

Subject: MATHEMATICS 2

Code: MX230E

Credit points: 30

**Passed: Passed by the Faculty Steering Committee, 22nd June, 2005
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1. Introduction

This course offers a study in mathematics and didactics of mathematics preparing the students for teaching in primary and lower secondary school. The basis for being admitted to the course is the compulsory course Mathematics 1 (MX130) from initial teacher education, or an equivalent background in mathematics. Mathematics 2E can be a part of the basis for the masters programme in mathematics education given at HiST-ALT. The course plan for Mathematics 1 states some overarching principles for the profile of mathematics courses at HiST-ALT. These principles are also valid for Mathematics 2E.

In this course the students will develop further their knowledge of central mathematical topics and concepts as well as their competence in the didactics of mathematics. A close relation with the practice field is central in the course. All students will be given the possibility to work with pupils in primary or lower secondary school, and thereby experience a varied practice in mathematics.

The plan is divided into three main target areas for the course:

- Mathematical and didactical knowledge
- To be a teacher in mathematics
- Cooperation and reflection

These three areas are in various ways connected, and they overlap to some extent. The first area reflects the specific theoretical background for the course. The second is connected to the professional development of the student as a mathematics teacher, and how to handle the subject in the teaching situation. The third has to do with each student's own development, individually and in cooperation with others – students, teachers, pupils, practice schools and the local community, which the school is a part of.

2. Contents

Mathematical and didactical knowledge

In the course the students shall develop their competence in mathematics and in didactics of mathematics. This means that the students shall develop their ability to observe, understand and act in learning and teaching situations. The main topics are number theory and geometry, but number strategies in connection with approaches to algebra will also be included.

Didactical topics will be related to identifying, characterising and understanding phenomena and processes that are part of the teaching and learning of mathematics.

Within geometry children's conceptions of shape and space are essential, and how these conceptions may be influenced by the way in which geometry is included in children's play activities. An important aspect in geometry is to study its presence in our surroundings – in daily life, in art and in architecture – in order to make the students appreciate how they can use the local environment as an arena for learning. An important issue is to study and describe figures, shapes, patterns and solids in two- and three-dimensional space. Various types of resources and material for practical activities will be used. Contexts of interest for this work may be geometry in art and culture, such as painting, knitting patterns, origami (paper folding) and tiling. Transformations and symmetries are important topics.

Geometry of the earth, some aspects of cosmology and some basic topics from graph theory may be included.

The work with number strategies concentrates on how children develop algorithms and how algebra generalises arithmetical operations and relations. Different approaches to algebra will be discussed.

Experimenting and exploring properties of numbers and number patterns will be an important part of this topic. This includes the study of recursive and explicit formulas for number sequences. Factorisation and divisibility are other relevant topics leading for instance to the connection between division with remainders and integer solutions of linear equations.

Topics from the history of mathematics may be included to the extent that they can help to develop the understanding of central mathematical concepts.

Computer software, such as spreadsheets and dynamic geometry programmes, will be used and it will be discussed to what extent such programmes are helpful in and the learning and teaching of mathematics.

In the development of the students' didactical competence questions about how children learn mathematics, how they develop concepts and their ways of thinking will be important aspects. In particular the course will address how different discourses may comply with the demand for a dialogic way of teaching mathematics. This will be linked to discussing the connection between views on the subject, ways of teaching and learning theories.

Relevant didactical topics are:

- Theories for learning and teaching of mathematics, in particular constructivistic and socio-cultural theories
- The implications of theory for ways of working with mathematics
- Mathematics as a social construction
- Connections between learning theories and directions in the philosophy of mathematics

- Connections between learning theories, views on the subject and how to organise teaching
- Teacher competence in a dialogue based classroom
- Development of professional knowledge about teaching mathematics
- Analysis of text books, teaching aids and curriculum

To be a teacher in mathematics

A basic goal for the course is that the students shall develop a deeper understanding of the connection between different mathematical topics. The students shall develop their ability to apply their mathematical and didactical knowledge in order to arrange good teaching of mathematics. Teaching strategies emphasising communication and cooperation will be important. It is an aim that the students shall develop a relational understanding for the topics they work with, and that they shall be able to transfer the value of such understanding to future work as teachers of mathematics.

The practice field as an arena for learning is important. Through the work in the practice field the students will develop methods for planning and teaching a given mathematical topic, and also concretise and develop the didactical theory the course is based on.

The significance of the teacher having a firm mathematical knowledge will be discussed, and related to the ability of providing effective learning opportunities to all pupils. A firm mathematical knowledge is also important in order to teach without being too dependent on the textbook. The students shall develop sufficient understanding of the mathematical topics included in the course to be able to analyse where a given pupil is in his/her developmental process, and to decide how to proceed with this pupil in order to stimulate further conceptual development.

It is also a part of this target area to work with pupils' attitudes towards mathematics, what will affect such attitudes and which measures could be taken to develop and maintain positive attitudes towards mathematics. In this connection a possible topic could be to discuss different attitudes among boys and girls, and how these differences could have an impact on the work with mathematics in the school.

The target area also addresses the development and analysis of survey tests and work with diagnostic teaching.

In the course it will be discussed how e.g. reflecting on experiences when it comes to working with mathematical problems as well as working methods, will influence the professional development as a teacher in mathematics.

Through the course the students shall obtain insight in and experience of using ICT –tools, so that they can be able to use and evaluate such tools in their own teaching.

Cooperation and reflection

The choice of this headline recognises that competence in mathematics and didactics of mathematics is developed in a social setting and as a result of human interrelations. In teacher education this means interaction between student teachers and teacher educators, among the student teachers themselves, and between student teachers and pupils. This also has to do with the relation to the school as an organisation and the relation between the school and the local community.

Being a teacher in mathematics requires cooperation with fellow teachers, both in mathematics and in other subjects. It is therefore important to see mathematics in relation to other subjects and the role it plays in interdisciplinary teaching. The development of positive attitudes towards mathematics will be discussed.

Cooperation also involves the ability to handle response from the pupils, and encourage mathematical inquiry and experimentation. It is important that the students acquire a firm basis both in mathematics and in didactics of mathematics, which will provide sufficient confidence to encourage the pupils to develop their own reasoning and algorithms, and thereby to foster creativity in developing solution methods and guide the pupils in their further development of mathematical knowledge.

The students shall develop their ability to reflect on their own experience with teaching and learning of mathematics. Through an essay based on own school practice, experiences should be used as a basis for a discussion of mathematical and didactical topics emphasised throughout the course. Each student's development as a mathematics teacher should be expressed through documented understanding of relevant concepts, or their content, and in reflection on classroom experiences

3. Organisation and teaching strategies

The course is a one-semester course. Organisational details are given in the semester plan. The course addresses a variety of teaching methods ranging from lectures, workshops, assignments, exercises and use of ICT. Process-orientated teaching strategies, with emphasis on inductive methods and student activity, are central. The course will partly be based on individual work, partly on various types of group work. Homework assignments will be given. The number of assignments, and when they are given, will be specified in the semester plan.

Compulsory student activities

- Activities that require cooperation among students
- Work with, and evaluation of, various types of teaching aids, including technological aids
- Trying various types of student active ways of working
- Course evaluation

Further details about the type and the occurrence of the compulsory activities will be given in the semester plan.

4. Assessment

Compulsory assignments

- An oral presentation
- Four problem sets
- A description and an analysis of an implemented teaching unit connected to one or more of the mathematical topics contained in the course.

The compulsory tasks are assessed using the terms approved/not approved, and they do not count towards the final grade. The final grade will not be awarded until the compulsory tasks are approved of.

Basis for the final grade

The final grade is awarded on the basis of two separate components, each counting 50%.

Part 1 Home examination taken as a group

Part 2 Individual oral examinations

Both components must be passed before the final grade is awarded. In settling the final grade, Part 2 is decisive. If a student fails on one of the parts, the student is entitled to a new trial in that particular component.

5. Curriculum, literature and permitted supports

The semester plan presented at the start of the semester will contain a preliminary literature list. The preliminary literature list will be revised in cooperation with the students during the semester. The dean makes the final decision about the literature list and the permitted aids for the exam within two months prior to the final exam.