The 9th Nordic Research Symposium on Science Education
11th - 15th June 2008 Reykjavik, Iceland
Planning science instruction:
From insight to learning to pedagogical practices

Symposium program and abstracts

Iceland University of Education
http://symposium9.khi.is
Dear colleague,

Welcome to Iceland and the 9th Nordic Research Symposium on Science Education. It’s a great honour for us to house this symposium.

In naming the conference we found it appropriate to borrow a title from a paper by Phil Scott: Planning science instruction: from insights to learning to pedagogical practices. For one thing, Phil is among the keynote speakers of this symposium. Secondly, we – the people in the organizing committee for the symposium – feel that Phil’s title points to a very significant issue, namely the necessity of bringing research findings and new perspectives on learning and teaching closer to the realities of the science classroom teacher. Educational research that ties strongly to science teachers’ concerns is urgently needed. Much to my delight, scanning the presentations to be given at this symposium, I found that many of them indeed address the issue I am raising. I take this as a sign that science education research is moving closer to the classroom and the practicalities of science teaching in schools and I really look forward to listening to you and participating in the associated discussions.

For us this symposium is historically significant. Our pupils do not score high on international comparative studies focusing on science education, such as TIMSS or PISA. This is taken to mean that science teaching in Icelandic schools is in poor shape and that we should do something to improve the situation. Research conferences of the sort we are partaking in could make a contribution to the debate. And to my delight, viewing the presentations I found examples of this, in positional papers, posters and, not least, in the round-table discussions.

In light of all this I very much look forward to participating in this symposium and I am sure that you feel the same. So, please enjoy both our academic program and the social activities offered.

A hearty welcome to Iceland!

Hafþór Guðjónsson
Chair of the organizing committee
Committee

Icelandic organising committee:
Hafþór Guðjónsson (chair)
Björg Pétursdóttir
Kristín Norðdahl
Kristján Ketill Stefánsson
Meyvant Pórolfsson
Stefán Bergmann
Gunnhildur Óskarsdóttir

Nordic committee:
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Hafþór Guðjónsson
Irmeli Palmberg
Jan Schoutz
Jari Lavonen
Jens Dolin
Martin Krabbe
Stefán Bergman
Tom Klepaker

The 9th Nordic Research Symposium on Science Education
11th -15th June 2008
Reykjavik, Iceland

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Symposium website
http://symposium9.khi.is
Abstracts, full papers and synopsis are available on the symposium website.

About the logo
The idea behind the logo was to create a symbol that could relate to the different subjects commonly taught in schools. The yellow circle around the three letters SUN represents the sun. The sun could, in our minds, easily be related to physics, chemistry, geology, biology as well as to multiple other science-related subjects. The sun will also play a big part in the symposium as the participants will experience 21 hours of daylight. During the symposium the sun will rise at 02:59 and set again at 23:57. The mixture of handwritten text, and the obviously handmade flowers and symbols in the background, represents research in science education as a human creation. This emphasizes that creativity is a necessary part of scientific progress and makes science both fun and interesting.
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Ph.D. workshop 11th June 09:00-12:00

On the morning of Wednesday, June 11th, one of the keynote speakers, Phil Scott, will have a workshop for Ph.D. students attending the conference.

Room: H-201
Teacher-student interactions in the science classroom

Fundamental to the science teacher’s art are the different ways in which they talk with students in the classroom: at times presenting information in an authoritative way, at other times promoting more open discussion. In this workshop I shall first introduce the concepts of ‘communicative approach’ and ‘patterns of discourse’. These are theoretical tools, developed from the work of Vygotsky and Bakhtin, which can be used in identifying different kinds of teacher-student classroom interactions. Time will then be given to analysing some short video extracts and transcripts of classroom interactions, taken from UK science lessons, using these tools. Finally we shall consider the purposes and points of development of this area of research.

National meetings 14th June 13:00-14:00

The national meetings have three goals:

1. Evaluate the conference. What was good, what was bad? Suggestions for the upcoming symposium in Sweden. The chair leads the discussion. Each participant fills out an evaluation form and returns it to the chair.
2. Election of two national representatives for the next symposium in Sweden.
3. Prepare one event for entertainment for the evening at Thingvellir.

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<th>Country</th>
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<td>Jens Dolin</td>
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<tr>
<td>Other nationalities</td>
<td>H-208</td>
<td>Kristján Ketill Stefánsson</td>
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Language

This symposium is held in Iceland we hope to be able to get as many Icelandic teacher researchers as possible to join the symposium. English is the dominant second language in Icelandic teacher researchers and therefore all formal presentations and the subsequent discussions are to be in English. Submissions of papers and posters can however be in English, Norwegian, Swedish or Danish.

Internet and printing

During the symposium the wireless local area network (LAN) in the conference buildings will be open to the symposium guests. You can use the username: sympo and password: sympo to log on to the LAN and into any computer in the university during the symposium. 20 computers and three printers are available in the computer room shown on the map of the university. If those computers are being used there are two computer rooms on the second floor in H-204 and H-205 with an additional 40 computers. If you run into any problems the technical staff in the computer room will assist you in solving the problem.
About paper sessions

In every room there is a PC and video projector. Please send your presentation to gagn@khi.is as an attachment and write Symposium 9 in the subject line. Use the last name of the first author when naming your file, for example jonsson.ppt. Please bring a backup of your presentation on a USB stick as well.

The chair starts the session with a short introduction of the presenters. This introduction should be no longer than 5 minutes. The presenters get a maximum of 20 minutes to finish their presentations. When 15 minutes have passed the chair gives the presenters a warning. After 20 minutes the presentation must have ended and the discussion started.

Our aim is to increase the amount of discussion. Therefore we ask the presenters to end their presentations with open-ended questions that will help to get the discussion going. Furthermore we ask the chair and other participants to prepare a few questions in advance. Each presentation will get 15 minutes of discussion time. The chair will lead the discussion.

At the end of the session we ask the chair to end the session with a short roundup and/or open discussion.

About poster sessions

The poster session will take place at 15:30 on Thursday in Fjara and Skáli. The area available for posters on each poster stand is 172 centimeters wide and 142 centimeters high. We will provide equipment for hanging the posters. Tables will be available for those who need them.

The chair starts the session with a short introduction. After that all presenters briefly introduce their poster (standing at the poster) for 3 minutes each. After that a general discussion starts. The chair and other participants are asked to have a few questions ready to get the discussion going. The chair concludes the session with a 10 minute discussion. The presenters are asked to continue to stand at their poster and answer questions from people arriving from other sessions. There are no projection facilities in the poster session.

About roundtable sessions

During the roundtable sessions we ask all the participants to sit together to form a circle in the room. The idea is to break up the traditional paper session format so ideas can flow freely between all the participants.

The chair starts the session by explaining the form and appointing a secretary to sum up the roundtable discussion. These notes are to be sent to symposium9@khi.is and will be made available on the symposium website. After that the chair introduces the topic and the author of the roundtable proposal. This should not take more than 5 minutes.

After that the author introduces the topic of discussion for about 10 minutes. In each roundtable session there can be 1-3 authors depending on the proposal. The chair and other participants are asked to prepare some questions to get the discussion going. At the end of the discussion the chair sums up the discussion. This should not take more than 5 minutes.
Program overview

Wednesday 11th

09:00 - 12:00  Ph.D workshop (Phil Scott)
16:00  Registration desk opens (Skáli)
18:00  Light dinner (Fjara)
20:00  Registration desk closed

Thursday June 12th

08:00  Registration desk opens (Skáli)
08:45  Opening ceremony (Skriða Auditorium)
09:00  Academic program starts
16:30  Academic program ends
18:00  Bus to Reykjavik Energy reception
(light refreshments, departure from symposium hotels)
20:30  Bus to symposium hotels

Friday June 13th

09:00  Academic program starts
16:30  Academic program ends

Saturday June 14th

09:00  Academic program starts
12:15  Academic program ends
13:00  National meetings (see page 6)
14:00  Closing ceremony (Skriða Auditorium)
15:00  Symposium ends
17:45  Bus to Thingvellir (departure from symposium hotels)
19:00  Symposium dinner
00:00  Bus to symposium hotels

Sunday June 15th

Travel home or excursions
## Academic program

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<td>09:00 Phil Scott (p.10)</td>
<td>09:00 Michael Reiss (p.18)</td>
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<td>09:15 Coffee break</td>
<td>09:45 Doris Jorde (p.14)</td>
<td>09:45 Doris Jorde (p.14)</td>
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<td>12:15 Lunch</td>
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<td>15:00 Coffee break</td>
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<td>16:30 Academic program ends</td>
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Inquiry good...traditional bad?: Approaches to teaching scientific conceptual knowledge

In this presentation I will explore what is involved in teaching and learning scientific conceptual knowledge, by drawing on a sociocultural perspective on learning and presenting an analysis of the practice of an expert science teacher. This analysis will focus upon the ways in which the teacher develops the scientific content over a short sequence of lessons, through different teaching activities and related communicative approaches, thereby engaging the students both intellectually and affectively.

I shall argue that the current ‘dash to inquiry approaches’ needs to be tempered with careful thinking about the teaching and learning purposes of such a pedagogy. My view is that the teaching of scientific conceptual knowledge through ‘traditional approaches’ is too often viewed as being necessarily transmissive in nature and therefore de-motivating for students. This certainly need not be the case, as will be demonstrated by the analysis of the expert teacher lessons. Furthermore there is a current tendency for the position of scientific conceptual knowledge to be down-played in contemporary curricula with heavy emphasis being placed on issues such as ‘inquiry’, ‘argumentation’ and ‘how science works’. My view is that these are legitimate areas for science education to focus upon but that they are being addressed whilst the challenges of teaching and learning scientific conceptual knowledge remain largely unsolved.

Phil Scott

Phil Scott is Professor of Science Education in the School of Education at the University of Leeds, UK. He is also joint editor of the international journal ‘Studies in Science Education’. Before working at the University Phil Scott taught science in high schools. He is currently involved in a number of research projects, one of which focuses on ‘Dialogic Teaching in Science Classrooms’ and builds on previous research with Eduardo Mortimer, UFMG Brazil, which led to the book ‘Meaning Making in Secondary Science Classrooms’. Apart from science education, Phil Scott is an enthusiastic mountain bike rider and a keen supporter of Sunderland Football Club.
Paper sessions 1 12th June 10:15-12:15

Strand: Interests and attitudes
Chair: Almar Halldórsson
Room: H-201 (Abstracts: page 21)
No. 125 10:55 Margareta Ekborg, Malin Ideland, Christina Ottander, Claes Malmberg and Agneta Rehn. Science for life - development of a conceptual framework for modelling socio-scientific cases

Strand: Science textbooks
Chair: Ellen Karoline Henriksen
Room: H-202 (Abstracts: page 22-23)
No. 9 10:20 Berit Bungum. Imaging the nature of physics: A study of visual images in Norwegian physics textbooks
No. 17 10:55 Niklas Gerike and Mariana Hagberg. Textbook authors’ intentions and ideas when writing upper secondary biology textbooks in relation to nature of science
No. 114 11:30 Allyson Macdonald, Audur Palsdottir and Helgi Grímsson. Writing for science and science textbooks: a case study from Iceland

Strand: Classroom research
Chair: Anita Wallin
Room: H-203 (Abstracts: page 24-25)
No. 16 10:20 Sonja M. Mork. An alternative approach to analysing student argumentation
No. 80 10:55 Marianne Ødegaard and Nina Elisabeth Arnesen. Video Tales of Teaching in Norwegian Science Classrooms
No. 55 11:30 Nina Elisabeth Arnesen. Meaning Making from a Socio Scientific Debate on Gene Modified Food

Strand: ICT
Chair: Björg Pétursdóttir
Room: H-207 (Abstracts: page 26-27)
No. 95 10:20 Terry Russell and Linda McGuigan. A qualitative exploration of teachers’ use of ‘digital creativity’ technology to re-engage detached learners
No. 115 10:55 Eggert Lárusson, Meyvant Thorolfsson and Allyson Macdonald. Learning science with ICT
No. 15 11:30 Anne Bonnevie Lund, Jardar Cyvin and George Sundt. The nature science teacher’s meeting with the pupil as an ICT user

Strand: Student’s conceptions
Chair: Bjørn Håland
Room: H-208 (Abstracts: page 28-29)
No. 83 10:20 Pernilla Grankład Enochson, Gustav Helldén and Britt Lindahl. Students’ understanding about the water transportation in the human body and their understanding of why water is healthy for them
No. 111 10:55 Hrefna Sigurjonsdottir and Halldóra Lóa Porvaldsdóttir. Student’s understanding of photosynthesis
No. 82 11:30 Gunnhildur Oskarsdóttir. The influence of the teaching material used in class on children’s ideas about the human body

Strand: Teacher and in-service education
Chair: Ola Magntorn
Room: H-209 (Abstracts: page 30-31)
No. 75 10:20 Lene Beck Mikkelsen, Troels Tunebjer, Bent B Andresen, Holger Hedemann and John Andersson. Blended Learning as a Basis for an In-Service Training Concept in Natural Science.
No. 10 10:55 Hanne Mehl and Berit Bungum. Authentic learning situations for teachers - perceptions of and gains from in-service courses in space technology
No. 85 11:30 Bodil Sundberg and Christina Ottander. Development of pre-school teacher students’ attitudes towards science and science teaching
Paper sessions 2 12th June 13:00-15:00

Strand: Interests and attitudes
Chair: Gunnhildur Óskarsdóttir
Room: H-201 (Abstracts: page 32)
No. 8  13:05  Stuart Naylor, Brenda Keogh, Jane Maloney and Shirley Simon. Puppets and engagement in science
No. 110 13:40  Haukur Arason and Kristín Norðdahl. Physics through Play

Strand: Curriculum studies
Chair: Svanborg R. Jónsdóttir
Room: H-202 (Abstracts: page 34-35)
No. 7  13:05  Pal J. Kirkeby Hansen. Weather and climate topics in primary and secondary education: Possibilities and restrictions in the new Norwegian national curriculum compared with the old
No. 126 13:40  Lars Domino Østergaard. Naturfagslæring på tværs af institutioner – hvordan skabes bedst motiverende og sammenhængende naturfagsformidling fra børnehaveliv til skole-hverdag
No. 116 14:15  Audur Palsdottir and Allyson Macdonald. Moving into the Zone of Feasible Innovation

Strand: Learning styles
Chair: Hafþór Guðjónsson
Room: H-203 (Abstracts: page 36-37)
No. 104 13:05  Lars Björklund. Why can’t you see what I see? Development of Expertise and Enquire based learning
No. 40  13:40  Clas Olander. Argumentative reasoning in peer groups; conceptual issues and epistemological underpinning
No. 96 14:15  Lena Tibell, Shaaron Ainsworth, Petter Bivall-Persson and Gunnar Höst. Haptic Influences on Reasoning and Learning in Protein Education

Strand: Outdoor education
Chair: Tom Klepaker
Room: H-207 (Abstracts: page 38-39)
No. 70  13:05  Ola Magntorn. The quality of memorable episodes in science education
No. 128 13:40  Niels Anders Illemann Petersen and Mette Dalgård Alders. Autenticitet i undervisningen i Aalborg Zoo’s skoletjeneste
No. 77 14:15  Per Ivar Kvammen. Planter, dyr og økologi i furuskogen. Erfaringer fra et undervisningssopplegg i femte klasse

Strand: Student’s conceptions
Chair: Anita Wallin
Room: H-208 (Abstracts: page 40-41)
No. 34 13:05  Lena Hansson and Britt Lindahl. Elevers sätt att hantera naturvetenskapen - Några fallbeskrivningar med fokus på världsbild
No. 67  13:40  Lena Löfgren and Gustav Helldén. Following how students from age 7 to 16 use their experiences when developing their ideas about transformations of matter
No. 42  14:15  Liselotte Österlund and Margareta Ekborg. Students’ Reasoning of Redox Reactions in Three Different Situations- a view of students’ conceptions of redox in different settings

Strand: Teacher education
Chair: Meyvant Pórolfsson
Room: H-209 (Abstracts: page 42-43)
No. 74 13:05  Kalle Juuti, Jari Lavonen, Mari Vainikainen and Ismo Koponen. Analysis of communication in student teachers’ videos during teaching practice
No. 107 13:40  Barbro Gustafsson. Dealing with the democratic aspects in science education
No. 127 14:15  Anna Tapola. When Human Dignity Becomes Biology - A Challenge for Teacher Training
Poster sessions 12th June 15:30-16:30

Strand: Outdoor education and sustainable development
Chair: Gustav Helldén
Room: Skáli (Abstracts: page 44-45)
No. 27 15:35  Eli Munkebye. “Læreres bruk av støttende dialog for å fremme naturfaglig læring på småskolterinenet, med naturen som undervisningsarena”
No. 78 15:40  Pernille Ulla Andersen and Signe Søndergaard. Positive effekter af samspillet mellem undervisning og oplevelser i formelle og uformelle læringsmiljøer
No. 117 15:45  Kristín Norðdahl and Stefán Bergmann. ActionESD: Educational action for sustainable development

Strand: Scientific literacy
Chair: Allyson Macondald
Room: Fjara (Abstracts: page 46-47)
No. 19 15:35  Britt Lindahl. POLLEN - Seed Cities for Science
No. 58 15:40  Jack Holbrook, Claus Bolte, Cecilia Galvão Couto, Wolfgang Gräber, Martin Lindner, Rachel Mamlok-Naman, Claus Michelsen, Miia Rannikmae, Jan Alexis Nielsen, Pedro Rocha dos Reis, Piotr Szybek and Georgios Tsarpalis. Popularity and Relevance of Science Education and Scientific Literacy - The PARSEL Project in Europe
No. 4 15:45  Malin Ideland and Claes Malmberg. Lost in translation? Who is learning from SSI?

Strand: Students’s conceptions and interests
Chair: Hrefna Sigurjónsdóttir
Room: Skáli (Abstracts: page 48-49)
No. 81 15:40  Gunnhildur Öskarsdóttir, Birgitte Stougaard, Finnur Lützen, Ane Fleischer, Britta Lohmann and Roar Kråkenes. Children’s ideas about the human body (bones and organs) – a comparative study involving 6 year old children from the Nordic countries
No. 50 15:45  Britt Lindahl and Maria Rosberg. Students’ attitudes towards and interest in science. A report from the research project “Science for Life”
No. 120 15:50  Annette Zeidler. Experiments in science as homework

Strand: Physics education and students’s interests
Chair: Haukur Arason
Room: Fjara (Abstracts: page 50-51)
No. 48 15:35  Karin Due. To challenge images of physics in the classroom
No. 66 15:40  Margareta Enghag, Torbjörn Brorsson, Tommy Englund and Bo Wahlqvist. Learning Study in mechanics – Newton’s second law
No. 53 15:45  Christina Ottander and Margareta Ekborg. Characteristics of Socio Scientific Issues that are interesting to pupils and teachers

Strand: ICT, climate change and student teacher’s conceptions
Chair: Auður Pálsdóttir
Room: Skáli (Abstracts: page 52-53)
No. 106 15:35  Harald Brandt and Benny Lindblad Johansen. It og naturfag i den danske grundskole
No. 35 15:40  Peer Schrøder Daugbjerg and Søren Cruys-Bagger. Long-term effects of a climate change teaching campaign – a case study
No. 86 15:45  Inger Holmberg. Why does it rain? Student teacher’s conceptions about rain and how they teach about this subject
No. 129 15:50  Lars Bo Kinnerup and John Andersson. Science, Life Science and Technology på læreruddannelsen
Doris Jorde - keynote lecture 13th June 09:00
Room: Skriða Auditorium

The contribution of information technology (ICT) to Inquiry based science teaching (IBST)

Doris Jorde – University of Oslo and Wenche Erlien – The Norwegian Center for Science Education

Recent publications in Europe and the US are encouraging the use of inquiry-based science teaching as the way forward for improving the teaching of science. In this talk we will explore the definitions of what is meant by inquiry-based science teaching (IBST). Does IBST bring in new ideas into the way we teach science, and if so, what are they? How does the role of the teacher change if we implement good ideas in IBST? And what about the learner and the curriculum?

Information technology is one of the many tools we can use in our science teaching. The talk will provide examples of how information technology may be used in science classrooms to encourage the use of dialogic processes between students and their teachers – a very important component of IBST.

Many thanks to Wenche Erlien from the Norwegian Center for Science Education who will contribute to this talk by introducing us to Naturfag.no and to Viten.no as resources for science teachers.

Doris Jorde

Doris Jorde is a professor of Science Education at the University of Oslo, Norway. After completing her doctorate at the University of California, Berkeley, she moved to Oslo, Norway in 1984 where she has worked with Svein Sjøberg developing science education as a research field. Her research interests have always centred on curriculum development and classroom practice in teaching and learning science. She is the project leader of the net based curriculum Viten.no; conducting research on the uses of ICT in science teaching. She is currently the vice dean of studies at the Faculty of Education. Doris Jorde will be leading the project “Mind the Gap” – a European initiative recently funded by the EU to improve the teaching of science through inquiry learning.
## Paper sessions 3 13th June 10:15-12:15

### Strand: Interests and attitudes
**Chair:** Stefán Bergmann  
**Room:** H-201  
(Abstracts: page 54)

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### Strand: Curriculum studies
**Chair:** Meyvant Þórólfsson  
**Room:** H-202  
(Abstracts: page 56-57)

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<th>Authors/Participants</th>
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<tr>
<td>68</td>
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<td>Investigating local school science cultures in order to facilitate long-term educational changes in science teaching.</td>
<td>Jan Sølberg.</td>
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### Strand: Classroom research
**Chair:** Hrefna Sigurjónsdóttir  
**Room:** H-203  
(Abstracts: page 58)

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<tr>
<td>97</td>
<td>10:55</td>
<td>Science for Life - development of a multi-concept instrument to study the impact of socio-scientific issues on student interest in science.</td>
<td>Mikael Winberg and Britt Lindahl.</td>
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### Strand: Outdoor education
**Chair:** Tom Klepaker  
**Room:** H-207  
(Abstracts: page 59)

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<tr>
<td>23</td>
<td>10:55</td>
<td>Students’ early experiences of biodiversity and education for a sustainable future.</td>
<td>Gustav Helldén and Sofia Helldén.</td>
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### Strand: Scientific literacy
**Chair:** Allyson Macdonald  
**Room:** H-208  
(Abstracts: page 60)

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### Strand: Teacher education
**Chair:** Kalle Juuti  
**Room:** H-209  
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Chair: Margareta Ekborg
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No. 98  13:05  Gudrun Jonsdottir. Naturfag nå!
No. 57  13:40  Lars Ullriksen and Henriette Tolstrup Holmegaard. Drenge og piger i det danske tekniske gymnasium (htx)
No. 30  14:15  Kristina Andersson and Anita Hussenius. Gender Theory as a Tool for Analysing Science Teaching

Strand: Technology and science education
Chair: Berit Bungum
Room: H-202 (Abstracts: page 66-67)
No. 112  13:05  Svanborg R. Jónsdóttir and Allyson Macdonald. The silence of innovation education in Icelandic science classes
No. 73   13:40  Björn Andersson, Maria Svensson and Ann Zetterqvist. Några uppgifter som belyser elevers uppfattningar om vad som är teknik
No. 2    14:15  Pal J. Kirkeby Hansen. Analyzing cases in technology and design education: How could designing and making technological products be a vehicle for enhancing understanding of natural science principles?

Strand: Learning styles
Chair: Gustav Hellden
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No. 100  13:05  Helge Strömdahl. Referent change, a neglected aspect in traditional conceptual change approaches to science learning and teaching
No. 43   13:40  Lene Møller Madsen and Carl Winsløw. A discipline-oriented focus on the links between research and teaching in a research-intensive university: the case of physical geography
No. 105  14:15  Camilla Rump and Frederik Voetmann Christiansen. Studiemønstre på naturvidenskabelige grundfag

Strand: Outdoor education
Chair: Kristín Norðdahl
Room: H-207 (Abstracts: page 70-71)
No. 3    13:05  Nana Quistgaard and Bruno Ingemann. Guided dialogue at science centers
No. 79   13:40  Jens Jakob Ellebæk. Karakterisering og kvalificering af det “uforberedte besøg” på Orion Planetariet
No. 26   14:15  Trine Hyllested. When the Teacher takes the School out of the School

Strand: Physics education
Chair: Carl Angell
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No. 25   13:05  Frank Bach. Argumentation om materiens förändring vid smältning
No. 118  13:40  Fredrik Jepsson and Helge Strömdahl. Mångtydigheten hos begreppet temperatur–En kvalitativ studie av fysikers och fysiklärarens uppfattningar av ordet temperatur
No. 33   14:15  Margareta Enghag. University students' personal ideas about school physics as starting point for dialogic /interactive talk

Strand: Teacher education
Chair: Britt Lindahl
Room: H-209 (Abstracts: page 74-75)
No. 22   13:05  Birgitte Lund Nielsen. Case studies and video from students' school practice used in teacher education
No. 46   13:40  Vanessa Kind and Rob Wallace. Train, teach; taught? How the content of specific science subject matter knowledge sessions impacts on trainee teachers' classroom practice and children's learning
No. 61   14:15  Martin Lindner, Jan Alexis Nielsen and Claus Michelsen. Science Teachers’ Professional Development in new Programs in Germany and Denmark
Round table sessions 13th June 15:30-16:30

Chair: Allyson Macdonald
Room: H-201  (Abstracts: page 76)
No. 65  15:30  Andreas Redfors. Science Teacher Education in Europe

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No. 21  15:30  Jardar Cyvin, Eli Munkebye and George Sundt. Starting from scratch? - Teacher students’ starting position for learning science

Chair: Meyvant Þórólfsson
Room: H-206  (Abstracts: page 78)
No. 99 15:30  Kamma Rasmussen, Birgitte Pontoppidan and Mette Bisp Jensen. En Roundtable session om erfaringer med partnerskab mellem skoler, seminarium og forvaltning, der skal styrke udviklingen af en naturfaglig kultur

Chair: Svanborg R Jónsdóttir
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No. 76  15:30  Lars Björklund. Att se med hjälp av sina tidigare erfarenheter: kan studenter upptäcka och skapa kunskap på egen hand?

Chair: Britt Lindahl
Room: H-208  (Abstracts: page 80)
No. 5  15:30  Mary Ratcliffe. Pedagogical content knowledge for teaching concepts of the nature of science. Synopsis available on the symposium website

Chair: Kristján Ketill Stefánsson
Room: H-209  (Abstracts: page 81)
No. 122 15:30  Robert Evans, Lars Ulricksen and Helene Sørensen. Roundtable about self-efficacy
Seeing the natural world: a tension between pupils’ diverse conceptions as revealed by their visual representations and monolithic science lessons

In this talk I report on drawings of the natural environment produced by a sample of 13-14 year-olds in work undertaken with Carolyn Boulter and Sue Dale Tunnicliffe at the Institute of Education, University of London and funded by the ESRC. One of our interests is in the extent to which these young people see the world in the way rewarded in science lessons. With rare exceptions, school science generally assumes that for any scientific issue there is a single valid scientific conception so that alternative conceptions are misconceptions. However, the drawings reveal a plurality of ways in which the natural environment is portrayed and we conclude that there is scientific as well as other worth in this diversity. We argue that schools need to take account of this diversity; many pupils will not be interested in a single, monolithic depiction of the natural world in their school science lessons.

Michael Reiss

Paper sessions 5 14th June 10:15-12:15

Strand: Evaluation
Chair: Auður Pálsdóttir
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No. 88  10:20  Maria Petersson. What educational objectives do biology teachers aim to achieve?
No. 38  10:55  Steffen Elmose. Kompetencebaseret naturfagsundervisning – operationalisering af et komplekt begreb

Strand: Learning styles
Chair: Gunnhildur Óskarsdóttir
Room: H-202  (Abstracts: page 84-85)
No. 113 10:20  Björg Pétursdóttir. “What matters is communication”. Secondary students’ responses toward a science learning environment”
No. 1 11:30  Are Turmo and Eyvind Elstad. Students’ study orientations and responses to teachers’ regulating approaches in science

Strand: Laboratory work
Chair: Christina Ottander
Room: H-203  (Abstracts: page 86-87)
No. 18 10:20  Olle Eskilsson and Gustav Helldén. The importance of science labwork
No. 91 10:55  Dag Atle Lysne, Shaun Nykvist and Margaret Lloyd. Can web-logg be used to link student’s practical activities to the use of theoretical concepts?
No. 11 11:30  Lærke Bang Jacobsen. Investigating the Need for Teachers and Students to understand the Purpose of Experimental Work in Physics

Strand: Physics Education
Chair: Eggert Lárusson
Room: H-207  (Abstracts: page 88-89)
No. 13 10:20  Sabina Jeschke, Olivier Pfeiffer, Thomas Richter and Christian Thomsen. Selected Aspects of Virtual Laboratories and Remote Experiments
No. 20 10:55  Carl Angell, Per Morten Kind, Ellen Karoline Henriksen and Øystein Guttersrud. Implementation of empirical-mathematical modelling in upper secondary physics: Teachers’ interpretations and considerations
No. 63 11:30  Andreas Redfors, Lena Hansson and Maria Rosberg. Digital support for Inquiry, Collaboration, and Reflection on Socio-Scientific Debates – CoReflect. A progress report.

Strand: Teacher education
Chair: Stefán Bergmann
Room: H-208  (Abstracts: page 90-91)
No. 64 10:20  Hans-Olof Höglund, Gustav Helldén, Maria Thomasson and Sara Wahlberg. Student teachers’ content knowledge of life in an aquatic ecosystem and their experience in a teaching situation – a case study
No. 123 10:55  Karin Stolpe. Science student teachers’ use of communicative support to make meaning of abstract phenomena in the area of energy
No. 29 11:30  Oleg Popov. Place of liberal values in science teacher education
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Strand: Interests and attitudes
Chair: Almar Halldórsson
Room: H-201


No. 125 10:55  Margareta Ekborg, Malin Ideland, Christina Ottander, Claes Malmberg and Agneta Rehn. Science for life - development of a conceptual framework for modelling socio-scientific cases

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Validering Af PISA (VAP) projektet søger gennem en række delundersøgelser at svare på disse spørgsmål ved at afdække gyldigheden af PISA 2006 science testen i en dansk kontekst. I det første delprojekt sammenlignes PISA science frameworket med de danske mål for naturfagsuddannelserne. I det andet delprojekt undersøges hvorledes PISA testformatet er i overensstemmelse med evalueringspraksis i Naturfagene i den danske folkeskole. I det tredje delprojekt sammenlignes elevers score i PISA science testen med deres resultater i en mere dialogbaseret evaluerings situation.

De tre delundersøgelser betjener sig af forskellige metoder, nemlig henholdsvis tekstanalyse, spørgeskemaundersøgelse/ interview samt en egentlig feltvalidering (konkret undersøgelse af PISA-testede elevers viden).

Resultaterne vil blive gennemgået i præsentationen og sat ind i en naturfagsdidaktisk sammenhæng. Specielt vil der blive lagt op til en diskussion af hvad der forstås ved viden, og hvorledes denne viden kan evaluieres. Dette vil kunne bidrage til en bedre vurdering af PISA-testens gyldighedsområde og dermed dens ønskværdige uddannelsespolitiske rækkevidde.

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Margareta Ekborg, Malin Ideland, Christina Ottander, Claes Malmberg and Agneta Rehn. Science for life - development of a conceptual framework for modelling socio-scientific cases

Abstract: The aim of this paper is to describe how a conceptual framework, which can be used as an analytical tool for understanding and constructing socio-scientific cases, was developed. The framework focuses on content and features of the SSI. It will be used as a tool for analyzing what components of the tasks are related to, and most influential on, interest and learning in work with socio-scientific issues in secondary school. The six components were chosen to reflect what we know from research literature about what might have an impact on interest and learning. They are relevant according to characteristics of SSI and to the national curriculum. It is possible to find variants within each component. Six socio-scientific issues were constructed which will be discussed. The framework consists of a grid with the six components and the six cases. We will describe the model in detail and how it can be used for construction of cases and analysis of the work in school. Six cases developed from the model are described.

This work is the first step in an evidence-based research project aiming at investigating if, how and why students and teachers in secondary school develop knowledge and interests when working with SSI in science. Also, we want to learn more about what kind of knowledge they will develop.
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Berit Bungum. Imaging the nature of physics: A study of visual images in Norwegian physics textbooks

Abstract: Images are important elements of the communication of physics in textbooks. This paper presents a study of visual images in a sample of nine different Norwegian physics textbooks from 1943 till present. It investigates the variation in how images articulate the nature of physics as a school subject, and how this variation relates to time periods, age level and specific authors. By means of a framework of three dimensions; content specialization, framing, and formality, a typology of five modes of imaging physics is developed inductively from the sample of textbooks. These modes are: involving the learner in experiments, visualizing a world of models, showing the actual appearance of objects, translating between representations, and demonstrating relevance and use.

The sample of textbooks is analysed quantitatively in terms of these modes. Results indicate a shift from realistic to conventional images and a somewhat higher formality in the images during the time period investigated. There also seems to be a shift of involvement of the learner in the text from involvement in experiments to demonstrating relevance and use of physics in society. Little systematic variation is found in modes of images used for the lower and upper level of secondary school. The largest difference, however, is found between specific textbooks independent of time and school level. It seems that authors develop specific ‘genres’ in their use of modes of images for given purposes. These may influence pupils’ learning and their view of the nature of physics as a subject and research enterprise.

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Niklas Gericke and Mariana Hagberg. Textbook authors’ intentions and ideas when writing upper secondary biology textbooks in relation to nature of science

Abstract: This study is aimed at finding out how and why upper secondary textbooks have been written as they have in regards to nature of science (NOS). It also aims to elucidate the authors’ intentions and ideas, particularly in relation to the subject matter content of genetics. A previous study of Swedish upper secondary textbooks showed that in genetics the NOS perspective was implicitly embedded. Conceptions of NOS are however considered to be best learned through an explicit approach. Also the national Swedish curricula for the science program emphasize the importance of using a NOS perspective. Five semi-structured interviews were conducted with authors representing all five textbooks which are published in biology for upper secondary school in Sweden. The results show that the textbook authors can be regarded as insightful in issues regarding epistemology and NOS. The most important aspect of NOS emphasized by the authors is the empirical basis of biology (and genetics). The authors have the ambition to make textbooks that are flexible, timeless and self-sustaining in the hands of the students. This in turn might constrain the possibility to emphasize NOS aspects, in general, as well as embedded, in the content of the textbooks. The explicit embedded NOS perspective is by most authors deliberately left out and handed down to the teachers to manage in the classroom. A crucial implication then is that teachers should be aware of this expectation. The demand of the teachers’ comprehension about content knowledge as well as NOS is extensive and it calls for a use of the textbook that differs from most of the research results found in the literature, which say that the textbooks influence the structure as well as the content of the lessons in school.
Allyson Macdonald, Auður Pálsdóttir and Helgi Grímsson. Writing for science and science textbooks: a case study from Iceland

Abstract: Science textbooks play an important part in school science in Iceland, as in many other countries. The purpose of this study is to analyse and understand the science ‘story’ told in a series of textbooks and teacher guides titled Auðvitað (Of course!) and written for the middle school, grades 5 to 7 (ages 10-12). In a small country resources must be carefully used and the science story being told in schools is of more than passing interest in a country which thrives on technology and change.

A revised national curriculum was published in 1999. The Auðvitað books, published in 2000 and 2001 by the National Centre for Educational Materials (NCEM), cover topics in physical and earth sciences in the middle school national curriculum. The Auðvitað materials are used each year in several hundred classrooms involving about 4000 or more learners per age group.

The study has three parts: an analysis of the activity of constructing the books, an analysis of the books using a framework developed in Greece and a consideration of the views of teachers on science teaching, science and the role of the learner and teacher. Interviews with teachers taken during the school year 2006-2007 were transcribed and analysed.

Preliminary results indicate that in the construction of the books, some of the science story told is constrained by practical and budgetary aspects of publishing materials. The relationship between the editor and the writer is a sensitive one, in which views of science and scientists need to be negotiated. The model of science suggested in the national curriculum is reshaped in negotiations between writer and editor. The role of the learner was shaped by the writer’s experience while the role of the teacher was shaped by the editorial process.
16
Sonja M. Mork. An alternative approach to analysing student argumentation

Abstract: This paper presents an alternative methodological approach for analysing argumentation in classroom debates, taking account of both content and structure of students’ argumentation. The alternative approach is explained and applied to empirical data from a case study of role-plays simulating TV debates between politicians. The controversial issue on the agenda is the question about the continued presence of wolves in the Norwegian landscape. An interactive learning environment served as the information source for the debates. The participants in the study are a class of students, age 14-15, who were randomly assigned roles to argue for or against wolves. Three role-play debates were conducted during one class period, each lasting about 10-15 minutes. The debates were organised as a panel with two opposing groups, each consisting of three to four students. Analyses of the transcripts show that students use biological, personal, political and economic arguments in the debates, and that the content in the majority of student utterances is of the expected quality. Moreover, student utterances vary from containing just simple claims, to more elaborate reasoning with examples backed up by evidence. The paper concludes with a discussion of the relative merits of this alternative approach as a method of analysing student argumentation in classroom debates.

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Marianne Ødegaard and Nina Elisabeth Arnesen. Video Tales of Teaching in Norwegian Science Classrooms

Abstract: The aim of this paper is to describe and scrutinize teaching activities in a selection of Norwegian science classrooms, with a special emphasis on conceptual framing and language use. This is done in order to shed light on and discuss the meaning-making activities students are offered in order to learn science. The research design is a classroom video-study supported with ethnographic observations and interviews with students and teachers. The study is done in ninth grade (students are 14-15 years old) in six schools differing in demography and organization. In our analysis we shed light on learning activities, classroom dialogues and use of language. Our analyses disclose that teachers have a strong focus on students and that they are very inclusive of student initiatives. However, there is not much emphasis on scientific language and scientific modes of speaking, like seeking explanations with the help of models and theory.
Abstract: During the last decades an increasing number of science educators has been emphasizing the importance of using everyday and actual situations, preferably a controversy, where scientific knowledge is used as a point of departure in instruction. To use knowledge in new situations is, however, a form of higher order thinking skill and will, as such, potentially make learning science a more challenging endeavour. Also, teachers may not be familiar with teaching science this way, and lack teaching repertoires for these kinds of activities. The analysis presented here is of data from an instruction sequence in lower secondary school, grade 9. The sequence is built up around a role play debate on a socio scientific issue; genetically modified food. The instruction sequence is analysed when it comes to how two students’ factual knowledge develops during the sequence, how the teacher guides them in their meaning making and how the students make use of their knowledge in the debate and in the interview afterwards. The students develop new scientific knowledge during the debate. It seems, however, that the knowledge exists parallel to older alternative conceptions, and the students are not aware of using different explanations in different situations. During the debate students use sound arguments as well as arguments partly based on alternative conceptions. This might strengthen alternative conceptions held by other students. Most of the students use only one piece of information to support their claims. The teacher listens to the students when guiding them, explains gene modification in different ways and does a very conscientious job. She focuses, however, almost solely on traditional factual knowledge rather than on how to use knowledge in new settings, e.g. in order to underline an argument during a debate.
Terry Russell and Linda McGuigan. A qualitative exploration of teachers’ use of ‘digital creativity’ technology to re-engage detached learners.

Abstract: ‘Digital creativity’ commonly refers to the interface between digital technologies and the ‘creative arts’. This paper takes a broader definition: the imaginative application of computer hardware and software to support learning in science. A one-year research project designed to explore the impact of ‘digital creativity’ on pupils’ behaviour, attitude, learning and attendance is reported. As well as identifying examples of the use of digital creativity to re-engage pupils in science education, the potential of the learners’ multimedia experience for instructional design and assessment are discussed.

Ten BESD schools - those catering to pupils experiencing behavioural, emotional and social difficulties - were given a selection of hardware and software on the understanding that their use and the impacts of use would be systematically recorded.

Illustrative examples of the use of digital creativity in science and some compelling evidence of impacts on pupils’ engagement, motivation and self-esteem are reported. The multiple modes of expression offered by the digital resources were appreciated by pupils both intrinsically and because they offer alternatives to verbal modes. The impact on ‘intermediate outcomes’ – motivation, perseverance, collaboration and reflection - was strongly confirmed by teachers.

Multimedia functionality offers scope for learners to make their ideas known in whatever representational form they favour, the new tools offering unprecedented possibilities for reduction of ambiguity in ideas-sharing between teachers and learners.

Learners’ 24/7 access to multimedia ICT functionality requires that urgent attention be paid to the challenges and opportunities afforded by these resources to the development of engaging science education. While the illustrative examples of practice refer to learners with particular educational needs, the issues raised are of fundamental relevance to mainstream science education.

Eggert Lárusson, Meyvant Þórólfsson and Allyson Macdonald. Learning science with ICT

Abstract: Five science teachers were interviewed and their teaching practices observed with the aim of assessing how they use ICT in their teaching. The 1999 national curriculum for Icelandic schools made considerable demands on teachers, both in science teaching and the use of ICT. We found that these five teachers, three male and two female - which were chosen as being known for their competence in science teaching - differ widely in their preparedness and approach to using ICT in science teaching. To complicate things further we did not find the presence of a strong science culture - the teachers also differed widely in their science teaching. A strong background in IT seemed to ease their task and allow them to take a more pupil-centered approach. One of them has a strong teacher-centred approach and uses ICT, mostly through e-mail and slide presentations where he is in the center. The teacher with the strongest ICT background used a variety of methods and applications as well as a smart board which was a novelty in Icelandic schools at the time. He also actively directed his pupils to seek information on the Internet. Lack of knowledge of what ICT can do for their teaching seemed more prevalent than lack of equipment - all the classrooms were reasonably equipped. Follow-up work is needed to look more closely at the conditions which seem to favour the use of ICT in science teaching and learning in Icelandic schools by studying teachers who are known to use ICT in learning and to understand critical points in their personal history of science teaching.
Anne Bonnevie Lund, Jardar Cyvin and George Sundt. The nature science teacher’s meeting with the pupil as an ICT user

Abstract: IKT har høystatus som læringsverktøy i Norge, maskintettheten er stor, det satses betydelig på IKT-opplæring. Samtidig viser undersøkelser begrenset databruk i naturfagene. Eisner beskriver undervisning som en kunstart som fordrer tilstedeværelse i nuet mens Max van Manen hevder forutsetninger for å fungere som dyktige pedagoger er opplevelsen av inspirasjon.

2002-2003 (n=782) og 2008 (n=516) gjennomførte vi spørreundersøkelser blant 9.klassinger i Trøndelag der vi blant annet ønsket å se hvordan elevene opplevde naturfagslæreren i forhold til faglig og IKT-teknisk fokus og hvordan elevene mente læreren klarte å møte læringsbehovet. Begge undersøkelsene viser at IKT sjelden benyttes. 2008 oppga ca 50 % at det var vanlig at lærer hadde faglig formidling rundt ulike tema når IKT ble benyttet som hjelpemiddel mens 66 % sa at læreren brukte mest tid på veiledning under selve IKT-arbeidet. Det er varierende syn på graden av kontakt med læreren under IKT-relaterte arbeidsformer med en tendens til at elevene mener de har mindre kontakt ved bruk av IKT.

Strand: Student’s conceptions  
Chair: Bjørn Håland  
Room: H-208  

No. 83 10:20  Pernilla Grankładt Enochson, Gustav Helldén and Britt Lindahl. Students’ understanding about the water transportation in the human body and their understanding of why water is healthy for them.

No. 111 10:55  Hrefna Sigurjónsdóttir and Halldóra Lóa Þorvaldsdóttir. Student’s understanding of photosynthesis.

No. 82 11:30  Gunnhildur Óskarsdóttir. The influence of the teaching material used in class on children’s ideas about the human body.

83  
Pernilla Grankładt Enochson, Gustav Helldén and Britt Lindahl. Students’ understanding about the water transportation in the human body and their understanding of why water is healthy for them.

Abstract: In discussions in schools and society the importance of living a healthy life is debated. The discussion often focuses on different kinds of food. In this paper the focus is on student knowledge about the water in the human body and how this is related to their thoughts about living a healthy life.

This study was done with 55 students from grade 9 in a Swedish school. Data were collected from drawings, open questions, multiple choice questions and interviews. On the drawings there was a question: “What happens in your body when you drink water?” The students’ answers are categorized and in four categories: A) No present understanding (9 students) B) Alternatives understandings (13 students) C) Incomplete understandings (33 students) D) Good understanding (2 students) In category B most students drew a tube from the mouth to the kidney. The two students in category D had done drawings with throat, stomach, intestines, blood system, kidney and bladder.

It seems that there is a connection between the knowledge of morphology and physiology. When a comparison between the answers of the multiple choice questions and the drawings were made, it seems that the students with an incomplete understanding have more knowledge of the function of the kidneys than the students with an alternative understanding. Interestingly the students with the alternative understanding are writing kidney on their drawings in contrary to the students with the incomplete understanding. When it comes to the health issue the students with alternative understandings are nearly the same as those with incomplete understandings. The students claim that the water has different purposes from being necessary for survival to being important as a nutrient. In the category ‘no present understanding’ the students didn’t have any deeper understanding at all.

111  
Hrefna Sigurjónsdóttir and Halldóra Lóa Þorvaldsdóttir. Student understanding of photosynthesis.

Abstract: In this study the objective was to study student understanding of photosynthesis in Iceland. The results are discussed in light of constructivism and compared to similar studies from other countries. No comparable study has been carried out previously in Iceland. In total 94 students from 3 rural schools answered 11 questions on the subject. The students were 10 years old (N = 38) and 15 years old (N = 56). The older group was also asked to explain further in writing four points.

The results suggests that the knowledge and understanding of the students is poor and the objectives given in the Icelandic curriculum are far from being achieved. The older students had difficulties in explaining the processes of photosynthesis and the relevant concepts. Also, their answers in their open questions suggested that their choice of answers in the multiple choice questions were sometimes coincidental. The conclusion is that Icelandic students seem to have the same misconceptions about photosynthesis as students in other countries and that their learning in this field is often of limited value.
Gunnhildur Óskarsdóttir. The influence of the teaching material used in class on children’s ideas about the human body

Abstract: The paper explores what kinds of ideas children in the first year of primary school have about the human body before being taught about the subject, how these ideas change and develop during the teaching and what factors especially influence the change in the children’s ideas. Special attention will be paid to the influence the teaching material used has on the ideas the children have about the human body. One primary school class of 19 children in Primary one was chosen to take part in the research along with its teacher. The research lasted for two school years (Primary one and two). The methodology involved classroom observation and individual interviews with the children. The children made drawings from the beginning of the project and right to the end. All the drawings were collected and analysed. At the very end of the project the children completed a few diagnostic tasks to get information from as many sources as possible. Using drawings to get access to children’s ideas can be very effective although young children may have difficulties in making drawings that represent their ideas, although the imitation effect has to be taken into account as drawings can present imitation rather than understanding. The research gives important information about children’s ideas about the body and how they change. It shows that teaching material and especially pictures in textbooks and tools and models e.g. the visual things can have great influence on children’s ideas. The results show that the drawings in the textbooks used have a substantial effect on the children’s ideas as the children tended to imitate the pictures in the book when they were asked to show their ideas in drawings, although the drawings did not always represent their ideas as revealed in the interviews and diagnostic tasks.
**Strand: Teacher and in-service education**  
**Chair: Ola Magntorn**  
**Room: H-209**

No. 75 10:20  Lene Beck Mikkelsen, Troels Tunebjerg, Bent B Andresen, Holger Hedemann and John Andersson. Blended Learning as a Basis for an In-Service Training Concept in Natural Science.

In connection with the EU subsidies objective 2 project NOFAN (Upgrading of Natural Science Qualifications through academic teaching, Activity centre and local network formation) a concept for blended learning was developed which is a tailor-made education and in-service training for students who work and live in outskirts regions (here Lolland, Falster and Møn). The concept is based on modulised teaching over a concentrated period with synchronous confrontational teaching for four hours every second week combined with asynchronous group-based e-learning courses based on the daily functions of the students, practical activities or field trips.

The article describes the development of a concept for in-service training and further education in natural science which is based on blended learning, and which has been carried with subsidies from the EU within the frames of the NOFAN project. The intention is to develop an overall workable concept on medium long educations. The target group comprises teachers in primary schools who prefer time and place flexible in-service training and further education.

The article describes benefits and drawbacks to the concept which is implemented in teacher education in Denmark in the teaching subjects of biology, physics/chemistry, geography and natural science. In particular, it is described, how one can split the content into modules, arrange the teaching and stimulate the activities of the participants through appropriate tasks. Finally, the article contains a number of recommendations for further development of pedagogical practice in in-service training and further education.

No. 10 10:55  Hanne Mehli and Berit Bungum. Authentic learning situations for teachers - perceptions of and gains from in-service courses in space technology.

Abstract: This paper reports a qualitative study of Norwegian science teachers' perceptions of in-service courses in space technology arranged at Andøya Rocket Range. Earlier studies have shown that the teachers participating in these courses are very content with the outcome and that they find the course elements useful in their own teaching. The purpose of the present study is to find out what characteristics of the courses are important for this positive outcome, and whether the apparent success can be ascribed to teachers' participation in authentic scientific practice. Eleven teachers who had participated in these courses at Andøya Rocket Range, and who to a large extent had been able to transfer course elements into their own teaching, were interviewed. During these interviews topics like the teachers' gains from the courses and their perceptions of the factors contributing to the gain were discussed. Several important issues were mentioned during the interviews, and especially factors connected to a situated learning situation seemed to be of great importance for the teachers' perception of the courses as successful. These were elements like working with professionals, participating in real, practical activities, and the surroundings and facilities they were able to use. The context of learning and the surroundings at Andøya appeared to be important components of the learning outcome itself. The results indicate that participation in authentic scientific practice is important for teachers' learning in in-service education programs, and for their later use of acquired knowledge in their classrooms.
Abstract: The research presented here is aiming at a better understanding of the development of preschool teacher students’ science knowledge and attitudes towards science and science teaching during their university studies. According to the EU there is a need to renew science education to bring about a change in young people’s interest in science education. A key to this improvement of science teaching is the establishment of a teacher education that forms a new generation of teachers. This is especially true for the training of preschool teachers. An early experience of quality science education leads to a positive attitude toward science and a better understanding of scientific concepts studied later in a more formal way. Most preschool teacher students however often have a negative attitude to science and science teaching. Science courses for preschool teachers therefore have the challenge of both teaching science and establishing a learning environment that improves attitudes towards science and science teaching. A better understanding for how preschool students develop their science knowledge and attitudes is therefore important.

The students in this study were all enrolled in a programme for preschool teachers. A questionnaire concerning attitudes towards learning was performed two weeks after the programme started. Two subsequent questionnaires will follow in the beginning of 2008. The learning outcome of the first science course was studied by comparing the students and teachers views of the scientific content of lectures.

The students showed a fairly good understanding of the main content of the lectures which increased after discussions with peers except in cases where the content was abstract. The majority of the teacher students had an initial view of teaching and learning as transmission of knowledge. Only a small group expressed a constructivist view. Results from the following two questionnaires of epistemological beliefs will be available in June.
Abstracts from paper sessions 2 12th June 13:00-15:00

Strand: Interests and attitudes
Chair: Gunnhildur Óskarsdóttir
Room: H-201

No. 8  13:05  Stuart Naylor, Brenda Keogh, Jane Maloney and Shirley Simon. Puppets and engagement in science

No. 110  13:40  Haukur Arason and Kristín Norðdahl. Physics through Play

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Stuart Naylor, Brenda Keogh, Jane Maloney and Shirley Simon. Puppets and engagement in science

Abstract: The PUPPETS Project uses puppets as a stimulus for children to engage in conversations involving reasoning in primary science lessons. This case study examines the impact of puppets on children’s engagement in a science lesson. Data were gathered from teachers who observed a series of demonstration lessons. The use of a puppet led to high levels of engagement from children, and some factors that enabled the puppet to achieve this were identified. The use of demonstration lessons is put forward as a possible model for teacher professional development.

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Haukur Arason and Kristín Norðdahl. Physics through Play

Abstract: In this presentation we will describe and evaluate a project where physics activities were introduced through semi-organized play activity into an early childhood education setting. The aim of the project was to develop and evaluate activities that from the point of view of the children were thought of as ‘play’, but that are also physics experiments with specific educational aims. The activities were developed by bringing together ideas and research results from physics didactics and early childhood education as well as the experiences of practitioners in the field. During both the development and evaluation of these activities, approximately 80 children from age two to six took part in the project along with eight teachers and two researchers. For each of the five activities one session was videotaped and observed and was immediately followed by a meeting with the teachers. All teachers kept notebooks during and after the sessions. More extensive evaluation meetings were held with all the teachers involved. In the follow-up, which has lasted about a year, interesting data has been collected by the teachers. One obvious finding is that the great majority of the children enjoyed the activities immensely. These activities are quite different from what the children are used to in school and they were delighted to be exposed to novel experiences. There were also indications that those experiences may have changed the way some of the children understand the physical world and how they observe and experiment on their own, however, the long term effect is not known.
Pal J. Kirkeby Hansen. Weather and climate topics in primary and secondary education: Possibilities and restrictions in the new Norwegian national curriculum compared with the old.

Abstract: The Knowledge Promotion (KP06, 2006) is the latest curriculum reform in Norwegian compulsory and upper secondary education. KP06 replaces The Curriculum for the 10-year Compulsory School (L97, 1996) and The Curriculum for Upper Secondary Education (R94, 1994). The most substantial news in KP06 is: less topics in all subjects, no prescribed teaching methods, all topics have competence aims. In KP06 Natural Science, competence aims concerning weather and climate years 4 and 7 have no explicit connections to water physics like in L97, and do no longer contain the vital competence “about the major weather systems and the terms used in weather forecasts” (L97). Has the ‘science-based’ cross-topic approach in L97 (tradition since 1987, perhaps influenced by Norwegian meteorological heritage) been replaced by ‘restrictions’ to single-topics with potential losses? Yes and No! In KP06 the teachers have a ‘possibility’ for connecting for instance weather topics to water physics, if they judge this method to be favourable bringing the pupils to the described competences (as can be seen in Hansen (2007): Kunnskap om været. Naturfag, 3, 52-60). Few weather and climate topics in compulsory education are a European trend (ibid.).

To meet our most significant environmental problem, competence “about the greenhouse effect and the effects of the ozone layer” (L97) year 10 compulsory, is in KP06 moved to upper secondary year 11, but only in Programme for General Studies, chosen by less than 50%. Geography KP06, both compulsory and upper secondary education, has almost the same weather and climate aims as L97/R94.

One substantial news in KP06, opening new science-areas, is the new subject Geosciences years 12 and 13, Programme for Specialization in General Studies, containing among other geo-topics: weather, forecasting, hazard weather, climate, global warming. Geosciences should also be a vehicle for introducing new groups of students to science, and perhaps bring them to science studies on higher levels.

Lars Domino Østergaard. Naturfagslæring på tværs af institutioner – hvordan skabes bedst motiverende og sammenhængende naturfagsformidling fra børnehavet til skolehverdag.

Abstract: Artiklen beskriver et aktionsforskningsprojekt, hvori hovedmålet har været at opstille, undersøge og kvalificere metoder, hvormed det er muligt at skabe sammenhæng i børns naturfagslæring fra børnehaven til 0. klasse og videre op i indskoleningen. Desuden er der søgt at etablere en fælles metode, hvormed både pædagoger og lærere i børnehaven og i skolen kan arbejde med naturfagsformidling, så det virker motiverende og engagerende for de børn, de arbejder med.

Alle involverede parter har været med til at opstille læse- og læreplaner med fælles overordnede temaer for naturfagsformidlingen fra børnehaven og op, og været fælles om at tilrettelegge formidlingen på de forskellige trin så der indgår få velvalgte aktiviteter, der belyser centrale begreber i det valgte tema. For hvert tema har der været opstillet en række aktiviteter, hvori børnene på egne præmisser skulle handle, undres, stille spørgsmål og reflektere. Aktiviteterne og begreberne i de forskellige læseplænsbånd har gjort det muligt for pædagoger og lærere at skabe overblik, sammenhæng og progression i deres naturfagsformidling på tværs af institutionerne.
Børnene har oplevet en formidling, der har taget udgangspunkt i aktiviteter på deres præmisser, hvor det centrale har været naturfaglige arbejdsmetoder som fx observationer, klassifikationer, undersøgelser og eksperimenter, der samlet har været med til at perspektivere de begreber, der har været centrale for det emne, børnene beskæftigede sig med.

Projektets resultater kan være med til at pædagoger og lærere på tværs af institutioner i højere grad begynder at samarbejde om at vælge (naturfaglige) temaer, begreber og aktiviteter, således at børnene gennem deres udvikling møder det samme tema og fortømbende skærper deres kognitive og praktiske erfaringer fra sidst, de arbejdede med temaet. Måden, hvorpå naturfaget formidles, kan endvidere være medvirkende til at børnene videreudvikler og fastholder den nysgerrighed mod omverdenen, som børn i alderen 5-9 år ofte besidder.

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Auður Pálsdóttir and Allyson Macdonald. Moving into the Zone of Feasible Innovation

Abstract: Science teaching and learning is considered a complicated challenge both by teachers and pupils. This paper addresses the question of how much change is appropriate in a given context of science teaching and school development.

Analysing science teachers' motivation and identity with regard to how their interests are met and identifying their potential to implement the national science curriculum can help to find ideas on activities which might help to change some of the experienced constraints on science teaching. The main findings of the study so far are that using Roth's (2007) ideas and Macdonald's (2008) framework to analyse teachers' motivation and identity have given a deeper understanding of some of the constraints realised when developing science teaching in schools. Also, the results indicate that the theory of Zone of Feasible Innovation (ZFI) by Rogan and Grayson (2007) is a useful idea to evaluate the levels of implementation where its major constructs are adapted to the national curriculum in Iceland, giving teachers and school administrators a new way to identify what to focus on as next steps in developing science teaching in their schools.
104
Lars Björklund. Why can’t you see what I see? Development of Expertise and Enquiry-based learning

Abstract: We all know how sensory systems like our vision can be fooled and how difficult it is to observe the relevant data in a myriad of sensory input. Analysis is very often “contaminated” with effect and feelings. People seldom behave rationally and logically. Students often have a strong preconception that will not be changed or altered. The ability to apply general knowledge and to transfer knowledge from one example to another seems to be very restricted.

This paper wants to show a new understanding of these phenomena in education and learning by using the latest findings from modern brain research and will try to show:
- How the implicit learning system affect our ability to observe, characterize and analyse phenomena in the world
- How this knowledge may guide us in the design of enquiry-based learning situations
- How the implicit system is used in problem solving and is an important part of “the scientific method”

This is done by presenting an “Integrative research review” using data from several areas of cognitive research. In focus is the Dual systems model for learning and understanding, and specifically the new understanding of the non-declarative, implicit and unconscious system, situated in the Basal Ganglia, deep inside our brain, a memory system with extensive value to our ability see, assess and act in a complex world. We have no conscious access to these patterns of memory but they are the workhouse of our daily life and give us what is termed “tacit knowledge”, intuition and many forms of expertise skill. “We know more than we can tell!”

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Clas Olander. Argumentative reasoning in peer groups; conceptual issues and epistemological underpinning

Abstract: Argumentation in school science settings is of growing interest, partly because formulation of arguments is involved in the learning process of science, for example coordination of conceptual issues and their epistemological underpinning. On the other hand it is through argumentation that reasoning and knowing becomes accessible, both to the learners themselves and others, and it could enhance the possibilities to perform assessment for learning. In this study the analysis is informed by Toulmins Argumentation Pattern (TAP). Students’ use of claims, data, warrants and backings when discussing an issue about the evolution of life on earth are analysed. The empirical data are generated through a peer group discussion between seventeen-year old students attending the natural science programme at a Swedish upper secondary school. As part of an ordinary lesson students were asked to discuss reasons for the origin of different traits i.e. variation among living organisms. The most frequently discussed issue was whether variation originates from individual needs or from random changes in the gene pool. Partly this is inherent in how the theory of evolution is understood; as one single process or two different processes. This gives insights to teachers in their practical action of assessment for learning. Students’ own wording is accurate most of the time, for example the utterance which settles one group’s arguing on the issue of randomness or need … random changes have occurred, just as it says, but they remained because they were needed. Students’ utterances are potential tools for teachers’ own “argumentation” that may have more impact i.e. a language that would touch and influence students more directly without devaluating the scientific clarity and stringency.
Abstract: An emerging viewpoint of cognition suggests that the body has a central role in shaping the mind and that cognitive processes are deeply rooted in the body’s interaction with the world, that “embodied cognition or learning”. If so, the documented difficulties for learners to grasp and to engage in molecular sciences might, at least in part, be explained by the lack of direct experience of the micro world.

The term haptics encompasses the tactual sensation and the human interaction with the external environment through touch. When integrated as part of a computer-based virtual environment, haptics refers to the artificial tactual sensation, used to simulate the experience of actually touching or feeling a real object, that occurs in response to user movements.

The present work aims to evaluate the gains of a haptic element from a learning perspective, when haptics is added to an educational virtual reality environment for students learning the concepts of molecular interactions in proteins. A combined qualitative and quantitative approach is taken, using data from tests and interviews (with a subset of the subjects). The study is an attempt to fill some of the gaps in the research about possible benefits from using force feedback technology, focusing specifically on the learning gains from a study of a virtual protein model.

The computer model did not help the students to solve their tasks faster, but it appears to help them to gain a deeper understanding of the docking process, partly by challenging their preconceptions. Further, we propose that the force feedback might constitute a critical feature for understanding the involvement of the dynamics and forces involved in the process.
Ola Magntorn. The quality of memorable episodes in science education

Abstract: This paper explores primary school students’ abilities to recall events from a teaching sequence taking place 18 months earlier. The aim of the teaching sequence was to develop students’ ability to read nature in a river habitat. The concept reading nature has to do with an ability to recognise organisms and relate them to material cycling and energy flow in the specific habitat which is to be read. It has to do with the natural world that we face outside and the tools we have are our experiences from previous learning situations both in and out-of-doors. The students’ developing abilities have been studied and presented in earlier work. Experienced teachers’ views on the teaching event, based on their comments to the content of a CD-ROM with the teaching sequence, has also been published earlier. In this paper the aim is to study whether there is a pattern in their view of important teaching events and what kind of episodes they recall. There is strong support for the importance of giving students a rich variety of first-hand experiences both in the outdoor environment and in follow-up studies in the classroom. As the results of this study indicate it is not only a question of students being active but there is a pattern of which activities and facts the students do recall. Being active in creating experiments, and intriguing tests challenging students’ everyday conceptions and ideas, seem to make lasting impressions in the long term memories of the large majority of students. The paper finishes by identifying some implications for teacher training to support fieldwork and ecological literacy in future classes.

Niels Anders Illemann Petersen and Mette Dalgård Alders. Autenticitet i undervisningen i Aalborg Zoo’s skoletjeneste

Abstract: Begrebet autenticitet betoner vigtigheden af, at undervisningen er i overensstemmelse med elevernes tankeverden, den del af omverdenen, der undervises i samt de fagligheder, der bruges i tilgængelsen af det pågældende indhold (Bangsgaard et al., 2001).

Vi antager, at autentisk undervisning er en del af det, som karakteriserer skoletjenesten i Aalborg Zoo’s arbejde. I dette delprojekt er formålet at undersøge autenticitet i undervisningen i Zoo.

Bangsgaard et al. (2001) beskriver tre former for autenticitet. Personlig autenticitet, samfundsmæssig autenticitet og faglig autenticitet. På baggrund af disse beskrivelser har vi i denne publikation fokus på personlig og samfundsmæssig autenticitet, ved følgende indikationer:

Personlig autenticitet
Undervisningens indhold er meningsfuld for eleven og knytter an til elevens erfaringsverden
Miljøet i Zoo er motiverende for elevens læring
Samfundsmæssig autenticitet
Globale problemstillinger
Sammenhæng med den daglige undervisning og Undervisningsministeriets Fælles Mål for undervisningen i grundskolen
Dato er indsamlet gennem observation af undervisningsforløb med 4 skoleklasser i Zoo, samt interviews af elever og lærere. I denne publikation har vi valgt at arbejde med resultaterne fra en enkelt klasse, 20 elever på 15-16 år fra Vittrup Efterskole
Nedenfor er fremhævet de faktorer der kendtegener undervisningsforløbet i Zoo.

Personlig autenticitet
Undervisningen knytter an til elevens erfaringsverden
Undervisningslokale og selve undervisningen er spændende, fordi der ingår levende dyr, og underviseren har viden om de enkelte dyr.
Samfundsmæssig autenticitet
Der arbejdes med globale problemstillinger og emner, men eleverne er ikke forberedte, og der er ikke sammenhæng med Fælles Mål eller læseplan.
Da der ikke er sammenhæng med den daglige undervisning og Fælles Mål, opfylder undervisningen samlet set ikke kriterierne for autentisk undervisning.

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Per Ivar Kvammen. Planter, dyr og økologi i furuskogen. Erfaringer fra et undervisningsopplegg i femte klasse.


Flere forskere har interessert seg for ulike didaktiske spørsmål knyttet til uteundervisning og læring, og mye tyder på at bruken av ekskursjoner og feltarbeid er redusert de siste årene. Min hovedinteresse er å fremme uteundervisningen i naturfag og styrke sammenhengen mellom naturstudier ute og læring.

Fire praktiske aktiviteter i furuskog er beskrevet: planter i skogbunnen, dyr i skogbunnen, undersøkelse av død furu og terrarier i klasserommet. Det er lagt vekt på samspillet mellom arbeidet ute og læringsaktiviteter inne. Hensikten er å dele våre erfaringer med lærere som ønsker å utvikle sin økologiundervisning.

Vi erfarte at vektlegging og tydeliggjøring av kunnskapsmål fremmer læring, at elevene er dyktige i å utføre det praktiske arbeidet ute, fallfellene samler godt, det er spennende å lete etter liv i råtnende ved og at terrarier fanger interesse. I femte klasse må feltarbeidet være godt forberedt, det må omfatte enkle og robuste oppdrag, ikke for mange.

Skal elevene ha et læringsutbytte er det nødvendig at feltarbeidet følges opp i ettertid med oppsummeringer, oversikter, presiseringer, forklaringer, analyser og tolkninger.

Det er mye som tyder på at barneskolen er en optimal periode for uteaktiviteter; motivasjonen hos elevene er stor og fleksible rammer som læreplan og timeplan gjør det lettere å arrangere ekskursjoner.

Det argumenteres for at bruk av binokularluper er et nyttig hjelpemiddel under etterarbeidet. Studier av insekter i binokularluper kan gi elevene spennende opplevelser som kan få betydning for deres naturinteresse.

En viktig årsak til at uteundervisningen er redusert er at lærerne mangler nødvendig kompetanse. Planlegging, gjennomføring og etterarbeid av ekskursjoner i naturfag må bli en del av profesjonskunnskapen i lærerutdanningen!
Lena Hansson and Britt Lindahl. Elevers sätt att hantera naturvetenskapen - Några fallbeskrivningar med fokus på världsbild


Lena Löfgren and Gustav Helldén. Following how students from age 7 to 16 use their experiences when developing their ideas about transformations of matter

Abstract: In this paper we present results from a 10 year longitudinal study with the aim of investigating how students use experiences when they develop their ideas about decomposition, burning, evaporation, and condensation. The theoretical framework of this study builds upon social constructivist perspectives. In our study (1997-2006) we have followed 23 students all born in 1990. We have conducted interviews allowing the students to explain the transformation of matter in fading leaves left lying on the ground, burning candles, and a glass of water with a lid on. Most students make progress in describing and explaining the situations in the first years of the study. Then there is a vast spread in the students’ capability to use their experiences and science taught in school in productive ways to improve their understanding of transformations of matter. We discuss the implications for science education research, compulsory school science curricula, and school science education out of these findings.
Abstract: The aim of this study was to analyze upper secondary school students' reasoning of spontaneous redox reactions in three different situations, two situations in a school context and one authentic context. The study focused on students' use of redox models, how they use the activity series of metals, which conception they have of the particles participating in the reaction and if there is any transfer of learning between the indoor and outdoor context. In the school context study 21 students participated in laboratory work about corrosion and a demonstration of a displacement reaction with zinc in a copper sulphate solution. Ten of them were chosen for individual semi-structured interviews. The same students were interviewed a second time in an authentic context – a copper statue on a corroded iron stand. Two individual and four two-groups interviews were taken. The results indicate that the students used the activity series of metals in terms of noble and ignoble metals to predict reducing agents. They exclusively used the electron model to explain redox reactions but some used partly the oxygen model in their reasoning in some of the redox reactions. The students showed an alternative conception in their explanation of the redox reaction of the laboratory work, compared to the scientific model. In the authentic situation the reasoning of the redox reaction became more scientific. The students' reasoning around the displacement reaction seemed scientifically reinforced.
74  Kalle Juuti, Jari Lavonen, Mari Vainikainen and Ismo Koponen. Analysis of communication in student teachers’ videos during teaching practice

Abstract: At the University of Helsinki physics and chemistry student teachers are taught to plan, organise and evaluate teaching during the first course of the pedagogical studies. In addition to basic teaching methods, the ideas of the communicative approach are introduced. Moreover, the students are guided to reflect on their teaching. During the teaching practice, the student teachers were asked to videotape one demonstration. In order to develop the first course, we analysed student teachers’ talk from their videos. There was authoritative/interactive talk in every student teacher’s video. Almost all of the 22 student teachers used dialogic/interactive talk. Based on the analysis, more emphasis should be paid to how to build teaching based on pupils’ ideas. Moreover, better software to guide reflection is needed.

107  Barbro Gustafsson. Dealing with the democratic aspects in science education

Abstract: More than 200 student teachers provided their written reflections on various arguments for scientific knowledge and literacy, often situating these in relation to their own school experiences. Many of them believe that scientific literacy is necessary, particularly for dealing with social issues related to nature and the environment. Also, many of them have missed – and are now requesting – democratic arguments in science education, describing current methods of science education as difficult, boring, and old-fashioned. They are surprised to see that scientific literacy and education can be motivated for democratic purposes, but they also report experiencing a clash between democracy and science with regard to both content and educational methods.

The lack of democratic aspects in science education and the contrast between subject matter and democracy form the starting point of this contribution, which problematises the relationship between teachers’ two main tasks: teaching subject matter and fostering democratic citizens. Supported by communicative perspectives on learning as well as research into the importance of dialogue for education in both subject matter and democratic competence, I propose that dialogue-based efforts could help bridge the gap between subject matter and democracy in science education. By democracy, I primarily refer to deliberative processes in which participants engage in mutual communication to discover how well their own and others’ arguments hold up when seen from a universal perspective. The idea that deliberative discussions are of both democratic and educational importance suggests that this type of dialogue can be seen as one possibility to integrate the teaching of subject matter and democratic competence. I suggest that education for sustainable development is a conceivable way to integrate discussions about complex social issues and scientific facts. I also outline a possible teaching scenario in which pupils engage in deliberative discussions on a theme involving these areas.
Abstract: Human dignity is supposed to be respected and maintained in democratic school systems. The problem is that there is no consensus about the meanings of human dignity, and hitherto, the standpoints among preservice teachers have been unclear. This study aims to analyse the Discourse of Human Dignity within teacher education. The corpus consisted of letters from preservice students where they discussed their understanding of human dignity. The data have undergone discourse analysis. According to this analysis, the discourse appears to a minor degree to be grounded in human rights. Instead, the findings showed that human dignity is charged with problematic issues related to biology, which might put human rights and democracy in peril. The findings have implications for teacher education.
Abstract for poster sessions 12th June 15:30-16:30

Strand: Outdoor education and sustainable development
Chair: Gustav Helldén
Room: Skáli

No. 27 15:35 Eli Munkebye. "Læreres bruk av støttende dialog for å fremme naturfaglig læring på småskoletrinnet, med naturen som undervisningsarena"  
No. 78 15:40 Pernille Ulla Andersen and Signe Søndergaard. Positive effekter af samspillet mellem undervisning og oplevelser i formelle og uformelle læringsmiljøer  
No. 117 15:45 Kristín Norðdahl and Stefán Bergmann. ActionESD: Educational action for sustainable development

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Eli Munkebye: “Læreres bruk av støttende dialog for å fremme naturfaglig læring på småskoletrinnet, med naturen som undervisningsarena”


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Pernille Ulla Andersen and Signe Søndergaard. Positive effekter af samspillet mellem undervisning og oplevelser i formelle og uformelle læringsmiljøer.


Kristín Norðdahl and Stefán Bergmann. ActionESD: Educational action for sustainable development

Abstract: The goal of the ActionESD project is to strengthen multi-disciplinary research and an integrated approach to educating for sustainable development in Iceland.

Its primary aim is to investigate ways in which education for sustainable development can be strengthened in schools. We need to ask: What types of educational practice lead to sustainable development?

The project has three objectives:
• To assess the status of education for sustainable development (ESD) in Icelandic schools in relation to Icelandic and international policies, for example the UN and the OECD.
• To develop, implement and evaluate action research projects in six Icelandic schools in order to provide guidance for schools and Icelandic society on education for sustainable development.
• To disseminate the results of the research and development work in Iceland and abroad.

We believe that educational action for sustainable development is based on the following three principles:
1. Developing knowledge and competences for sustainable development,
2. Encouraging respect for nature and society, and
3. Nurturing a sense of shared responsibility for our common future.

The project is carried out by a consortium of universities and six schools from different school levels, preschools included. Some masters and doctorate works are connected with the project. The methods used to collect data in the research project are: questionnaires, interviews, observations and analysis of documents.

The first part is finished and results from the analysis and interpretation of the policy regarding education for sustainable development in Iceland are presented in one of the sessions in the symposium.

The project will benefit students, teachers, schools, teacher education and educational policy. It will support a sustainable way of living and re-orienteering of the school curriculum.

The project is funded by the universities and Reykjavík Energy.
Britt Lindahl. POLLEN - Seed Cities for Science

Abstract: Science education is a decisive factor for future scientific and technical careers, but also a key instrument in the child developing process and the global educative approach leading to social inequality reduction and active citizenship. The current situation in Europe is agreedly far from satisfactory and a way to improve it could be experiences from the POLLEN project. This is a project supported by the European Union under the Science and Society part of the Sixth Framework. Its aims are to develop a model for the renewal of science education in primary schools based on an inquiry approach already successfully experimented with in most of the 12 participating countries which are France, Belgium, Estonia, Germany, Italy, the Netherlands, Portugal, Spain, Sweden, the United Kingdom, Slovenia and Hungary. POLLEN addresses critical issues such as attitudes of children towards science, involvement of the scientific community, and social conditions. Common methodological and organisational schemes, such as tools for teachers and trainers, e-centers, evaluation and dissemination strategies, are shared in order to amplify the added value of the exchanges (see http://www.pollen-europa.net/).

In an evaluation of different on-going EU projects done by High Level group on Science Education POLLEN is said to be a significant and adequate initiative as POLLEN demonstrates how its approach can be applied in different national settings. The specificity of POLLEN is that it promotes a change in the pedagogical approach used to teach science. Therefore the project is recommended for more funding in the future.

The participating community in Sweden is Stockholm with the national project Science and Technology for All. This is a project developed by The Royal Swedish Academy of Science. More information is to be found on http://www.nta.kva.se/. With this poster I will present the project and some results from the evaluation that I am responsible for.

Jack Holbrook, Claus Bolte, Cecilia Galvão Couto, Wolfgang Gräber, Martin Lindner, Rachel Mamlok-Naman, Claus Michelsen, Miia Rannikmae, Jan Alexis Nielsen, Pedro Rocha dos Reis, Piotr Szybek and Georgios Tsarpalis. Popularity and Relevance of Science Education and Scientific Literacy - The PARSEL Project in Europe

Abstract: A consortium of researchers from 8 European nations launched the PARSEL project to
- attempt to create a network community from those working on the same topic to develop relevant and interesting teaching-learning materials;
- assemble notions of ‘best practice’ from the diversity of considerations by partners;
- develop a model which encompasses philosophical consideration, learning theories and teaching approaches;
- modify existing exemplars, as appropriate,
- evaluate examples in the practice and
- make best practice teaching-learning materials available in a range of European languages.

In line with modern thinking, PARSEL is developed on an ‘education through science’ interpretation of science education. This means science teaching is expected to include all the goals of education. These include:
- Cognitive goals through which students acquire scientific conceptual learning,
- goals associated with the development of process skills and the nature of science,
- attitudinal and aptitude skills acquired through making the subject popular and relevant,
- communication skills, through written, oral, graphical, tabular and symbolic means,
- social skills strongly related to career enhancement and future everyday life within society.
To achieve ‘education through science’ goals, students are guided to: think rather than remember; do rather than listen; discuss within groups as well as work individually and be expected to find out; experiment; make predictions; as well as report orally and in writing on solutions, processes and decisions made.

In this poster we will present the PARSEL project including the PARSEL model for modules of creative science teaching.

4 Malin Ideland and Claes Malmberg. Lost in translation? Who is learning from SSI?

Abstract: Working with socio-scientific issues (SSI) is often said to be a successful way to engage students in science. Moreover it is said to make science relevant outside the school context. Work with SSI presupposes and may develop students’ competences such as problem-solving, information literacy and argumentation. But what students does SSI suit?

SSI-tasks deal with incomplete information, contain conflicting perspectives and media reports in this field are often biased. This means that students have to understand the context to interpret the tasks. In this study we compare how students from areas with different socio-economic status (SES) are able to deal with complex tasks, in which the students are supposed to retrieve information on their own. Our hypothesis is that so called mainstream students are more likely than non-mainstream students to encounter ways of dealing with complex issues since they are continuous with mainstream students' habits at home.

The research questions are: What differences are there between the two groups of students in their experiences of working with SSI? How do they use different sources to solve their tasks?

The data consist of questionnaires from 20 classes, 400 students and 20 teachers, in compulsory school in Sweden. 10 classes are from schools in areas characterized by low SES and high ethnic diversity. The other 10 classes are from areas with medium or high SES and low ethnic diversity, which means that the inhabitants are mostly ethnic Swedes. Criteria used for categorization in SES-groups are income, media use, employment level, educational level and family structure. The data are statistically processed during spring 2008.

The study is part of a larger study on what impact SSI have on Swedish students’ interest and learning.
Abstract: International comparative project ROSE (The Relevance of Science Education) engaging 15 year old students in Latvia (Spring 2003) showed basic similarities between the students’ interest to study many topics of natural science in Latvia and Nordic countries. At the same time, the median (Likert scale; 1≤M≤4) of the whole sample of Latvian students was slightly higher than that of the Nordic students. In addition, stronger cognitive interest in science was observed in Russian-speaking schools in Latvia.

During the academic year 2006/2007 a smaller project was launched based on the ROSE instrument. The basis of the research was analysis of 9th grade students’ answers, but for comparison investigations of connectedness were carried out in 8th, 10th, 11th and 12th grades (in total 745 students). Keeping the same 108 topics of science in the ROSE questionnaire, the respondents marked their interest to study the topic and what motivated their choice. The responses were analyzed not only by gender and Latvia’s regions, but also by the students’ attitude to school science (4 typological groups, including science-enthusiasts and science-negationists).

The comparison of results in 2003 and 2006/2007 shows an overall decrease in the interest for biology, physics and chemistry of 15 year old students in Latvia (lower average value). The students’ interest in medicine (health) and environmental topics has increased; however the interest in mysterious phenomena (pseudoscience) has decreased. Students are still least interested in botanical and agricultural topics. There is an overall increase in the interest in chemical substances, atoms and molecules.

Girls’ interest in chemistry topics has slightly increased, though it is still much lower than that of boys. At the same time, there are schools where the gender difference in responses is negligible, moreover the responses in these schools show a stronger desire to study these topics (M>2,5). However, gender stereotypes still dominate in motivation responses.

Abstract: The poster explores preliminary findings of research carried out by members in the Nordplus netværk Alka-net (http://www.alkanet.dk/) to see what kinds of ideas 6 year old children in the Nordic countries have about the human body e.g. structure and location of bones and organs (heart, lungs, stomach, brain, etc.) and the function of these before being taught about it formally at school. The research idea builds on and aims at extending further ideas emerging from an Icelandic PhD study: The development of children’s ideas about the body: How these ideas change in a teaching environment (Gunnhildur Óskarsdóttir, 2006). Twenty 6 year old children in each country are chosen and asked to draw the bones and the organs in the body. The drawings are analysed by using special scales (Reiss and Tunnicliffe, 1999). Each child is also asked about the names of the organs they draw.

The aim of the research is to see if there is a difference between the ideas of children in the different Nordic countries and if so what kind of difference. The aim is also to make a joint project between the countries, and to develop, in light of the results, a programme for teacher education in the teaching institutions involved in the Nordplus Alka netværk.
Britt Lindahl and Maria Rosberg. Students’ attitudes towards and interest in science. A report from the research project “Science for Life”*

Abstract: According to the EU there is a strong need to renew science education to bring about a radical change in young people’s interest in science education. The current importance of this question needs to be even more emphasized as young people’s interest in choosing a scientific career is declining. One way to increase students’ interest in science can be to bring in a humanistic perspective and to focus more on scientific literacy than science literacy. To be scientifically literate means to be able to understand and take part in the public debate about socio-scientific issues, to form a personal opinion and to make decisions using both knowledge in and about science, from other knowledge areas and to consider personal values.

We have designed an evidence-based research project to understand more about how and why students in lower secondary school develop interest, knowledge and self-efficacy working with socio-scientific issues. The project is built up in three steps. In the first we have developed a teacher guide with six authentic cases. In next step about 1500 students will answer a questionnaire, work with the cases and then answer another questionnaire. Many of the questions have earlier been used in different contexts and therefore it will also be possible to compare the results from this study with others to see if there are any tendencies of change. In the last step we will perform a qualitative study in about 6 classes.

On the poster the first preliminary results from the first student questionnaire will be presented. Here we will give a picture of about 1500 students’ views of science education and science in society. We will also compare girls’ and boys’ views of science and compare their interest in science with other subjects in school.


Annette Zeidler. Experiments in science as homework

Abstract: Less time is spent on science homework and tests in Sweden than in other countries. Classrooms in primary schools are usually not planned to allow experimenting where water is involved. From research in other countries we know that there is a strong link between time spent on homework and achievement. Solomon (2001) has found that children talked much more when experimenting at home and that the worth of using experiments as homework lies in the possibility of making children interested in science and enjoying it. These positive feelings will have an effect on children’s self-confidence when meeting science in school. This study aims to deepen our understanding of how experiments in science/chemistry as homework could be a means of enhancing understanding as well as interest in science/chemistry among pupils. Four classes have followed a chemistry module of three lessons including two experimental homework tasks. The results so far indicate that time spent at home on experiments help to develop an interest among both parents and pupils. An unexpected result is that instead of carrying through the experiment together, parents acted as ‘teachers’ to their child.
**Karin Due. To challenge images of physics in the classroom**

Abstract: Presented work is part of a PhD-study about the connection between gendered discourse positioning and learning physics in small group discussions. In the poster I describe images of physics, physics learning and the physics student, expressed in group discussions and in interviews. 8 groups of 3-5 upper secondary school students were videotaped solving problems together. Afterwards 15 of the students were interviewed. Transcripts from the discussions and interviews were analysed by means of discourse psychology and different discourses about physics were identified. The result illustrates how the subject physics is talked about as something that is related to formulas, logic, correct language, right answers and as something that must be understood. However, counter-discourses were also expressed e.g. in terms of feelings as arguments.

In the poster I discuss how physics could be taught including both rational thinking and emotional aspects. It is further discussed how physics can be taught as abstract, universal and relevant in a lot of different contexts and at the same time as something that is a human product and experienced by humans.

**Margareta Enghag, Torbjörn Brorsson, Tommy Englund and Bo Wahlqvist. Learning Study in mechanics – Newton’s second law.**

Within a learning study (Marton & Ling, 2007), a group of teachers work together with a researcher to improve the students’ learning outcomes of a learning object that is found to be of special difficulty for the students. The learning study cycle proceeds from 1) the students’ pre-conceptions, 2) the teachers’ experiences, and from 3) insights from didactic research. A learning study consists of several lessons, in which the critical aspects of learning are identified and varied. Pre- and posttests regarding the students’ conceptual understanding are given. Each lesson is videotaped and all the teachers analyze the film, or are present in the classroom, during all lessons. Learning studies are a step towards use of research-based teaching.

There are several physics concepts that give students in upper secondary school difficulties. Newton’s second law is one of them, as it is contra intuitive and shows a big step from everyday thinking to the scientific way to see how forces have an impact on speed and acceleration of objects. Students face different learning demands (Scott, 2005). Especially Newton’s law give students a big learning demand. In this study, the aim is to contrast the teaching of Newton’s Law in a way that has an impact on learning outcomes. We focus especially on the classroom talk, and how different activities give different types of talks. We use the communicative approach (Mortimer & Scott, 2003) in order to analyze the classroom conversation.

The result so far show that the teachers’ approaches are very different. The most experienced teachers use an interactive/dialogic talk even during the demonstrations, and take time to let the students express their views. The students work part of the lessons in groups, and discuss and work on tasks that are demanding, especially in the way the students have to use algebraic notions instead of complete calculations. The students’ results in the Force Concept Inventory test given four weeks after the intervention are high. Other teachers use a completely different way to let the students work for themselves with experimental problems in a laboratory portfolio book, where they make their own notes, which the teacher takes part of later. Those students results are low in the Force Concept Inventory test four weeks after the lessons. We discuss these very different ways of teaching, and the teachers share approaches as they now are prepared to start another cycle of lessons. They are very interested in learning from each other’s lesson designs. We have not reached a level where we are ready to vary fine-grained levels in the design of the lesson, but the four teachers aim to find a teaching design that addresses a more communicative approach, as it seems to give results concerning both student learning and interest in the lesson.
Christina Ottander and Margareta Ekborg. Characteristics of Socio Scientific Issues that are interesting to pupils and teachers.

Abstract: We present initial results from a research project aiming at investigating how pupils and teachers develop interest and knowledge in science when working with socio-scientific issues (SSI). The theoretical framework developed for modelling and analysing authentic socio-scientific cases has been submitted to the conference (Ekborg et al.). So far, research concerning work with SSI has not particularly discussed the characteristics of the content of the issues. We need more detailed knowledge about what features, in content and organization of the SSI, affect the development of interest, knowledge and self-efficacy among the pupils. The socio-scientific cases developed and used in this project are relevant according to characteristics of SSI described by Ratcliffe & Grace (2003) and to the national curriculum.

During the autumn of 2007 approximately 2000 pupils in Sweden worked with one or several cases. A questionnaire-based instrument was used to measure the affective domain of students' attitudes towards, and interest in, science. The students were asked to answer one questionnaire before starting to work with the first case and a second questionnaire after finishing a case. The theoretical base for development of the instrument and a description of how we will consider the multivariate characteristics of student and the situation (and in later stages of the research project - the learning outcomes) has also been submitted to the conference (Lindahl & Winberg).

On the poster the first preliminary results of which components of the tasks are most influential on students' interest to work with socio-scientific issues in secondary school will be presented. How do the task characteristics relate to students' affective and cognitive experiences during the work with the cases? Will, for instance, the context influence boys and girls differently?

1 Hvornår, hvordan og hvor meget anvendes it i naturfagsundervisningen?
2 Hvad er lærernes holdning/tilgang til og oplevelse med brug af it i naturfagsundervisningen?
3 Hvordan er skolens rammer og lærernes forudsætninger med hensyn til brug af it i naturfagsundervisningen?

Undersøgelsen dokumenterer blandt andet at it anvendes i størst omfang til lærerens egen forberedelse af undervisningen og elevernes informationssøgning. Naturfagspecifikke it-værktøjer som datalogning og robotter, anvendes meget lidt i naturfagsundervisningen, dog noget mere i fysik/kemi end i andre naturfag. Naturfagslærerne har behov for vejledning og efteruddannelse, hvis de for alvor skal benytte sådanne værktøjer i undervisningen. Dog viser undersøgelsen at de generelle efteruddannelseskurser i it, ingen effekt har. Det er først når efteruddannelseskurser kombinerer fagligt indhold og it, at det får lærere til at tage naturfagspecifikke it-værktøjer i brug. Lærerne vurderer at IT har positiv effekt på deres forberedelse til undervisningen, og til en vis grad også til formidling af naturfag. Umiddelbart skulle man forvente, at brugen af IT ville have en positiv effekt på undervisningsdifferentiering, men undersøgelsen kan ikke bekræfte det. Mangel på velegnede digitale læremidler fremhæves som en væsentligst barriere i forbindelse med inddragelse af it i naturfagsundervisningen. Posteren vil, udover at præsentere flere resultater, fokusere på mulige forklaringer og implikationer for undervisning og fremtidige indsatsområder for efteruddannelse.

Peer Schröder Daugbjerg and Søren Cruys-Bagger. Long-term effects of a climate change teaching campaign – a case study.

Abstract: Danish Society for Nature Conservation tours Denmark in 2007, 2008 and 2009 with a campaign on education in relation to climate change. The campaign is called Klimakaravanen (www.klimakaravanen.dk) – Climate Caravan. The campaign bus visits one school in 80 Danish municipalities. The visit focuses on demonstration of energy saving technology in households and discussions of CO2 reduction in general. This is typically conducted as a whole-day thematic teaching in relation to natural science and social science. It is expected that 9000 pupils in 2008 have worked with the educational materials from the campaign.

The authors perform, in association with School of Education, Aarhus University, an evaluation of the long term effects of the campaign visit. We ask the teachers to formulate the change in their education using wiki questionnaires on a separate website - http://klimakaravane.wikispaces.com/. We are interested in how the teachers are including climate topics in their teaching after the campaign visit. The answers will be analysed for the teachers’ knowledge and understanding of climate science, the craftsmanship performed by the teachers in their education, the relation to technological companies and civil society and finally teaching skills in regards to planning, performing and evaluation of teaching.

This will be summarized as the footprint of the campaign on the visited schools, in terms of science education and culture. The perspective of the case study is to extract guidelines for obtaining sustainable change in teaching in regard to climate change. The wiki questionnaire will be performed in spring of 2008.
The poster will focus on the methodological aspects of using wiki webpages as an evaluation tool. Preliminary results will only be presented to illustrate the type of data that can be obtained by using a wiki questionnaire. The study is financed by the Center for Science Education - www.cand.nu

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Inger Holmberg. Why does it rain? Student teachers’ conceptions about rain and how they teach about this subject (poster)

Abstract: Student teachers subject matter knowledge of the phenomenon connected to how it rains, and their way of teaching about this, has been studied and is the content of this poster. 15 students were asked to explain why it rains both in writing and orally. Eight of them also presented recorded lessons where they taught about this subject. The students were trained for teaching science in primary schools and had different backgrounds. Only four of them had studied science in upper secondary school. The study shows that everyday explanations are common among the student teachers. Their level of understanding is often similar to the level among the children they are trained to teach. A school book survey about how rain is explained indicates that the books seldom tell the whole story and that the explanation to why it rains is divided between the physics and the geography subjects. The study also shows a positive correlation between the students’ subject matter knowledge and their ability to challenge their pupils understanding and make variation in their lessons. An analysis of the talk in the classroom shows that the talk varies from something similar to lecturing to a lesson where the pupils more or less guide the direction of the talk. The different communicative approaches make the views of the pupils more or less visible and the scientific story more or less told. The conclusion is that subject matter knowledge is important for how the students teach and vice versa, and that an analysis of the talk in the classroom has potential in understanding how teachers challenge their pupils’ understanding.

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Lars Bo Kinnerup and John Andersson. Science, Life Science and Technology på læreruddannelsen


I undervisningen har vi lagt vægt på, at de studerende får lejlighed til at arbejde med den naturvidenskabelige arbejdsmetode/tankegange samt, at de oplever en praktisk og eksperimenterende måde at tilegne sig kundskaber og færdigheder på.

I et af forløbene, hvor det faglige indhold drejede sig om “kræfter”, blev de studerende efter en gennemgang af de to grundlæggende typer kræfter (skubbende og trækkende) stillet overfor opgaven: I skal bygge en bro, som spænder 1 meter. I må bruge de udleverede materialer således:
- træ må kun anvendes i lodret position
- avispapir kan anvendes valgfrit
- snor kan anvendes valgfrit

De studerende, der var inddelt i grupper på 3 – 4 personer, var først lidt tøvende overfor opgaven, men efterhånden som snakken kom i gang, skred arbejdet frem. Disse aktiviteter foregik om tirsdagen og sideløbende med dette arbejdede de om onsdagen med følgende generelle model for udvikling af forståelse:
Kombinationen af det praktiske arbejde og refleksionen over det, sat ind i rammerne af den teoretiske model, var frugtbar, og ideudviklingen blev virkelig sat på prøve, da vi indførte belastningsforsøg på brokonstruktionerne i form af mursten. Dette gav gruppernes arbejde med at udvikle forbedringer autencitet, med deraf følgende fokuserede diskussioner og aktiviteter.

Dette forløb understregede to ting:
1. værdien af naturvidenskabelige metoder som didaktisk ramme
2. at undervisningen bør rumme mulighed for praktiske og eksperimenterende aktiviteter

- Og det vil fortsat være bærende elementer i Science, life science and technology!
Abstracts from paper sessions 3 13th June 10:15-12:15

Strand: Interests and attitudes  
Chair: Stefán Bergmann  
Room: H-201

No. 59  10:20  Margareta Ekborg. The case of genetically modified plants – secondary school pupils’ opinions

No. 51  10:55  Hanne Moeller Andersen. Elevers motivation afhænger af andet end undervisningens faglige indhold

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Margareta Ekborg. The case of genetically modified plants – secondary school pupils’ opinions.

Abstract: This paper presents results from a study with the following research questions:
• Are pupils’ opinions on genetically modified organisms (GMOs) influenced by biology teaching?
• What is important for the opinion pupils hold and how does knowledge work together with other parameters such as values?

64 pupils in three upper secondary schools answered questionnaires, in which they expressed opinions and gave arguments on applications of GMOs, before and after biology courses. The pupils’ knowledge of genetics and GMOs was also investigated. Eleven pupils were then interviewed in order to go into argumentation in more depth. Results from questionnaires show more pupils were positive about genetically modified tomatoes after the courses. No correlation was found between knowledge of basic genetics and opinion. Most of the pupils could express arguments for and against the applications but they built their personal opinion on different arguments. An important concern was potential risks. This was confirmed in the interviews. Few had any idea of how the different applications are risk assessed or how scientists work. Depending on risk judgement and/or how they trusted scientists, the pupils came to different opinions. Other important factors for opinions were the purpose of the application, the time perspective and emotions.

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Hanne Moeller Andersen. Elevers motivation afhænger af andet end undervisningens faglige indhold


Jan Sølberg. Investigating local school science cultures in order to facilitate long-term educational changes in science teaching

Abstract: In order to achieve and maintain high levels of quality in science teaching it has repeatedly been noted by researchers that schools need to develop local school science cultures (LSSC) that can facilitate long-term educational changes. This paper describes a model for understanding LSSC that can be used to identify the complex, local, socially defined factors of individual schools that either work to maintain existing practices or that can become potentials for change and development.

The model was developed through an empirical investigation of a large development project called Science Team K (2003-2006) using a combination of quantitative and qualitative methods (mainly case studies).

LSSC are defined here as the emerging result of the ongoing negotiation through participation in practice between key actors of relevance to science teaching in schools. They are created, developed and maintained through the influence of a wide range of contributing factors that can be categorized into two closely interrelated categories:
- Key actors of the school
- The relationships between key actors

Drawing upon organisational and complexity theory this model presents an analytical as well as a developmental tool that can explain why so many change initiatives fail to generate long-term results. The paper discusses the implication and educational potentials of adapting this model in facilitating educational change.

Auður Pálsdóttir, Ingólfur Á. Jóhannesson, Gunnhildur Öskarsdóttir and Kristín Norðdahl. Education for sustainable development in the Icelandic public school curriculum

Abstract: As a part of a research project called ActionESD (Educational action for sustainable development) we analyzed and interpreted the policy of the Icelandic government, as presented in laws and the national curricula, the policy of selected local authorities and the policy of selected non-governmental organizations regarding education for sustainable development.


The main findings of the study are that the curriculum for early childhood, primary, and secondary schools in Iceland give opportunities for an increased emphasis on education for sustainable development. The schools themselves are responsible for putting the policy into action in the school curricula, and they also have some space for doing so. However, the education for sustainable development policy is mostly hidden in the curricula and it is up to the schools to interpret the curricula.
Abstract: Despite social changes and political efforts to establish equal opportunities, women are still a minority in the fields of natural sciences and technology studies. At the same time, technologically-oriented studies are not less interesting for women, but their motivation, interests, learning styles, goals and demands often vary from those of men. The broad interests of women often are opposed by a unilateral, outdated, techno-centric learning-/training program, which is not only unattractive to women, but also bypasses the demands of modern education and the job market. A change within the curricula towards a support of non-technological basics and social skills would thus not only support the interests of women and men but also follow the demands of economy. The GALILEA project, located at the TU Berlin, is developing several models of co-educative, gender-sensitive model-courses within the three areas: Natural Sciences, Computer Sciences and Engineering.

A lack of diversity in technical conception and development reduces the potential of ideas and innovation within a society, as well as the quality of products, resulting in a loss of competitiveness for a business. For companies, the absence of women in the technical fields amplifies another problem: the demand for qualified specialists is increasing and cannot be satisfied by men alone. Technical studies are connected to a disadvantageous image that conflicts with feminine preferences and approaches and keeps young women and, increasingly, even young men away.

Within the project GALILEA several model courses were developed. All courses are based on an ambitious theoretical education in the respective areas and a broad variety of possible elective courses which can be combined very flexibly. The model-courses all emphasize a thorough mathematical education which reflects the increasing importance of mathematical modeling and simulation in all fields of Natural and Engineering Sciences.

Due to the Bologna declaration, European universities provide an ideal setting for these types of model-courses, since traditional studies are currently modularized into Bachelor and Master courses, which quite naturally implies that the contents of the studies are reviewed and ideally modernized. Thus, it is the perfect opportunity to integrate gender-sensitive components into curricula and teaching models.
Priot Reiska and Helmut Dahncke. Handling of natural growth in interdisciplinary science lessons - seeing global problems of environmental relevance from students’ local perspectives

Abstract: Our starting point is environmental education as a good example of an interdisciplinary approach in teaching.

In this paper we focus on two central problems:
- do students understand the relevance of environmental problems as a global rather than a local perspective?
- is it possible to combine mathematics to environmental items? (e.g. the difficult concept of natural growth of environmental quantities by means of the e-function f(x)=ex).

We started with a self-assessment of students based on TIMSS and had teaching activities on problems such as natural growth, that normally follow the e-function f(x)=ex, as well conducting in-classroom activities such as interviews. We collected data in Estonia, Germany and in the U.S. using questionnaires, paper-pencil-tests and interviews.

The self-assessment shows the students’ general relation to science is positive. Despite their generally good relation to science teaching they don’t head for more science lessons in school. Nor do students in Estonia and Germany see any future gain from it, neither at university nor as job-applicants. This is noticeably different with the students in the U.S. They rate science as well as school science lessons as helpful for getting into the university of their choice and as support for daily life.

Our outcomes show that there is a rather simple way to teach exponential growth without the difficult mathematics of e-function f(x)=ex and logarithm ln x. We did so by simple calculation of percentages and ‘doubling-periods’. The common result is that we find a local rather than a global point of view. But the consequences for different items aren’t the same.

Following the principle “What touches me has to be the most important environmental problem” brings about the same rating of virus diseases in Estonia, Germany and the U.S. but different ratings of global population increase.


Abstract: According to many stakeholders there is a strong need to renew science education to bring about a radical change in young people’s interest in science. One way to increase students’ interest in science can be to bring in a humanistic perspective and to focus more on scientific literacy than science literacy. We have designed an evidence-based research project to understand more about what happens when students in lower secondary school are working with socio-scientific issues. Concepts within the affective domain are very complex and therefore many researchers have claimed that we have to construct multidimensional instruments and use multivariate analyses to interpret the results, as science learning cannot be explained solely by examination of cognitive factors.

The project is built up in three steps. In the first we have developed a teacher guide with six authentic cases and attitude questionnaires. In the next step about 2000 pupils work with the cases and answer the questionnaires and in the last one we will perform a qualitative study in about 6 classes aiming at studying teacher and student development in more detail. In this paper we present the development of two questionnaire-based instruments that allow us to simultaneously consider the multivariate characteristics of student, the situation and the outcomes and how they relate to each other. A large number of items were collected from extant questionnaires and if necessary, adapted to Swedish conditions. In addition, new items were constructed, based on theory within the relevant fields of research. The aspects we want to assess besides different types of knowledge outcomes are for example attitudes, motivation, epistemological beliefs, self-efficacy and the impact of different working forms.
Marianne Mortensen, Carl Winsløw and Robert Evans. Museographic transposition: a didactical approach to museum exhibition design

Abstract: Science museum exhibitions are important educational devices; yet exhibition design remains based on inspired guesswork and instinct rather than theory or empiricism. The aim of this presentation is to introduce the framework of museographic transposition as a theoretical approach to museum didactics. The framework of museographic transposition is based on an epistemological approach to the science subject or theme to be exhibited, and distinguishes itself from other museum learning research by taking a holistic view of exhibition design which encompasses the transformations of knowledge from the source (scientific articles, textbooks, etc.) through the exhibition planning and the exhibition itself to the visitor. A case study is presented as an example of the use of the framework in which an existing exhibition component is critically analysed in terms of its stated objectives. The analysis presented, although based on preliminary data and thus non-exhaustive, illustrates how museographic transposition may be used to discern opportunities and constraints in exhibition design, but more importantly, how new ideas and approaches for exhibition design may be generated on the basis of the scientific subject or theme to be exhibited.

Gustav Helldén and Sofia Helldén. Students’ early experiences of biodiversity and education for a sustainable future

Abstract: In order to be able to help students to read nature and to get an ability to discern biodiversity in different contexts and discern changes in the environment we need to investigate how they experience biodiversity and how they discern different components in an ecosystem. Therefore, we undertook an interview study of fifteen 10-12 year old students’ experiences of biodiversity and how they discerned organisms in different ecosystems. Besides the students’ ability to discern organisms, we analysed how they described the organisms and how they referred to experiences from everyday life when they talked about the plants and animals. In order to be able to carry out a more complete analysis of the interviews, we interviewed the students again 2 years after the first interview occasion. After they had individually listened to their previous interviews, we asked them to comment on what they had said 2 years before. Seven of the fifteen students had developed a good ability to discern and describe plants and animals. They did not always know the names of the organisms but could often give detailed and colourful descriptions of what they saw. Episodes they had experienced with family members seemed to be of great importance for them when they tried to identify organisms. Another group of eight students showed only a weak ability to discern organisms. They did not talk about characteristic features of the plants and animals. They seldom referred to personal everyday life experiences. Experiences of biodiversity at an early age seemed to be important for future development of their understanding. It is important that teaching takes students’ early ideas into consideration in teaching for lifelong learning and for a sustainable future. We also need to give students real experiences of biodiversity and opportunities to talk about their experiences in nature.
Strand: Scientific literacy  
Chair: Allyson Macdonald  
Room: H-208

No. 24  10:20  Christine Tippett, Larry Yore and Robert Anthony. Creating Brochures: An Authentic Writing Task for Representing Understanding in Middle School Science

No. 60  10:55  Jan Alexis Nielsen, Martin Lindner, Claus Bolte, Cecilia Galvão, Wolfgang Gräber, Jack Holbrook, Rachel Mamlook-Naaman, Claus Michelsen, Miia Rannikmae, Pedro Rocha dos Reis, Piotr Szybek and Georgios Tsarpalis. Popularity and Relevance of Science Education and Scientific Literacy - The PARSEL Project in Europe

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Christine Tippett, Larry Yore and Robert Anthony. Creating Brochures: An Authentic Writing Task for Representing Understanding in Middle School Science

Abstract: This project is one of several being conducted at the University of Victoria’s Pacific Centre for Research in Youth, Science Teaching, and Learning (Pacific CRYSTAL) supported by the Natural Sciences and Engineering Research Council (NSERC) of Canada. Our focus is the development and implementation of innovative teaching approaches that facilitate increased scientific literacy, within a theoretical framework of fundamental and derived literacy. Our project explores the interaction between literacy tasks and science learning and examines the contributions of direct scientific language instruction embedded in regular science programs. This presentation describes teachers’ use of an authentic writing task—creating an informational brochure—that allowed students to enhance, consolidate, and demonstrate scientific understandings. We examined how teachers implemented the informational brochure activity and how that activity impacted students’ subsequent comprehension and interpretation of novel science concepts that were presented in a brochure format. Participants were grades 6 and 7 middle school science teachers from one local school district. These teachers were part of a larger group that has attended a series of professional development workshops over the last two years. Teacher response to the brochure genre was favourable: at the introductory workshop, all teachers reported that they would use brochures with their science classes. Classroom observations confirmed teachers’ reports that students completed brochures enthusiastically, with an unusually high percentage of assignments handed in on time. Students with a range of special needs were able to produce brochures that met the established criteria. It appears that when middle school students participate in the authentic science writing task of creating informational brochures they are highly engaged and are able to demonstrate their understanding of science concepts.

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Jan Alexis Nielsen, Martin Lindner, Claus Bolte, Cecilia Galvão, Wolfgang Gräber, Jack Holbrook, Rachel Mamlook-Naaman, Claus Michelsen, Miia Rannikmae, Pedro Rocha dos Reis, Piotr Szybek and Georgios Tsarpalis. Popularity and Relevance of Science Education and Scientific Literacy - The PARSEL Project in Europe

Abstract: The European Commission concern that ‘Europe needs more scientists’ (2004) was recently supplemented by the call for “Science now” (Rocard et al. 2007). Our societies, regardless of any cultural differences, need scientifically literate citizens (NRC, 1996; Bybee, 1997; DeBoer, 2000; Holbrook & Rannikmae, 2002; Fensham, 2004; Brown et al., 2005; Bolte 2003; 2007). This is seen as being broadly consistent with the EU’s Lisbon agenda - to become the world’s most dynamic knowledge-based society. Scientific literacy furthermore stresses the social dimension – “the capacity to use scientific knowledge to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity” (OECD, 2003). Other definitions go further and include everyday life relevance (Holbrook and Rannikmae, 1997; Bolte 2006) and responsible citizenship (Zeidler et al., 2005). Unfortunately research shows a decline of interest in science among students, especially girls (Gräber, 1998; Bolte 2006, Sjöberg 1997).

A consortium of researchers from 8 European nations launched the PARSEL project to - attempt to create a network community from those working on the same topic to develop relevant and interesting teaching-learning materials;  
- assemble notions of ‘best practice’ from the diversity of considerations by partners;  
- develop a model which encompasses philosophical consideration, learning theories and teaching approaches;  
- modify existing exemplars, as appropriate,  
- evaluate examples in the practice and  
- make best practice teaching-learning materials available in a range of European languages.

In this talk we will present the PARSEL model and some of the modules of creative science teaching. We will further reflect on strategies to implement the PARSEL-Modules into teachers’ professional work.
**103**
**Birgitte Stougaard, Beth Wehner Andersen, Alex Schou and Jens Jakob Ellebæk. Partnership between informal learning environments and the educational system**

Abstract: The idea of this project was to make a joint project and partnership between teacher education, schools, informal learning environments and universities to strengthen interest and motivation for learning science. Several studies show that the preparation of visits and the subsequent use of visits are crucial for the learning outcome in connection with use of informal learning environments (Rennie et. al. 2003; Falk & Dierking 2000). A preliminary study by Nielsen et al. (2007) shows that also from the perspective of most of the informal learning environments, the degree of success of such visits is crucially connected to the degree of teacher involvement regarding pre- and post-visit treatment at the schools. With examples from the use of informal learning environments ranging from a sewage plant, an observatorium, a zoo and a science center to visits in the nature, the following questions will be discussed: Does a successful visit always need pre-visit treatment? How to involve student teachers and professional teachers in the planning of visits? In which way can the use of informal learning environments in teacher education be qualified? How to strengthen the reciprocal transparency; i.e. the transparency between the teacher’s professional intentions with the visit and the educational strategy of the informal learning environment?

**56**
**Lena Renström. Teacher Educators’ and Student Teachers’ conceptions of Teaching and Learning**

Abstract: In this study five teacher educators and eight student teachers were interviewed about how they interpret one of the objectives in the curriculum for the teachers’ education in Sweden. The objective concerns teaching and learning “to transform good and relevant knowledge in subjects and subject areas so that all students will learn and develop”. The study has its base in the phenomenographic approach and the theory of variation. The contextual analysis of the transcripts reveals six conceptions of teaching and learning. The conceptions are caught in the following categories of descriptions:
I: The subject which is taught in school
II: Subject-teacher is an entity
III: The subject is transformed to the student
IV: The subject is exposed to the student
V: Student’s prior knowledge is related to the concept structure of the subject
VI: The subject is seen as a human construction

Relations between the conceptions and their aspects, and architecture of the variations are described in a system of the concepts which has the form of a staircase and is referred to as “The Staircase of Teaching” in this study. The staircase of teaching shows how the qualitatively different conceptions of teaching increase in complexity and how new aspects of each conception color all the aspects of the previous conception. The aspects are subject, the role of the teacher, the role of the student, learning, the structure of the concepts and the thought-subject relation. Five qualitatively different meanings for the concept of learning are described in this research.

The outcome space of the six categories of description shows how teacher educators and student teachers conceptualize the objective in terms of teaching and learning. The result of the study might have important implications for teacher education in; writing course curriculums, students’ assignments, criteria for grades, assessment, and evaluating reports.
Bjørn Håland. Teacher-training students’ conception of matter and substances - some results from 31 interviews.

Abstract: Recent research has shown that, in addition to the particulate view of matter, the concepts matter and substances are crucial to the understanding of chemistry. This investigation tries to bring forward some knowledge about what Norwegian teacher-training students think about matter and substances and to what extent they use a particulate view of matter explaining physical and chemical phenomena. Common relevant anchoring concepts, available for introductory chemistry education, were searched for.

31 students were interviewed before they started on an introductory course in chemistry for teacher-training students. The interviews were semi-structured and linked to a sorting task and some demonstrations. All the interviews were tape-recorded and some photos were taken.

It was found that 21/31 students had one to several views on matter (“stoff”) that did not correspond to the scientific view. Most students seemed to have a rather vague notion of the concept substance. None of the students gave explanations that revealed anything near a complete (basic) particulate view of matter. Only 4 students used some sort of particles relatively consistently across more tasks (4-8 times).

Summing up over all three main aspects discussed, 28/31 students either have some kind of view of matter and / or substances deviating from the scientific one or they used ideas about particles only sporadically.

Relevant anchoring concepts seemed to be rather limited. As all students recognized solid substances as matter, this could be used as one common starting point. As most students spontaneously introduced some sort of particles in their explanation of the dissolving of solid matter (salt) in water, this might be the best starting point for the introduction of the particulate model of matter.
Abstracts for paper sessions 4 13th June 13:00-15:00

Strand: Gender studies
Chair: Margareta Ekborg
Room: H-201

No. 98  13:05  Guðrún Jónsdóttir. Naturfag nå!
No. 57  13:40  Lars Ulriksen and Henriette Tolstrup Holmegaard. Drenge og piger i det danske tekniske gymnasium (htx)
No. 30  14:15  Kristina Andersson and Anita Hussenius. Gender Theory as a Tool for Analysing Science Teaching

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Guðrún Jónsdóttir. Naturfag nå!


57
Lars Ulriksen and Henriette Tolstrup Holmegaard. Drenge og piger i det danske tekniske gymnasium (htx)

Abstract: Dette paper præsenterer resultater fra en del af et forskningsprojekt om htx (højere teknisk eksamen). Htx er en treårig dansk gymnasial uddannelse med vægt på teknik og naturvidenskab. I papiret fokuseres på spørgsmålet om køn, ikke mindst i lyset af at 80 % af eleverne på htx er dørende. Papiret tager afsæt i forståelsen af identitet, herunder køn, som noget der udvikles i et samspil mellem den enkelte og omgivelserne, og hvor der er nogle positioner, som er mulige at indtage (dvs. mulige måder f.eks. at være pige på htx på), mens andre er lukkede. Positioner som er lukkede for nogen, kan være åbne for andre. Analysen bygger på både kvantitative og kvalitative data.

Analysen viser, at pigerne er glade for at gå på htx, og på mange måder fungerer fint. De kvalitative dele viser, at de positioner, som er til rådighed for pigerne sætter grenser for, hvordan de kan indgå i skolen, først og fremmest i forhold til deres kropslige fremtræden, som har betydning for oplevelsen af deres faglige kompetence. Hos drengene ses en ambivalent, som er knyttet til de positioner, pigerne gives, og drengenes egne muligheder for at vise den seksuelle del af maskuliniteten.

Analysen bekrefter tidligere undersøgelser af den tvetydige opfattelse af piger inden for det tekniske og naturvidenskabelige område og bidrager med at vise, at både drenge og piger rammes af den snævre forståelse af piger og faglighed. Samtidig viser analysen at selv om der er forskelle i hvilke emner piger og drenge interesserer sig for, lægger de vægt på de samme kendeteogn ved teknik og naturvidenskab. Der er således en risiko for at overbetone forskelle, og overse fælles træk.
Kristina Andersson and Anita Hussenius. Gender Theory as a Tool for Analysing Science Teaching

Abstract: Attempts to reform science education have to a minor extent taken into account that gender issues may have an influence on the pupils, their learning and interest. Therefore, examples of using feminist or gender theories for analyzing or planning science education are difficult to find in the literature (Nyström 2007, Sinnes 2006). The aim of this study is to examine to what extent experienced teachers apprehend the gender order within the scientific classroom and also to explore if it is possible to achieve a change in these apprehensions. In-service teachers have unprepared written down their reflections about a real classroom situation, a case, and afterwards got the task of analyzing the situation once again after reading a gender theory. The teachers’ texts have been analyzed in several steps: first, the written material was analyzed to find and form categories of relevance; second, sections were raised that pointed out if the teachers had used the gender theory and in what way they had used it; and third, a comparison was made on an individual level of the teachers’ explanations in the two different tasks. The results show that the participating teachers’ understandings about gender and society were challenged, which is expressed in different ways in their texts. One group of teachers was able to apply the theory on the concrete classroom event, another group had a discussion on a more general level, while one teacher showed a resistance to the theory and thereby also to the task. The fact that the teachers deepen and widen their interpretation of a real classroom’s event when they get access to a gender theory indicates that this method can be applied in teacher education. The usage of cases can be an instrument to link theories to practical work.
**Strand: Technology and science education**  
**Chair: Berit Bungum**  
**Room: H-202**

**No. 112**  
13:05 Svanborg R. Jónsdóttir and Allyson Macdonald. The silence of innovation education in Icelandic science classes

**No. 73**  
13:40 Björn Andersson, Maria Svensson and Ann Zetterqvist. Några uppgifter som belyser elevers uppfattningar om vad som är teknik

**No. 2**  
14:15 Pal J. Kirkeby Hansen. Analyzing cases in technology and design education: How could designing and making technological products be a vehicle for enhancing understanding of natural science principles?

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**112**  
**Svanborg R. Jónsdóttir and Allyson Macdonald. The silence of innovation education in Icelandic science classes**

Abstract: Innovation and science are often spoken of together in policy documents in Iceland. Innovation education has been in the official curriculum for Icelandic schools since 1999. It was introduced as a special subject or as a tool or a method to influence and change the teaching of existing subjects. The curriculum for science from the same time invites constructive or integrated approaches such as those involving innovation education. The authors wanted to find out if and how innovation education had entered science teaching in Icelandic compulsory schools almost a decade after its introduction in the formal curriculum in 1999.

This paper draws on data from current research on the science curriculum and innovation education in Icelandic schools carried out in compulsory schools. A mixed methods approach was used in data-gathering. Data was gathered through self-evaluation by teachers of science in selected schools using a questionnaire about science and on innovation education. Descriptions of school science were collected from on-site visits. Science teachers, older learners and administrators were interviewed and classroom observations undertaken in schools. Written documents in the policy areas of science, technology, innovation and science were analyzed.

Bernstein’s theories are used to understand the findings. Bernstein developed a code for pedagogy that can be used to reveal influences, powers and control that are not apparent without such keys to understanding. Bernstein’s analytical framework includes concepts about the regulative discourse, the instructional discourse and classification and framing.

The results show that innovation education is uncommon in these schools in general and in science lessons. Even though the regulative discourse towards innovation education seems on the surface to be supportive, the discourse of the schools demands conduct, manner and criteria of knowledge that are often in opposition with innovation education. In general innovation education is little known and is therefore a silent discourse in schools. An understanding of the forces affecting education may help to integrate these discourses in school practice, a mixed pedagogic practice in science can open up locations for use of innovation education.

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**73**  
**Björn Andersson, Maria Svensson and Ann Zetterqvist. Några uppgifter som belyser elevers uppfattningar om vad som är teknik**

Abstract: Diskussioner om ‘technological literacy’ har lett till ståndpunkten att en tekniskt bildad person skall känna igen teknik i dess många former och vara medveten om att tekniken genomsyrar det moderna samhället. Elever skall kunna skilja mellan naturen och den värld som är gjord av människohänder. Tidigare undersökningar pekar på att elevers syn på vad som är teknik har sina begränsningar. Visserligen uppvissar elever med stigande ålder en bredare syn på vad som är teknik, men i en undersökning menade likväl 30% av de äldsta att en stenyxa är exempel på teknik, till skillnad mot 100 % för en dator.

Mot bakgrund av detta blev vi intresserade av att undersöka om svenska elever skiljer mellan naturen och tekniken, samt vad de uppfattar som exempel på teknik. Vi gav papper-och-penna-uppgifter på detta tema till 150-200 elever, huvudsakligen från årskurs 8 och 9, som alla haft teknikundervisning.
Av resultatet framgår att eleverna uppfattar de system vilka är hämtade från naturen som åtskilda från teknikens värld. Detta kan inte tolkas som att de har en generell uppfattning om var gränsen mellan artefakter och natur går, men väl som ett tecken på att två betydelsefulla ontologiska kategorier hålls isär i det aktuella sammanhanget. Det framgår vidare att elevernas uppfattning om vad som är teknik är begränsad. Liksom i andra studier är det datorn som toppar listan, men det är bara cirka en tredjedel som menar att vardagsbetonade tekniska produkter som tvål och stickad luva är exempel på teknik.

Eftersom alla tillfrågade elever har mött ämnet teknik drar vi för svensk del den preliminära slutsatsen att undervisningen inte leder till en generell kunskap om vad som hör till området teknik. Detta kan få olika konsekvenser, exempelvis när det gäller framtida yrkesval.

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Pal J. Kirkeby Hansen. Analyzing cases in technology and design education: How could designing and making technological products be a vehicle for enhancing understanding of natural science principles?

Abstract: The Knowledge Promotion (Utdanningsdirektoratet, 2006a) is the recent curriculum for the Norwegian 10-year compulsory school. Technology and Design (T&D, Utdanningsdirektoratet, 2006b, p.3) is a new main subject area in Natural Science. T&D should be taught cross curricular between Natural Science, Arts and Crafts, and Mathematics. The main goal is that pupils should be able to plan, develop and make useful products. “The interaction between natural science and technology is a key part of this main subject area. Natural science principles constitute the basis for understanding technological activities.” (p.3). The present analyses of T&D education is based on case studies in three schools. The main outcome is that the actual T&D-project seems successful in developing pupils’ skills in designing and making products, and has great potential to be a vehicle for enhancing understanding of adequate natural science principles. If T&D-projects are carefully planned this conclusion might be generalized to other projects.
100
Helge Strömdahl. Referent change, a neglected aspect in traditional conceptual change approaches to science learning and teaching

Abstract: The educational challenge of polysemy of words that are used both in non-formal (every-day) and scientific formal languages is addressed. Based upon a two dimensional semiotic analysis, 2-D-SAS, (Strömdahl, submitted) the properties and the polysemy of words are made explicit by discerning on the one hand the word as a symbol, concept and referent, and on the other hand a set of meaning comprising non-formal senses, a scientific quality and a physical quantity. Traditional conceptual change approaches are generally not analysing a word like e.g. force from a semiotic perspective, eliciting the word as a symbol, a concept and connected to a referent. By applying the 2-D-SAS the educational relevance of identifying the referent will be salient. The potential of this approach will be illustrated by an analysis of the recurrent problems among students to learn the separate scientific meaning of heat and temperature.

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Lene Møller Madsen and Carl Winsløw. A discipline-oriented focus on the links between research and teaching in a research-intensive university: the case of physical geography

Abstract: Numerous research papers have been published on the links between research and university teaching in general. That is, these studies deal with the links without fixing the involved disciplines. They reach from attempts to find quantitative correlations between measures of research and teaching “quality” (see e.g. Hattie and Marsh 1996) to more descriptive or interpretative studies which explore conceptions of the links held by university professors (e.g. Elen et al. 2007). The overall outcome of quantitative studies seems to be that there is little or no global, measurable relationship between quality in research and teaching, while the qualitative studies tend to provide rich pictures of a complex and also contested experience of such relations. To cite Robertson: ‘Complexity is evident, not only in the apparent contradictions between quantitative and qualitative accounts but also within the qualitative arena of academic experience’ (Robertson 2007: 543).

In an attempt to go beyond simply recognising this complexity we focus on the role of disciplinary knowledge structure as a crucial condition for understanding the research/teaching relations in higher education. The paper analyses the practices of five professors of physical geography at the University of Copenhagen, as described by them in semi-structured interviews. It turns out to involve a highly developed integration of teaching and research strongly influencing the students’ activities. Our analysis suggests, as explanations for this, the discipline’s horizontal structure and the vertical distribution of roles within the research process. At the same time we noticed, from the interviews, a lack of articulated discourses about teaching practice and its relations to organisation of knowledge for teaching. Therefore, in line with Robertson (2007), the study suggests the need for an epistemological ‘meta-awareness’ to make explicit the structures of disciplinary knowledge in different contexts and to explore how these structures shape the links between teaching and research in higher education.
Abstract: Data presented in this paper involves asking questions of 15-16 year old students during a science center visit. The hypothesis was that it is possible to create a room for reflection at a science center by using an inquiry approach and thereby stimulating and facilitating a mutual dialogue. The background was the vast amount of studies showing that free-choice, unstructured school trips result in little (if any) student reflection. The underlying theoretical perspectives of the project are Bakhtin’s concept of dialogism supplemented by Dewey’s ideas of learning exchange and mutual communication. Each of six participating students constitutes a case and data consist of audio recordings during the visit and follow-up interviews conducted one year later. Data gathering was conducted in a one-one situation with the guide/facilitator and a student except for one event with the guide and two students. All data are analysed according to the phenomenological analysis model. The analysis gives an outline of how each student reacts to and is impacted by the guided dialogue and of what scientific level and cognitive style their responses are. The findings indicate that guided dialogue indeed holds potential to create high-level reflections both in the situation and in a long-term perspective as demonstrated by the follow-up interviews. The six students show clear differences though in how they react to the guiding. The survey shows how the inquiry approach can be adjusted in the guiding situation in order to maximise the outcome for each type of student. These findings can serve as a first step into gaining knowledge of how school visits to science centers can seek to maximize the learning potential through a teacher and/or explainer led facilitation of mutual dialogue. It is clear though that the survey has limitations due to the one-one or one-two situation of guiding.

Jens Jakob Ellebæk. Karakterisering og kvalificering af det “uforberedte besøg” på Orion Planetariet

Trine Hyllested. When the Teacher takes the School out of the School

Abstract: This study investigates the use of out-of-school activities in science classes in primary and lower secondary schools in Denmark. From a historical point of view the active, concrete and practical methods in contemporary pedagogical practices are not new. Based on works of Giddens and Bourdieu the study analyses the professional out-of-school centres as representing new expertise. The study presents three empirical studies. It focuses on the views of the students and the views of the teachers. The empirical work is primarily based on qualitative interviews, which are supplemented by a questionnaire.

The teachers believe that a new place will enrich the students with special experience and expertise. This understanding is a social construction. The teachers also have a pedagogical purpose. They aim to give the students cognitive, affective, psychomotor and sociocultural experiences during the excursion.

The three empirical studies as a whole show that the use of out-of-school activities back at the school was related to the way the teacher chooses to support the learning process. The questionnaire about the pedagogical use of a professional nature centre shows that half of the teachers did not use the visit as a part of the curriculum in their daily teaching. It was considered a one day experience. But the studies also found teachers who prepare their students and follow up on the excursions. They stimulate curiosity before, during and after. They act as resource providers and senior co-investigators. They help the students to articulate the learning process following the excursions.

The out-of-school activities provide learning stimulus, but the teacher is a key person in providing the learning conditions for the students, and the students are key persons in the learning processes.
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Frank Bach. Argumentation om materiens förändring vid smältning

Abstract: Detta paper handlar om en klass elevers diskussion om vad som händer med vikten hos en tillsluten burk med is när den smälter. Förblir, ökar eller minskar den och varför? Detta och annat behandlades under två lektioner i svensk årskurs åtta. Den första lektionen var arrangerad som en gruppdiskussion med tre till fyra elever i varje grupp, den andra som en diskussion i storgrupp. En av grupperna filmades under första lektionen och storgruppen under andra. Den aktuella uppgiften diskuterades under delar av båda lektionerna och det är dessa delar som analyserats.

Elevernas argument har analyserats med hjälp av TAP (Toulmin Argument Pattern). Individers uttalanden har kategoriserats med den begreppsapparat TAP erbjuder. Genom diskussion förtydligades elevernas argument och tre aggregerade ”Patterns of Argument” framträdde. Dessa utgör mer generella beskrivningar på ett kollektivt plan. Ett utgår från att is är lättare än vatten och när isen smälter kommer således burken att väga mer. Ett annat att eftersom inget tillförs eller lämnar burken händer ingenting med vikten. Det tredje att vikten minskar på grund av att is är hårdare och större än vatten.

När eleverna blir satta att diskutera en fråga som denna och möter andras uppfattningar raffineras efter hand deras argument på sätt som går att beskriva med TAPs logik och resonemangen framträdde som begripliga från deras perspektiv. Både skillnader och likheter mellan olika sätt att resonera framträder. Detta kan utnyttjas av lärare och elever i undervisningen för att förhandla fram gemensam förståelse för de frågeställningarnas diskuterar. I detta aktuella fall ligger skillnaderna snarare i grundläggande föreställningar om vikt, massa och tyngd än om materiens bevarande på ett allmänt plan.

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Fredrik Jeppsson and Helge Strömdahl. Mångtydigheten hos begreppet temperatur. En kvalitativ studie av fysikers och fysiklärares uppfattningar av ordet temperatur

Margareta Enghag. University students’ personal ideas about school physics as a starting point for dialogic /interactive talk

Abstract: In this study aeronautical engineering students’ views of physics lessons were investigated in a dialogic/interactive (Mortimer & Scott, 2003) talk between a student and a ‘discussion partner’ in an interview situation. The background is that the current physics course had a compulsory task when students solved context rich problems, and the discourse when students were deep in conversation during small group work with problem-solving was analyzed (Enghag, Gustafsson, Jonsson, 2007). A main finding in that study was that one student’s personal ideas, experiences and questions often drove these group talks. We concluded the physics course with student interviews that had more the qualities of a dialogic/interactive talk around physics as subject-matter, rather than final questions for students to make a statement about. The aim was to highlight students’ personal ideas about physics lessons. The pattern for the transcribed student/interviewer conversation showed partly exploratory talks (Mercer, 1995, 2000; Barnes & Todd, 1995) between the student and ‘the interviewer’. The paper presents six students’ own ideas developed during the exploratory talk parts of the conversation. The focus of the analysis is how the talk around 20 start questions elucidates student ideas after prompting utterances from the discussion partner/interviewer. The research questions are: 1) What personal ideas do the students bring into the discussion? 2) What ‘unexpected’ questions and utterances does the discussion/partner interviewer prompt the student with to get deeper into the student ideas? Several of the 20 starting questions in the ‘interview guide’ developed a talk that was exploratory and dialogic/interactive. The way to prompt the students with supportive questions and encouragement helped them to reach a deeper meaning and expression of their ideas.
Birgitte Lund Nielsen. Case studies and videos from students’ school practice used in teacher education

Abstract: Teacher knowledge is described in a variety of different ways in the research literature. Pedagogical Content Knowledge (PCK), where teaching knowledge is connected to a given content, is a framework that has been used for the last 20 years. More recently the terms CoRe (Content Representation, linked to a particular content) and PaP-eR (Professional and Pedagogical experience Repertoire) have been used to articulate and document PCK, and place it in the interacting fields of paradigmatic and narrative knowledge. This paper describes how this extended framework, along with ideas from Donald Schön’s The Reflective Practitioner, were used in a development project with student teachers specializing in geography from Aarhus Teacher Training College, Denmark.

At the start of their final year of education during student teaching (school practice) the student teachers were asked to write a case which should include questions for reflection. After finishing student teaching these narratives were used in the geography class in teacher education, functioning as a learning community. Students were filmed as they taught, and the resulting videotapes were used to supplement the case studies. Furthermore the students worked with constructing CoRe schemas.

On first evaluation this project looks promising. The three approaches complement each other and together serve as examples of a possible way of challenging and developing the student teachers’ knowledge. The practice of two student teachers teaching the carbon cycle/climate change with different approaches in different classes is used as an example. The complexity of challenges facing the teachers is well documented by studying the students’ case studies, video excerpts and the systematically described CoRe.

Vanessa Kind and Rob Wallace. Train, teach; taught? How the content of specific science subject matter knowledge sessions impacts on trainee teachers’ classroom practice and children’s learning

Abstract: The impact science sessions for trainee science teachers have on 11-14 year olds’ learning of science was assessed using questionnaires and a novel “Video-Interview (trainee) – Interview (children)” technique. The study raises questions about the effectiveness of training sessions on trainee teachers’ practice, and subsequently children’s learning.

A cohort of 42 science trainees taking a one-year postgraduate teacher education course in the UK completed a questionnaire probing issues relating to the relevance and value of training sessions for developing science subject matter knowledge (SMK) and pedagogical content knowledge (PCK). Three trainees’ science lessons were video-recorded. The same three trainees were interviewed about their teaching, SMK, and lesson preparation methods. Children from each science class took part in group interviews held immediately after the video-recorded lessons.

Preliminary findings suggest that reform to training sessions is required to maximise impact on trainees’ classroom practice. Presenters’ intended distinctions between subject matter knowledge (SMK)- and (PCK)-oriented sessions were absent from trainees’ perceptions. Trainees saw all sessions as SMK-based. Videos of trainees’ lessons revealed that describing activities, promoting activity completion and good behaviour were main foci. Explanation of key science ideas and use of materials and ideas from training sessions were absent. Interviews with trainees confirmed their perception of “success” relied on children completing activities in a good working atmosphere. Trainees avoided explaining difficult science ideas. Interviews with children immediately after the videoed lessons showed positive attitudes towards science and to learning difficult ideas, but little specific learning of topics taught.
Our paper offers an insight into a collaborative process of developing effective science teacher education, contributing to on-going debate about how best to prepare effective science teachers. The study continues: preliminary findings from year one are presented, revealing the complex processes occurring from those training, to those being trained and ultimately those being taught.

61 Martin Lindner, Jan Alexis Nielsen and Claus Michelsen. Science Teachers’ Professional Development in new Programs in Germany and Denmark

Abstract: As a response to the poor performance of science and mathematics teaching in students’ assessments, large efforts were made to improve science and mathematics teaching. In Germany the SINUS-Programme (Increasing the efficiency of science and mathematics instruction) started in 1998. From 2002 onwards a triad of “in context” programs were launched: Chemistry in Context, Physics in Context and Biology in Context.

Since November 2006 the Center for Science and Mathematics Education at the University of Southern Denmark has conducted, as the pilot project, “Science Teachers of the Future”, an education program in mathematics and science education for in-service lower secondary science teachers. Based on this pilot project, the University of Southern Denmark will now offer the master degree program in mathematics and science education in Denmark.

The German and the Danish programs involve the teachers in design, implementation and evaluation of innovative instructional sequences, which deal with a wide range of aspects of mathematics and science, e.g. modern science and the importance of science in society. Contemporary science and mathematics education research serves as a basis for the design and development of warranted practices with which the teachers may experiment in their classroom.

In this talk we will present some of the experiences with the Danish pilot project and the results of the German interview study. We will focus on the outcomes of offering a program which is intimately tied to (i) contemporary science and mathematics education research, (ii) modern science and mathematics and (iii) the teacher’s practices in the classroom.
Abstracts for round table sessions 13th June 15:30-16:30

Chair: Allyson Macdonald
Room: H-201
No. 65  15:30  Andreas Redfors. Science Teacher Education in Europe

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Andreas Redfors. Science Teacher Education in Europe

Abstract: In many European countries there is an ongoing process – The Bologna process – towards a common structure of three cycles (3+2+3 years), for Bachelor, Master and PhD degrees respectively. Not all European countries follow this process, and some countries end up with national variations. It is this diversity that underlies this roundtable.

Teacher education was one of the foci in the project Tuning Educational Structures in Europe. It was found that teacher educations in Europe are diverse in several aspects, but there are also similarities. For instance, many countries have national guidelines, but not all. All secondary, almost all primary and many preschool teacher educations give a first cycle degree. However, sometimes differences are extensive, especially for primary and preschool teacher educations since they are not at university level in all countries.

In most countries we find it difficult to recruit students to science teacher education. One starting point for a process attempting to remedy this is to compare structures, principles and requirements of teacher educations in Europe, and see if patterns evolve that can be related to the recruitment of science teachers.

The intended focus of the discussion is science teacher education in Europe, specifically the Nordic countries. The discussion will focus on:
- Structure of teacher education in different countries
- Requirements of students who wish to enter science teacher education
- Content of science teacher education in different countries
- Strategies for recruitment of students to science teacher education
- Possible need of an informal network for science teacher education in the Nordic countries.

All participants are invited to contribute to the roundtable by sending a 3-page-description of their country’s/institution’s pre-service teacher education programme to the organizer. Received materials will be summarised and a very short overview will be presented at the onset of the discussion.
Abstract: Målsettingen har vært å se på lærerstudenters naturfaglige kompetanse ved starten av deres 3. studieår. De har da avsluttet felles obligatorisk del av allmennlærerutdanningen og skal starte spesialisering i naturfag. For å kunne tilby et best mulig naturfagstudium ønsker vi å danne oss et bilde av hva studentene kan ved studiestart. Vi gjennomførte derfor en pretest før studiestart i faget. Etter henholdsvis 1⁄2 og 1 års studium vil vi gjøre posttest.

66 studenter svarte på utsagn/spørsmål innen utvalgte tema i fysikk, biologi, miljølære/naturgeografi samt holdningsutsagn relatert til naturfag. Dette er spørsmål/utsagn som det med bakgrunn i den formelle læreplan er rimelig at studenter bør kunne svare på/ta stilling til.

En første analyse fra pretesten viser at studentene gjennomsnittlig har knapt 50 % korrekte svar på spørsmål om biodiversitet ca. 35 % korrekte svar på spørsmål om karbonsyklus. 16% svarte rett på hvordan en sluttet krets med lyspære/batteri fungerer, 31% svarte rett på hvordan tyngdekraften virker og 47 % hadde rett forståelse av friksjon. 44 % hadde rett forståelse av termodynamikkens 2. lov. Bare 2-3 % av studentene kunne lese av eller angi kart-koordinater korrekt.


Vi ønsker en diskusjon om hvordan vi kan gi kommende naturfaglære tilstrekkelig naturfaglig kompetanse gitt den kompetansen dagens studenter har. Ett aspekt å drøfte er om det bør stilles økte krav til studentene i form av fordypningsfag i realfag fra videregående skole (gymnas). Våre resultater indikerer ikke at dette nødvendigvis er veien å gå idet det er lav korrelasjon mellom studentenes faglige prestasjoner og gjennomførte fordypningsfag fra videregående skole. Andre aspekter er forholdet mellom bred basiskompetanse i naturfaglige disipliner kontra dybdekompetanse i utvalgte tema.
Chair: Meyvant Þórólfsson  
Room: H-206  

No. 99  15:30  Kamma Rasmussen, Birgitte Pontoppidan and Mette Bisp Jensen. En Roundtable session om erfaringer med partnerskab mellem skoler, seminarium og forvaltning, der skal styrke udviklingen af en naturfaglig kultur.

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Kamma Rasmussen, Birgitte Pontoppidan and Mette Bisp Jensen. En Roundtable session om erfaringer med partnerskab mellem skoler, seminarium og forvaltning, der skal styrke udviklingen af en naturfaglig kultur.

Abstract: I denne roundtable session diskuteres et udviklingsprojekt, der har til formål at etablere et partnerskab mellem skoler, den kommunale forvaltning og læreruddannelsen. Projektet finder sted i Århus Kommune og har særlig fokus på undervisningen i naturfag. Hensigten med partnerskabsprojektet er først og fremmest at udvikle de lokale naturfaglige kulturer på skolerne og styrke de lærerstuderendes undervisningsfaglighed på naturfagsområdet.

Det er et problem, at mange af naturfagslærerne kun underviser i få lektioner i naturfagene og ikke har tilstrækkelige faglige forudsætninger for at varetage undervisningen. Derfor har lærerne brug for, at der på skolen udvikles en naturfaglig kultur. Gennem partnerskabet vil der komme input udefra, fx fra læreruddannelsen.

En PD-uddannet naturfagslærer er en central person på skolen, når den naturfaglige kultur skal udvikles og forankres. Vi ønsker at præsentere partnerskabet som det forum, hvor lærerne kan hente viden og inspiration til udviklingen og vedligeholdelsen af den naturfaglige kultur.

Denne roundtable session præsenterer partnerskabsprojektet fra tre forskellige vinkler:
- Partnerskab – et rum for udvikling af lærerstuderendes undervisningsfaglighed
- De PD- uddannede som centrale personer i partnerskabet
- Skolernes naturfaglige kulturer og naturfagslærerne

Denna nya kunskap om dubbla kognitiva system och framför allt det nyligen upptäckta implicita, omedvetna systemet och dess funktion har stora implikationer för undervisning och pekar på det stora värde en erfaren lärare har som en expert som kan ”se”. Samtidigt förklarar det de problem som elever har att se och upptäcka på egen hand i ”Enquiry based learning”.

I en Round table diskussion skulle jag gärna utveckla detta tema som också har relevans för såväl PCK debatten om lärares utveckling av expertis som förståelsen av ”conceptual change” inom science education.

Mer information om detta minnessystem beskrivs i:
Mary Ratcliffe. Pedagogical content knowledge for teaching concepts of the nature of science

Abstract: This conference contribution seeks to provoke discussion of the question: If pedagogical content knowledge (PCK) can be represented for key science concepts, can it be established for aspects of the nature of science? I start from the premise that explicit, rather than implicit, teaching of aspects of the processes and practices of science is now expected in science curricula (variously labelled as 'how science works,' 'ideas-about-science,' 'nature of science'), presenting challenges in classroom practice. The evidence base for understanding effective teaching and learning of the nature of science is developing but still limited. Much early research took the perspective that if teachers have a good understanding of the nature of science sound practice will follow. More recently, research projects have suggested a complex relationship between teachers’ understanding and their classroom practice. Little is known about how pupils develop and progress their understanding of the nature of science, adding to the difficulties in curriculum design and in understanding the PCK needed for effective practice. Nonetheless these are not reasons for not attempting to gain a better understanding of PCK for the nature of science. This contribution attempts to promote discussion of how barriers to understanding may be overcome. It will present examples of seeking PCK.
This roundtable about self-efficacy will first clarify just how it differs from other capacity beliefs such as self-confidence and self-esteem and then briefly review recent research, which establishes the basis for its relevance to educators. Next, three quite different perspectives about how knowledge of self-efficacy can be applied in educational settings will be described, followed by a general discussion.

The first perspective will be that of teacher educators and beginning teachers. The use of self-efficacy to not only prepare new teachers of science for the classroom, but as a formative tool to assess how they are doing and consequently support them, will be described.

The second contribution will suggest an application of self-efficacy in two different teaching contexts. The first of these is vocational education training for unskilled workers (the so-called AMU-centres). Drawing on research that has taken a life-history approach to the development of a teacher identity, we will suggest how a self-efficacy perspective on the experiences of teachers could illuminate how they draw upon their capacities in constructing an identity as a teacher. The second context is that of university teachers. Just like the teachers at the AMU-centres, university teachers bring with them a craft knowledge where they feel competent. With a self-efficacy approach we will point at challenges and potentials for new assistant professors coping with teaching. In both contexts we will suggest implications for teacher training activities.

The third contribution will look at how gender differences in self-efficacy may affect science achievement. For example, PISA 2006 asked eight questions to assess student self-efficacy and found some instances where gender differences were related to overall scores. These and other examples of this issue will be explored and suggestions for ameliorating differences will be addressed.
Abstracts for paper sessions 5 14th June 10:15-12:15

Strand: Evaluation
Chair: Auður Pálsdóttir
Room: H-201

No. 88  10:20  Maria Petersson. What educational objectives do biology teachers aim to achieve?
No. 38  10:55  Steffen Elmose. Kompetencebaseret naturfagsundervisning – operationalisering af et komplekst begreb

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Maria Petersson. What educational objectives do biology teachers aim to achieve?

Abstract: What educational objectives do biology teachers aim to achieve?

Syllabus in the national curriculum states aims for the Biology course, but these are general and vast. Professional teachers make interpretations of which content to emphasise. In this study where 21 experienced teachers reflect on a course, many all-embracing aims emerge. The teachers answer the question on what the teachers want their students to know when they have passed the course Biology A. From transcripts of the interviews with the teachers over one hundred aims emerged. The obvious aim, that the students shall have knowledge in Biology (the content in it self), is accompanied by reasons on why the students shall study this and for what purposes. These purposes are here called all-embracing aims. These aims are of 16 different kinds and can be categorised into five main categories:
- The identity and character of the school subject Biology
- Worldviews
- For further studies
- Science in society
- Quality of life for students

To be part of the school biology tradition and to experience the enjoyment of being outdoors is one highlighted all-embracing aim, by 16 of the teachers. Teachers emphasizing Nature of Science are also the ones that emphasise an evolutionary perspective in their descriptions on what they highlight in the course.

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I det forskningsstøttede udviklingsarbejde arbejdes der med nødvendigheden af 5 niveauer af det naturfaglige kompetencebegreb for at det kan knyttes til en konkret undervisningssituation: 1) Naturfaglig kompetence som synteseegenskab, 2) de 4 naturfaglige delkompetencer, 3) Generelle karakteristika for delkompetencerne, f.eks. modelleringskompetencen, 4) Specifikke af læreren udvalgte karakteristika, der passer til netop dette undervisningsforløb og 5) Udvalgte tegn på kompetencedybden – udvalgt af lærere.

Funktionaliteten vurderes dels i forhold til lærernes planlægning, gennemførelse og evaluering af et undervisningsforløb i natur/teknik (3.-4. klasse) om solsystemet, og dels vurderes om kompetencebegrebetets dybdedimension kan realiseres i undervisning og træde frem i en evaluering af elevernes læring. Nedenstående synopsis er den foreløbige beskrivelse af en metode til at undersøge og dokumentere kompetencebegrebetets eventuelle funktionalitet i naturfagsundervisningen. Foreløbig, idet undervisningsforlabet er i gang, og evaluering og forskningsproces først vil være afsluttet i løbet af foråret 2008. Og foreløbig, fordi metoden er at betragte som et af de første bud på systematisk at undersøge naturfagskompetence i anvendelse.
Björg Pétursdóttir. “What matters is communication”. Secondary students’ responses toward a science learning environment

Abstract: This presentation focuses on the response of students to new types of learning environments. It draws on two studies carried out by the author. The first study is practitioner research on the response of students at the Suðurland College (Fjölbrautaskóli Suðurlands) to a new type of learning environment. The presentation also draws on results from the Intentions and reality (IR) project. As part of the project, the researcher took part in group interviews with students in upper secondary schools (autumn 2006 and spring 2007).

Features of the new environment included an emphasis on lectures in relatively big student groups (50 to 70 students), group work, assignments, information technology and field work. Data were collected on student answers to a questionnaire about the use of information technology, group work, attitudes toward science, learning and teaching methods. In all 185 students responded to the questionnaire. These contained both multiple choice and open-ended questions and were collected four times through the course in three terms in the years 2003-4. Furthermore semi-structured interviews of six students about group work were carried out in spring 2003. The researcher was the course coordinator and also taught parts of the course.

The results show that student attitudes to lectures vary and seem to depend on their basic knowledge of the content of the lecture, in that the less their basic knowledge the more difficult it was for them to make use of the lecture. The size of the group seemed to have a disturbing impact on the students in the beginning but they seemed to acclimatize to this feature with time. Although most students mention group work as the most positive part of the learning environment their views on its usefulness vary considerably. Those most critical towards it are in general able students who complain that they are required to do most of the job given to the group and feel that it is not fair that all group members get the same grade for the group’s task. However, most of the students think that the main reason for unequal distribution of work load is due to laziness on their part and their lack of interest in the subject. Other explanations were offered, for example that some students simply want others to do the job for them, that some students are pushy and prone to take control so that others in the group have difficulties becoming active participants and that some students are simply too shy or reserved to make a contribution.

In the interviews (year 2007) the students were not very keen on group work. They mentioned the importance of experiments and laboratory work and a relation of the topic into the daily world. In one of the interviews the importance of fairness in the communication between teachers and students was discussed and it was pointed out that students with low self-esteem in natural science tend to experience guidance from teachers as degrading.

The conclusions of the research are that although some teaching methods are more favourable than others, education is an individual process and different instructional strategies suit different kinds of personalities. Furthermore group work/cooperative learning as a teaching strategy should be carried out with care as students’ attitude on its usefulness vary considerably. That refers to execution and assessment of the group work. Furthermore communication between teachers and students with low self-esteem in natural science should be characterized by encouragement, avoiding judging and dissuading.
Anita Wallin. Samband mellan gymnasieelevers studiemönster och kunnande i evolutionsteori ett år efter undervisning

Abstract: Studien ingick i ett projekt vars övergripande syfte var att studera hur gymnasieelever lär biologisk evolutionsteori i samband med undervisning. Focus i denna studie är att undersöka om det finns något samband mellan kunnande i evolutionsteori ett år efter undervisning och vilket angreppssätt eleven hade i sina studier, här kallat studiemönster.


Eleverna besvarade också en enkät med 86 påståenden om deras förhållande till skolan, lärarna, undervisningen och studierna. Av dessa påståenden hade 20 med studiemönster att göra. Vid en faktoranalys grupperades påståendena i djupt studiemönster och ytligt studiemönster.


1 Are Turmo and Eyvind Elstad. Students’ study orientations and responses to teachers’ regulating approaches in science

Abstract: The Norwegian school reform ‘Knowledge Promotion’, implemented from 2006 onwards, emphasizes that teachers should base their teaching on high ambitions and provide more academic pressure to learn in class. Furthermore, the school reform puts particular focus on schools’ responsibilities for fostering student learning strategies. This paper reports on an empirical study of high school students’ motivation, learning strategy use and self-regulation in science and how they respond to teachers’ regulating approaches (teachers who promote mastery goal orientation and teachers who challenge their students in a positive manner to achieve better). An extensive questionnaire was administered to 532 students (16- to 17-year-olds) in five high schools. The results show that the teacher mastery approach seems to have a more positive effect on boys, while girls respond more positively to teacher academic pressure orientation in science classes. Furthermore, the majority of students respond more positively to the mastery approach, while the academic pressure to learn seems to be more important for the minority. We argue that the assumption of a one-sided negative effect of academic pressure to learn in theoretical literature has to be more nuanced.
Olle Eskilsson and Gustav Helldén. The importance of science labwork

Abstract: This study deals with the role of different elements in chemistry labwork and how these elements can contribute to a better understanding of science phenomena and to the development of a more positive attitude to science. The study is carried out from a view of learning that involves both social interactions between students, and between students and teachers, as well as an individual construction of knowledge. That means that higher mental processes in the individual derive from social life. Interactions in the classroom are based on Ann L. Brown’s reciprocal teaching strategy. The reciprocal teaching groups are designed to help students to monitor their comprehension.

The study is carried out with sixty 14-15-year old students in chemistry education. The data originates from analysis of (a) interviews with the students, (b) interviews with the teachers, (c) students’ talk during the lab work, and d/ students’ reporting from their experiments to other groups. In the interviews with the teachers they comment on students’ work and on discussions during labwork in video-sequences from the lessons. We use a revised SOLO-taxonomy to analyse the quality of students’ science talk during the labwork.

The students like laboratory work and feel that it is important for their learning of science, and that they also learn about cooperation. The teachers’ analysis of the video-cuts from the lessons contains both comments on students’ interaction and learning, and reflections on their own teaching. They feel that they learn a lot from this analysis. Reporting to another group in the intervention seems to stimulate the students’ abilities to use science knowledge. All groups but one have relational categories according to the SOLO-taxonomy. In 70% of them the quality of the discussions are increasing during the presentation. The presentation to another group stimulates students’ learning of science and the quality of their science talk.

Dag Atle Lysne, Shaun Nykvist and Margaret Lloyd. Can web-log be used to link student’s practical activities to the use of theoretical concepts?

Abstract: When students deal with theoretical concepts, in Science and other subjects, it is of central importance that they have the opportunity to discuss their view and perceptive on the meaning of school scientific phrases and how theoretical concepts are connected. In this study the students have been building technical constructions in Technology and design. At the same time they should describe the process and their plans at a web log on the project’s web site. This study is part of a larger cooperation with schools in Australia. The students therefore had to use English, which, of course, is an extra challenge for Norwegian students. There is an Australian web site on the project (http://www.oz-teachernet.edu.au/projects/yachts/2007/) and a Norwegian version (http://www.oz-teachernet.edu.au/projects/yachts/ice2007/). The Norwegian students used the information on the web site in their building process and were loyal to the restrictions set on the constructions. However, they did not use the web-log to discuss solutions. Instead the blogings were used as an ordinary log where the constructions done at the point of time, the further plans and the cooperation in the groups were described. On the other hand, very few students described the trails they eventually had carried out.
Lærke Bang Jacobsen. Investigating the Need for Teachers and Students to understand the Purpose of Experimental Work in Physics

Abstract: A qualitative empirical study of an experimental physics module in Danish upper secondary school is performed. The study investigates an experienced teacher’s aim and purpose for the laboratory work within a specific topic of the ideal gas law. The module is a 3 week lesson series of both theory and laboratory work for year 11 students.

The teacher’s statements of the purpose of the module are compared with the observed action in the classroom and again compared to the students’ understanding of the teacher’s purpose. These are the first data of a larger study investigating whether it is necessary for students to understand the teacher’s purpose - measured on both motivation and learning outcome.

The teacher’s ability to articulate the purpose of an experimental module is analyzed within the framework of Pedagogical Content Knowledge (PCK). Other investigations indicate that teachers’ understanding and articulating of the purpose of the specific laboratory work is a highly demanding and ongoing task, which only teachers with a large degree of PCK are able to possess.

The teacher of this study is highly articulate of the purpose of the module. She introduced the module by explaining her goals for the activity to the students. The four focus students were highly motivated to work on the activity, even though the laboratory work was a traditional ‘cook-book’ exercise, giving the students poor chances to gain ownership of the work. After the module the students are all able to explain the teacher’s purpose, and the module was graded positively among the focus students. They all handed in reports showing a high learning outcome of the activity.
Sabina Jeschke, Olivier Pfeiffer, Thomas Richter and Christian Thomsen. Selected Aspects of Virtual Laboratories and Remote Experiments

Abstract: The science of physics is built on theories and models as well as on experiments: the former structure relations and simplify reality to a degree such that predictions on physical phenomena can be derived by means of mathematics. The latter allow verifying—or falsifying—of these predictions. Computer sciences allow new access to this relationship, especially well-suited for education: New Media and New Technologies provide simulations for the model, virtual instruments for running and evaluating real experiments and mathematical toolkits to solve equations derived from the theory analytically and to compare the outcome of all three methods. We will demonstrate this approach on two examples: Ferro-magnetism and elementary thermodynamics.

Carl Angell, Per Morten Kind, Ellen Karoline Henriksen and Øystein Guttersrud. Implementation of empirical-mathematical modelling in upper secondary physics: Teachers’ interpretations and considerations

Abstract: Models and modelling are receiving increasing attention from the science education community as important components of a contemporary science education. In this paper, we draw on experiences from a project, PHYS 21, which has implemented an empirical-mathematical modelling approach in upper secondary physics education in Norway. By empirical-mathematical modelling approach we mean physics teaching emphasizing activities where students conduct experiments and construct and evaluate mathematical models of phenomena. We see modelling as important both because it reflects the nature of physics and because modelling activities are considered useful for learning physics concepts and processes.

Teacher interviews and questionnaire results indicate that new curriculum ideas were adapted to teachers’ ways of doing, and reflecting on teaching and learning, rather than radically changing these. All the teachers found a place for modelling in their personal rationale for teaching physics. Although several of the activities were designed to teach ‘modelling’ rather than concepts, the teachers assessed their quality in the perspective of conceptual learning. Teachers generally agreed that learning skills and learning ‘about physics’ were important, but they had few strategies for handling these feature in their teaching.
Abstract: In the EU-project - CoReflect - we are developing interactive web-based inquiry materials that embrace the guided constructivist approach to learning and support collaborative and reflective work. We are working together with groups at universities in Cyprus, Israel, Germany, the Netherlands, Greece and England. A web-based platform (STOCHASMOS) is used in a collaborative learning environment. We engage small groups of teachers in the design and implementation of these environments so that a mechanism can be developed with potential for subsequent scale-up.

The project methodology is based on the idea of design-based research. The design-based approach seeks to bridge the often disconnected worlds of academia and theory with the realities, complexities, and constraints of educational practice. The learning environments will be iteratively tested and refined, first as pilot projects, then during local implementations, and finally during implementations and synthesis work at the European level.

At Kristianstad we are working with secondary students (8th-9th grade, 15-16 years) and the teaching environment will have driving questions like: Are we alone in the galaxy, or are there other intelligent beings out there? Is terraformation of Mars an option for mankind?

We have a research interest that prompts the inclusion of the following, i.e., aspects that are part of the learning environment and evaluated by the research. That 1) students live their life in society and have a specific worldview that influences the presuppositions they see as necessary for science 2) students tend to associate additional presuppositions with scientific theories and this influences their interest in science 3) critical evaluation of scientific data and reports in relation to scientific theories is of central importance.

Through analysis of video recordings and specific paper and pencil tasks we will investigate A) the presuppositions that students and teachers associate with science in our contexts B) what kinds of evidence-based arguments the students use in their discussions with peers in groups C) views on scientific theories that follow the teachers’ teaching as companion meanings, and correlate these views with learning outcomes and students’ interests/attitudes.
Hans-Olof Höglund, Gustav Helldén, Maria Thomasson and Sara Wahlberg. Students’ teachers content knowledge of life in an aquatic ecosystem and their experience in a teaching situation – a case study

Abstract: The aim of the present study was to investigate student teachers’ content knowledge about life in an aquatic ecosystem and how they can accomplish a teaching situation. Participants were 32 teacher students enrolled in a teacher training education program from preschool to primary school. Before and after an ecology sequence the students were asked about life and transformation of matter in an aquarium. From their answers in a questionnaire, four categories could be identified from very poor knowledge to more scientifically correct. After the ecology sequence, two students from each category were chosen for a semi-structured interview. The results from the interviews showed that the students believed understanding had been developed even though they still had difficulties in understanding cycles of matter and ecosystem processes. One student was video-recorded during an authentic teaching situation and after that interviewed while watching the video clip. The film revealed several situations where the student ignored important questions and comments from the children. This ignorance might result both from not seeing the children and from poor content knowledge.

The implication of this study was the necessity to develop a teaching strategy in teacher education where we to a greater degree challenge the student teachers’ own ideas about the phenomena and give the student teachers a possibility to discuss their ideas in relation to scientific explanations. Student teachers also need to develop a more active way of learning by improving their metacognitive thinking.

Karin Stolpe. Science student teachers’ use of communicative support to make meaning of abstract phenomena in the area of energy

Abstract: This study aims to describe what kind of communicative support student teachers use to concretise abstract phenomena in the content area of energy. Three student teachers attending the teacher training program at a university for Swedish primary schools were asked to associate energy with other concepts in two interviews; the first interview before and the second after a four week teaching practice where the students taught the content of energy. The analysis of the transcribed interviews showed that the students used three different kinds of experiences to make meaning: examples from everyday life, examples from science and examples from own studies of science. The results indicate that the communication support functions both as a facilitator of communication as well as support for the students’ own learning. The use of communication support was more frequent in the second interview, after the four weeks of teaching practice. To integrate experiences as communicative support is suggested as a way to develop a scientific language.
Abstract: This paper describes challenges in the value-based work in science teacher education in Sweden and other countries. Currently, the teacher educators’ place great focus on humanistic values in science education (e.g. debating and discussing, analysing and position taking, exercising critical thinking) rather than on liberal education values (learning for the sake of enjoyment of learning and knowing). Many prospective teachers in Sweden are handicapped in relation to their task of teaching students who are interested in science. If a student is not interested in everyday life applications of science, but wants to satisfy his/her own curiosity and just enjoy solving “science puzzles” many teachers do not have enough competence to help such students. She or he is not trained for that and may not even see the problem. This poses new challenges for science teacher education. Apparently, the values and priorities in science education are not on “hard science” anymore but on “light science”. Swedish science teacher training for compulsory school focuses more on pedagogy than on subject knowledge, providing students with tools to be reflective in educational sciences rather than in natural sciences. At the same time, teacher education takes rather a minimalistic approach in providing prospective teachers with skills to develop students’ abstract and logical thinking (or theoretical thinking, in Vygotsky’s terms). The focus is rather on varieties of practical acquisitions and uses of knowledge. Prospective teachers’ interests in developing methods of advancing student skills of abstract-theoretical thinking in science education almost do not exist (as is reflected by the content of their examination projects). This can partly reproduce the absence of teacher educators’ interest in these issues. Using methodological principles of complementarity, it is argued that the modern science education curriculum should provide space for students to pursue liberal education values as well as humanistic values.
The abstract and synopsis of each proposal was reviewed in double-blind review. The Nordic committee for the symposium suggested ten names from Finland, Denmark, Iceland, Norway and Sweden to participate as reviewers. The reviewers participated in a bidding round before the proposals were assigned to them for the review. After the review authors of accepted and borderline accepted proposals resubmitted the final version of their proposal. 104 proposals were accepted and 7 were rejected.

The top 16 paper proposals from the first round were reviewed again by the organizing committee. 8 of these 16 paper proposals will be published in a special issue of the academic journal NorDiNa after the conference. Each proposal was reviewed two times, therefore the total number of reviews is 247. Here is the list of reviewers. The organizing committee wants to thank all the reviewers for their selfless effort.

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Total 247
This year authors from 14 countries have papers presented at the NFSUN. Some papers are written by more than one author from different countries, therefore the number of accepted proposals from each country does not add up to a whole number.

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# List of participants

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