anni della scuola primaria, ad esempio per verificare la correttezza di calcoli mentali e scritti e per esplorare i fenomeni del mondo dei numeri e delle forme." (page 95)

No Changes in the other types of school.

Slovakia

No changes.

Spain

No changes.