

Report of the
First Meeting of the International GeoGebra Institute

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Faculty of Education, University of Cambridge, UK

Abstract

On May 7th and 8th, 2008 a small group of about twenty invited international guests assembled at the Faculty of Education, University of Cambridge for the first meeting of the International GeoGebra Institute (IGI). During these two days of focused interaction, certain key issues were discussed at length, namely, the vision, structure, and goals of both the centralized International GeoGebra Institute and the regionally-based GeoGebra Institutes (GIs). During the sessions, researchers, developers, and teacher educators from the US, Canada, England, Spain, Hungary, Norway, Poland, Luxembourg, Iceland, and France (via video link) shared experiences from their respective projects relating to GeoGebra software, research, and teacher development. This report presents the vision statement of the IGI; brief summaries of the international project updates; and, comments on publicity, funding, and future meetings.

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1 Vision and Structure of the International GeoGebra Institute

1.1 Vision of the International GeoGebra Institute

The International GeoGebra Institute (IGI) provides free dynamic mathematics software and shares expertise in training, support and the development of materials for all students and teachers to improve mathematics, science and technology education world-wide. It nurtures and promotes collaboration between practitioners and researchers, seeking to establish self-sustaining user communities.

1.2 Structure of the International GeoGebra Institute

The structure of IGI and its relationship to local GeoGebra Institutes (GIs) in different countries and regions was an important discussion topic during the meeting. The following sections describe the overall structure and mission of the International GeoGebra Institute, the accreditation of regional GeoGebra Institutes, and the certification of GeoGebra users and trainers.

1.2.1 Mission of the International GeoGebra Institute

The *International GeoGebra Institute* (IGI) is a virtual, not-for-profit organization which has established the following three goals:

1. **Training and Support:** To coordinate and provide professional development opportunities and support for both pre-service and in-service teachers.
2. **Development and Sharing:** To develop and share workshop resources and classroom materials, and to continually improve and extend the dynamic mathematics software GeoGebra.
3. **Research and Collaboration:** To conduct and support GeoGebra-related research which focuses on the teaching and learning of mathematics in order to inform and improve the IGI's training and development activities, and to promote collaboration between IGI and local GIs and between international colleagues.

1.2.2 Local GeoGebra Institutes and their Accreditation

The International GeoGebra Institute is a central, virtual organization that works together with independent regionally-based *GeoGebra Institutes* (GIs). These local organizations must first apply to the International GeoGebra Institute in order to become an officially accredited GeoGebra Institute. In order to apply for accreditation as a local GeoGebra Institute, the local organization must send an application letter to the IGI (igi@geogebra.org) with the following information:

- **Name and Region:** The applying organization states the official name of the prospective local GeoGebra Institute and explains its intended region of operation. Names need to be of the form “GeoGebra Institute of XXX” (e.g., “GeoGebra Institute of Cantabria”). This title will then also define the related web address for the local GeoGebra Institute (e.g., <http://cantabria.geogebra.org>). It is possible to have

more than one GI per country. In this case, the applying organization needs to describe how it will share responsibilities and collaborate with other local GIs.

- **Common Goals:** The applying organization declares that it fully accepts the founding goals of the International GeoGebra Institute (training and support, development and sharing, research and collaboration). GeoGebra Institutes can emphasize single goals, but are expected to try and support all of the stated goals of IGI in some capacity.
- **Non-Commercial Nature:** The applying organization declares that it is (part of) a non-profit organization (e.g., university, teacher education college) with only non-commercial interests. Normally, services offered by a GeoGebra institute should be free of charge for teachers and students. If there are revenues created in connection with GeoGebra (e.g., books, online materials, workshops), it is expected that this money would be used to support and sustain the goals of IGI.
- **Licensing:** The applying organization declares that it will share all developed materials under a Creative Commons Attribution, Non-commercial, Share Alike license (see <http://creativecommons.org/licenses/by-nc-sa/3.0/>) and will respect the license of the GeoGebra software itself (see <http://www.geogebra.org/download/license.txt>). The spirit of the IGI and its local GeoGebra Institutes is to share materials and be open for collaboration with everyone.
- **Structure:** The applying organization describes its structure (e.g., research group or a existing centre within a university department) and the people (i.e., names, affiliation, email) involved with the prospective local GeoGebra Institute. In particular, the organization must provide name and contact address of the Chair, or representative, of the local GeoGebra Institute.
- **Activities:** The applying organization describes its past, current, and future activities in relation to the GeoGebra software.
- **Annual Activity Report:** The applying organization states that it will submit an annual report regarding its activities to the IGI (igi@geogebra.org). The common and stated IGI goals should be used to structure this annual report.
- **Certification (Optional):** If the applying organization would like to certify local GeoGebra users and trainers, it must describe the requirements and procedures pertaining to this certification process. Note that only a GeoGebra Institute Trainer can approve applications for such certificates, which are then issued by her/his local GeoGebra Institute (see below).

Individuals involved with GeoGebra Institutes are welcome to also work with other freely available software that supports mathematics teaching and learning. However, this other software may not be promoted using the name “GeoGebra Institute” without permission to do so being granted by the IGI.

1.2.3 Certification of Users and Trainers

IGI issues official certificates for GeoGebra users and GeoGebra trainers. There are several levels of certification:

1. **GeoGebra Users:** Demonstrate effective use of GeoGebra in their own classrooms
2. **GeoGebra Experts:** Demonstrate the ability to create and share innovative GeoGebra teaching materials. These individuals may offer GeoGebra workshops and support other teachers in their own schools or regions.
3. **GeoGebra Trainers:** Demonstrate innovative practices and have the ability to do practitioner research and to give presentations at the regional level.
4. **GeoGebra Institute Trainers:** Highly experienced GeoGebra presenters, trainers, and researchers involved in an accredited GeoGebra Institute who provide training and support for teachers, and give presentations at the regional and international level.

GeoGebra Institutes can issue certificates for users and trainers (Levels 1-3) within their region of operation. Only *GeoGebra Institute Trainers* (Level 4) have the right to approve certificate applications on behalf of their GeoGebra Institute. Thus, every accredited GeoGebra Institute should have at least one *GeoGebra Institute Trainer* who can approve certificate applications within its region according to its guidelines of certification (see “accreditation” above). GeoGebra Institutes must then use the official template provided by IGI to issue certificates (Levels 1-3) which need to be signed by the president of IGI (currently Markus Hohenwarter) and the chair of the local GeoGebra Institute. Copies of all these certificates are kept by the local GeoGebra Institute and are also made available to the centralized IGI.

Presently, IGI (igi@geogebra.org) accepts applications for the certification of *GeoGebra Trainers* (i.e., independent of local GIs) and *GeoGebra Institute Trainers* (i.e., involved with an accredited GI) which should consist of the following three items:

- Curriculum Vitae
- Letter describing past, current and planned GeoGebra activities (e.g., workshops, research, software/resource development)
- Sample GeoGebra materials (print/digital)

The International GeoGebra Institute has the right to withdraw the accreditation of a GeoGebra Institute if it is in violation of any of the aforementioned common IGI goals.

2 Current GeoGebra Activities

This section summarizes current GeoGebra activities in research, software/resource development, and teacher training initiatives which were presented during the meeting in Cambridge. The group from Rouen, France joined the IGI meeting via a *Skype* video-conference link to report on their progress. Further, reports which had been written and pre-delivered by Klinger (Austria), Weigand (Germany), Korhonen (Finland), and Tuska (US)—unable to attend the IGI meetings—were presented by Hohenwarter and Lavicza.

Other individuals who have expressed an interest in GeoGebra research and/or development, but who were not able to attend the Cambridge IGI meetings would include the following: Jim Lewis (University of Nebraska-Lincoln, USA), Michael Spector (Florida State University, USA), Lingguo Bu (Southern Illinois University, USA), Keith Jones (University of Southampton, UK), Vlasta Kokol-Voljc (University of Maribor, Slovenia), and Joao Pedro Mendes da Ponte (University of Lisbon, Portugal).

2.1 GeoGebra Activities in Europe

2.1.1 Austria

Walter Klinger and others (PH Niederösterreich, Baden near Vienna)

Austria is GeoGebra's country of origin and has a large number of teachers using the software in secondary schools due to the many workshops that have been held at professional development institutions. Today, several new textbooks are also referencing GeoGebra material. Since 2004, Markus Hohenwarter's GeoGebra software has been part of the project entitled, "Media Diversity in Mathematics Teaching," in cooperation with Austrian Centre for Didactics of Computer Algebra (ACDCA) and "mathe-online" funded by the Austrian Ministry of Education. Based on this existing collaboration, a group of educators at the PH Niederösterreich (i.e., the teacher education college of Lower Austria) will establish the GeoGebra Institute of Austria at their institution in Baden with funding from the Austrian Ministry of Education. The main activities of GI-Austria will be classroom material development, coordination and organization of GeoGebra workshops throughout Austria, and collaboration in research projects with European partners and other GIs. GI-Austria will also support the organization of the first international GeoGebra conference in Hagenberg near Linz, Austria in July 2009.

2.1.2 Finland

Kirsi Malinen and others (Jokelan koulukeskus, Tuusula)

Seven Finnish schools are collaborating in a project that involves both lower and higher secondary schools and which focuses on the use of GeoGebra in learning mathematics. Malinen and her colleagues are now working on the Finnish translation of the GeoGebra user interface and manual, developing interactive worksheets, and suggesting necessary changes in instructional practices for their teachers. Their project is financed by the Foundation for the 100th Anniversary of the Association of Technological Industries of Finland.

2.1.3 France

Mathieu Blossier and others (University of Rouen)

The GeoGebra Institute in Rouen (GI-Rouen) is composed of a group of 10 highschool teachers and computer science researchers working at the Institut de Recherche sur l'Enseignement des Mathématiques (IREM) of the University of Rouen. The general purposes of the GI-Rouen are the following: (i) providing training on GeoGebra for highschool teachers; (ii) developing teaching activities using GeoGebra; and, (iii)

developing code for a 3-D version of GeoGebra. In this proposed 3-D version, all the capabilities of the current 2-D version would still be available. Further, it will feature the creation of 3-D elements (e.g., vectors, points, lines, planes, polygons), special 3-D rendering (using default Java API with clipping abilities) and mouse interactivity.

2.1.4 Germany

Hans-Georg Weigand (University of Würzburg)

Weigand reports that there are five areas in which GeoGebra is currently being used in Würzburg and its environs. The first is teacher education, in which they are using Geogebra in geometry lessons (Elementary Euclidean Geometry, Didactics of Geometry), arithmetic lessons (Foundations of the number system), and in Algebra (Didactics of Algebra) and calculus (Didactics of Calculus) lessons. Secondly, a website (www.mathematik-digital.de) has been developed which provides students with a wiki-based system in which interactive learning paths have been constructed to be used by students in self-optimized mathematics lessons. Thirdly, a group of teachers known as “AK GeoGebra” have developed online materials based on the software and dealing with functions, geometry, and area. Fourthly, courses have been developed by Drs. Weigand and Weth at the universities of Würzburg and Nürnberg, respectively, for the Virtual University of Bavaria using MOODLE as an online platform and featuring interactive elements based on GeoGebra software. Fifthly, Anzenhofer, a graduate student at the International Graduate School of the University of Würzburg, has written an interdisciplinary dissertation on the topic “Graphs and Music,” wherein her time-frequency diagrams were constructed using GeoGebra graphs and then transformed into sound and music using other related technology.

2.1.5 Hungary

Susan Papp-Varga (Eötvös Lorand University, Budapest)

The Hungarian GeoGebraWiki was started in late 2007, and Papp-Varga is presently working on the Hungarian translation of a manual. On the Hungarian wiki there are several reports written about GeoGebra by undergraduate teachers, as well as other supplementary materials developed by university students and teachers. An email discussion forum has also been established for GeoGebra users in Hungary. GeoGebra is becoming more popular in teacher education programs, and a small group of individuals is now preparing to establish an Hungarian GeoGebra Institute with one of its first goals being the development of supplementary materials for an Hungarian textbook series.

2.1.6 Iceland

Freyja Hreinsdottir (Iceland University of Education, Reykjavik)

In Iceland, Hreinsdottir has used GeoGebra in her Calculus course (2008) involving future secondary school teachers, as well as introducing it to a small group of graduate students who teach in secondary schools. She is now completing the Icelandic translation and also plans to increase usage of the program at the Iceland University of Education, share GeoGebra with colleagues in mathematics education, and offer summer workshops.

2.1.7 Luxembourg

Yves Kreis (University of Luxembourg)

Yves Kreis discussed highlights from two studies in which he is presently involved. The first, entitled “GeoGebra Prim: GeoGebra for Primary School” is a project funded by the University of Luxembourg (2007-09) which focuses on the application of GeoGebra to primary school curriculum and the integration of GeoGebra into TAO (computer based assessment). The aims of this project are increased understanding of basic geometric concepts and deeper student insight regarding the relationship between geometry and algebra. This study will involve a pre- and post-test of one hundred 4th and 6th grade students and will be funded by a consortium of ten partner organizations. The second project, entitled “InterGeo” is a very large, European initiative with the following three main aims: to provide a searchable and metadata-tagged online material pool for interactive geometry resources; to develop a common data transfer format; and, to encourage quality enhancement cycles (peer review, ranking, feedback).

2.1.8 Norway

Anders Sanne (Norwegian University for Science and Technology, Trondheim)

The popularity of GeoGebra in Norway is likely due to several key reasons: (i) the software has been translated into both variants of Norwegian by Sigbjørn Hals since 2006; (ii) digital literacy is regarded as one of five basic skills in the national curriculum; and, (iii) GeoGebra is used and supported by the main textbooks for the Norwegian upper secondary school. While teacher training with GeoGebra has been offered by universities, university colleges, publishing houses, and others on a commercial basis in Norway, there has been very little participation in the Norwegian GeoGebraWiki or Forum, and there remains a lack of formal coordination of development, research, and training. The GeoGebra Institute in Norway (GI-Norway) is now hosted by the Norwegian Center for Mathematics Education (NCME) located in Trondheim, with some funding from NCME. Further plans for GeoGebra in Norway include working with NCME’s network of skilled teachers in building up their knowledge of GeoGebra, and offering workshops for teachers and future GeoGebra trainers. Hals received a scholarship from NCME to pursue a Masters degree in Mathematics Education and will be able to work part time for GI-Norway in translations, training, development of material, and GeoGebra-based research.

2.1.9 Poland

Katarzyna Winkowska-Nowak (Institute SPIK SWPS, Warsaw)

The Geogebra Institute of Warsaw is a joint project of the Institute SPIK at the SWPS University in Warsaw and Polish Teachers Association ROSE (Regional Centres for E-learning). The ROSE Centres already feature a large base of capable ICT instructors with experience in both traditional and Internet-based training. This joint project is based on a 4 year collaboration of scientist and teachers aiming to disseminate best practices of using ICT in classroom teaching. The collaboration is based on the experience of scientist and teachers. The result of this collaboration is a series of teacher enhancement programs

at ROSE centres through workshops, courses and Internet support which has led to the creation of online teacher communities. The main goal of the GeoGebra Institute of Warsaw is to introduce GeoGebra to Polish schools and universities through: development of materials in Polish and adaptation for Polish curriculum; support of users via wikis, web pages, and on-line forums; creation of traditional and e-learning courses for teachers; providing a platform for users and developers of GeoGebra; organization of conferences, meetings and seminars for researchers and users; support of research. The user interface of GeoGebra was translated to Polish in 2007 and the Polish forum and wiki started in spring 2008. A group of 10 members of ROSE has already begun training GeoGebra instructors within an existing e-learning course, as well as the creation of resources for teacher training in local communities. The GeoGebra Institute of Warsaw is currently trying to acquire funding for professional development both at the central and local levels in Poland.

2.1.10 Spain

Tomás Recio (Universidad de Cantabria)

The GeoGebra Institute of Cantabria (GI-Cantabria) represents a joint project of the Departamento de Matemáticas, Estadística y Computación of the Universidad de Cantabria and the Centro Internacional de Encuentros Matemáticos (CIEM). GI-Cantabria will seek to serve all GeoGebra users in the Spanish language, cooperate with other nearby GIs (Barcelona in particular), and adopt a 3-part structure involving development and service, research and evaluation, and course offerings. Goals for GI-Cantabria include the following: (i) setting up dissemination materials (web page, wiki forum, leaflets, etc.); (ii) preparing educational materials based on GeoGebra and adapted to the Spanish curriculum; (iii) supporting users in an online GeoGebra forum; (iv) building up new courses and validating existing ones; (v) organizing a meeting at CIEM (Castro-Urdiales) of staff from Teacher's Centers throughout Spain to help them to organize GeoGebra training and support at the various centers; (vi) preparing some evaluation and quality testing of GeoGebra materials being used in the school system; (vii) possibly launching a research project on GeoGebra by math education researchers; and, (viii) looking for external funding for GI-Cantabria.

José Manuel Yábar and others (Universitat Autònoma de Barcelona)

In Catalonia, GeoGebra projects have been the shared focus of a consortium of educational entities: Department of Education of Catalonia, Universitat Autònoma de Barcelona, and the local Association of Teachers. The stated goals of the GeoGebra Institute of Catalonia (GI-Catalonia) are the following: (i) the promotion of research projects about the educational use of the software in different levels of education; (ii) the creation of educational materials involving GeoGebra; (iii) the compilation of existing GeoGebra-based materials and possible translations/adaptations of these materials to meet local needs; (iv) the development of a structure with the promotion of courses of training for teachers and certification; (v) the development of a support structure for teachers featuring the sharing of experiences and resources through local meetings, lectures, conferences, and congresses; and, (vi) a careful analysis of the software so that

constructive feedback and recommendations can be made for GeoGebra developers. An online course entitled “Mathematics and GeoGebra” has been launched in the Departament d’Educació by the three educators Bartrolí, Gomà, and Bujosa.

2.1.11 United Kingdom

Zsolt Lavicza (University of Cambridge, England)

At the University of Cambridge several studies relating to GeoGebra are planned or underway. Zsolt Lavicza and Markus Hohenwarter are leading an NCETM project involving a small group of local mathematics secondary school teachers using GeoGebra in their classrooms. This study investigates ways to establish a professional development network in England which centers on GeoGebra software usage. Two Cambridge graduate students are conducting comparative studies involving GeoGebra usage (masters candidate is comparing Taiwanese and English student use in secondary school teaching; doctoral candidate is comparing Cyprian and English student use in elementary school teaching). Further interest in GeoGebra-related activities has been expressed by representatives of the National Strategies, NRICH, and Further Mathematics Network.

Yu-Wen Allison Lu (University of Cambridge, UK)

Lu, a graduate student at Cambridge, has been completing a comparative study of the use of GeoGebra in teaching mathematics at the pre-university level in Taiwan and England. This study involves four case studies of how GeoGebra is being used in both countries and an interview with GeoGebra creator, Markus Hohenwarter, for the purpose of gaining international perspectives on GeoGebra implementation. In her interviews, Lu has found that there are a number of ways that Taiwanese teachers are using GeoGebra in their classrooms: visualisation, demonstration, computation, investigation, and, occasionally, as a checking tool for research or analysis.

Toni Beardon (NRICH, University of Cambridge, England)

Several members representing the NRICH project (www.nrich.maths.org) were in attendance at the GeoGebra Institute meeting. The web-based NRICH initiative is part of the Millennium Mathematics Project (MMP) group based at the University of Cambridge. NRICH publishes mathematical problems and activities every month with solutions sent in by learners to the previous month’s challenges. NRICH started in 1996 and its large archive contains challenges for all ages from five years upwards, is meta-tagged by topic, and provides notes for teachers. The team is currently revising old problems and, as part of this work, converting a collection of about 30 interactive geometry challenges to GeoGebra. These, and other problems using GeoGebra, will be highlighted on the website in the coming months. NRICH will develop and publish new classroom-tested, rich tasks that encourage learners to program and experiment with GeoGebra themselves. The organizers shall be doing this in collaboration with teachers, and are particularly interested in developing learners’ skills with GeoGebra through problem solving. Working with learners and teachers using GeoGebra will help NRICH to fulfil its project aims which include: (i) to enrich mathematical experiences so that all students have the

opportunity to explore, engage with and communicate mathematical ideas; (ii) to offer challenging activities and resources which can develop mathematical thinking and problem solving skills; and, (iii) to research and develop the use of existing and new technologies to enhance the learning and teaching experience.

Chris Sangwin (University of Birmingham, England)

Sangwin has been using GeoGebra with students at the university level in his geometry courses. Based on his experience, he has suggested that the text feature in GeoGebra be enhanced to support text with integrated mathematical notations (i.e., including an equation editor). Sangwin has received funding to support the work of Michael Borchers, a teacher and GeoGebra developer from Birmingham, for this new feature. Further collaboration with Sangwin may be possible in the area of online assessment using computer algebra systems.

2.2 GeoGebra Activities in the United States

2.2.1 Florida, Boca Raton

Markus Hohenwarter (Florida Atlantic University, United States)

Further development of the GeoGebra software is presently being undertaken by its creator, Markus Hohenwarter (Florida Atlantic University, USA), along with a small coordinated team of programmers located in Florida, England, France, and Luxembourg. During the meetings in Cambridge certain new features of the software were discussed and suggested by participants (e.g. spreadsheet feature, text and math symbol editor), presenting rationales for these changes in terms of teacher practice. Experienced teachers from a National Science Foundation (NSF) funded “Math & Science Partnership” project at Florida Atlantic University will provide more than 15 GeoGebra workshops in school districts throughout the United States during the summer of 2008 (see <http://www.geogebra.org/msp-ws>). The workshop materials created in cooperation with the teachers in Florida will be shared with the GeoGebra user community and will provide a basis for adaptations to other languages and local needs by GIs worldwide.

2.2.2 California, Fresno

Agnes Tuska (California State University, Fresno)

Tuska’s GeoGebra involvement has included teacher workshops, supervising a graduate level research project, and summer courses for prospective high school teachers. The establishment of a GeoGebra Institute in California (GI-California) to be housed at California State University, Fresno would serve teachers in California as well as those in Sri Lanka and Hungary via online video-conferencing. The California Mathematics Project (CMP) is a multi-million dollar per year initiative funded by the State of California for teacher leadership and professional development. GeoGebra would be disseminated through the CMP’s leadership meetings at the 23 project sites throughout the state. GeoGebra software would also be featured in Lesson Study projects through California Math and Science Partnerships, Lesson Study projects with Sri Lankan and

Hungarian teachers, and in teacher preparation programs in the California State University system. GI-California would develop interactive GeoGebra-based materials (e.g., non-Euclidean geometries, algebra and geometry for prospective middle school teachers) for professional development institutes to be attended by in-service teachers.

2.2.3 Other activities in the United States

Furthermore, GeoGebra is, or will be, part of the following activities in the United States:

Jim Lewis, University of Lincoln-Nebraska

GeoGebra is being used in the NSF Math & Science Partnership project, “Math in the Middle”. Local educators are presently providing GeoGebra workshops in Nebraska.

Michael Gage, University of Rochester, New York

GeoGebra is currently integrated into WebWork, an online assessment system used at hundreds of universities.

Lingguo Bu and Robert Schoen, Florida State University, Tallahassee, FL

In three consecutive semesters since Spring 2007, GeoGebra was a major component of a method course which focuses on the use of technology in the teaching and learning of mathematics (preservice teacher education).

Lingguo Bu, Southern Illinois University-Carbondale, Illinois

GeoGebra will be a focus of the newly proposed research centre for dynamic mathematics software at Southern Illinois University-Carbondale.

Pamela Buffington, Educational Development Center, Boston, Massachusetts

GeoGebra is part of the professional development activities of a Math & Science Partnership project in Maine in which all middle and high school students are equipped with laptop computers.

Analucia Schliemann & David Carraher, Tufts University/TERC, Boston, Massachusetts

GeoGebra is planned to be an integral part of a proposed NSF Math & Science Partnership project for middle school mathematics teachers in Massachusetts.

2.3 GeoGebra Activities in Other Regions

2.3.1 South Africa

Toni Beardon (AIMSSEC, South Africa / University of Cambridge, UK)

The African Institute for Mathematical Sciences Schools Enrichment Centre (AIMSSEC) is a voluntary organisation, modelled on the MMP, based in Muizenburg, South Africa and an outreach project associated with a joint initiative of Cambridge, Oxford, Paris Sud XI, Stellenbosch, Cape Town, and Western Cape Universities (www.aimssec.aims.ac.za). AIMSSEC runs residential professional development courses for teachers from historically disadvantaged communities from all parts of South Africa, in the school holidays, taught by a team of unpaid volunteer teacher trainers from around the world. As many of the South African teachers have never had the opportunity to previously use a computer, they become very excited during the 10-day course as they overcome their hesitancy and spend every spare minute in the computer lab. They learn to use GeoGebra and other free software, both for their own personal development and to enhance their

teaching. They take away a CD with a large collection of resources for teaching and learning mathematics including GeoGebra applets. The South African Provincial Education Departments are installing computer labs in schools and the AIMSSEC teachers are keen to use GeoGebra whenever they get the opportunity. AIMSSEC also runs Saturday classes and after-school maths clubs for learners from the township schools, tutored by the postgraduate students from the African Institute for Mathematical Sciences, and under Beardon's (often remotely situated) guidance. The children are able to use GeoGebra with the tutors in the AIMS computer lab.

2.3.2 Other activities

As of May 2008, there are about 400,000 visitors from 190 countries to the GeoGebra web pages every month. The activities listed in this report are only a portion of the actual GeoGebra events around the world. Most likely, many more may exist that we don't know about at the moment. An important goal of the International GeoGebra Institute will be to provide online environments for international collaboration, so that we can find out what others are doing and further share our experiences and learn from each other. IGI will be especially interested in gathering information about the users in Africa, Asia, South America and Australia.

3 Discussion Topics at the IGI Meeting

3.1 GeoGebra Software/Resource Development

During the meeting in Cambridge the important topics of software and resource development were discussed at length. In terms of GeoGebra software development, key issues that emerged were: new/modified features (e.g., spreadsheet, further CAS capabilities, plug-ins, arrangement of windows and toolbars); and, local extensions of the software development (e.g., local funding for specific extensions/plug-ins, local project leaders, student programmers). Issues pertaining to resource development comprised the following: classroom resources (e.g., GeoGebra worksheets for students, video resources); course resource sharing (e.g., searchable databases, the possibility of common file formats for dynamic mathematics software [project "InterGeo" developments], the necessity of providing context and guidance for quality resource collection); workshop resources (e.g., existing slideshows/handouts, wikis/blogs, alignment with curriculum materials, books, Barcelona course, workshop materials); licensing issues; translation procedures/protocol; and, self-help courses/tutorials (e.g., "GeoTutorial").

3.2 GeoGebra Professional Development/Training

Another obvious and significant topic of discussion during the meeting was that of teacher professional development/training. The IGI was described as an organization that would want to ensure the high quality of both the training resources *and* the related professional development experiences at which these resources were to be used. In this light, IGI would take as its responsibility to make informed recommendations concerning teacher development resources. National and/or regional GIs, by extension, could therefore potentially approve workshops, develop materials, train trainers, and provide

certification. Several ideas surrounding how trainers/teachers could receive certification were also discussed (e.g., courses, submission of creative GeoGebra work, portfolio).

3.3 GeoGebra-Related Research

There was a general agreement that research on GeoGebra should be a top priority on the IGI agenda in order to establish its credibility on an international scale, provide scientific evidence, and further expand the GeoGebra user base. Research in the areas of teacher development, instructional design, assessment of student learning, software improvement, cross-cultural collaboration, and on-line support/course development were among those topics suggested. The IGI would assist GIs and individual participants in designing and implementing such projects, promoting graduate/post-graduate research studies in this area, coordinating research efforts, and encouraging collaboration between and within national GIs.

3.4 GeoGebra Translations

The language translation feature found on the website has led to the translation of GeoGebra into approximately 40 languages by international volunteers using the translation resources. For example, Hals has been involved with the translation of the software into the two official languages of Norway; Papp-Varga with the Hungarian translation; and, Hreinsdottir with the Icelandic version of the GeoGebra software.

3.5 GeoGebra Publicity and Publications

Various methods of publicizing the IGI and its mandate/resources were also discussed. These ideas including the following: submitting workshop proposals and posters at conferences (providing slideshow presentations, workshop materials, posters); distributing cards at conferences; translating and printing cards for local sites/PD events; writing about and publishing research articles, books¹; and, resource materials relating to GeoGebra features and related pedagogy.

One idea that was discussed in detail was the formulation of a new online journal. This proposed peer-reviewed journal would have two separate parts: one part specifically focusing on the submission of longer, academic research papers; and, a second part focusing on the submission of shorter, practice-based articles/reports/teaching ideas written by teachers. This online journal would be well-organized and easily searchable/usable by all stakeholders. Chris Sangwin and Zsolt Lavicza agreed to investigate the possibility of establishing such a journal.

¹ First GeoGebra book entitled, *Model-Centered Learning with GeoGebra: Theory and Practice in Mathematics Education*, to be edited by Lingguo Bu and Robert C. Schoen (Series Editors Spector, Seel, and Morgan)

3.6 GeoGebra Funding

Many funding ideas were brought forth during the first meeting of the IGI. Overall, the IGI would like to see, whenever possible, the collaboration of national- or regionally-based GIs in terms of applying for local grants/research funds from granting agencies. These might include international organizations/projects (e.g., “eContent+,” “Comenius,” UNESCO); national organizations (e.g., NSF, SSHRC, NCETM); institutional/university support; and, private foundations (e.g., MacArthur, Gates, Carnagie, Ford Foundation). Due to the open source nature of the software, a serious interest in introducing GeoGebra to developing countries, using the financial support of the above-mentioned organizations was also discussed (e.g., the idea of an African GeoGebra conference).

3.7 Future IGI Meetings

Communication between members of GIs and others interested in the IGI activities could, and likely will, take various forms. One idea for future meetings is to host working/discussion groups at existing large conferences/symposia, reducing travel/accommodation costs for participants. Specific events that could feature such meetings would include:

- ICME-11 in Monterrey, Mexico (July 2008);
- NSEC in Trondheim, Norway (September 2008);
- CERME in Lyon, France (January 2009); and,
- CADGME/GeoGebra Conference in Linz, Austria (July 2009).

Other ideas for regular communication might include scheduled *Skype* Internet meetings (general, or sub-divided by topic groups); an updated presentation/attendance calendar on the website; an updated wiki or blog interface (RSS feeds of new announcements pushed out to subscribers); and, of course, regular email messages.

4 Concluding Remarks

GeoGebra has been described by many of its proponents as having several key advantages over other existing mathematics programs: open source status, versatility (algebraic and geometric input and separate windows), use of software in one’s own language, the ability to work online with the software (even without downloading being necessary) and to share files on the web—thus, students can use GeoGebra for homework and voluntary studies without any special arrangements.

The growing number of international groups interested in establishing local GeoGebra Institutes (GIs) bears witness to the quality of the software and the excitement surrounding its potential. The first meeting of the International GeoGebra Institute (IGI) was no doubt significant in that it not only provided a showcase for existing and imagined projects, but also provided a sounding board space for important structural, logistical, and financial issues surrounding the institutes and their representatives. We would like to thank all of those who took part in this special event, and we look forward to future international collaboration.