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mathematics and science for life

National policy paper: Norway

"National working paper on analysis of policy context"

mathematics and science for life

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mascil aims to promote a widespread implementation of inquiry-based teaching (IBL) in math and science in primary and secondary schools. It connects IBL in schools with the world of work making math and science more meaningful for young European students and motivating their interest in careers in science and technology.

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Introduction

Background
This document reports on the processes and the outcomes of the first set of activities carried out within Work Package 2 (WP2) ‘Educational Systems and policy contexts’ of the Mascil project. To provide an overview about how this work fits within WP2, the overall scope of this WP is two-fold: first, it aims to give insights into the strengths, weaknesses, opportunities and threats of Inquiry Based Science and Mathematics implementation from a context perspective, taking into account patrimonial aspects of learning, and to uncover the complex relationships between general education, vocational education and labour market requirements. Second, the activities in this WP focus on cooperation and synergies among research, policy and practice fields, producing strategies to support the more widespread uptake of inquiry-based science teaching. The scope of the work reported in the document is to highlight the contextual factors that support or hinder a widespread implementation of inquiry based learning in vocational contexts.

Aims and purpose of the report
For the accomplishment of the general aims of WP2 of the Mascil project, as presented above, the basic step is the analysis of the educational systems and the policy contexts in the Mascil partnership countries, under the scope of investigating the contextual and regulatory conditions in which teachers work and are called upon to implement (or not) inquiry-based approaches to their teaching. This document reports on the processes and the first outcomes of such an analysis conducted in Norway.
Details about the framework for analysis, methods used, findings, conclusions and recommendations on an international level can be found in the full D2.1 deliverable[1].

[1] http://www.mascil-project.eu/resources/reports-and-deliverables

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1.1 National Report of Norway

PART 1: A DESCRIPTIVE, EVIDENCE-BASED ACCOUNT OF THE NATIONAL CONTEXT

Introduction: Organization of education in Norway

The structure of education in Norway and the associated 'types' of teachers and teacher education requirements are represented in the following figure:

Organisation of Education in Norway (linked to teacher education)

Grade	Age	Type of school[1]	Disciplines[2]	Type of teachers[3]	Initial training[4]
-3	*			Pre-school teacher	Specialist pre-school Ted: 4 years at specialist University College
-2					
-1					
1	6	Primary school	Maths & Integrated science	Generalist up to 2010, and most practising teachers are generalists, after 2010 more specialist teachers as teacher education is now separated for grades 1-7 and 5-10, with specialist training in particular for the grades 5-10 teachers.	TEd at University College: 4 years (+2 years MA if so wished) New reform since 2010: choice between TEd for grades 1-7, or grades 5-10 (see report)
2	7				
3	8				
4	9				
5	10				
6	11				
7	12				
8	13	Lower secondary		(1) Univ Coll: with specialisation since 2010 (2) Specialists-univ	Two routes: (1)University Colleges used to train generalists, but after 2010 more specialisation (2) University traditionally train specialists (see report)
9	14				
10	15				
11	16	Upper secondary		Specialists in maths, biol, phys & chem	University TEd
12	17		Maths obligatory, but science not: Choice of weak and strong maths; Choice between Biol, Chem and Physics		
13	18-19		Maths and science not obligatory, otherwise same choice as above		

*Note: kindergarden starts at any age, if so wished, but it is not obligatory. However, every child has the right (but not obligation) to attend kindergarden, and it is a government policy that every child has a place. Anecdotal evidence shows that some kindergardens actually already teach a bit of maths at that age.

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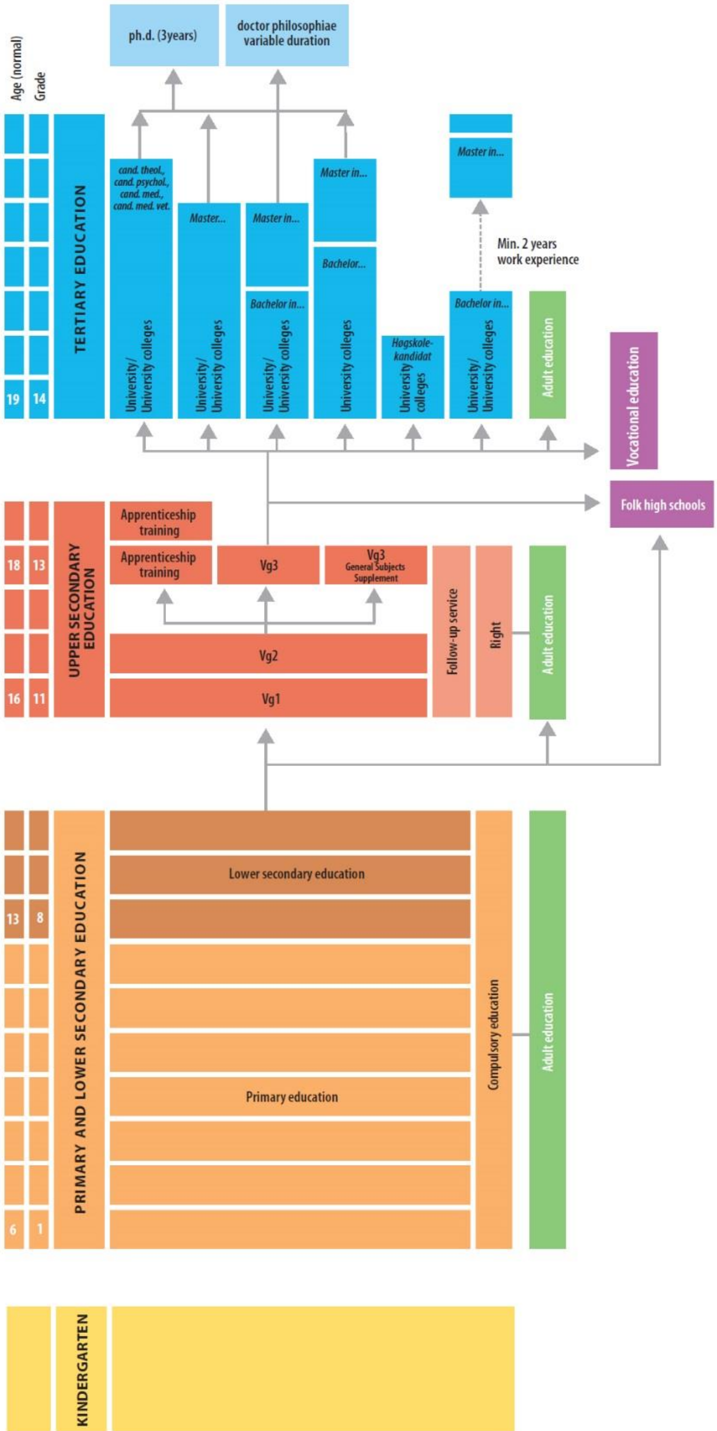
The Norwegian education system



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Universal schooling for children was introduced in Norway 250 years ago. From 1889 seven years compulsory education were provided, in1969 this increased to nine years, and since 1997 10 years schooling are obligatory. Norway is a large country and it is scarcely populated. As a result of Norway’s scattered population, 40% of primary and lower secondary schools are so small that children of different ages are taught in the same classroom. Primary and lower secondary levels are often combined in the same school.

In Norway the goals and framework for the education sector are defined by the Norwegian Parliament (Stortinget) and the Government. The collective objectives and principles for teaching in primary and lower secondary schools are outlined in the national curriculum. However, and in line with Norway’s various populations, there is also a Sami curriculum. The culture and traditions of the Sami community are regarded as part of the common Norwegian and Nordic culture, and state support is provided for the development of textbooks written in Sami language. There is also a Sami college which has special responsibility for training Sami teachers.

In Norway pupils attend 10 years of compulsory education, from the age of 6 to the age of 16. This includes both primary education (grades 1-7) and lower secondary education (grades 8-10). Among the mandatory subjects at these levels mathematics and natural science play an important part. At the age of 16, after having finished compulsory education, pupils may start their upper secondary education, choosing the academic/general programme or the vocational programme. The former is a three-year programme qualifying students for acceptance to higher education. Pupils attending the vocational programme who would like to qualify for higher education may either attend a fourth year or change programmes after the second year, and follow supplementary studies the third year. Norway has a national curriculum for grades 1-13. Mathematics is compulsory both the first (Vg1) and the second (Vg2) year of the general upper secondary education programme. According to the mandatory guidelines there are two mathematics subjects for Vg1 and Vg2; curriculum T and curriculum P. The former is more theoretically oriented, whereas the latter is more practically oriented. Natural science is compulsory only for the first year (Vg1). For the second and third year the natural science subjects are elective and go from being integrated subjects to being organized according to discipline (biology, chemistry, physics and recently earth science/geology). For those pupils choosing a vocational upper secondary education, mathematics and natural sciences are obligatory in the first year. However, the curriculum is not the same, as these pupils have three fifths of the mathematical curriculum for Vg1P or Vg1T and only parts of the natural sciences curriculum for Vg1.

The collective objectives and principles for teaching in primary and lower secondary schools are laid down in the national curriculum. The curriculum for primary and lower secondary education includes:

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- Core curriculum for primary and lower secondary, upper secondary and adult education (see selected principles below)
- Principles and guidelines for primary and lower secondary education
- Curricula for individual subjects (e.g. mathematics, science, vocational subject areas)

The subject curricula lay down a common learning content for all pupils, which increases in scope throughout the school and is greatest at the lower secondary stage. This common learning content is enlarged on and supplemented to adapt it to local conditions and to the needs of individual pupils.

The culture and traditions of the **Sami community** are part of the common Norwegian and Nordic culture that both the national curriculum and the special Sami curriculum require all pupils to be acquainted with. In areas defined as Sami districts and according to specific criteria elsewhere in Norway, this teaching is given in accordance with the special Sami curriculum.

For Sami pupils, this teaching is intended to build a sense of security in relation to the pupils' own culture and to develop Sami language and identity, as well as equipping Sami pupils to take an active part in the community and enabling them to acquire education at all levels. State support is provided for the development of textbooks written in the Sami language. The Sami College has a special responsibility for training Sami teachers. The University of Tromsø has responsibility for Sami language and Sami studies.

School subjects at primary and lower secondary levels

Religion, Philosophies of life and Ethics
Norwegian
Mathematics
Social Studies
Art and Crafts
Natural Sciences
English (is compulsory from the primary level)
Music
Home Economics
Physical Education
Compulsory additional subjects

In addition, time is set aside at all levels for **School's and pupils' options**. These hours are taken from the teaching hours allocated to the main levels. A separate quota of hours is allocated to **class and pupils` council work** at the lower secondary level. At

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the lower and upper primary levels, it is possible for schools to allocate a quota of hours locally for this purpose from the hours allocated to other subjects.

In addition to the compulsory subjects, pupils in lower secondary school are required to choose one of the following options:

- **Second foreign language**. Pupils can choose a foreign language in addition to English, i.e. German or French or another language on the basis of local or regional needs.
- **Supplementary language study**. Pupils can choose additional in-depth study of a language they already have a basic knowledge of.
- **Practical project work**. This is an activity that is planned in cooperation with the pupils.
- From academic year 2013/2014 schools must offer at least two new electives, from a total of 14 new curricula (ex. Technology in practice, Research in practice, Democracy in practice, Tourism, Trafic, Nature- environment and outdoors, Production of goods and services, Design and redesign, Physical activity and health).

(source: http://www.regjeringen.no/en/dep/kd/Selected-topics/compulsory-education/the-norwegian-education-system.html?id=445118, http://www.udir.no/Lareplaner/Valgfag/)

In terms of upper Secondary Education and Training, all young people between the ages of 16 and 19 have a right to upper secondary education and training. The pupils can choose between **vocational education programs or programs for general studies**. All levels in upper secondary education and training are adopting new curricula with clearly stated competence objectives. The curricula place a general emphasis on basic skills in being able to express oneself orally and in writing, in reading, in numeracy and in the use of digital tools. The county authorities fund upper secondary education and training and have a great deal of freedom when it comes to organizing the education. The vocational education programs include training in training establishments or education in school.
(source: http://www.regjeringen.no/en/dep/kd/Selected-topics/compulsory-education/upper-secondary-education.html?id=87102

Tertiary vocational education is an alternative to higher education and is based on upper secondary education and training or equivalent informal and non-formal competence. Higher Education Entrance Qualification is not required. The education consists of vocational courses lasting from half a year to two years. Apart from the traditional schools of technical management and maritime subjects which are publicly financed (by the county authorities), most of the schools offering this kind of education

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are private ones. All courses must be accredited by the Norwegian Agency for Quality Assurance in Education (NOKUT).
(source: http://www.regjeringen.no/en/dep/kd/Selected-topics/Tertiary-Vocational-Education-.html?id=87103)

As basic principles the 'core curriculum' stipulates the following for the three levels of education (source: Norwegian Board of Education, Oslo, 1997):

Primary and lower secondary education (principal aims):
"Primary and lower secondary education shall, with the understanding of and in cooperation with the home, assist in providing pupils with a Christian and ethical upbringing, develop their mental and physical abilities, and give them a broad general education so that they can become useful and independent persons in their private lives and in society. Schools shall promote intellectual freedom and tolerance, and emphasize the establishment of cooperative climate between teachers and pupils and between school and home."

Upper secondary education (principal aims):
"The purpose of upper secondary education is to develop the skills, understanding and responsibility that prepare pupils for life at work and in society, to provide a foundation for further education, and to assist them in their personal development. Upper secondary education shall contribute to increased awareness and understanding of basic Christian and humanist values, our national cultural heritage, democratic ideals and scientific thought and method. Upper secondary education shall promote human equality and equal rights, intellectual freedom and tolerance, ecological understanding and international co-responsibility."

Vocational training (principal aims):
"The Act aims to develop competence, understanding and responsibility in relation to craft, profession and society; to provide a basis for further education and to assist apprentices in their personal development. Vocational training shall contribute to increased awareness and understanding of basic Christian and humanist values, our national cultural heritage, democratic ideals and scientific thought and method. Vocational training shall promote human equality and equal rights, intellectual freedom and tolerance, ecological understanding and international co-responsibility.
The apprentice is under an obligation to participate actively to achieve the objects of the training and contribute to establishing a favorable working climate and a spirit of cooperation."

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Theme 1: State of affairs-recent changes

Wider policy perspectives

In terms of statistics the Norwegian government provides the following numbers:
Primary and lower secondary: 615 000 students (1-10)
Upper secondary: 76 500 students (11-13)

Teachers/school leaders
Primary and lower secondary 95 000 (72 000)
Upper secondary 34 000 (27 000)
Primary and lower secondary schools: 3400 (1-7; 1-10; 8-10)
Upper secondary schools: 400

(Grøttvik, 2013)

The “Knowledge Promotion” programme (LK 06) is the latest reform in the 10-year compulsory school and in upper secondary school education and training.
“The goal of the Knowledge Promotion is to help all pupils to develop fundamental skills that will enable them to participate actively in our society of knowledge.” (Norwegian Ministry of Education, 2006)
The Norwegian school system is said to be inclusive and it is stressed that everyone is given the same opportunities to develop their abilities; hence differentiated education is claimed to be ensured. The main changes in the school system that stem from the Knowledge Promotion are the following:

- Basic skills are strengthened;
- Reading and writing are emphasised from first grade;
- New subject syllabi in all subjects (clearly indicating what pupils/students are expected to learn- competencies);
- New distribution of teaching hours;
- New structure of available choices in education programmes;
- Freedom at the school/local level with respect to working methods, teaching materials and the organisation of classroom instruction.

Within the reform efforts several issues can be identified that seem to be emphasised. These relate to the teacher’s role in education, and the government has introduced a new teacher education programme for primary and lower secondary education with strong emphasis on subject knowledge and teaching skills, quality of studies and research orientation. Another relates to language in the curriculum, and a Council of

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Europe Study highlighted differences of the role of language/communication in four different national mathematics curricula (England, Sweden, Rumania, Norway) (Ongstad et al, 2007).

The National Curriculum is also clear that mathematics is one of the subjects important for developing society, for example by helping to understand nature, technology and society:

“Mathematics is part of our global cultural heritage. Throughout the ages humankind has used and developed mathematics to explore the universe, to systematise experiences and to understand relationships in nature and society. Another source of inspiration for the development of the subject has been the joy people have felt when simply working with mathematics. The subject is part of many vital societal areas, including medicine, economy, technology, communication, energy management and construction. Solid competence in mathematics is thus a requirement for developing society. Active democracy requires citizens who are able to study, understand and critically assess quantitative information, statistical analyses and economic prognoses. Hence mathematical competence is required to understand and influence processes in society.” (Mathematics Subject Curriculum, LK06)

In the National science curriculum this is even more explicit:
“Natural science is the result of human curiosity and our need to find answers to questions about our existence, life and life forms, and our place in nature and the universe, and in this way it becomes part of our culture.” (Science Subject Curriculum, LK06)

The laws and theories of natural science are seen as models of a complex reality, and these models, it is argued, are changed or developed through new observations, experiments and ideas. In our general knowledge it is regarded as important to realise that natural science is developing, and that research and new knowledge in natural science and technology have great importance for societal development and the environment in which we live.

Knowledge on, understanding of and experiences in nature can strengthen the will to protect natural resources, preserve biological diversity and contribute to sustainable development, it is contended. In this context Sami and other indigenous peoples are said to have knowledge of nature that it is important to respect. Natural science shall also help children and young individuals “attain knowledge and form attitudes that will give them a considered view of the interaction between nature, individuals, technology, society and research”. This is important, it is said, for the possibilities the individual has to understand various types of natural science and technological information and shall give one the basis for participation in democratic processes in society.

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Norwegian schools are guided by a national curriculum. Children start school at six and attend primary school for seven years, lower secondary for three years and upper secondary for three years (7 + 3 + 3). The goals and framework for the education sector are defined by the Norwegian Parliament (Stortinget) and the government. The overall responsibility for the educational system lies in the Parliament. The national curriculum plans have legal authority as regulations pursuant to the Education act.

Educational reforms have been initiated about every tenth year the last 30 years (1987, 1997 and 2006) through new national curriculum plans. The last reform is the *Knowledge Promotion* (LK06). It took effect in autumn 2006 for pupils in compulsory school, grades 1- 10 and for pupils in their first year of upper secondary education and training (i.e. the 11^{th} grade). Reform work over the years has influenced the development in the math& science education field, and vice versa. Research in the field has been initiated and innovative projects and research on maths & science teaching and learning has been carried out, again having an impact on new reforms. Curriculum reforms have been completed involving politicians from different political parties as well as researchers and representatives from the educational sector. The changes in and development of national curriculums may therefore be characterized as a collaborative school policy project and the outcome as consensus products.

Thus, the Knowledge Promotion comprises different points of views and different points of views might be enhanced in different curriculum documents of the Knowledge Promotion. It is also interesting to reflect upon the fact that the different parts of the curriculum plans, the Core curriculum, the Subject curriculum plans and the Quality framework, where passed through the Storting by three different ministers of education, from three different political parties. Engelsen (2008) concluded in their Report no. 1 on the Knowledge Promotion concerning coherence and consistency between intention, strategy and operationalization regarding the new curriculum plans, their form and content, that the different parts of the Knowledge Promotion represent different types of curriculum plans, resulting also in different epistemological views on the concepts of knowledge and competence. The utterances and views stated explicitly or implicitly in the documents and mandatory guidelines are further to be interpreted and implemented by different actors in the education sector.

There is abundant information published about the Knowledge Promotion from The Ministry of Education and Research and from the Directorate for Education and Training, as the Knowledge Promotion introduces changes in substance, structure and organization in the Norwegian school system at all levels of primary and secondary education and training. These are the most important changes related to science education:

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- Five basic skills are integrated in the subject curricula, and shall be adapted specifically to each subject: the ability to express oneself orally, the ability to read, the ability to do arithmetic, the ability to express oneself in writing, the ability to make use of information and communication technology

- The new national core subject curriculum in science has two new main subject areas: The budding researcher and Technology and Design

- Competence aims to promote learning (formulated to also intergrate basic skills)

- Changes in distribution of teaching hours per subject (increase of one hour per week in primary school)

- Freedom at the local level with respect to work methods, teaching materials and the organization of classroom instruction

Subject curriculum plans, the Core Curriculum, the Quality Framework and the distribution of teaching hours per subject (F-12-08) have legal authority as regulations pursuant to the Education act. Individual assessments are also part of regulations connected to the Education act. The Education Act with regulations concerns contents and financing of primary and secondary education and training. Compulsory education lasts until the pupil has completed the tenth year of schooling. The act transfer authority on curriculum planning, choices of syllabuses, on how to represent and present subject content and on how to perform teaching and learning, to the education sector in municipalities and counties, and to a great extent to schools and teachers. The newest Norwegian revision of the national curriculum, the Knowledge Promotion, emphasizes, even more than before, the local responsibility of curriculum planning. The County Governors are responsible for supervision and dealing with complaints, and are links between the Ministry of Education and Research and the Directorate for Education and Training on the one hand, and the education sector on the other hand.
The Norwegian Directorate for Education and Training is an executive subordinate agency for the Ministry of Education and Research. Some of the main tasks of the Directorate are to promote quality development in teaching and learning, quality assessment, analysis and documentation in primary and secondary education and training. The team for Mathematics, Science and Technology (MST) in the Ministry of Education and Research has the overall responsibility for a network among key national players related to education on this field.

The mandatory guidelines for the education sector are:

- Curriculum – the Core curriculum and the Common core subjects (e.g. the Maths and the Natural Science Subject Curricula)

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- Law /regulation – the Education act and regulations. Including regulations on Individual Assessment.
- The Quality Framework
- Regulation of distribution of teaching hours per subject (F-12-08)

The Quality framework (the principles) states the responsibility of school owners to promote development of basic competences: social and cultural skills, motivation for learning and learning strategies. Pupil participation and cooperation with parents /superiors, adapted education and equal opportunities and the competence and roles of teachers and instructors are also accounted for. Municipality authorities as school owners, are responsible for the public compulsory primary and lower secondary school. County authorities are responsible for the public compulsory upper secondary school.

Distribution of teaching hours is part of the mandatory guidelines (F-12-08). Teaching hours are established for primary school as a whole (grades 1-7) and for lower secondary school (grades 8-10) as a whole. Municipality or county authority is responsible for the distribution of teaching hours at each level. Distribution of hours for upper secondary education and training is established for each specific grade.
Total hours (listed as 60 minutes) may also be distributed in units of for instance 45 minutes, or less or more, but the total time spent will remain the same.

	Primary school Grades 1-7	Lower secondary Grades 8-10	Upper secondary 1st grade
Science	328	256	140
Total (all subjects	4930	2566	842
Mathematics	812	313	140
Social Studies	385	256	84

Table 1. The amount of hours spent on mathematics and social studies are for comparison.

School owner (municipality, county authority or private) may not offer fewer hours than stipulated in the regulations, but may distribute hours in between grades within one level (between 1st and 7th, and between 8th and 10th). Each school is free to adapt units within the distributed hours on the level.

Science and mathematics teachers' education

To ensure that pupils receive an education compatible with the curriculum for primary and lower secondary education, the Ministry prepared a plan for competence building

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for the period 1996–2000, giving special attention to supplementary training for teachers at primary and lower secondary schools. For the period 2000–2003 a targeted plan for competence building, development and experimentation gives particular priority to the lower secondary level. As part of the Knowledge Promotion and in collaboration with the Norwegian Association of Local and Regional Authorities and the teachers' unions, the Ministry of Education and Research has presented a Strategy for Competence Development in Primary and Secondary Education. The strategy "Skills for Quality 2009 - 2012" is a lasting commitment to continuing education for teachers.

In Norway a reform of teacher education was seen necessary because

(a) Of a relatively low performance of pupils in central subjects (see e.g. PISA; TIMSS); and

(b) teachers were often not adequately qualified to teach particular subjects.

There were also challenges in terms of teacher education provisions:

- a wide variation in programme quality between institutions;
- broad general teacher education programmes did not sufficiently address adequate subject knowledge and teaching competence; and
- collaboration between teacher education institutions and schools needed to be strengthened.

The shortage of sufficiently qualifies teachers was particularly relevant for mathematics and science, and a reform of teacher education, both pre- and in-service, was seen as necessary to 'heal' this situation (Abusland 2011).

The broad objectives for the reform were the following:

- to improve learning outcomes of pupils in schools;
- to enhance quality and relevance of initial teacher education in terms of (a) solid subject knowledge and teaching skills at specific age levels; and (b) to enhance the quality of teaching practice (in teacher education programmes);
- to increase the recruitment to the teaching profession and to teacher education programmes;
- to provide closer follow-up and support to newly-qualified teachers;
- to improve competencies of teachers and raise qualification standards;

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- to conduct more research and development relevant for teaching and in schools and teacher education.

Within the measures to enhance quality and relevance of teacher education, the dominant ones relate to a more specialised preparation of teachers for the diversity of pupils in schools; and to enhance the subject knowledge, teaching skills and social/cultural competence of teachers, where mathematics and science were main target areas.

The new teacher education programmes (since the 2010 reform) now contain a 4-year programme for primary and lower secondary school teachers which differentiates between programmes for years 1-7, and year 5-10. In the programmes for years 1-7, students normally study four school subjects, three with 30 ECTS, and one of 60 ECTS; in addition to Norwegian and mathematics which are compulsory. Programmes for years 5-10 include the choice of (normally) three school subjects, each of which at 60 ECTS, and the possibility of specialising in one subject area (e.g. science). One of the foci of the new reforms relates to the enhancement of the quality of teaching practice (in local schools) and an integrated part of subject teaching, which led to closer partnerships with local schools. It is now stipulated that students have to conduct a minimum of 100 days supervised teaching practice (over four years) (Abusland 2011).

Implementation in the classrooms

In Norway there is “one school for all” (Enhetsskole), a few private schools and a strong national curriculum. Large scale international comparative studies in mathematics and science (TIMSS; PISA) have shown that Norwegian pupils perform relatively poor and significantly lower than the mean of other countries (Kjærnsli et al, 2004; Lie, 2001; Lie et al, 1997). There has also been noted a decrease in recruitment to science related studies (Schreiner, 2008). This together with the low performance on international achievement tests, is likely to have influenced the Government in terms of increasing the emphasis on sciences and mathematics education. Moreover, societal organizations such as Tekna (The Norwegian Society of Graduate Technical and Scientific Professionals), LO (The Norwegian Confederation of Trade Unions) and NHO (Confederation of Norwegian Enterprise) have developed a joint initiative (“Kunnskapsdugnaden”) and expressed concern for the lack of interest in the mathematics and science related subjects.

In Norway every student has the right to continue with upper secondary education, regardless their grades at the end of compulsory schooling (grade 10). More than 95% of students in Norway continue with upper secondary education, either in ‘professional’ (e.g for apprenticeships) or ‘theoretical’ (e.g. traditional upper secondary mathematics and science) tiers. The theoretical tier leads to the ‘atrium’ which is the university

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entrance examination. In 2002/03 47% of students chose a vocational programme (two years in school plus two years as apprentice in enterprises). Since 2004 all students in grades 4 and 10 sit national tests in mathematics, and since 2005 students in grades 7 and 11 are also nationally tested (Stedøy, 2004). There are no national tests in science, except at upper secondary level.

Extracts from the government's policy papers:

Secondary senior teacher positions
"To strengthen the partnership and collaboration between the labour sector and educational institutions, the Government wishes to pave the way for personnel with a mathematics and science educational background in enterprises and organizations to be given secondary senior teacher positions in schools. In this way they may contribute in schools as role models and be useful resources. Various attempts involving exchanges between enterprises and schools have been made, but not in a particularly systematic way."

Relevant enhancement of skills for teachers of mathematics and science
"In line with the Raising of Standards in Mathematics and Science, it is important that teachers of mathematics and science receive relevant enhancement of skills in mathematics and science. Teachers must be updated both professionally and pedagogically so that pupils receive knowledge that they find interesting, thus developing the drive to do research we wish to encourage."

Evaluating financing systems to increase recruitment of graduates taking teacher training
"In order to increase the proportion of teachers with mathematics and science in their portfolio of subjects, the Ministry will evaluate financial instruments for recruiting teachers/trainee teachers to take master's courses in mathematics and science, and to recruit mathematics and science students to the teaching profession. There may be a great potential source of skilled mathematics and science teachers among engineers and other graduates with a mathematics and science background. ..."

Constrains in relation to the aims of MASCIL project

It is interesting to note that in terms of historical developments in Norwegian education, Braathe (2012) claims that ''although Norway has been influenced by international trends within education, it has retained its national identity, particularly its egalitarian school tradition'' (p. 1), and that one of the defining characteristics of Norwegian egalitarian principles is reflected in the enhetsskole—the unitary school system. Towards the end of the twentieth century the ideological emphasis in Europe (also in France) shifted from social justice to individual choice and economic advantage, but somehow paradoxically, Norway seemed to uphold its ideology of enhetsskole and the

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associated egalitarian principles (e.g. little differentiation in curriculum content). Braathe (2012) contends that ‘‘cross-curricular themes and project-based teaching methods had a major influence across the enhetsskole ideology and were important aspects in all curricular revisions in the 1970s and 1980s’’ (p. 3).

This also includes mathematics, where as early as the 1930s ‘learning by doing’ (according to Dewey) and project- based teaching (in particular outdoor projects) were advocated. Although there had been a short period where streaming pupils according to perceived ability was common (e.g. three tracks in mathematics), in the 1970s all tracks had to be abolished—‘mathematics for all’. Instead, differentiation and adaptation of the content according to pupils’ individual needs was encouraged.

The latest curriculum in Norway (LK06) is built on the general part of L97, now named “Learning programme” and which comprises of “Important principles for the school’s activity and must be seen in relation to law and regulations and the general part of the curriculum” (Kunnskapsdepartementet, 2006). The competence in the subject is not specified as detailed in LK06 as it was in L97. There are now clearly stated aims in terms of ‘competence’, not for each year, but for each stage in compulsory schooling (i.e. 1-4.; 5-7.; and 8-10.), and for each year at upper secondary school. Working methods and ways of organising teaching activities are not specified in the same way in LK06, as they were in L97. However, ‘problem-solving’ is emphasised and explorative activities and creativity are encouraged, in addition to procedural knowledge and skill training. It appears that teachers are more free to choose their own working methods, at least ‘on paper’. However, classroom studies and related to PISA+ (e.g. Klette, 2003; Ødegaard and Arnesen, 2010) provide a picture that show limited use of ‘creative’ instruction in mathematics and science.

Theme 2: Schooling and the world of work

Wider policy perspectives

The main model is based on a 4-year programme (with a final examination): two years in schools (Vg1 and Vg2) followed by 2 years apprenticeship in enterprise where training and productive work is to me ‘taught’ together.

Norway has a VET (Vocational Education and Training) system built upon the tripartite cooperation principle. A system of cooperation, mandated by the Education Act, is established both at national and regional level, involving both employers’ and workers’ unions. At national level, the National Council for VET (Samarbeidsrådet for yrkesopplæring), a body for cooperation on vocational education and training, appointed by the Ministry, gives advice and takes initiatives within VET. One Vocational Training

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Council (Faglig råd) exists for each VET programme. At regional level, there are county vocational training boards (Yrkesopplæringsnemnder), one in each county. These boards have specific advisory tasks as stated in the Education Act. The organisation of pupils/apprentices is represented in both in the National Council for VET and in the County Vocational Training Boards. (Norwegian Directorate for Education and Training, 2008)

Education and training is conducted both in schools and in enterprises. Both public and private enterprises accept apprentices and are approved as training enterprises by the county. Training Offices and Training Circles, enterprise driven cooperation ensuring apprenticeship place provision, have become increasingly common. (Norwegian Directorate for Education and Training, 2008)

Issues regarding schools/institutes

The first stage at which VET is provided in Norway is at lower secondary level through Elective programme subjects (utdanningsvalg). These enable 8–10th year students to try out subjects from the different upper secondary level programmes, including VET. Having completed lower secondary education, a student can choose to enter one of the following nine Vocational Education Programmes: Programme for Technical and Industrial Production; Programme for Electricity and Electronics; Programme for Building and Construction; Programme for Restaurant and Food Processing; Programme for Health and Social Care; Programme for Media and Communication; Programme for Agriculture, Fishing and Forestry; Programme for Service and Transport; Programme for Design, Arts and Crafts. The standard model for VET at upper secondary level is often called the 2+2-model. This refers to the division of the standard four year programme into two years school-based training followed by two years enterprise-based training which corresponds to one year in school. The model carries a certain degree of flexibility depending on the different programmes. After the first year at upper secondary level in one of the nine programmes, the student has to choose between several specialisations in year 12 leading to a further specialisation in year 13 when the profession is chosen. The subjects within VET are divided into Common Core Subjects, Common Programme Subjects and In-depth Study Project (prosjekt til fordypning). As the curricula are regulations, the schools and training establishments are bound by their content.

Should a student wish to transfer to a General Studies Programme, he/she may do so by completing a year of Supplementary Studies Qualifying for Higher Education (Norwegian Directorate for Education and Training, 2008).

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In terms of statistical facts: in 2006-2007 187 314 students enrolled in upper secondary education, out of which 52 % applied to a VET programme in 2006. In 2012 200 000 young people took up upper secondary education; and there were 38 900 apprentices. Interestingly, every third student was between 16-18 years of age, with the rest being over 18 years old. Overall, there were respectively 117 000 and 84 000 participants in general studies and vocational programs, representing respectively 58 and 42 percent. There was a majority of girls in general studies (55 percent), whilst more boys took up vocational education (55 percent) (source:http://www.ssb.no/utdanning/statistikker/vgu).

Issues regarding classrooms

The newly established project FYR provides resources for teachers (at upper secondary education) of mathematics and science (also Norwegian and English): *Læringsressurser for fellesfag, yrkesretting og relevans* (Learning resources for common education, vocational education and relevance) (see http://fyr.ndla.no/). For example, in mathematics and science, resources can be found that link to electrical engineering, health sciences, building, technical and industrial production, amongst others.

Constrains in relation to the aims of MASCIL project

Whilst the policy documents state that the connection between schooling/teaching and industry should be strengthened, and teaching should be made more relevant for students, it seems that teachers find it hard to adjust to the propositions. For example, teachers in the FYR project said that they did not find it helpful to have simply task resources on the FYR website (which they were asked to produce), but that 'less can be more', and they wanted a proposed lesson plan for each task, so that they can see how the content could be taught differently.

Theme 3: Science and Mathematics curricula and IBL

Wider policy perspectives

The Scandinavian countries represent traditions of student autonomy and cross disciplinary work in science education. The dominant teaching practices in Norway vary from school to school, but one could generally say that over recent years a science education with few practical activities (earlier years) turned into a science education with many practical activities. Today the 'efficiency' of the practical activities is questioned. Researchers do not find clear links between the number of student activities and their

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subject knowledge. However, there are proven links between students working ‘actively’ and positive attitudes towards science (Haug 2003). In addition, there is a focus on ICT in science education, for example with NDLA – ‘Nasjonal digital læringsarena’ (National digital learning platform). In mathematics education a more traditional picture of teaching (presentation followed by exercises) is still common practice.

The strategy document “A joint promotion for Mathematics, Science and Technology (MST) (2006 – 2009) ” is a dynamic plan, revised every year, with a new “Plan of Initiatives” . The strategy plan describes initiatives to be taken to develop competence in the natural science and technology areas. The strategy’s overall goal is to improve the MST competence in the whole educational system, in working life and in the general public; to increase the recruitment to working life and education in MST; to instil positive attitudes to MST among everyone in the educational system and among the general public.

The rationale is the following: curricula are to be reviewed in the scope of the extent to which they prioritise science and mathematics education, as well as IBSMT approaches. The review of the curricula is to be done in three levels: in a macro-level in terms of the aims, objectives, content and expected outcomes as envisioned by the policy makers, the meso-level that regard how schools and institutes mediate the implementation of the policies, and the micro-level that regards the implementation in the classrooms.

Whereas little can be found in terms of IBL in the mathematics National curriculum, the science curriculum is explicit about the need for IBL, in fact it seems part of the ‘scientific identity’:

> “Practical and theoretical work in laboratories and in the field using different theses and research questions is necessary to gain experience with and develop knowledge of the methods and approaches in natural science. This may contribute to developing creativity, the critical eye, openness and active participation in situations involving natural science knowledge and expertise. Varied learning environments such as fieldwork in nature, experiments in the laboratory and excursions to museums, science centres and business enterprises/industries will enhance the teaching in natural science and impart a sense of wonder, inquisitiveness and fascination.” (Science subject curriculum, 2006)

The mandatory guidelines for science teaching can be represented in the following way:

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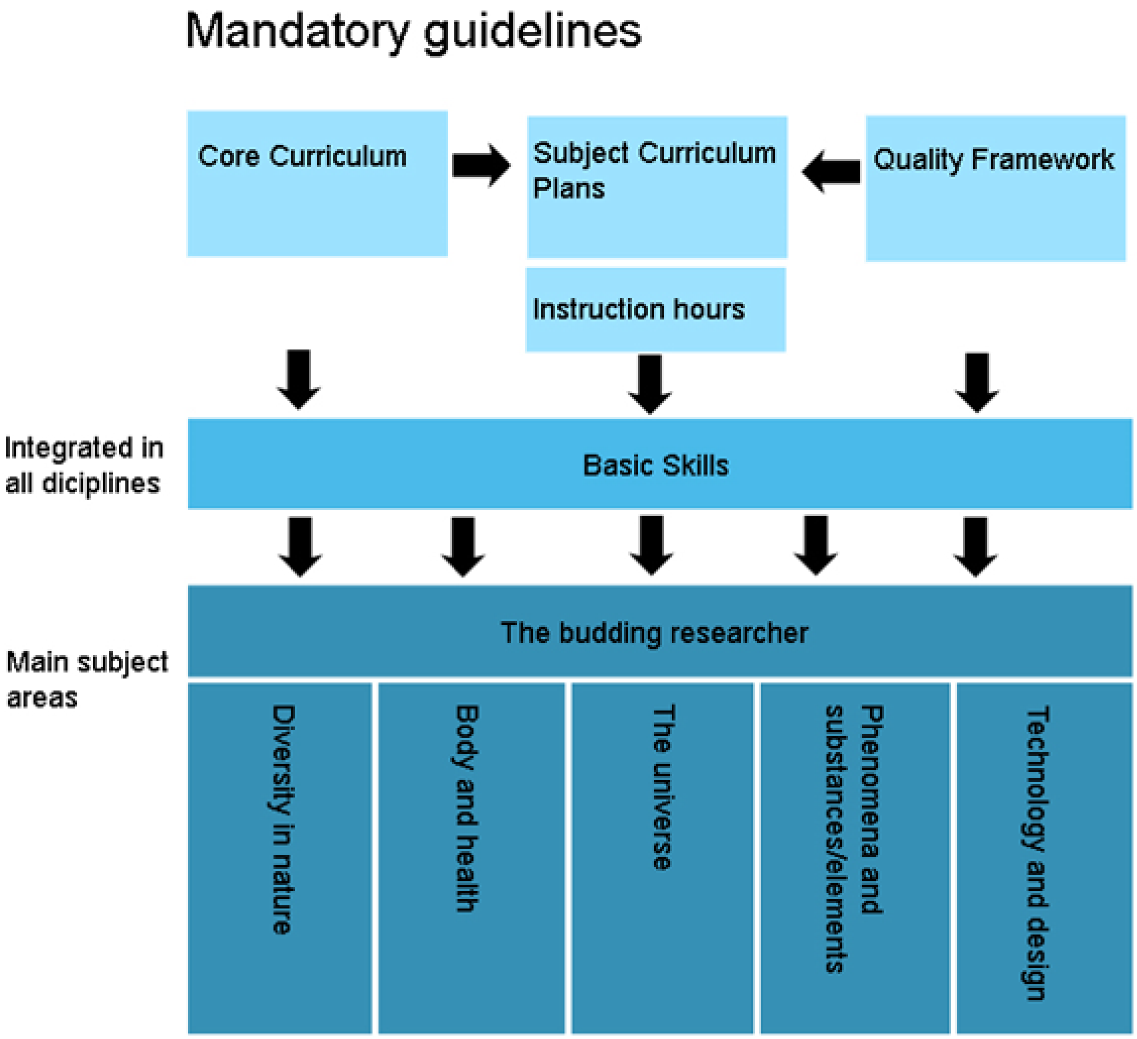

The notion of ‘**budding researcher’** reflects that the curriculum is inquiry-based - this is a permeating theme through all the different parts of the science curriculum (see below).

Issues regarding schools/institutes and classrooms (including influence of other projects)

In terms of Inquiry Based Science Teaching (IBST), this has been given a boost with the permeating theme “the budding researcher”, introduced as a part of the curriculum by the Knowledge Promotion reform of 2006. This theme deals with natural science

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methodologies for developing knowledge which involves the formulation of hypotheses, experimentation, systematic observation, openness, discussions, critical assessment, argumentation, grounds for conclusion and presentation. “The budding researcher“ is introduced in the first grade and accompanies the pupils all through primary; lower upper secondary and upper secondary school, even though the name changes after Vg1 to “the young researcher”. (Klette and Jorde 2010)

The “budding researcher” involves all elements of IBL, but lacks the description of pedagogical tools to implement them. Klette (2007) underscores the scarcity of pedagogical tools in many subjects in Norwegian classrooms. The Norwegian PISA+ study (Ødegaard and Arnesen, 2010) also reported few observations of science lessons that included inquiry elements. The PISA+ study (Klette and Lie, 2006) showed that science teaching was dominated by teacher centred instruction and instruction with the entire class together.

There are also three important projects that link to the MaSciL project in science education in Norway: (1) PRIMAS; (2) Mind the Gap , (2) S-TEAM ; and (3) the ‘Budding Science and Literacy’ project. The key concept of the PRIMAS and Mind the Gap-project is inquiry-based teaching of secondary school science. Research and development done in Europe in the area of inquiry-based science teaching (IBST) is abundant, however, the knowledge is spread and indistinct, and thereby not utilised to its full potential by teachers and educators throughout Europe. Whilst PRIMA is still running, the Mind the Gap project has been finished, and the network has disseminated ideas of good practices in IBST from different European countries (Norway, Denmark, Germany, Hungary, United Kingdom, Spain, and France) which are available on their internet page. S-TEAM (Science-Teacher Education Advanced Methods) is a another Seventh Framework Programme Science-in-Society project, funded by the EU, which aims to disseminate inquiry-based science teaching methods (IBST) to the widest possible range of teachers and teacher educators across Europe and associated countries. The Norwegian University of Science and Technology has responsibility for overall management of the project. The “Budding Science and Literacy” project aims to study how the interplay of indoor and outdoor inquiry-based science activities and literacy activities can improve teachers’ instructional competence and students’ learning outcome in science. The project is an intervention and development study that seeks to combine teachers’ unique competence from the classroom with the competence of science education scholars (researchers). Teachers, with the guidance of researchers, will develop and adapt curriculum material in science education (based on Seeds of Science/Roots of reading, California) that concurrently will be tried out in the science classroom and improved. The material will be based on using inquiry-based science activities and basic skills in particular reading and writing in the service of learning science.

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Constrains in relation to the aims of MASCIL project

One of the challenges with “the budding researcher”, and with other mathematics IBL projects, is that teachers do not necessarily have the skills to use IBST in the classroom, as IBST demands not only methodological skills but also subject knowledge and confidence in one’s own subject knowledge (Pedagogical Content Knowledge). The lack of subject knowledge in the natural sciences is therefore a common challenge and an obstacle for the use of IBST in the classroom (Klette & Jorde 2010). Norway have no subject specification requirements for teaching science education at primary and lower secondary level. This is considered a shortcoming in the evaluation (Rambøll, 2007), showing that fewer teachers participate in qualification training, despite a stated need. There may be a lot of reasons for the teachers not participating: e.g. insufficient supplementary teacher training, documented in TIMSS 2003 (Rambøll, 2007); economic factors. Another obstacle to IBST lesson sequences is likely to be the few instruction hours. Thus “the budding researcher” is clearly a part of the intended curriculum, but it is difficult to estimate how much of this is actually being implemented in Norwegian schools (Klette and Jorde 2010).

Theme 4: Pre-Service teacher training in relation to i) IBL and ii)the world of work

Linking to the fact that Norway is a large country but scarcely populated, it is interesting to observe that there are about 30 teacher training colleges distributed over a large land area with only 5 063 709 mill inhabitants. It can be understood in the light of the ‘small school’ culture and cultural heritage in Norwegian small communities (e.g. Sami population). For example, local dialects are not only preserved, but fostered and supported in school instruction. It used to be the case that compulsory schools in Norway were often organized with primary school and lower secondary school together. Teachers at these schools were employed to teach from 1st grade to 10th grade. This has changed with the new teacher education programmes: to teach at lower secondary level mathematics, or science, teachers must specialise in at least one of these two scientific subjects.

Implementation

More generally, there are two ways to become a qualified teacher in Norway. For primary and lower secondary levels a four year general teacher education is offered at most regional colleges in the country. This education used to qualify teachers to teach all subjects offered in the lower levels of education in Norway (although it allowed students to specialize in particular subjects); since 2010 students have to choose

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between teacher education in grades 1-7; or grades 5-10. Mathematics is obligatory for the 1-7 grades program, and with the new teacher education reform, mathematics has become a core curriculum subject. Science is not obligatory.

For upper secondary school taking a degree at a university within the appropriate subject is the preferred practice. After taking a degree, either at Bachelor or Master level, a 1 year teacher education program is required before qualified teacher status is granted. To teach a particular subject at the upper secondary level, 60 credits in the appropriate field is required, making most teachers qualified to teach two or three subjects.

Teachers' voice

From previous projects (e.g. PRIMAS) we have findings about teachers' perceptions of IBL (see Sikko et al., 2012). It was found that teachers in Norway would like to use more IBL strategies in their day-to-day teaching. They were also asking for more, and more relevant, professional development courses. Textbooks were not seen as a main hindrance to the use of IBL, but these would need to include more IBL approaches. Even if the curriculum, articularly in the natural sciences, did not represent an important hindrance, in their view it would need to advocate IBL more.

Constrains in relation to the aims of MASCIL project

There is an ongoing discussion about the balance of time spent at teacher education college as compared to time spent in school, and how much time/years spent on subject specialization (i.e. pure science or mathematics) as compared to mathematics or science didactics (education), or even general education. With the introduction of the new teacher education programme from 2010 for primary and lower secondary education ("The teacher – the role and the education", Report to the Storting No. 11, 2008-2009), these programmes are expected to strengthen teachers' subject knowledge and teaching skills in the subject area.

In which ways these changes will influence the teaching strategies (of new teachers), in particular with respect to IBST, is not clear. Teacher education institutions have for a long time tried to influence student teachers' views and practices, but it appears that as soon as student teachers are immersed into school life, as novice teachers, they lose confidence and conviction to promote and practice new approaches. Often experienced colleagues are not supportive of 'new interventions' and help novice teachers to 'align' their practices with that of colleagues- hence no prolonged influence of IBST.

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Statistics of 2003 concerning teachers in school showed that approximately 37% of teachers in primary schools (grades 1-10) are between 45-54 years of age, and 25% is 55 years old or more. (source: http://www.regjeringen.no/nb/dep/kd/dok/nouer/2003/nou-2003-16/7/3.html?id=370677) Other statistics show (http://www.ssb.no/utdanning/nokkeltall) that 47% of teachers in upper secondary schools is 50 years or older.

This means that most teachers have finished their pre-service teacher education before 1990, and this is important as mathematics as a subject in teacher education for primary school was not compulsory until 1992. This is linked to the principle of 'enhetsskolen' where a Norwegian primary school teacher can teach every subject from grade 1 to 10. Statistics from 1996 show that more than 50% of primary teachers who teach mathematics were not 'qualified' in the sense that they did not have mathematics as a particular subject discipline during teacher education (KUF, 1996). This may explain the finding (by TIMSS) that teachers organise their lessons leaning heavily on textbook-type curriculum materials (Lie et al, 1997).

Theme 5: In-Service teacher training in relation to i) IBL and ii)the world of work

Traditionally, the pay for teacher is competence based, which in turn is linked to their level of education. Hence, it can be argued that teacher education is regarded as most 'fruitful' if it is related to a competence enhancement linked to study credit points. However, for those teachers who have reached the top of their salary scale, the credit-linked teacher education courses do not seem more interesting than the non-credit linked ones: they want interesting courses that they can use in the classroom. Traditionally, teaching and teaching strategies has been the personal responsibility of teachers, whereas the (provision of the) curriculum is, at least since 2006, the responsibility of central (and local) government.

Wider policy perspectives

The strategy for competence enhancement in common education (2005-2008) provided a new dimension. This competence strategy was developed in a cooperation between KS (organization for municipalities and counties), Utdanningsforbundet, Norsk lektorlag, Skolenes Landsforbund, Norsk Skolelederforbund and the central education administration. It provided a common foundation for the Knowledge Promotion Reform that was implemented 2005–2008.

The aims were that the teaching personnel must have a competence that can "ensure students and apprentices an education adapted to individual needs and which can make it possible for them to develop capabilities and talents in accordance with the

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curriculum". Through this strategy to enhance the competence of school leaders, teachers and trainers in training establishments were seen to be stimulated and given a chance to meet the challenges posed by the changes of structure and content of the Knowledge Promotion Reform.

As the implementation of the programme did not work satisfactorily (see below), a 2nd (2009- 20012) and 3rd (2013- 2015) cycle were initiated.

Implementation

The central government spent approx. 40 mill Euro per year, and the local governments were expected to use the same amount. The partners formed a central working group and the work was administrated by Directorate of Education. Most of the money were sent to counties and municipalities to be used according to local priorities.

An evaluation report in 2008 showed that in spite of the strategy the total amount of in-service training had not increased. However, there were some tendencies of improved culture for systematic learning within the school. On the negative side, teachers were not much involved in decisions at local level, and approximately 20 % of the money was used for formal learning. In general, those teachers and school leaders were more satisfied when more decisions are delegated to the school level. It became clear that there was a lack of consistency and long-time planning in choice of themes, and a disproportionate large part of the funds was used for school leaders.

Hence a new cycle tried to improve in-service teacher education: Competence for Quality 2009-2012, and a third from 2013- 15. In these rounds the system became more centralised and more emphasis was given to quality. The costs for study time were also distributed between the different stakeholders (government- school- teacher) in the ration 50: 25: 25, and informal training and formal training for school leaders were included. Under the third cycle the number of teachers in formal learning increased from 1500 to 1850 per year, most of them part-time students.

Teachers' voice

(see attached short descriptions of teacher interviews in appendix)

Constrains in relation to the aims of MASCIL project

One of the main problems with respect to in-service education of teachers is (and was) that employers (e.g. school leaders) refused to let their teachers use the system. This was also felt in earlier IBL professional development initiatives (e.g. PRIMAS) in

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Norway, where school leaders asked the professional development institution to ‘buy teachers out’, that is pay for replacement teachers (during their time of learning).

The aim is now to establish a permanent system for in-service training for all school teachers and school leaders, and this system must be integrated with initial teacher education and induction. It is also envisaged that teachers should get a right, and an obligation, to do in-service training- which would alleviate the problems mentioned above. The system should be linked to an established professional career path for teachers (and as an alternative an administrative path) (Grøttvik 2013).

PART 2: EMERGING ISSUES FOR REFLECTION

Equity specific issues

The figure 3.3 (see appendix) shows results from 5th grade national tests in mathematics, reading and English. No similar data exist for science, because the subject is not included in national tests (On comparable data for upper secondary, as national tests at that level). The figure shows that the scores for boys are higher than for girls in mathematics. This is mainly due to the large number of boys at the highest level.

Regarding TIMSS, Norway did better than in previous years/rounds, in particular at grade 4. In one of the math test the boys generally scored 7 points higher than the girls at 4th grade, and boys have generally outperformed girls in the last two TIMSS testing rounds. There is no significant difference between the achievement of boys and girls at 8 grade. In science, boys and girls are now performing equally well (Grønmo et al 2012,) after the boys did significantly better in the implementation in 1995 and 2003.

Addressing low achievement

As explained in the report, addressing ‘low achievement’ of pupils in particular at lower and upper secondary level, is now one of the priorities of the government.

Preparation of training adapted to the students' abilities and aptitudes
All pupils in primary schools have the right to education suited to their abilities and aptitudes. The right of customized training for both those who need extra support to get a satisfactory yield of the regular teaching and the students who need additional challenges .

For several years in the early 2000s, the proportion of pupils with special education was around 6 percent. As shown in Figure 1.4, this percentage has increased significantly in

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recent years. Since 2006/ 07 has 14 000 students received special education, i.e. an increase of 36 percent. In recent years, the increase slowed, and last school year, the number unchanged from the year before.

68 percent of students receiving special education in 2012/13 were boys. The proportion of boys was highest at the beginning of primary education by 71 percent. At the secondary level , the proportion of boys 66 percent. Since the school year 2007/ 08 there has been an increase in the proportion of students with special needs at all levels. But the increase has been greatest in 5 to 7th grade.

The proportion of pupils with special education increases during the primary and the secondary level. In autumn 2012, the 4.3 per cent of pupils in 1st grade decisions about special education, while at 10 step, the proportion of 11.6 percent. The percentage of special education increased most from the 2nd to 5 grade.

It is thus far more students who have special education in secondary schools. This may indicate that students' who first received a decision on special education, largely continue with the rest of the special education schools. At the same time special education late start for many. In the White Paper on Early Intervention for Lifelong Learning (Ministry of Education 2006) , it emphasized how important it is to implement measures for the student at an early stage when it occurs or is identified challenges .

The figure and table (see appendix) show the percentage and number of low achievers in primary and lower secondary school in general (we do not have numbers for maths and science separately).

Promoting entrepreneurship

The government, and through their ministries, have supported the work of the Young Enterprise (JA-YE) through programs for entrepreneurship in education since 2002. The program maintains activity in the schools and institutions that work well with entrepreneurship, and it has as its aims to reach all schools in the country. The main objective of the program is to contribute to maintaining and strengthening the focus on entrepreneurship education in Norway in terms of scope and quality. The main goal we will reach the goal within the strategic focus areas:
-Anchoring and cooperation
-Scope, competence and quality.
-Internationalization
-Special Focus on Student, Youth and Student Business
-Special focus on higher education
-Documentation, evaluation, research and development

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Both the Parliament and the Government will strengthen the work on entrepreneurship in education. This will be done in a way that entrepreneurship becomes an integral part of teaching in several schools in Norway. It is said that students should get an equally good education in entrepreneurship regardless of where they live in the countryside or in the cities, and to facilitate entrepreneurship through education. In the political parties' programs, we find entrepreneurship in education as a priority both nationally and in the counties.

(Summary) Conclusions

The case of Norway

In Norway, there is currently a reform on teacher education mainly aiming at enhancing teachers' subject knowledge, their teaching skills and their social/cultural competence.

In relation to wider policy perspectives, policy documents state that the connection between schooling/teaching and industry should be strengthened, and teaching should be made more relevant for students. Priority is also given to inquiry based methodology both in sciences and mathematics.

At a school and classroom level though, it seems that teachers find it hard to adjust to the propositions. Teachers do not necessarily have the skills to use IBT in the classroom, as it demands not only methodological skills but also subject knowledge and confidence in one's own subject knowledge. The lack of subject knowledge in the natural sciences is therefore a common challenge and an obstacle for the use of IBST in the classroom. Norway have no subject specification requirements for teaching science education at primary and lower secondary level.

In relation to teacher training, there is an ongoing discussion about the balance of time spent at teacher Education College as compared to time spent in school, and how much time/years spent on subject specialization (i.e. pure science or mathematics) as compared to mathematics or science didactics (education), or even general education. With the introduction of the new teacher education programme from 2010 for primary and lower secondary education these programs are expected to strengthen teachers' subject knowledge and teaching skills in the subject area. However, in which ways these changes will influence the teaching strategies (of new teachers), in particular with respect to IBST, is not clear. Teacher education institutions have for a long time tried to influence student teachers' views and practices, but it appears that as soon as student teachers are immersed into school life, as novice teachers, they lose confidence and conviction to promote and practice new approaches. Often experienced colleagues are

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not supportive of ‘new interventions’ and help novice teachers to ‘align’ their practices with that of colleagues- hence no prolonged influence of IBST.

There is a general conductive context in Norway for the implementation of the project and for the achievement of the mascil objectives. Constrain towards this aim is regarded the lack of teacher confidence in their subject knowledge, rather than lack of inquiry teaching skills. Schools and teachers resistance towards change represents another constrain.

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Important web links:

Core curriculum in English:
http://udir.no/upload/larerplaner/generell_del/Core_Curriculum_English.pdf

The Mathematics curriculum in English:
http://www.udir.no/upload/larerplaner/Fastsatte_lareplaner_for_Kunnskapsloeftet/english/Mathematics_subject_curriculum.rtf

The Natural science subject curriculum in English:
http://www.udir.no/templates/udir/TM_Artikkel.aspx?id=3593

For more information on Education in Norway see:
http://www.regjeringen.no/upload/KD/Vedlegg/Veiledninger%20og%20brosjyrer/Education_in_Norway_f-4133e.pdf

Ministry of Education and research:
http://www.regjeringen.no/en/dep/kd/

Facts about education in Norway 2010 – key figures 2008:
http://www.ssb.no/english/subjects/04/02/facts/facts2010.pdf

http://www.udir.no/templates/udir/TM_Artikkel.aspx?id=3593

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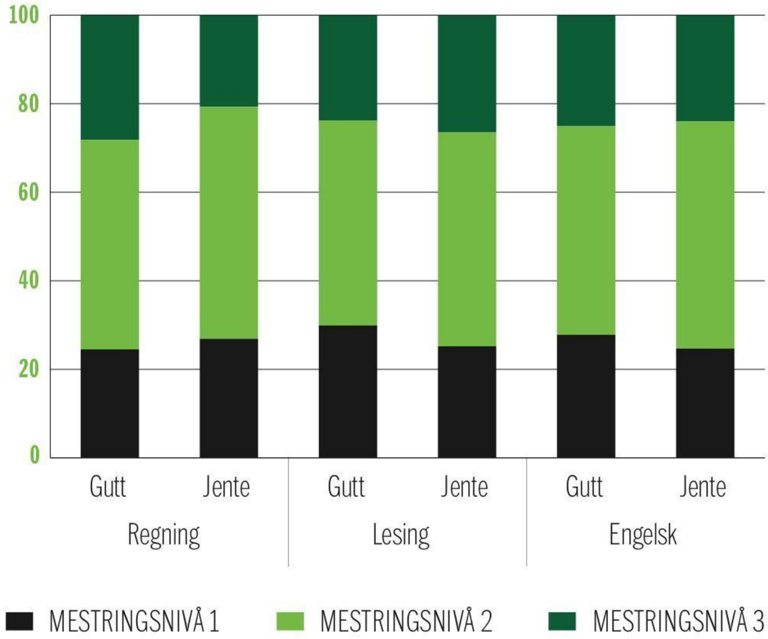
Appendix

The figure below shows results from national tests in mathematics, reading and English, 5th grade. No similar data on science exists, because the subject is not included in national tests. (National testing in science does not exist, except for exams in upper secondary school). The figure shows that boys have a better score than girls in mathematics. This is mainly because of the large group of boys on the highest level.

FIGUR 3.3 Fordeling på mestringsnivå for gutter og jenter på de nasjonale prøvene på 5. trinn, 2012. Prosent.



Kilde: Utdanningsdirektoratet 2012 (Analyse av nasjonale prøver i regning)

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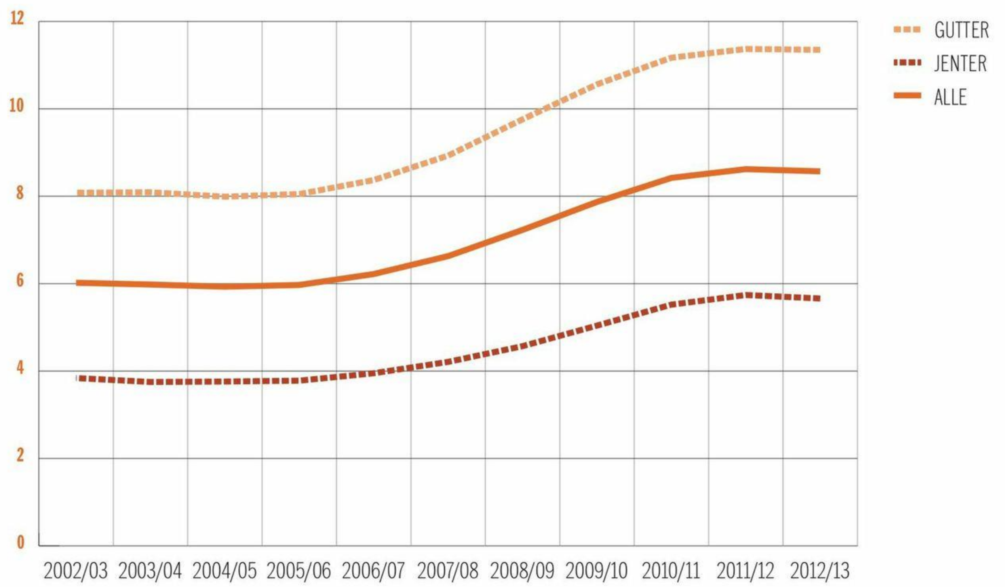
Figure 1.4 and Table 1.3 shows % and number of low achievers in primary and lower secondary school in general

FIGUR 1.4 Elever i grunnskolen med enkeltvedtak om spesialundervisning, 2002/03 til 2012/13. Prosent.



Kilde: GSI/Utdanningsdirektoratet

TABELL 1.3 Elever i grunnskolen med enkeltvedtak om spesialundervisning. 2008/09 til 2012/13. Antall og prosent.

	Elever med spesialundervisning	
Skoleår	**Antall**	**Prosent**
2012/13	52 723	8,6
2011/12	52 972	8,6
2010/11	51 853	8,4
2009/10	48 470	7,9
2008/09	44 525	7,2

Kilde: GSI/Utdanningsdirektoratet.

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