

## RECENT DISSERTATIONS

**VUOKKO AHORANTA, 2004:**

*The quality of learning in a primary school grades 4-6 from the viewpoint of general didactics using concept maps and Vee-heuristics*

The University of Joensuu, Savonlinna Department of Teacher Education, Finland  
University of Joensuu. Publications in Education No 99.

### Abstract

The purpose of this study is to research and develop teacher's work and pupil's learning from the viewpoint of general didactics in sustainable development. It was part of the OECD/ENSI-project (Organisation for Economic Co-operation and Development/Environment and School Initiatives) in Finland. The research problem is to find out how concept maps and Vee heuristics help a teacher in following and promoting pupils' learning.

Subjects in this research and development project were two separate groups of pupils, both of which had about 20 pupils. They were followed in 1997-2003. From the teacher's viewpoint, teaching was planned as design experiments and from the pupils' viewpoint as learning projects. There were twenty-three learning projects altogether. At the beginning of a new learning project the pupils constructed their first concept maps to reveal their former knowledge. Likewise at the beginning the pupils completed the left side of their Vee heuristics. These Vee heuristics were used to follow pupils' thinking during the learning project. At the end the pupils constructed their second concept maps and the rest of their Vee heuristics. To enable the precise analyse nine pupils (three high achievers, three average achievers and three low achievers) were selected according to their earlier school achievement. The concept maps of these nine pupils were analysed both qualitatively and quantitatively.

The first main result was that it is possible to follow and promote pupils' learning and thinking by using concept maps and Vee heuristics systematically for many years. The special merit in concept mapping proved to be the fact that all the pupils individually got strong support of learning a lot during the learning projects. Also the teacher got plenty of such knowledge about her pupils' learning and thinking which otherwise would have been impossible to get. By knowing this it was possible to the teacher to guide and promote her pupils' learning and thinking better than earlier.

The second main result was that concept maps reveal only what is in pupils' metacognition and what they are able to construct in their maps. When the teacher designed a school achievement test (short answer test) and transformed pupils' ordinary answers into concept maps it turned out that pupils know much more than they themselves presented.

A well working and revealing version of Vee heuristics for the 4th -6th graders was successfully developed during this research and it seems that both girls and boys benefit equally much in combined use of concept maps and Vee heuristics.

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## RECENT DISSERTATIONS

ANDERS BERG, 2005:

*Learning Chemistry at the University level: Student attitudes, motivation, and design of the learning environment*

Department of Chemistry, Umeå University, Sweden

### Abstract

The main purpose of the research this thesis is based upon was to study students' attitudes towards learning chemistry at university level and their motivation from three perspectives. How can students' attitudes towards learning chemistry be assessed? How can these attitudes be changed? How are learning situations experienced by students with different attitude positions?

An attitude questionnaire, assessing views of knowledge, learning assessments, laboratory activities, and perceived roles of instructors and student, was used to estimate students' attitude positions. It was shown that a positive attitude was related to motivated student behaviour. Furthermore, it was shown that factors in the educational context, such as the teachers' empathy for students learning chemistry, had affected the students. It was also found that students holding different attitude positions showed different learning outcomes and differed in their perceptions of the learning situation. Students' holding a more relativistic attitude more readily accepted the challenges of open experiments and other more demanding tasks than those holding a dualistic attitude.

In addition, the teachers were found to play important roles in the way the tasks were perceived and the development of students' ideas. In studied laboratory activities open tasks resulted in positive student engagement and learning outcomes. Preparative exercises, such as a computer simulation of the phenomena to be investigated, affected students' focus during laboratory work, encouraging them to incorporate more theoretical considerations and increasing their ability to use chemical knowledge. Finally, it was shown that students' focus during laboratory work is reflected in the questions they ask the teacher, implying that questions could be used as tools to evaluate laboratory teaching and learning processes.

The findings imply that students' attitudes towards learning and motivation, and the design of learning situations, are key factors in the attainment of desirable higher educational goals such as the ability to judge, use, and develop knowledge. For universities encountering students with increasingly diverse attitudes, motivation and prior knowledge, these are important considerations if they are to fulfil their commissions to provide high quality learning environments and promote high quality learning.

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## RECENT DISSERTATIONS

CHRISTINA BERGENDAHL, 2004:

*Development of competence in biochemical experimental work: Assessment of complex learning at university level*

Department of Chemistry, Umeå University, Sweden

### Abstract

Biochemistry is part of life science: a fast developing multidisciplinary area. The overall aims of this thesis and the work underlying it were to find ways in which to develop competence in biochemistry at university level and to assess complex learning. A particular interest was the development of experimental work as a means to promote learning.

The study focuses on changes made in two educational settings. The aim of the changes was to develop competence, amongst both students and teachers. Therefore, the research in the three first papers has in some aspects, and to different extent, the characteristics of action research. Broadly, the changes can be described as making experiments more open, with multiple formative and authentic assessment methods involving both students and teachers. The empirical studies included questionnaires, interviews, questions asked during experimental work, written material as formulated objectives, examination questions and answers, reports, other products; and grades/judgements made by teachers and students.

The main results can be summarized as follows;

The students' learning was improved by open ended versions of experimental work, according to both their and the researchers' opinions. Planning, approaching problems from different perspectives and evaluating the results of their own experimental work promote the students' capacity for higher order cognitive thinking. However, the synthesis level constitutes a threshold and particular support is needed for students with a more dualistic view of teaching, learning and experimental work.

Introducing formative and authentic assessment is a way to help students to make progress, and to develop competence. The importance was clearly demonstrated of involving both teachers and students in discussions of aims and criteria and of making them explicit. Feedback from teachers' and students' own reflective activities about subject content, and their learning as well as affective factors were shown to be central for complex learning. Based on our studies, areas were identified for the critical development of competence and for promoting learning in biochemistry at university level. These areas are; multidisciplinary and complex learning, communication skills of different types, metacognitive perspectives, attitude development, and affective factors.

The students see experimental work as crucial for their learning and therefore important in terms of assessment. Therefore, experimental work can and ought to be assessed. However, similarities and discrepancies were observed between students' and teachers' perspectives for both the aims and assessment of experimental work. Our conclusion is that a combination of assessment methods is needed in order to be able to make a high qualitative assessment.

Language: English

ISBN: 91-7305-711-8

Download: <http://www.diva-portal.org/umu/theses/abstract.xsql?dbid=313>

*Christina passed away June 19th 2005 only 49 years old. Our condolences go to Christina's family, friends, and colleagues in Umeå*

## RECENT DISSERTATIONS

MICHAL DRECHSLER, 2005:

*Textbooks', teachers', and students' understanding of models used to explain acid-base reactions (licentiate thesis)*

Department of Chemistry, Karlstad University, Sweden  
Karlstad University Studies 2005:1.

### Abstract

This thesis reports an investigation of how acid-base models are understood in the Swedish upper-secondary school. Acid-base reactions can be described in several ways: by formula equations as reactions between substances, or by ionic equations as proton transfer reactions according to Brønsted's model. Both models are introduced in chemistry teaching at Swedish secondary schools. The aim of this study was to determine how textbooks and teachers handle the different models to explain acid-base reactions. Further to investigate the ideas Swedish students from upper secondary school had about the role of chemistry models in general and those related to acids and bases. The four most widely used chemistry textbooks for upper secondary school in Sweden were analyzed. Further, semi-structured interviews were conducted with six chemistry teachers and seven students from upper secondary school. The textbooks neither described the differences between the models used to explain acid-base reactions nor clarified why the Brønsted model was introduced. Teachers were well aware of the importance of using models in their lessons. However, they seemed to have difficulties in applying this view with respect to acids and bases. There was no clear distinction between the models used to explain acid-base reactions and some teachers had not reflected on the differences between them. In addition, teachers seemed to rely on the content of chemistry textbooks. In spite of the positive selection the students in our study had difficulties to properly describe acid-base reactions using the Brønsted model. They were aware of the importance of using models in chemistry in general, but could not apply their views to acid-base reactions. Implications for textbook writers, teaching and further research are discussed.

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## RECENT DISSERTATIONS

ASTRID BIRGITTE EGGEN, 2004:

*Alfa and Omega in Student Assessment. Exploring Identities of Secondary School Science Teachers*

Department of Teacher Education and School Development, University of Oslo, Norway

### Abstract

The dissertation is aiming at investigating the identity formation of the secondary school science teachers. The core phenomenon is student assessment, and more specific epistemological and ideological assets and dilemmas of student assessment as teacher identity formation. Student assessment has grown in number of purposes and has been extended due to institutionalization as well as multifold educational agendas. However, student assessment seen as the challenges teachers are facing and their reflection about student assessment has had less focus empirically. This dissertation is attempting at capturing some of these challenges by combining two theoretical foci and traditions; science education and pedagogy.

The main research question is: *Within an overall sociocultural view on reflective identity formation what are the assessment dilemmas, epistemological and science ideological viewpoints that constitute the science teacher's student assessment practices and corresponding reflections?*

Subquestions relate to science teachers' actions and reflections, their implicit and explicit epistemological and ideological assessment dilemmas, and the varieties of identities within science education. Finally, the methodological considerations concerning the investigation of science teachers' actions and reflections concerning student assessment are discussed.

Selected teachers labeled Alfa, Gamma, Pi, Sigma and Omega form a typology illustrating ideological and epistemological positions and dilemmas regarding student assessment. Alfa is ideologically and epistemologically non-dualistic. His essentialistic and behaviorist assessment practice that contains summative purposes does not relate to dilemmatic reflection. Gamma is the manager of assessment and curricula guidelines. His reflections are based on mandated documents. Pi's identity is ideologically and epistemologically dualistic. His concern is to build on individual cognition for learning while his assessment procedures are entirely based on summative testing traditions. He does not acknowledge this dilemma, but emphasize organizational solutions like ability grouping and additional grading scales to capture effort and conceptual learning. Sigma is ideological and epistemological diverse. She recognizes dilemmas of student assessment and sees these as sources for reflection and professional development. Finally, Omega is the progressivist teacher with sociocultural perspectives on learning as well as entirely concerned with formative purposes of assessment.

The dissertation is presenting the complexity of student assessment, and how the teachers are positioning themselves according to different educational contexts. They construct and reconstruct different identities ideologically and epistemologically. These are important dimension in order to develop knowledge and reflection about student assessment within the present multifold objectives for education. Such increased student assessment awareness is alpha and omega for the teaching of science as a knowledge area.

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## RECENT DISSERTATIONS

MARGARETA EKBORG, 2003

*Natural Science for Sustainable development?*

*A longitudinal study of how student teachers develop scientific conceptions and ability to discuss complex issues relevant for environmental education.*

Department of education, Göteborg University, Sweden

### Abstract

The aim of the study is to provide evidence about student teachers' learning about some specific science concepts, relevant for environmental education, during their initial training. The aim is also to investigate the students' reasoning about a socio-scientific issue. Finally the aim is to also to provide evidence about the student teachers' learning from a student perspective by using the theory of intentional learning. The research questions are:

- How do science student teachers develop conceptual understanding of some key ecological concepts, relevant to their future practice as science teachers, during their initial training?
- How do the students teachers develop ability to discuss complex issues develop?
- What intentions do the student teachers bring to the teacher education programme and how do these intentions influence their learning during their initial training?

The study originated from an interest in how science teachers are prepared for environmental education. Therefore understanding of the following concepts was investigated: matter, energy, photosynthesis, respiration, decay and combustion. The ability to discuss complex issues is defined as ability to draw upon knowledge from several subject areas, to describe a complex issue, to use causes and consequences in explanations, to identify conflicts of interest and arguments underpinning the interests and to identify values.

Data were collected mainly by questionnaires and interviews. The whole student group (N=62-47) answered questionnaires three times and 14 students were interviewed three times. In the questionnaires the students answered questions about the ecological concepts. In the interviews the student teachers discussed a complex issue dealing with weather or not it is ethical to use surplus heat from a crematorium for district heating. They were also asked explicit questions about what happens to the bodies in cremation and when buried. Finally they were asked about reasons for the choice of the teacher education programme and about their learning experiences. The teachers were asked about the courses and about the students' learning.

The results show that a majority of the students did not develop understanding of the investigated concepts. Most students did not use much science as a tool for decision-making when discussing the complex issue. All the students had the intention to become teachers for young pupils. Parallel to this they wanted to pass the exams and to understand. Depending on the intentions the students interpreted both the questions they were asked and the relevance of the contents in the science courses. There was a discrepancy between the students' intentions and the teachers' intentions for the students. When the students experienced this gap they went into rote learning to pass the exams. Students with the intention to understand developed a better scientific understanding.

*Language:* Swedish with summary in English

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## RECENT DISSERTATIONS

### MARGARETA ENGHAG, 2004:

*Miniprojects and Context Rich Problems. Case studies with qualitative analysis of motivation, learner ownership and competence in small group work in physics (Licentiate's dissertation)*

The Swedish National Graduate School in Science and Technology Education, FontD, Linköping University, Sweden  
Department of Thematic Studies.  
Studies in Science and Technology Education No1

### Abstract

The thesis reports case studies of students working with context rich problems (CRP) and mini projects (MP) in physics in an upper secondary school class and in a physics teacher education class at university. The students report a big shift from physics in secondary school as fun and easy, to physics in upper secondary school as boring, difficult and with lack of time for reflections and physics talking, but they also found physics as interesting in itself. In order to study how group discussions in physics influence the students' learning and to study the phenomena of students' ownership of learning (SOL) we introduced CRP and MP. We video recorded five groups with 14 teacher students at university in the end of 2002, and five groups with 15 students at upper secondary school during the beginning of their second physics course in the spring term in 2003. MP and CRP in physics were used as instructional settings in order to give students possibility to strengthen their contextual understanding and their possibilities to ownership. When students get the opportunity to manage their own learning and studying by open-ended tasks in physics, without the teacher determining all details of the performance, this gives more ownership of learning. The advantage of MPs and CRPs from the student's point of view is more freedom to act, think and discuss, and from the teacher's view, to get insights of the students' ability and how they really think in physics. The ownership is found to be crucial for motivation and development of competence.

Students' ownership of learning is the students' influence/impact to affect tasks and the learning environment in such a way that the students have a real opportunity to achieve learning of physics. SOL is found at two levels:

Group level: At the start of a task the SOL is determined by the design of the task. The choice of task, the performance (when, how, where), the level of result and presentation and report have to be determined by the students themselves.

Individual level: A person's experiences and anomalies of understanding have created unique questions that can create certain aspects of the task that drive this person to be very active and highly motivated. This gives the person a high individual ownership. We developed hypotheses concerning the relation between ownership, motivation and competence and we see some evidence in the cases reported in this thesis. The importance of exploratory talks to enhance learning, and to see aspects of communication as part of the motivation are discussed in the model of ownership, motivation and competence that is proposed.

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## RECENT DISSERTATIONS

MAIJA KIVIAHDEM, 2005:

*Effects of Authentic Learning and e-Learning in an Introductory Chemistry Laboratory Course*

Department of Chemistry, University of Oulu, Finland

### Abstract

Research into memory processes has progressed in recent years through the combined efforts of neuroscientists and cognitive scientists. This is especially aided by modern scientific research methods of the brain such as positron emission tomography and functional magnetic resonance imaging. The learner, through interaction with his environment, must actively create individual cognition; the brain is a dynamic adaptable organ. This research will limit the discussion of authentic learning and e-learning to an introductory chemistry laboratory course. The most popular, and yet the most heavily criticized style of laboratory instruction is the traditional (also termed verification or expository) style with a “cookbook” nature. On the basis of pilot action research, the goal of this study has been the use of e-learning for the purpose of placing more emphasis on the contemplation of chemistry’s theoretical topics for effecting the quality of conceptual understanding. With systems thinking as a background, the qualitative research method was primarily used, but statistics of the external influences in the e-learning process were also improved. In an e-learning environment, the individually supported development of a learner’s conceptual understanding was analyzed by SOLO-taxonomy by comparing the learner’s own outcomes. The results show that e-learning with traditional laboratory activities has the effect of forming chemistry concepts, and results in meaningful learning. The SOLO-taxonomy would be a powerful tool for faculty for analyzing points of difficulty or confusion in students’ understanding of chemistry concepts. To better understand the effectiveness of e-learning, studies have to be directed toward higher-order cognition by collaborative learning in addition to conceptual understanding of individuals.

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## RECENT DISSERTATIONS

ÅSA RYEGÅRD (2004):

*Interaction Between Practical and Theoretical Knowledge - A Study in Electronics Education at University Level*

Department of Electronics, Mälardalen University, Sweden

Licentiate thesis No.37

### Abstract

Scores on standardized tests in the field of electronics is below average compared to other fields, indicating a need for improved education methodologies. This licentiate thesis presents the results of a teaching method called “Interactive Teaching” which exposes the student to practical aspects of electronics at the same time as student is learning the theory.

Within the scope of “Interactive Teaching” strategy, each lecture is followed by an interactive exercise. In this exercise the students verify theories with practical work and discuss the results in smaller groups. The practical verification of theoretical learning is intended to strengthen the interaction between theory and practice and to make students actively find answers to their own questions. “Interactive Teaching” also obliges the students to continuously demonstrate their practical and theoretical learning. The aim is to motivate the students to follow the course and to influence the students learning strategy. The course is finished with an interactive exam, which contains both theoretical and practical problem solving in order to influence the students learning strategy even more. In addition, each student receives a kit with all the equipment necessary for the laboratory exercises. The kit can be used both at home and at school. The purpose of the kit is to make the practical work more easily available and to encourage practical work and experimental work procedures.

Interactive and traditional teaching methodologies, as described in the thesis, were compared in a study comprising 110 engineering students. The study was implemented by a randomized controlled trial called “pretest – posttest control group design”. To make the study as complete as possible, the experimental design was complemented with an attitude test, a formative assessment and an examination assessment.

It was shown that interactive teaching, with its verification of theoretical concepts with practical examples, did strengthen the student’s capability to solve problems in electronics. Also, the open framing of questions encouraged the students to find answers to their own questions. Interactively taught students were just as good in theoretical knowledge and better in practical knowledge compared to their traditionally taught peers. Interactively taught students increased their self-confidence when solving problems. They also increased the time they spent on studies as well as that they used their electronic knowledge outside the university. 70% of the interactively taught students passed the final exam versus only 60% of the traditionally taught students, thus they understood the course objective in larger extent.

The positive student response and the increased examination scores show that interactive teaching is an improvement in relation to traditional teaching methodologies. The interactive teaching method most likely influenced the students’ study methods. The licentiate thesis presents a domain specific hypothesis.

Language: *Swedish with summary in English*

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## RECENT DISSERTATIONS

ANTTI SAVINAINEN, 2004:

High School Students' Conceptual Coherence of Qualitative Knowledge in the Case of the Force Concept  
Department of Physics, University of Joensuu, Finland  
Dissertations no 41.

### Abstract

The theoretical research aims were to characterise students' conceptual coherence of qualitative knowledge in the case of the force concept, and how it can be evaluated. Students' conceptual coherence can be divided into three aspects: representational coherence, which is the ability to use multiple representations and move between them; contextual coherence, i.e. the ability to apply concepts in a variety of contexts (familiar and novel), and conceptual framework coherence, which addresses the relations - integration and differentiation - between relevant concepts. Certain groupings of the Force Concept Inventory (FCI), the Force and Motion Conceptual Evaluation (FMCE), and the Test of Understanding Graphs - Kinematics (TUG-K) questions were used to probe students' contextual and representational coherence of the force concept. Written extended response questions and interviews were also used in addition to multiple choice tests to provide complementary data.

The empirical part of the dissertation consists of designing a teaching approach (Interactive Conceptual Instruction (ICI)) and teaching sequences for kinematics and the force concept. The ICI approach involves several features or components: conceptual focus (concepts are introduced and rehearsed before quantitative problem solving), the use of multiple representations in varying contexts, classroom interactions (peer instruction), research-based materials, use of texts (reading before formal treatment), and concept maps.

An empirical study was conducted to test the effectiveness of the ICI teaching. The study involved two pilot and two study groups in Kuopio Lyseo High School: Preparatory International Baccalaureate students (age 16; npilot = 22 and nstudy = 23) and Finnish National Syllabus students (age 17; npilot = 52 and nstudy = 49). The pilot groups followed the ICI approach without a focus on forces as interactions whereas the study groups followed the ICI approach with a focus on forces as interactions. The study groups were taught to think of forces as interactions through the systematic use of a modified version of the 'Symbolic Representation of Interactions', which provided a bridging representation to more abstract free-body diagrams. Otherwise, introductory mechanics was taught largely in a similar manner to the pilot and study groups.

Statistical testing, normalized gain, and effect size were used to analyse the statistical and practical significance of the changes along different dimensions of the force concept. The most impressive conceptual gains were made in verbal representation of Newton's first and third laws, and contact force. Focusing on forces as interactions proved to be very effective: all indices showed that the study groups had much better results in Newton's third law than the pilot groups. However, the data in this study suggest that focusing on forces as interactions does not necessarily enhance students' conceptual understanding of the force concept in dimensions other than Newton's third law.

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## RECENT DISSERTATIONS

### ASTRID SINNES, 2005:

*Approaches to Gender Equity in Science Education: Two Initiatives in Sub-Saharan Africa Seen Through A Lens Derived From Feminist Critique of Science*

Department of Teacher Education and School Development, Faculty of Education, University of Oslo, Norway.

Series of Dissertations submitted to the Faculty of Education, University of Oslo No38. Oslo: Unipub AS.

### Abstract

Gender equity in education has gained renewed attention after the General Assembly of the United Nations adopted the Millennium Declaration in the year 2000. This committed all member states to the target of eliminating gender disparity in all levels of education by 2015. Science, Mathematics and Technology Education constitute the areas within the educational system where the gender disparity is greatest in the majority of the poorest countries of the world.

This thesis explores strategies for increasing gender equity in science education. Using feminist critique of science as a theoretical point of departure, an analytical framework is constructed describing three different approaches to attain gender equity in science education. Each of these strategies is grounded in different understandings of the impact of sex/gender on pupils' engagement in science education.

The analytical framework is used in a study of how two major sub-Saharan African initiatives work towards increased gender equity in science education. The two initiatives that were studied are African Forum for Children's Literacy in Science and Technology (AFCLIST) and Female Education in Mathematics and Science in Africa (FEMSA). Based on analysis of relevant documents, interviews of eighteen science educators representing eleven sub-Saharan countries and site visits to six countries in sub-Saharan Africa, the two initiatives' distinct strategies are described and analysed. Contradictory recommendations within the two initiatives are identified and discussed.

The analysis shows significant differences between the two initiatives both in their perceptions of how sex/gender impacts on pupils' engagement in science education and in their views on how gender equity in science education should best be achieved. The analysis suggests that it is mandatory that planning and implementation of initiatives and strategies to increase gender equity in science education is in accordance with their perception of the impact of sex/gender on pupils' engagement in science education.

Language: English

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## RECENT DISSERTATIONS

KARI SORMUNEN, 2004:

*Seventh-graders' epistemic views related to science lessons*

University of Joensuu, Department of Education, Finland

Publications in Education No. 95

### Abstract

The aim of this study was to explore seventh-graders' views on knowledge and their acquisition of knowledge. The pupils' views were examined in the context of six double lessons in physics, where their study focused on the structure and states of matter. The research task was divided into four main research questions (RQ). (1) The pupils' epistemic conceptions were approached from three different perspectives: their own, their teacher's and a scientist's. (2) The pupils' notions related to their epistemic judgement of their own learning were examined, as well as (3) their conceptual understanding of the contexts in question. (4) The composite view of each pupil was correlated with his/her personal conceptions, and these personal epistemic views examined and compared with each other.

The first main result was that developmental theories of personal epistemological belief are not the best for explaining young pupils' epistemic conceptions. It can be claimed that theoretical models of development, in fact, underestimate seventh-graders' epistemic views. In contrast, when such epistemological beliefs are approached in greater detail and with their context taken into account, they can be seen to be structures that consist of epistemic primitives, and thus offer the possibility of a promising and more pedagogically applicable approach.

The 2nd RQ was designed to facilitate the linking of pupils' epistemological conceptions and their metacognitions, both on a conceptual-theoretical level and on an empirical-hypothetical level. The findings of the present study, though preliminary in nature, suggest that epistemic cognitions are in fact separate from metacognitions and that the relating processes are hierarchical in nature. Both processes guide the cognitive processes, but the epistemological processes function at a higher level.

The 3rd RQ has provided valuable insight into pupils' conceptual understanding of the topic under study, an aspect that was also essential for the contextual interpretation of the research. The use of models and modelling as an instructional approach can be claimed to have produced a relatively far-reaching understanding of the structures and states of matter. Combining the pupils' conceptions as parts of their composite epistemic views has also been of value in a methodological sense: few, if any, studies exist in which conceptual understanding has been explored as a part of epistemological beliefs.

The conclusion for the 4th RQ was reached that the composite epistemic views of each pupil were very different. This major finding suggests that, when science is taught, pupils' epistemically different conceptions and their sheer variety also need to be taken into account. This situation should be regarded as a challenging opportunity to examine and re-think the various epistemological ideas and forms. In other words, pupils' epistemological beliefs should be seen not as developmental constraints but as epistemological starting-points and resources for class discussion.

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## RECENT DISSERTATIONS

### MARGARETA SVENNBECK, 2004:

*Care for nature. About the selective traditions in science education, with a focus on environmental education and gender.*

Department of Teacher Education, Uppsala University, Sweden.

Uppsala Studies in Education 104. Uppsala: Acta Universitatis Upsaliensis.

### Abstract

This thesis is intended as a contribution to the discussion about science education, especially with regard to how care for nature can be understood, to what extent care for nature is included or excluded in the science education discourse and the importance of this in regard to an environmental education and a gender perspective. The empirical part of the thesis is carried out as a case study, where the discourse of physics is studied as a case within the discourse of science education. The discourse of physics is investigated by analyses of textbooks for lower secondary school in Sweden.

In the thesis, I present two ways of understanding care for nature. The first way is related to a systemic aspect of ethics that is based on principles. If the principles in use ascribe intrinsic value to nature, then the ethics can be seen as an expression of a systemic aspect of care for nature. The second way is related to an aspect of ethics based on care in 'I-Thou encounters' with nature, and is seen as a non-systemic aspect of care for nature.

Three forms of analyses are performed: 1) of the discourse and selective traditions in physics, 2) of orientations (attitudes) towards nature, and 3) of ways of knowing (indicating what meetings with nature students are offered in science education).

The analyses performed showed one discourse in physics education, consisting of two selective traditions. The systemic aspect of care for nature is excluded as the discourse has an anthropocentric foundation. The non-systemic aspect of care for nature is also excluded, as no I-Thou meetings are offered through the ways of knowing and no expression for the I-Thou attitude is found in either of the traditions. Further, ways of knowing and an ethical orientation associated with female gender are excluded. Thus, the discourse in physics does not contribute to obtaining the goals of the national syllabuses concerning gender equality and care for nature from the perspectives investigated.

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## RECENT DISSERTATIONS

ELSI TORN, 2004:

*Chemistry is cool. Research on how scientifically talented 9th graders view chemistry teaching*

Faculty of Behavioral Sciences, Dept of Applied Sciences of Education, Helsinki University, Finland.  
Department of Applied Sciences of Education, Studies 254.

### Abstract

This research declares in the phenomenographical way, pupils' impressions about their effective and useful models of learning as well as social grouping of pupils when studying primary level chemistry. The informants (N=47) are the most scientifically talented third of homogenous 9th grade at the comprehensive school in Finland. The research material was collected mainly by conducting conversations from the feedback after teaching.

The analysis of feedback discussions shows that pupils adopt different attitudes in studying chemistry. You can find four groups. One group fails to do studies (outsiders), the other group wants to have excellent marks (mark-hunters) being content with learning by heart and superficial strategies. These pupils are not interested in chemistry as a science. About half of the pupils develop enthusiasm. One group is merely interested in the subject itself and the other in learning by doing. Even in their own handling of knowledge, the pupils of different adaptations considered various models of learning to be efficient.

Those most interested in the subject, **the "matters"** listened to the teacher and they liked to read. They deepened their knowledge and experienced pleasure by reaching conclusions and demonstrating comprehension. Those who learned by doing, **the "doers"** got support for their learning by means of doing even when thinking and seeking knowledge. For instance, it was important for the doers to arrange knowledge by writing, for example, in dialogue journals. They experienced pleasure through their own observations while working in the laboratory. **The outsiders** longed for varying and exiting models of learning. This is where you can feel as if you are participating even if you are merely sitting. It was important for **mark-hunters** that the model of learning allow them to realize easily, for example, by using ready-made classifications or tabulated materials.

Everybody experienced that the teacher's information was important. Classmates as informers were not appreciated at all. Letter writing they considered to be a highly effective model of learning. Nearly everyone considered discussions in their home group to extend one's comprehensions and help understanding. The investigated models of learning formed a varying wholeness of studies and they were based on different concepts of learning. Doers and matters lived in a socio-constructivist society, getting knowledge from each other in their home groups.

Nine of ten informants had felt pleasure in their chemistry studies. The doers and matters obtained pleasure from just studying processes. The mark-hunters experienced less pleasure. Sufficient challenges were posed as voluntary and elective jobs for talented pupils and they considered their studying to be sensible. The teacher is the expert and has the role of creating atmosphere and ensuring that the pupils work in peace.

Language: *Finnish with summary in English*  
ISBN: 952-10-1988-3  
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Download: <http://ethesis.helsinki.fi>

## RECENT DISSERTATIONS

ANITA WALLIN, 2004:

*The theory of evolution in the classroom. Towards a domain specific theory for teaching biological evolution.*

Department of Education, Göteborg University, Sweden

Göteborg Studies in Educational Sciences 212. Göteborg: Acta Universitatis Gothoburgensis

### Abstract

The overall purpose of this thesis is to study how upper secondary school students (grade 10-12) develop an understanding of evolutionary biology as a result of teaching. Taking students' pre-conceptions as the starting point a teaching sequence is designed with the aim that students shall learn the theory of evolution by natural selection in such a way that it becomes an intellectual tool. In other words they shall be able to describe, understand, explain, and partly predict biological phenomena from an evolutionary point of view.

Three different teaching experiments were performed and studied in a cyclic process with design and evaluation of both teaching and students' learning, followed by a new design and so on. The students' knowing was tested before, during, and after teaching by written tests, interviews, small group discussions, and a database-driven Internet problem. Similar results emerge from the analyses of the students' performances in the different data collections: e.g. all students do not accept random processes before teaching, many students use the same alternative ideas, and existing variation is a key idea to understand the theory of evolution, and to reason scientifically. The majority of the students, about 80 %, had alternative ideas about evolution before teaching. They viewed evolution as a gradual process where every member of the population adapts to the environment. They consider adaptation as the driving force that is regulated by, for instance need, strive, or purpose. In the delayed post-test one year after teaching most students, about 75 %, had reached a scientific level. This result can be considered good compared to many other studies reported in the literature.

The students' reasoning in the different tests was carefully analysed having preconceptions, the conceptual structure of the theory of evolution, and the aims of teaching in mind. This gave insights into those learning and teaching demands that constitutes challenges to students as well as to teachers, when beginning to learn, or to teach evolutionary biology. The combined results from these analyses of the three experiments are summarized in a domain specific hypothesis for teaching. It consists of three different aspects: content specific aspects, which are unique for every field of science, aspects concerning the nature of science, and general aspects. This hypothesis can be tested in new design experiments, and if it will withstand future tests it can be developed into a domain specific theory for teaching evolutionary biology.

Language: *Swedish with summary in English*

ISBN: 91-7346-497-X

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Download: <http://na-serv.did.gu.se/avhand/wallin> (English summary)

## RECENT DISSERTATIONS

ANNA M. VIKSTRÖM, 2005:

*Ett frö för lärande. En variationsteoretisk studie av undervisning och lärande i grundskolans biologi (A seed for learning. A variation theory study of teaching and learning in biology.)*

Department of Educational Sciences, Luleå University of Technology, Sweden

Doctoral thesis no: 2005:14

### Abstract

The background of the study is an action research study described in a licentiate thesis (Vikström, 2002). In that licentiate study six teachers extended their reflective focus in science teaching from a limited focus upon activities where learning of the content was taken for granted to a focus upon both the content and their students' understanding of that content. This extension of reflective focus was seen as a premise for further professional development.

The research focus in this doctoral thesis, carried out together with the same six teachers, is the relationship between teaching and learning of a specific object of learning, the life cycle of angiosperms, concerning matters such as sexual reproduction, photosynthesis and cellular respiration. Within the framework of variation theory, experienced critical aspects of the object of learning are compared with the patterns of variation in the enacted object of learning. Video-recorded lessons and interviews with teachers and pupils provided the researcher with data about how the teachers handled, and related to the object of learning and how the pupils' understanding developed. The result shows that it is possible for even very young pupils to develop their understanding of abstract biological phenomena, if that possibility is offered to them in school. The opportunity to learn is in turn provided by the created patterns of variation, which make discernment of critical aspects possible. The teachers' professional competence, meaning their competence for promoting pupils' learning by forming patterns of variation, also developed. An overall conclusion is that collaboration between researchers and teachers in such a process of curriculum improvement is a way to increase and accumulate teachers' professional knowledge.

*Language: Swedish with summary in English*

*ISSN:1402-1544*

*Contact: Anna.M.Vikstrom@ltu.se*

*Download: <http://epubl.ltu.se/1402-1544/2005>*

## RECENT DISSERTATIONS

ANN ZETTERQVIST, 2003:

*Competence in the subject matter didactics of evolutionary biology. A interview study with science/biology teachers*

Department of Education, Göteborg University, Sweden.

Göteborg Studies in Sciences 197: Acta Universitatis Gothoburgensis

### Abstract

Since the 80's researchers have discussed how teacher's professional competence should look like in order for students to learn in different subject matter areas. My view is that a concept is needed to elucidate the specific knowledge required to teach and to develop teaching in a specific subject matter area for a specific group of students. I call this knowledge *competence in subject matter didactics*. In order to have and develop this competence I suggest that the teacher must integrate different kinds of knowledge, which I specify in a *knowledge base of subject matter didactics*. It contains knowledge of: subject matter theory, theories of learning and knowledge, curricula and syllabuses, frame factors, textbooks, students' preconditions to learn the subject matter, the teacher's preconditions to teach the subject matter, teaching strategies and evaluation.

The purpose of this thesis is to elucidate and discuss teachers' competence in didactics of evolutionary biology by studying the knowledge in a group of teachers regarding teaching strategies, subject matter theory and students' preconditions to learn evolutionary biology. Data is generated by interviews with 26 experienced science/biology teachers.

Two "teaching projects" are identified, *orientation and conceptual understanding*. In the orientation teaching project focus is on descriptions of evolution and sometimes proofs of evolution and its chronology. The scientific concepts genealogy, diversity and variation are not linked to evolution, and the concepts natural selection, adaptation and speciation are not taught at all or only briefly defined. In the conceptual understanding teaching project focus is on the mechanisms of evolution. The scientific concepts genealogy, diversity and variation are linked to evolution, and conceptual understanding of natural selection, adaptation and speciation are considered important.

Many teachers expressed everyday conceptions during the interview when using the concepts *natural selection and adaptation*. Natural selection could be expressed in terms of individuals changing in order to survive. In addition several teachers attributed evolutionary theory a low explanatory power and/or low scientific status. Many teachers showed good knowledge about students' everyday conceptions, but several teachers did not comment on formulations in a written student response, that could be interpreted in terms of that want or need of individuals is the driving force of evolution.

Most teachers in the test group do not describe a teaching of evolution with focus on conceptual understanding. One possible explanation is that they don't have the competence required. This is not surprising since the knowledge needed to teach with that focus is extensive. The consciousness of this have been low or missing in school politics, educational research, teacher education and in schools. Therefore teacher students and active teachers have not had the opportunity to develop this competence.

Language: Swedish with summary in English

ISBN: 91-7346-469-4

Contact: Ann.Zetterqvist@ped.gu.se



## THIRD SCANDINAVIAN SYMPOSIUM ON RESEARCH IN SCIENCE EDUCATION

Karlstad University, Sweden, 9-10 February 2006

*“Teaching science for understanding:  
new strategies, representations and other tools”*

### Invitation and first circular

This symposium is a follow-up of the successful symposia, organized by Hans-Jürgen Schmidt (Karlstad) and Veijo Meisalo (Helsinki). As earlier, the aim is to bring together researchers from Scandinavian countries to present and discuss empirical studies in biology, chemistry, physics, and general science education. Special attention will be paid to interesting teaching strategies and tools like representations (visualizations, models, analogies, and so on). Research that is already finished as well as ongoing research can be presented. The symposium language will be English.

Please, send a one-page outline for a paper or poster presentation before 20 November 2005 to [Onno.dejong@kau.se](mailto:Onno.dejong@kau.se). The decision about your proposal will be sent before 20 December. Participants without a paper or poster are also very welcome. They should express their interest by sending a mail to the address above (preferably before 20 December).

**Conference dates:** 9 –10 February 2006.

**Location:** Karlstad University, Sweden. See [www.kau.se/eng](http://www.kau.se/eng). Karlstad is a wonderful town in the middle of Sweden near the famous big Lake of Vänern. See [www.karlstad.se](http://www.karlstad.se). Karlstad is easy to reach by plane (via Stockholm or Copenhagen), by train (from Stockholm, Göteborg or Oslo), or by car.

**Conference fees:** No fees. Participants shall cover their own expenses for travel and stay.

**Conference Chair:** Dr Onno de Jong, Dep. of Chemical Education, Karlstad University.

**Deadline for proposals (paper, poster):** 20 November 2005.

**Further information:** [Onno.dejong@kau.se](mailto:Onno.dejong@kau.se). A second circular with details about the program, possible accommodation, and so on, is sent out in the beginning of January 2006.

**IOSTE XII SYMPOSIUM**  
**Science and Technology Education in the Service of Humankind**  
**<http://ppip.usm.my/ioste12>**

30 July – 4 August 2006  
Penang Grand Plaza Parkroyal Beach Resort, Malaysia.

The XII IOSTE Symposium will be held in Penang, Malaysia on 30 July – 4 August 2006. It will be hosted by the *School of Educational Studies, Universiti Sains Malaysia (USM)* - with the support of local, regional, and organizations and dedicated to the improvement of STE. This is the first time IOSTE Symposium will be held in the Asian region, and Malaysia is honoured to host this international gathering.

The XII IOSTE Symposium will gather researchers, policy makers, teachers and others who are concerned about how *Science and Technology Education (STE)* can contribute to individual development as well as to sustainable global development and international understanding. It will provide participants with a unique opportunity to look back and evaluate where STE education has been going, review challenging issues, and to look forward and plan for the future.

The Symposium will be a 5 full-day session event with participants checking in on (or before) Sunday, 30 July 2006, and checking out on (or after) Friday, 4 August 2006.

Symposium Theme: "Science and Technology Education in the Service of Humankind".

Subthemes include:

- 1 Promoting peaceful and ethical use of Science and Technology through STE
- 2 STE for Development, Empowerment and International Understanding
- 3 STE from different cultural and humanistic perspectives: promoting international collaboration and understanding through cultural diversity
- 4 Making relevance of effective teaching-learning in STE

**CALL FOR PROPOSALS**

E-mail Addresses for Proposal Submission: [sfatimah@usm.my](mailto:sfatimah@usm.my) or [zurida@usm.my](mailto:zurida@usm.my) or [syoong@usm.my](mailto:syoong@usm.my) Deadline for submission is **November 31, 2005**.

Technical details are given at the IOSTE XII website

**REGISTRATION AND FEES**

The registration and participation fee (240 Euro before May 2006) will cover all lunches, 2 coffee breaks, welcome reception, a conference dinner, a cultural field trip, and a conference bag with documents (Programme Book, Proceedings, etc.)

**VENUE AND ACCOMMODATION**

The XII IOSTE Symposium will be held at the 5-star's Penang Grand Plaza Parkroyal Beach Resort, Malaysia. Hotel rates at this hotel are about 50 Euro per night (sharing), and cheaper accommodation is also available. Penang is a tropical island resort in Peninsular Malaysia, which is situated in the heart of Southeast Asia. Travel to Penang is convenient via most international airlines.



Final call for papers

**Sixth conference of  
EUROPEAN RESEARCHERS IN DIDACTICS OF BIOLOGY  
ERIDOB 2006**

**At the Institute of Education, University of London, UK  
from the 11<sup>th</sup> to the 15<sup>th</sup> September 2006**

The Academic Committee invites researchers in Biology Didactics to take part in the Sixth Conference of European Researchers in Didactics of Biology (ERIDOB). Its theme is "Biology in Context: Learning and teaching for the 21st century".

The aim of the conference is to give researchers in Biology Didactics the opportunity to present and discuss their research work and results. The following are eligible to attend ERIDOB 2006:

- All people who submit a proposal on time, including co-authors, regardless of the outcome of the review process.
- Research students being supervised by any of the presenters.
- Students at the host university who are actively involved in biology education research.

Papers may be presented as an oral contribution or a poster. No participant may submit more than **one** first authored paper. The first author is assumed to present the paper unless otherwise stated. No participant may present more than once during the conference. No individual should appear in the programme more than three times.

**Proposals must be submitted by 1<sup>st</sup> January 2006**

Further information can be found in the web page of the conference at [www.ioe.ac.uk/mst/eridob](http://www.ioe.ac.uk/mst/eridob)

## **Call for PhD students' contributions to the ESERA Summer School 2006**

Braga, Portugal, 15-22 July

The next ESERA Summer School will be held at the Institute of Child Studies of the University of Minho, in Braga, Portugal, 15-22 July 2006.

The organising committee will be happy to receive the proposals of PhD students working in the field of science education.

At the ESERA Summer School you will be working with a team of 6-7 PhD students and two well-known mentors from European universities. You will have a chance to attend workshops and talks as well as to present and discuss your work in detail with your peers. We expect about 45 students and more than 16 mentors to attend the Summer School.

### ***Schedule***

- Submission of proposals: 1 December 2005
- Proposals reviewed before: 1 February 2006
- Synopsis set up at the ESERA website before: 1 May 2006
- Registration before: 1 June 2006
- Preliminary programme before 1 June 2006
- Summer-School: 15-22 July

### ***Registration fees***

The cost of the Summer School is not yet confirmed but our estimate is 450 Euro for Students and 500 Euro for supervisors. The fee includes accommodation, meals and a conference pack. A small number of ESERA grants are available to students in financial hardship.

### ***Recommendations***

Priority will be given to students who have been studying full-time for one-two years or part-time for two-four years. Supervisors of the applicant students are very welcome to join the Summer School.

### ***More information***

See [www.naturfagsenteret.no/esera/summerschool](http://www.naturfagsenteret.no/esera/summerschool)

## Tegn abonnement på NorDiNa

**For subscription details in English, see  
[www.naturfagsenteret.no/tidsskrift/nordina](http://www.naturfagsenteret.no/tidsskrift/nordina)**

NorDiNa kom ut med to numre i 2005, men for påfølgende år vil antallet øke til 3.

Et årsabonnement på NorDiNa koster 250 NOK for enkeltpersoner og 400 NOK for institusjoner. Abonnement tegnet for 2006 inkluderer også nummer 2/05.

Bestill ditt abonnement på [www.naturfagsenteret.no/tidsskrift/nordina](http://www.naturfagsenteret.no/tidsskrift/nordina). Vi oppfordrer alle til å bestille på Internett, fordi det forenkler registreringsarbeidet betraktelig. Vi legger opp til elektronisk innbetaling med betalingskort. Innbetaling i Norge kan eventuelt skje med faktura, men vi ber innstendig alle om å bruke elektronisk innbetaling. Ved bruk av faktura kommer et fakturagebyr på 50 NOK i tillegg. Valg av betalingsform gjøres på nettet.

Trenger du mer informasjon? Kontakt [lise.faafeng@naturfagsenteret.no](mailto:lise.faafeng@naturfagsenteret.no)



GÖTEBORGS UNIVERSITET