I2G

INTERGEO

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The INTERGEO Consortium

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Contents

1 Project Objectives

Interactive Geometry is a way to improve mathematics education with the help of a computer. Using sophisticated software, sketches and figures can be brought to life, comparable to what movies mean to images.

Although many examples of class materials that were created using Interactive Geometry Software exist, interactive geometry software is still not used regularly in classrooms. In fact, many teachers do not know about the new possibilities, or they do not have access to the necessary software and geometry resources.

The EC-co-funded project INTERGEO creates a web portal with interactive geometry resources to attack the three main barriers for a EC-wide adoption of the existing material: missing search facilities, lack of interoperability, and missing quality information.

The available content will be enriched with curricular Metadata that makes it easy to find the proper examples for a certain teaching situation. The intellectual property rights for the content will be cleared. Teachers should not have to bother whether they are allowed to redistribute material to their students or not.

Also, a common file format for interactive geometry software is being developed. Because the project consortium includes leading commercial and open source software suppliers for interactive geometry this format will enable teachers to use the content regardless of which software they use.

Finally, experts and practitioners in mathematics education rate material for its classroom suitability. This data, as well as additional comments, is available to users of the web portal. Users can also add their own ratings and comments.

Teachers all over Europe will be able to use and re-use quality teaching material. The project partners already collected more than 3000 resources that serve as an initial seed for the database. User contributions to it are highly encouraged, both for content and quality assessment.

The project involves contact persons from governments and national centres for education, as well as curriculum experts. Software and content providers as well as people working in math education can join the project as associate partners. After the official project duration of three years the infrastructure will be transferred to the public for a sustainable success of the initiative.

2 Consortium

INTERGEO was initiated by a consortium of academic partners and software companies who are leading the field of Interactive Geometry in Europe. The broad coverage of commercial, semi-commercial and free software products, and the diversity of the educational settings the partners come from, ensures that the project can address the needs of its target audience.

In the following we briefly describe each consortium member.

2.1 Pädagogische Hochschule Schwäbisch Gmünd (PHSG)

The University of Education Schwäbisch Gmünd, Germany, is a small University of approximately 2400 teacher students located east of Stuttgart. It hosts the Project Office and coordinates INTERGEO. Besides administrative and public relations work, PHSG is also involved in other work packages. As the interactive Geometry Software Cinderella is being developed in Gmünd, a lot of work was done for the common file format, and content that has been developed in cooperation with Prof. Dr. Dr. Jürgen Richter-Gebert from the Technical University of Munich was contributed.

Project members in Schwäbisch Gmünd have been: Prof. Dr. Ulrich Kortenkamp (Project Coordinator, Member of the Steering Committee), Christian Dohrmann (Project Office), Dipl.-Päd. Axel Blessing (Project Office), Christian Markus (Webmaster).

2.2 Deutsches Forschungszentrum für Künstliche Intelligenz GmbH (DFKI)

The German Research Center for Artificial Intelligence GmbH, DFKI was founded in 1988. Today, DFKI is one of the largest non-profit contract research institutes in the field of innovative software technology based on Artificial Intelligence (AI) methods. DFKI is focusing on the complete cycle of innovation - from world-class basic research and technology development through leading-edge demonstrators and prototypes to product functions and commercialization. Based in Kaiserslautern, Saarbrücken, Bremen, and Berlin, the German Research Center for Artificial Intelligence ranks among the important "Centers of Excellence" worldwide. The key directors of DFKI are Prof. Dr. Wolfgang Wahlster (CEO) and Dr. Walter G. Olthoff (CFO). DFKI's mission is technology transfer, which is to move innovations in AI as quickly as possible from the lab into the marketplace by maintaining research projects at the forefront of science. Expertise and experience of the company DFKI is involved in numerous industrial, academia projects including projects in the EC programmes dealing with research and development in the broad areas of intelligent applications.

In 2000 an Education Technology Center of DFKI, headed by Prof. J.H. Siekmann, has been established. It has carried out basic research and applications in several fields of AI, including presentation planning (for education material), user modeling, proof planning, knowledge representation (for educational and mathematical web-documents) and integration of (mathematical services). Its main prototypical product so far has been the web-based, user-adaptive, generative learning environment

ActiveMath that integrates several external services. Members of the group are actively involved in the international academic life by organizing or contributing to conferences and workshops.

Relevant project members at DFKI GmbH have been: Paul Libbrecht (WP4[1] and WP2 leader, member of steering committee, WP3 active member), Erica Melis (group leader), Oliver Keller (administrative contact), Michael Dietrich (WP4 and WP2 active member), Martin Homik (WP2 active member), Jasmin Lehmann (WP4 translator)

2.3 Cabrilog (CABRILOG)

Cabrilog is a French spinoff company of the University Joseph Fourier in Grenoble and the CNRS in France. It was founded in 2001 with the mission of pursuing the development of the Cabri Technology started some 15 years earlier as an academic project at IMAG (Informatics and Applied Math Grenoble). Main industrial and academic partnerships of Cabrilog are with Texas Instruments (USA) and the Universities of Grenoble (DIAM, Didactique, Informatique et Apprentissage des Mathématiques – LIG). Currently, Cabrilog is distributing, worldwide, Cabri II Plus, the European initiator of all dynamic geometry systems (started in 1985 and to date reaching more than 100 Million users), Cabri 3D, the dynamic math software for Space Geometry, and is strongly engaged in the development of a new Cabri, Cabri LM, an environment aimed for elementary education in math.

Project members at Cabrilog have been: Dr. Jean-Marie Laborde (Research and Development Director), Mathieu Ippersiel (Research engineer, Leader of WP5), Prof. Dr. Colette Laborde (Math Education Expert), Thierry Bissuel (Control and Management), Pierre Laborde (Project manager Users and Pedagogy).

2.4 Université Montpellier II (UM2)

The University Montpellier II is a large science university by the Mediterranean shore, counting around 15 000 students. It is involved in several work packages, most notably it leads the Quality Framework WP6. With the help of the Institut National de Recherche Pédagogique (INRP, Lyon), and the Sésamath association, it coordinates a team of secondary teachers who lead the collection of resources on the central web server. We worked as well on the common file format, especially for the TracEnPoche software belonging to the MathEnPoche e-Learning framework of the Sésamath association. Another software hosted by UM2 is Geoplan/Geospace.

Project members supported by UM2 are: Dr. Christian Mercat (Member of the Steering Committee), Benjamin Clerc (President of the Sésamath association of secondary math teachers), Sophie Soury-Lavergne and Jana Trgalova (INRP, Quality Framework), Emmanuel Ostenne (TracEnPoche integration), Arnault Ioualalen (Web platform and Geoplan/Geospace integration), Jean-Marc Ravier, Isabelle Gache, François Pirsch, Noël Lambert, Liouba Leroux, Paul Byache, Christian Buso and Jalil

[1] The project work is split up in several workpackages called WP1, WP2, ..., WP8. Further information about the specific workpackages is available on our website `http://inter2geo.eu`.

Haraki (secondary math teachers and contributers), Cyrille Desmoulins (LI Grenoble, Ontology and File Format).

2.5 Universität Bayreuth (UBAY)

The University of Bayreuth with its approximately 9 000 students is among the youngest universities in Germany. Since its opening in the year 1975 it has evolved into a high-performance university with a dense net of international partnerships and research cooperations.

Prof. Dr. Peter Baptist is the leader of the chair for Mathematics and Mathematics education at the University of Bayreuth. One major project at the chair is the development of the free dynamic mathematics software GEONExT, successor of the software GEONET, which was developed by Dr. Alfred Wassermann and improved in cooporation with Dr. Matthias Ehmann and Dr. Carsten Miller. The newest project is the development of JSXGraph, a browser-independent, interactive geometry library implemented completely in JavaScript, see `http://jsxgraph.org`. The small-footprint open source software JSXGraph will support the Intergeo file format.

The InterGeo Team of the university consists of: Dr. Alfred Wassermann and Dr. Matthias Ehmann (responsible for implementing the I2G file format in GEONExT), Dr. Wolfgang Neidhardt (responsible for public presentation / promotion), Dr. Carsten Miller and Heiko Vogel (responsible for collecting and tagging GEONExT Traces).

2.6 Universidad de Cantabria (UCAN)

The University of Cantabria is located in the North of Spain, at the coastal city of Santander. The university, with over 12 000 students, offers especially science and technology studies, but it also includes a large teacher training school.

The UCAN team for INTERGEO, lead by Prof. Dr. Tomas Recio, includes professors and secondary education teachers from many different institutions all over Spain. Prof. F. Botana (U. Vigo at Pontevedra), M. Abanades (CES Felipe II at Aranjuez) and J. Escribano (U. Complutense of Madrid) have contributed to Work Package 3 (Common File Format). On the other hand, developing WP5 and WP6 has been the task of Prof. M. Fioravanti, L. Gonzalez Vega, M.J. Gonzalez Lopez and C. Valero, all of them at UCAN, working together with a large group of teachers: J. M. Arranz (Ponferrada), M. Diaz Regueiro (Lugo), R. Losada (Pravia), J.A. Mora (Alicante), M. Sada (Pamplona), C. Ueno (Fuerteventura), J. L. Valcarce (Santiago de Compostela). Gathering communities of practice –through dissemination activities and by attending many different user meetings all over Spain and Portugal– as well as organizing quality assessment teams, has been their main contribution for this year.

2.7 Université du Luxembourg (ULUX)

The University of Luxembourg, founded in 2003, is a small University in the heart of Europe having students with 85 different nationalities, (assistant) professors coming from 21 different countries and using 3 languages. So the University has a level of multilingualism and internationality, which cannot be found in any other surrounding University.

The Intergeo library to handle the common file format is based on the huge efforts done by the Luxembourgish team together with the project coordinator of the open-source dynamic geometry system GeoGebra. Besides the contribution of content has been prepared.

Project members at the University of Luxembourg are: Dr. Yves Kreis (ULUX coordinator, common file format development), Ingo Schandeler (common file format development and testing) and Carole Dording (content collection and meta-data tagging).

2.8 Maths for More (M4M)

Maths for More is a mathematical software company based in Barcelona, Spain. Its main goal is to offer advanced calculation and presentation tools for mathematics education with emphasis on Internet technology solutions. Maths for More is responsible for WIRIS, a software suite of tools for mathematics education. The most relevant member of this family is WIRIS CAS, a multilingual on-line platform for mathematics calculation and contents. Today, WIRIS is actively used by thousands of students and teachers in Spain, Italy, Belgium, The Netherlands, Luxemburg and Estonia. WIRIS tools are multilingual; there are WIRIS servers in English, French, Spanish, Italian, Dutch/Flemish, Estonian, Catalan and Basque language.

The commercial policy of Maths for More is to offer WIRIS CAS through a public education portal accessible for all the education community. The institution responsible of the portal assumes the cost of the server and license, which are reasonably low. The open access approach to the use of WIRIS increases the community usage of the tool and associated materials.

Project members at Maths for More have been: Ramon Eixarch (Maths for More member coordinator, support tasks and testing), Daniel Marques (WP3 leader), Albert Creus (WP2 staff), Santiago Egido (WP4 staff) and Joana Villalonga (support tasks).

2.9 Technical University of Eindhoven (TUE)

The Technical University of Eindhoven (TU/e) is a university located in the south-east of The Netherlands. The TU/e hosts multiple projects concerned with mathematical education and e-Learning. It is actively involved in the development of OpenMath, which is part of knowledge the university contributes to INTERGEO. They worked mainly on workpackages 2 and 3, helping to develop the metadata standard, the ontology and the new common file format.

Project members from the TU/e: drs. Maxim Hendriks (main participant), Prof.dr. Arjeh Cohen (OpenMath expert), dr. Hans Cuypers (OpenMath and general support), dr. Hans Sterk (support with educational contacts).

2.10 University of South Bohemia (USB)

The University of South Bohemia, Czech Republic, is located in Ceske Budejovice, the capital of South Bohemia, 140 km from Prague. The university has approximately 12 000 students in seven faculties.

USB is involved in several work packages of the project INTERGEO. A lot of work was done in the work package gathering communities of practice and dissemination and sustainability. Now it starts working on quality assessment and evaluation.

Project members at Ceske Budejovice have been: Pavel Pech, Roman Hasek, Pavel Leischner (all Dept. of Mathematics of Pedagogical Faculty), Sarka Gergelitsova, Hana Mahnelova, Vaclav Zemek, Vera Tumova (secondary school teachers).

3 Project Results and Achievements

The INTERGEO Project reached all its first year goals. In the following sections we will highlight a few of the major achievements. For a more detailed description see [KBD+09].

3.1 Content Aggregation

The consortium promised to offer a significant amount of content for use in the database. Before the project started in Oct. 2007 we identified more than 3 000 interactive resources to be used. All these and more[2] have been collected through the INTERGEO platform by September 2008, first as traces, and now being converted to real assets that are searchable and tagged with meta-data. The available content ranges through all ages and educational levels, and also mathematical topics and competences. See `http://i2geo.net` to access and use the content.

A major issue with content re-use and exchange is the handling of intellectual property rights. This affects not only the copying of resources, but also the modification and the classroom use. Without being able to process the data, it is also impossible to offer the added value of cross-curriculum search, for example. Thus, all content that is added to the INTERGEO portal has a clear license, usually of the creative commons type allowing for modification and free (non-commercial) use. See `http://creativecommons.org` for details. The guidance for licensing as well as the default choice of license has been long discussed among the partners settling to Creative Commons Attribution Sharealike as default choice.

All in all, the content available through the INTERGEO first-steps already exceeds our expectations for the first year even though its classification is shallow.

3.2 Agreement on Common File Format

A major obstacle in exchanging dynamic geometry content is the large variety of interactive geometry software available. While this diversity is a good thing *per se*, it is difficult to share constructions with others if they are using a similar, but different system. There is no de-facto standard as it is the case for, say, word processing software.

Of course, each software manufacturer chose the file format to be used by his product as closely as possible to the internal representation of constructions. As these internal representations differ widely, it was very challenging to find a common denominator that captures all the subtleties of dynamic geometry.

Nevertheless it was possible to agree on a common file format, the `i2g`-format, that seems to be able to cover all current and future implementation aspects. The first version is available as a deliverable of the project on the web [HKKM08].

[2] By September 30th more than 3 500 traces were available

3.3 Theoretical Framework for Ontologies and Curriculum Mappings

Mathematical – and in particular geometric – content is often independent of a language and can be used in various educational settings. This makes it easy to re-use the content, but at the same time it becomes extremely difficult to categorise the content and to enable users to browse and search it.

The consortium had to work both on the theoretical foundations and the implementation feasibility of an ontology and matching curriculum mappings that make it possible to use fine-grained metadata. This in turn enables searches that will return relevant results in a multi-lingual environment. This is an unprecedented result, described in [LDM+08], and a major achievement of the project that would not have been possible without the special combination of knowledge within the consortium. It has resulted in the thorough encoding of several curriculum years, see [LCME+08]

3.4 Developing the INTERGEO Platform

Both content/metadata collection and searching would not be possible without the proper technical foundation. After a thorough evaluation of available base platforms for the INTERGEO portal that is used to access, browse, search, evaluate, and rate the content, the Curriki platform was chosen. This Java-based and highly scalable platform itself is based on XWiki. Collaboration with the Curriki team and the XWiki community have made it possible to specialize that platform for the INTERGEO purposes even though lack of personnel has delayed these works.

On that basis, it was possible to set-up a beta status of the INTERGEO platform, which offers the categorization and will offer the search facilities as described in the preceding section. The platform went live in September 2008 and is continuously improved based on the consortium work and user feedback. The platform can be found at `http://i2geo.net`.

3.5 A Quality Assessment Framework

A major issue of educational content is the pedagogical, scientific, and technical quality of the activities. A Quality Assessment Framework for the Intergeo project was set up which is primarily based on a questionnaire filled freely by the teachers using the content themselves [MSLT08]. This assessment has two different aims:

- To rank the resources so that, in response to a query, “good” resources are ranked before “bad” resources, at equal relevance with respect to the query.
- To help improve resources by identifying criteria to work upon in order for the author to revise his resource according to the user’s input.

The QA Framework developed is based on a technique that allows both quick reviews and thorough evaluations, with the latter being weighted more. Also, users get individually weighted ratings based on their needs and user groups. The first implementation of the QA Framework into the platform is detailed in [LMSLT08].

4 Target Users and their Needs

4.1 Changing Mathematics Education

The INTERGEO project aims at changing mathematics education throughout Europe, by enabling *teachers* to use interactive geometry content in their teaching.

Teachers usually do not have the time or motivation to evaluate possible technical solutions for their classes. In particular, they cannot afford to waste their efforts on introducing electronic content into their teaching if they cannot be sure that it really helps *learners* to understand mathematics better.

As geometry is one of the pillars of mathematics that can dramatically help understanding complex concepts and notions, it is perfectly suitable to support students in developing a way of mathematical thinking. However, the material must fulfil a certain standard. While the INTERGEO project tries to identify good material and improve the quality of the content overall, as described in Sec. 3.5, it is also necessary to approach these target users and to help them using the content in their teaching.

The need for an initiative such as INTERGEO is underpinned by the findings in the 2008 Status Quo Report on DGS usage [HIK+08]. In that report we present a by-country analysis for the whole European Community.

4.2 Building a Community

The participation of External Partners, as Associate Partners, Country Representatives, and User Representatives justifies the basis for assuring the sustainability of the project's goals as mentioned above. Furthermore, gathering partners, as software developers, teachers, and persons at school administration level enables the development of a Europe-wide network that is indispensable for obtaining the project's major achievements.

Since the project start in October 2007, several key actors in interactive geometry throughout Europe, including software producers, mathematics educators, governmental bodies, and innovative users that can provide additional content or serve as test users for the first content iterations were acquired.

4.2.1 Associate Partners

The role of Associate Partners implies a variety of tasks and expectations, as the adoption of the common file format for their software, the provision of significant content to the Project, the development of ontologies, and the conduction of classroom tests. The project could successfully find several important Associate Partners, see `http://www.inter2geo.eu/en/partner` and Table 1.

Nº	Country	Name
1	Austria / USA	Markus Hohenwarter (GeoGebra)
2	Brazil	Leônidas de Oliveira Brandão (iGeom)
3	Canada / Spain	Philippe R. Richard, Josep Maria Fortuny (GeogebraTUTOR)
4	Canada	Jérémie Farret (3D Geom)
5	Croatia	Sime Suljic (Normala)
6	France	Cyrille Desmoulins
7	France	Odile Bénassy (OFSET)
8	France	François Pirsch (JMath3D)
9	France	The Sesamath association
10	France	EducTice - INRP / Luc Trouche
11	France	IUFM - Jacques Gressier (Geometrix)
12	Germany	Jürgen Roth (Universität Würzburg)
13	Germany	Heinz Schumann
14	Germany	René Grothmann (C.a.R. / Z.u.L.)
15	Germany	Andreas Göbel (Archimedes Geo3D)
16	Germany	Reinhard Oldenburg (Feli-X, Uni Frankfurt)
17	Germany	Andreas Meier
18	Germany	Roland Mechling (DynaGeo)
19	Germany	Jürgen Richter-Gebert (Cinderella, MatheVital, TUM)
20	Italy	Giovanni Artico (CRDM)
21	Luxembourg	Daniel Weiler
22	México	Julio Prado Saavedra (GeoDin)
23	Portugal	Arsélio Martins
24	Portugal	José Francisco Rodrigues (CMAF)
25	Slovakia	Dusan Vallo
26	United Kingdom	Albert Baeumel
27	United Kingdom	Nicolas van Labeke (Calques 3D)
28	USA	Joshua Marks (Curriki)

Table 1: Associate Partners of INTERGEO.

4.2.2 Country Representatives

For each EC country a Country Representative serves as a contact person in their respective country. They come from ministries of education, preferably, and enable the Project to easily contact the relevant persons at school administration level. Using these contacts, it was possible to extract the best formatted documents containing the curriculum standard for Germany and France so that the project develops ways to map curricula into the ontology for geometry that suits all countries of the EC. So far, The project could successfully find Country Representatives for Austria, Czech Republic, France, Germany, Lithuania, Luxembourg, Portugal, and Spain. A list of all representatives is available at `http://www.inter2geo.eu/en/partner`.

4.2.3 User Representatives

User Representatives, as teachers and software partners, build the basis for the sustainability of the project. They are a contact point with their associations, in order to support the relationship with potential INTERGEO-users.

- Selected teachers ease experimentation in the classroom of educational content gathered by the project, promote the use of the INTERGEO platform and the philosophy of resource sharing and quality control.
- Selected Software-partners promote the uploading of content to the INTERGEO platform.

4.2.4 Local User Meetings

Among others, the selection of external partners was and will be performed at several local user meetings during the project period. The local user meetings have a central role in gathering the community of practice. They intend to help providing a complete European coverage:

- The Local User Meetings present INTERGEO to the users: The need of a common file format for interoperability, the need of a web platform to share resources, the need of the ontology and the curriculum mapping to share resources across all European countries.
- The Local User Meetings are a good way to reach power users and engage them into the project to improve the project's dissemination.
- Local User Meetings identify suitable schools for the Quality Assessment.

A list of all LUMs is available on the web at `http://www.inter2geo.eu/en/lum`. In 2008, INTERGEO was already present in Valencia (Spain), Chiechocinek (Poland), Coimbra (Portugal), Paderno del Grappa (Italy), Vilnius (Lithuania), Elvas (Portugal), Horska Kvilda (Czech Republic), Trondheim (Norway), and Fuldatal (Germany). Further meetings are scheduled for Sevilla (Spain), La Rochelle (France) and Luxembourg.

5 Underlying Content

As stated in Sec. 3.1 a lot of content has been collected so far: more than 3 500 interactive constructions, exercises, animations, etc. that cover all mathematical fields and educational levels.

While all content is now equipped with a proper license that enables users to use or re-use them, there has been no quality control that might have stopped low-quality content from being listed in the database. However, as the content was mainly contributed by consortium partners it does have a certain quality level.

Also, the only metadata that could be entered in a first step while the platform was not fully operational was the author and license information as well as a free-form categorisation. Currently, the missing metadata is being added and the new ontology based categorisation is then used for a proper structure.

The availability of the platform now also enables external partners and even people without affiliation to the project to add new content. We identified at least 9 000 further assets that their authors are willing to add. Of course, this will make it even more important to add quality information to the metadata of each resource. The Quality Assessment Framework as explained in Sec. 3.5 and its technical implementation on the platform will help.

Despite the lack of quality control during the initial phase of content harvesting, we do have certificates that demonstrate the high standards achieved so far. The content of MatheVital (see `http://www.mathe-vital.de`) by Jürgen Richter-Gebert was awarded the Medida-Prix 2008 (see `http://www.medidaprix.org`), the most prestigious award for E-Learning material in German speaking countries, worth 50 000 Euro. This vote of an independent jury shows that INTERGEO does contain several ‘pearls’ of interactive content.

6 Summary of Activities

INTERGEO is currently working on a wide variety of activities, each being targeted to overcome the problems in sharing geometry content collectively.

Most actions revolve around the now-available INTERGEO *platform*. With more and more mature features and more and more metadata-enriched content it is becoming a central point for collecting, exchanging, categorizing, searching, improving, evaluating and distributing geometry content.

The platform's *user community* is being built and, by giving a lot of helpful feedback, is showing the way to improvements. Real-world experience and data give the opportunity to improve on the current design – which proved to be suitable so far.

For searching and proper metadata annotation the current *ontology* is used. Again, based on user's and expert's input we can find out what might be missing. Also, the internationalization of ontologies can be approached now that we have a starting point. This includes that *competency editing* will be fully implemented as a mature step for concretising.

Surely, the *metadata enrichment* will be continued for the consortium-provided content. Based on this, the search tool of the platform is going to use that data to provide the first fully *cross-curriculum multi-language search* ever. The final implementation of this search tool will need a lot of effort, which is justified by the fact that it ensures reliable access to the digital resources we offer.

To enable users to work with the tools and the content we provide, *local user meetings* are ongoing, and we will continue to offer informal meetings at conferences or teacher training courses.

With enough content available and searchable, we can address the *quality assement* tasks of INTERGEO. Several teams of teachers are currently waiting for the start of quality testing, and we are going to collect and distribute their feedback according to the quality assessment framework. At the same time, we start to invite external testers to provide even more information than we can yield.

Moreover, there has been a large number of Intergeo informal presentations with occasion of teacher training courses, or through teacher's association bulletins, specialized mailing lists, etc.

Finally, we offered a first draft for the `i2g`-format. Besides adopting the format ourselves, we are going to add the missing parts – again based on community feedback. If we can show that the format is as universal as promised, then we can work on further adoption, also by software packages outside of the consortium and associate partners.

7 Impact & Sustainability

7.1 Impact on Content Availability and Visibility

With the advent of INTERGEO there is now a one-stop portal for interactive geometry content that bundles a lot of content that was scattered on the net before. By offering a vendor-neutral database joining commercial, semi-commercial and free software it is now possible to select content on a educational basis, instead of a technical one.

By offering this service to the community, we are able to collect material from all over Europe (and also from outside of Europe). Serving as an information hub, the platform has the potential to become the most important resource broker for interactive geometry.

While this potential is already recognisable, it contrasts to the current visibility of the project. Most educators and content providers in Europe know and appreciate INTERGEO, but only a few users already use it. This is not surprising, and we did not plan to attract many end-users in the first year: The first-steps phase was a mere census of links with shallow classification; the current platform `http://i2geo.net` is not usable for end-users. As soon as the platform and the search tools are out of the beta phase within the next months, we will announce this to the users, via our already existing dense network of partners.

7.2 Impact on the Academic Community

The academic community did acknowledge both the need for a project such as INTERGEO as well as the inherent difficulties it will have to solve. We received strong support so far, and our project presentations at various conferences were favourably accepted.

At the world conference ICME-11 of ICMI[3] in Monterrey, Mexico, Intergeo was mentioned prominently in a plenary talk for approx. 2 000 leading researchers in mathematics education. In addition, project flyers in English and Spanish were distributed. All in all, this created a lot of attention for the project, which has now to be sustained on the base of a working content platform.

At the Mathematical Knowledge Management (MKM) conference in Birmingham, July 26^{th} till 31^{st}, the vision of the INTERGEO search tool and its cross-curriculum search was presented and recognised as a deep research track.

At the Second International Workshop on Search and Exchange of e-le@rning Materials (SE@M'08) in Maastricht on September 17^{th}, the cross-curriculum approach was presented and discussed with e-learning technology specialists. This may lead to the participation to a format for exchangeable curriculums.

[3] The International Commission on Mathematical Instruction

7.3 Impact on the Software Situation

One important aspect of interoperability is that we enable users to use any software of their choice. While the basic idea is very good and well accepted, we have to take care that this does not lead to a drain of sales for the commercial partners.

The main focus of the academic partners and software developers is to do research and to develop new ideas for math teaching, which might also include creating innovative software. But it is not a task of Universities to deliver ready-to-use software for the masses with proper customer support (even if some of the packages developed in Universities are quite professional, and the enthusiastic support of volunteers can match or exceed commercial support) with massive engineering tasks or other substantial efforts which have a price that are incompatible with University organisation. A usual strategy, as exercised with Cabrilog, for example, is to create spin-off companies. The commercial approach also guarantees that a software (and the whole community built on it) is no longer dependent on individuals who feel responsible for it but on a tradition carried by a symbolic entity.

The INTERGEO Consortium deems it important that we continue to break down technological barriers that hinder the exchange of content, and will continue to do so. An innovation-stimulating competition between partners can benefit from this kind of exchange, promoting the individual capabilities and strengths of each package.

7.4 Next Steps

In the next years we will improve the visibility of the project for end-users, i.e. teachers. This will be one of the major tasks as soon as the platform is out of beta status.

As it is the case that the web sites of each software product of the Consortium members have more visits per day than the INTERGEO website, all partners will link to the INTERGEO site very visible on the front page of each software site. While this will not increase the user base of interactive geometry software in a whole directly, it will be possible to increase it indirectly by showing potential software users the wealth of available material.

The `i2g`-file format will be implemented completely in all software products that participate in INTERGEO. Based on that, we will issue `i2g`-compliance badges that software can use to show its level of support for INTERGEO constructions.

Since we now have a significant amount of content available, we can also start to promote the use of the content through the Country Representatives. Most of them are working in positions at the Ministries of Education, and INTERGEO will serve as another reason for introducing computers into the Curriculum.

Finally, we will now start to send out quarterly newsletters. The mailing list for this has been set up already in the beginning of the project, but the lack of a usable platform and the overall 'beta-feeling' of the project did not suggest to send out newsletters. All we could ask for was to wait until there is user-usable substance. Now that we have completed the first technical steps, we can announce the platform widely and with pride.

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