The Sixth Nordic & Baltic GeoGebra Conference
Karlstad University, October 23-25
Program

Friday (Room 21A258 – ”Pedagogisk verkstad”)

13.30-14.00 **Registration**

14.00-14.10 **Opening**

14.10-15.10 **Plenary talk:** ***István Juhos, GEOMATECH Project***

15.10-15.30 **Coffee**

15.30-16.30 **Plenary talk:** ***Development and Use of Resources – Presentation of the work of the Key Topic group 2014/2015***

16.40-18.10 **Parallell session 1:**

New Key Topic Group (90 minutes) **Room 21E205**	**Short Talks** (3x30 minutes) **Room 21E202**	**Workshop** (90 minutes) **Room 21A258**
Teacher's knowledge and classroom management in a technological environment Chair: **Rokas Tamošiūnas**	**Thomas Lingefjärd** *GeoGebra became the dominant tool in the ICT module in the Swedish MatematikLyftet*	**Cecilia Christiansen and Jan Olsson** *Is research guiding teaching or is teaching guiding research; an example of teacher-researcher collaboration in the matter of students´ reasoning and GeoGebra* The workshop will be held in Swedish
	Anders Sanne *How to get some mathematics out of a GPS track log?*	
	Anne-Mari Jensen *Modelling with GeoGebra to describe Physical Fitness.*	

18.10 **Welcome reception**

Saturday

09.00-10.00 **Plenary talk (Room 21A342):** ***Alexandra Viðar, Kvennaskólinn í Reykjavík***

10.00-10.30 **Coffee**

10.30-12.00 **Parallell session 2:**

Short Talks (3x30 minutes) **Room 21D302**	**Short Talks** (3x30 minutes) **Room 21E202**	**Workshop** (90 minutes) **Room 21E205**
Laura Kauppinen and Mikko Rahikka *How to improve learning functions by using GeoGebra (Highschool)*	**Jonas Hall** *Modelling a zombie apocalypse with differential equations in GeoGebra*	
Hannu Mäkiö *Geogebra as a tool in a derivate course*	**Thomas Lingefjärd** *How do we learn mathematics?*	**Bo Kristensen and Martin Thun Klausen** *Get started using GeoGebra in primary school - Level 1/4 (not advanced)*
Bjørn Bjørneng *Some examples showing how Norwegian secondary School students have worked with GeoGebra and also with programming on calculator in physics and mathematics*	**Adrian Bull** *How a program like GeoGebra can be used as a didactical tool to support pupils in the development of mathematical proof schemes*	

12.00-13.00 **Lunch**

13.00-14.30 **Parallell session 3:**

Key Topic group 2014/2015 Room 21A344	**Short Talks** (3x30 minutes) **Room 21D302**	**Workshop** (90 minutes) **Room 21E205**	**Workshop** (90 minutes) **Room 21E202**
Further discussions concerning *Development and Use of Resources*	**Ričardas Kudžma** *Invers function and GeoGebra*	**Bo Kristensen and Martin Thun Klausen** *Investigations in primary and lower secondary schools using GeoGebra - Level 2/4*	**Līva Ozola and Liene Krieviņa** *"Sequence" command for series of graphic objects*
	Trude Veen Tje Alsterberg *The relationship between graph and function formula*		
	Kristi Kreutzberg *Student competitions with the use of GeoGebra*		

14.30-15.00 **Coffee**

15.00-16.30 **Parallell session 4:**

Short Talks (3x30 minutes) **Room 21D302**	**Short Talks** (3x30 minutes) **Room 21E202**	**Workshop** (90 minutes) **Room 21E205**
Jonas Hall *New functionality in GeoGebra and GeoGebraTube*	**Jonas Ågren and Mattias Boström** *Geogebra included in the "Flipped classroom" concept*	
Mikko Rahikka *Chennai GeoGebra Workshop and some new theorems*	**Sirje Pihlap and Liis Mardi** *Learning mathematics by using screencast and GeoGebra in flipped classroom*	**Bo Kristensen and Martin Thun Klausen** *3D GeoGebra in primary and lower secondary school - Level 3/4 (semi advanced)*
Lorena Solvang *If computers are the vanguard of education then GeoGebra is the tip of spear.*	**Exchange of experiences and discussion related to a flipped classroom with GeoGebra** Discussion moderator: **Eva Mossberg**	

18.00 **Art museum**

19.15 **Conference Dinner (Elite Stadshotellet)**

Sunday

09.00-10.30 **Parallell session 5:**

New Key Topic Group (90 minutes) **Room 21D302**	**Short Talks** (3x30 minutes) **Room 21E202**	**Workshop** (90 minutes) **Room 21E205**
	Anders Karlsson and Svetlana Yushmanova *Sold in a coffee break - how to get more teachers to use GeoGebra*	
Teacher's knowledge and classroom management in a technological environment	**Sigbjørn Hals** *A presentation of an international certification program with instructional videos and automatic feedback in GeoGebra constructions.*	**Bo Kristensen and Martin Thun Klausen** *Programming applets for primary and lower secondary school in GeoGebra - Level 4/4 (kind of advanced)*
	Freyja Hreinsdóttir *Intensive course in ICT for upper secondary school teachers*	

10.30-11.00 **Coffee**

11.00-12.00 **Plenary talk (Room 21A342):** ***Miguel Perez, Linnæus University***

12.00-12.15 **Closing**

12.15 **Lunch**

ABSTRACTS

PLENARY TALK 1 (Friday 14.10-15.10)

István Juhos

The GEOMATECH project in Hungary

The GEOMATECH project, funded by the European Union, is a large-scale mathematics and science research, curriculum development, countrywide teacher training and dissemination programme for K12 education in Hungary. Its aim is to create free access interactive teaching and learning materials fostering learning by doing, based on experimentation and discovery of the students (that is consequent trials with immediate feedbacks). The materials also involve methods of highly-respected Hungarian teaching traditions by Pólya, Varga and Dienes, as well as successful technology integration programmes from other countries. The development is based on GeoGebra, mobile and sensor technologies and collaborative techniques. Besides creating contents for mainly GeoGebra, the project improves the GeoGebra software capabilities and provides a learning management system by extending GeoGebraTube functionality. The talk will briefly overview the goals and results of the project.

PLENARY TALK 2 (Friday 15.30-16.30)

Development and Use of Resources *– Presentation of the work of the Key Topic group 2014/2015*

The aim of a key topic is to get teachers and researchers to collaborate on common projects. The aim of this particular key topic - development and use of resources - is to collaboratively develop teaching materials to be used in various classrooms across the Nordic/Baltic countries. The key topic group agreed to work on materials both for lower secondary and upper secondary school concerning functions and using mathematics in connection to some other school subjects like economics, science, and English. In the process, both learning activities for pupils and demonstration materials for teachers were developed and published in a GeoGebra book online. The group will present their work in this plenary talk.

PLENARY TALK 3 (Saturday 9.00-10.00)

Alexandra Viðar

Since the school years 2008-2012 a new law was implemented in Icelandic education. Our school was a pilot school for the shortened secondary education reform, giving a three-year secondary education instead of a four-year one. This plenary talk will review past and present reform work in Kvennaskolinn in Reykjavik in the faculty of mathematics and the sciences. New designed courses in mathematics faculty focus on use of the dynamic software GeoGebra. I will present examples from the classroom works of my colleagues, students and myself. In addition I will give an introduction to a study that I conducted 2 years ago. This study examined the effect of dynamic GeoGebra-enhanced discovery learning environment on students' learning geometry, investigating the relationship between students' self-efficacy in geometry, attitude and their achievements.

PLENARY TALK 4 (Sunday 11.00-12.00)

Miguel Perez

The use of ICT tools such as GeoGebra in mathematics classrooms may affect students learning in different and sometimes unexpected ways in terms of students learning outcomes. This plenary talk will focus on how I have worked with secondary mathematics teachers in order to unpack some of the critical issues when supporting teachers in the appropriate and effective use of the affordances provided by GeoGebra.

PARALELL SESSION 1 (Friday 16.40-18.10)

Thomas Lingefjärd

GeoGebra became the dominant tool in the ICT module in the Swedish MatematikLyftet

The Swedish initiative Matematiklyftet – Lifting the mathematics – is an extensive in service project covering all stages of the school in a K – 12 perspective and also containing in service modules in areas such as
Arithmetic
Algebra
Geometry
Relations and Change
Probability & Statistics
Problem Solving
Language and Mathematics
Teaching Mathematics with ICT
Even if the Geometry modules 1-3, 4-6, 7-9, contains some examples of GeoGebra, the ICT module is an example of how GeoGebra can be used in several different ways for teaching mathematics at several different stages. I will talk about the different faces of GeoGebra in this work.

Anders Sanne

How to get some mathematics out of a GPS track log?

Every smart phone with a GPS receiver can record track logs. Track logs are the cyber equivalent of dropping breadcrumbs so that you can retrace your steps. They provide a history of your travels. The logs include your latitude, longitude, horizontal position and time recorded automatically as you travel.

How to make an elevation plot, a time-distance chart, and a time-speed chart in GeoGebra from a GPS track log? I will show you some of the technical obstacles I had to overcome and some of the mathematics that show up along the road.

Anne-Mari Jensen

Modelling with GeoGebra to describe Physical Fitness.

My students in the first year of upper secondary school (videregående skole) are supposed to learn about functions and modelling in mathematics. We have had a project where they registrated their

own pulse after a work period in gymnastics. These data were the base for a study in both subjects mathematics and gymnastics.

Cecilia Christiansen and Jan Olsson

Is research guiding teaching or is teaching guiding research; an example of teacher-researcher collaboration in the matter of students´ reasoning and GeoGebra

Teachers who are using GeoGebra in their teaching for other purposes than one way demonstrations often find the powerful environment of GeoGebra as benefitting for students mathematical exploring, reasoning and problem solving abilities. Addressing reasoning research has shown promising results when it comes to interventions associated to dynamic software like GeoGebra. Software affording multiple synchronized representations, easy creating and manipulation of representations, and support for constructions and calculations have been suggested to enhance conceptual understanding and development of reasoning competence. Anyhow, teaching is complex and it is seldom easy to transform research findings into successful classroom activities. This workshop will give both teachers' and researchers' perspectives on a fruitful collaboration in the matters of linear functions, students' reasoning, and GeoGebra, intertwined with hands-on activities and discussion of teaching and research of the subject. Participants are welcome to bring their own computer with GeoGebra installed.

The workshop will be held in Swedish

PARALELL SESSION 2 (Saturday 10.30-12.00)

Laura Kauppinen and Mikko Rahikka

How to improve learning functions by using GeoGebra (Highschool)

In spring 2015 two finnish high school math teachers Laura and Mikko decided to try something new. Students would first learn functions by using GeoGebra. After having achieved a basic understanding of functions they would continue with normal course exercises. In autumn 2015 Mikko improved the concept further. Come to see the results

Hannu Mäkiö

Geogebra as a tool in a derivate course

As a math teacher, I had been using Geogebra for years. It is a great tool to visualize problems ad hoc in a class or to show visualizations done beforehand. But the problem was, I was the active user of Geogebra, not the students. I have tried to tackle this problem different ways. In this talk I report the study I made with two secondary school math classes in their derivative course. Classes were held in a successive years, in 2012-2013 and 2013-2014. One course takes 6 weeks.

The questions I tried to answer were 1) how to use Geogebra in a derivate course and 2) how students feel about it. After first year I changed the use of Geogebra in many ways. I used problem based learning and Geogebra was more used at the school. In both classes I recorded once the way students used Geogebra. As students solved problems with Geogebra, they also explained in a record what they were thinking. With computer programs such as Geogebra, it is easy to produce different kind of algebraic representations (algebraic equations, tables, diagrams and graphs). In the course I used these different kind of representations and tried to make students to talk about them.

Bjørn Bjørneng

Some examples showing how Norwegian secondary School students have worked with GeoGebra and also with programming on calculator in physics and mathematics

example 1: Interference with double split (Youngs Experiment)
example 2: Movements of planets 1.
example 3: Movements of planets 2.
example 4: Acceleration
example 5: A Pythagoras Puzzle.
example 6: A Surprice.

On Calculator. Very briefly how one student created a calendar program, and how a Group of students created a program for training calculations.

It is very important to let students create their own programs and see how happy they are when they succeed.

Jonas Hall

Modelling a zombie apocalypse with differential equations in GeoGebra

In this talk I outlined the main results of my teaching differential equations with GeoGebra in the Swedish top math course (Ma5) in High School, yr12. The group was mixed ability. Teaching focused completely on formulating DE's from problems, solving them in GG (and W|A in some cases) and then analyzing resulting solutions with sliders. We used container diagrams and y' or y'/y vs y or t diagrams as mind tools to help translate problems to DE's. The curriculum does not include solving systems of first order ODE's but this was easily done with container diagrams and GeoGebras NSolveODE command. Some (top) students really got the hang of it and were able to freely modify and create new models to great success. Some students still struggled with the basic material, but to some extent, GeoGebra helped us to go beyond the curriculum and motivate the students.

Thomas Lingefjärd

Learning of Mathematics

Humans constantly receive and interpret a vast amount of information and consider if it is worthwhile to save the information in the mind. If you can read this it is because you already have met and saved these letters together with a system to arrange these letters.

In mathematics we need to meet and save objects in the same sense. We also need imagination since a large part of mathematics is impossible to realize. We need to be able to imagine a perfect circle or a sequence of digits such as 0.14159 where we can add 3 and call the sum for π. Someone will also tell us that the decimals are too many or to few.

Vygotsky and many other psychologists after him argue that learning is in the interplay between external and internal representations. Cobb claim that all teaching should focus on exactly this interplay and exchange of information and also that we should emphasize this importance for our students. Tretsky and Mayer argue that we receive graphical and verbal information at different parts of our brain. That in turn has a theoretical explanation since we were decoding graphical information so many years and generations before we had a language to express it with. Internal and External representations are important. I will explain how this relates to GeoGebra.

Adrian Bull

How a program like GeoGebra can be used as a didactical tool to support pupils in the development of mathematical proof schemes

This shorttalk describes how a program like GeoGebra can be used as a didactical tool to support pupils in the development of mathematical proof schemes in mathematical education. This development of pupils' mathematical skills is specifically developed to help pupils convert between Duval's mathematical representation registers. It is also an approach connecting the pupils' own idiosyncratic representations and society's conventional representations. Through empirical inquiries, the pupils can get experience with the conventional representations and acquire them as empirical or deductive proof schemes. The objective is for pupils to expand their mathematical skills.

Bo Kristensen and Martin Thun Klausen

Get started using GeoGebra in primary school - Level 1/4 (not advanced)

GeoGebra is used in many parts of the educational systems, but many teachers still find it hard to integrate the program from an early age. There are a lot to gain from using GeoGebra in lower primary school, and in this workshop I'll show different approaches on how to introduce GeoGebra at this level in the school system.

In this workshop I distinguish between on one hand to look upon GeoGebra as a tool the kids needs to master and on the other hand as a means for the kids to reach other goals in mathematics.

The workshop will be a combination of trying out different activities for kids in primary school and discussions about what is to be gained form using this approach.

PARALELL SESSION 3 (Saturday 13.00-14.30)

Ričardas Kudžma

Inverse function and GeoGebra

Here we‘ll pay our attention to the presentation of inverse function both at secondary schools and universities or colleges. There are two quite opposite points of view. Let us say $y = f(x), x \in X, y \in Y$, is a given monotonic function, $x = g(y) or\ x = f^{-1}(y)$ is the inverse function of *f*. Then such sentences do appear in huge number of textbooks "Let‘s change variables and consider the function *g* as the function of variable *x*. Graphs of function $y = f(x)$ and its inverse $x = g(y)$ are symmetric with respect to the line *y = x*" Such treatment of inverse function can be named as "traditional one".

Another point of view can be found, for example, in textbooks of R.Courant and G.M.Fichtengolc. Graphs of $y = f(x)$ and its inverse $x = g(y)$ is the same curve. At least two generations of American and Soviet mathematicians studied from these briliant textbooks.

In this presentation we‘ll try to show how GeoGebra can help to accept this second approach of teaching.

References:

1. Courant, R (1967) Differential and Integral Calculus (in Russ.), Vol.1, Nauka, Moscow.

2. Fichtengoltz, G.M. (1962) Differential and Integral Calculus (in Russ.) , Vol. 1, Fizmatgiz, Moskow.
3. Kudžma, R.,Inverse function. Which one? Teaching Mathematics: Retrospective and Perspectives, 4th International Conference 23-24 May, TPU Kirjastus, Tallinn, 2003 p. 79-83.

Trude Veen Tje Alsterberg

The relationship between graph and function formula

We often experience that the students first learn a lot about function formula and then, later and isolated, they learn about the graph. We want the students to learn about the relationship between the graph and the function formula, learn and experience what the relationship means. If we do some changes in the function formula what consequences will it do for the graph. We let the students work with different ways to present the function formula.

Kristi Kreutzberg

Student competitions with the use of GeoGebra

The 8th student competition took place in Estonia this year. In this talk I will give an overview of the last two competitions where students had to submit a GeoGebra worksheet about symmetry and tessellation, show the best works and talk about student feedback.

Bo Kristensen and Martin Thun Klausen

Investigations in primary and lower secondary schools using GeoGebra - Level 2/4

By doing investigations in math, we can setup a learning environment, where the pupils are the ones coming to conclusions about math instead of just being told by the teacher. This also means shifting the balance of the lessons from teacher presentations to pupil activity.

GeoGebra is an excellent program for doing math investigations in school. Because its dynamic and has several easy-to-use tools you can start using the program already in primary school.

In this workshop we focus on different investigation activities aimed at primary and lower secondary school. The workshop is a combination of examples of hands-on activities followed by discussions about the potentials of these activities in school.

Līva Ozola and Liene Krieviņa

"Sequence" command for series of graphic objects

Most of us and most of our students are visual learners therefore a great enrichment in understanding sequences and seeing regularities is the possibility to perceive sequences as series of graphic objects. Such opportunity is given by one of most powerful tools of GeoGebra – the "sequence" tool.

We are going to present a set of exercises for teaching and understanding sequences using GeoGebra. Also examples of our own classroom experience and feedback will be given.

PARALELL SESSION 4 (Saturday 15.00-16.30)

Jonas Hall

New functionality in GeoGebra and GeoGebraTube

In the autumn of 2015, GeoGebraTube and GeoGebra in general have seen some big improvements. I will quickly show some examples of these, including

GeoGebra on Android smartphones
GeoGebraBooks with worksheets that can contain many different types of media
GeoGebrabooks with questions
Groups for collaboration in GeoGebraTube
A few minor technical upgrades to GeoGebra

Mikko Rahikka

Chennai GeoGebra Workshop and some new theorems

On July 2015 a GeoGebra Workshop was held in Chennai India. It was funded by US Fulbright Organisation. Dr. Zekeriya Karadag , Ms. Sangeetha Gulati and I were the "teachers" for 60 math teachers from 25 different Chennai schools. GeoGebra is becoming a big thing in countries where there is not much money to spend to licences for educational programs.

I will tell you about the conference and about a couple of new theorems I invented playing with GeoGebra.

Lorena Solvang

If computers are the vanguard of education then GeoGebra is the tip of spear.

Curricular development in several countries suggests that ICT should be included in the primary and secondary level curriculum (for Norway, Sweden, Italy).
Furthermore in the OECD PISA documents, mathematical modeling competence together with the problem solving competence and the reasoning competence is listed as some of the basic mathematical competences.
In addition to that the cross-curricular activities is one of the goals for the developing work in the school I work in.
While trying several concepts that would help med to achieve these goals I sign in to become a part in a research project conducted by Karlstads University. Here I first came in contact with the dynamic system, GeoGebra and the journey to include ICT, mathematical competences and cross-curricular activities got to a touring point.
I would like to present to you the advantages and disadvantages of using GeoGebra in the classroom. My personal opinion is that if computers are the vanguard of education then GeoGebra is the tip of spear.

Jonas Ågren and Mattias Boström

Geogebra included in the "Flipped classroom" concept

We are several teachers working to introduce the concept of the "Flipped classroom" in upper secondary school for students between the ages of 16 and 19. Geogebra has been a tool in this

development to visualize mathematics. The aim of the "Flipped classroom" concept is to prepare the students before entering the classroom by having them watch a short movie, describing the new field. By preparing the students in advance, more classroom time can be devoted to discussion and activities instead of a teacher monologue.

We are going to talk about our experiences with the concept "Flipped Classroom" and how to include Geogebra as a tool in the process

Sirje Pihlap and Liis Mardi

Learning mathematics by using screencast and GeoGebra in flipped classroom

Several researches have shown that flipped classroom strategy where screencasts are often used has given good results in study process. Thus the interest how to change learning more active and fascinating has increased tendency to introduce this kind of learning approach more widely.
We are going to present study material for learning geometry using screencast and GeoGebra in flipped classroom. Also we are going to introduce students and teachers feedback about the model lesson.

Bo Kristensen and Martin Thun Klausen

3D GeoGebra in primary and lower secondary school - Level 3/4 (semi advanced)

The introduction of GeoGebra 3D has opened new possibilities in the classroom.
Just constructing things can be a challenge, and by adding a third dimension the pupils have to rethink the way the do their constructions.

In this workshop you'll get a chance to get to know GeoGebra 3D better.
At the same time you'll try out activities which:
- makes it possible for the pupils to discover and investigate volume formulas
- makes the pupils do mathematical modelling by inventing containers for different consumer demands
- introduces investigations not as easy to do before GeoGebra 3D.

PARALELL SESSION 5 (Sunday 9.00-10.30)

Anders Karlsson and Svetlana Yushmanova

Sold in a coffee break - how to get more teachers to use GeoGebra

We would like to show several hopefully innovative examples of GeoGebra quick-fixes, i.e. constructions which can be made in under 3 minutes but still have high explanatory value.

Such examples, rather than fancy constructions you spend a weekend working on, might get more teachers keen on starting to explore GeoGebra.

We like to think of GeoGebra as chess: a minute to learn, a lifetime to master: we hope to show that it only takes "a minute" to learn. At least to get started.
Mathematics behind the constructions range from primary school to upper secondary.

Sigbjørn Hals

A presentation of an international certification program with instructional videos and automatic feedback in GeoGebra constructions.

In the GeoGebra conference for teachers in Copenhagen in 2013, I presented the Norwegian GeoGebra-Kikora certification project with instructional videos, GeoGebra exercises and tests. After completing this program, the teachers become certified GeoGebra users at level 1. So far more than 2,600 Norwegian teachers have qualified for a GeoGebra certification, and about 50,000 have completed parts of the program.

In this presentation I will show how the certification model will be expanded and made available in many different languages. I will also demonstrate a nice new feature where we may get stepwise and automatic feedback when working with GeoGebra constructions.

Gathering teachers in workshops and traditional courses is often expensive and inefficient. With instructional videos and stepwise feedback, teachers (and students) may learn how to master this wonderful software at their own pace, and when it suits their own schedule.

Freyja Hreinsdóttir

Intensive course in ICT for upper secondary school teachers

During the years 2014 – 2015 a review was made of mathematics teaching in 9 (out of 35) upper-secondary schools in Iceland. Following this a new 2 year study program for teachers was developed with the aim of improving their mathematical knowledge and ICT skills. This new program started in August 2015 with an intensive 5 ECTS course on the use of ICT in mathematics. The course was given from August 10th to September 19th 2015. The students were taught the use of GeoGebra, LaTeX, Screencastomatic and other programs. They made experiments using these programs in their teaching and handed in reports.

At the end of the course the students filled in a survey where they answered questions on their view on the use of ICT in mathematics teaching, their expected use of GeoGebra and screencast technology as well as other questions.

During the talk a description of the course will be given and the results from the survey.

Bo Kristensen and Martin Thun Klausen

Programming applets for primary and lower secondary school in GeoGebra - Level 4/4 (kind of advanced)

In this workshop you will program applets for your pupils. The applets are mix of self correcting worksheets and files for investigating different areas of mathematics in primary and lower secondary school.

Even though the applets are aimed at primary and lower secondary school, we introduce general programming principles which are useful when producing applets for older students.