

RECENT DISSERTATIONS

GUNILLA GUNNARSSON, 2008:

Interactions in Laboratory Classroom Activities – A study of what meaning making can be afforded to students in their 7th year at school in encounters with laboratory activity instructions, artefacts and language within Elementary Electricity, and of teachers' didaktik action patterns in such encounters.

Department of Social and Welfare Studies, Linköping University, Norrköping, Sweden. Studies in Science and Technology Education, 24, Linköping University.

Abstract

This thesis studies students' encounters with school science language games within the framework of laboratory classroom activities in elementary electricity. The aim is to describe ongoing interaction activities and instructions as well as student focusing in relation to the teacher's aims, and to elucidate the interactions appearing in students' encounters with new artefacts and new language usage. The aim is also to describe the way the teacher can assist the students in their learning process during these encounters.

Three student groups from the Swedish comprehensive school year 7 and their teachers have been studied by observation *in situ*. Data has been gathered via field notes and video recordings made during approximately three weeks per group. One of the teachers was interviewed about the aims of the laboratory sessions.

The result shows that the aim of the laboratory sessions as expressed by the teacher in the interview – what the students were expected to learn from the laboratory sessions – remained implicit to the students. Explicit to them, were, however, the descriptions in the laboratory instructions – the *doing* that was supposed to take place. The lab instructions can be viewed as interaction affordances by which the students act, which gives the instruction a great impact on what students focus on and actually learn. The artefacts, as participants in the activity, offer several different interaction affordances, depending both on their design and on students' earlier experiences. This means that the interaction with artefacts creates learning differences for different students in different situations. The method for analyzing classroom interactions is also further developed. The encounter with scientific language usage and everyday language often leads to so-called *language game clashes*, the result of which may be that *distracting gaps* (problems/questions) in the communication are noticed (they distract students in their continued learning). Terms that are known to students in the everyday language game but which obtain another meaning in the new scientific language game may, since the discrepancy is unclear to the student, be viewed as *gaps unnoticed so far*. The action pattern as an expression of the teacher's *didaktik finger-tip sensitivity* as part of the teacher's PCK or PCxK is described. Teacher aid may either be described as *indirect*, when the teacher helps students to notice problems, *desirable gaps* in the situation, or as *direct*, when the teacher helps students to solve the problems they have noticed, to fill the gap with relevant relations.

Language: Swedish with summary in English

ISBN: 978-91-7393-791-7

Contact: gunilla.gunnarsson@hik.se

Download: <http://liu.diva-portal.org/smash/record.jsf?pid=diva2:25545>

RECENT DISSERTATIONS

PER SUND, 2008:

Discerning selective traditions in the socialization content of environmental education – implications for education for sustainable development

Mälardalen University, School of education, culture and communication, Sweden

Abstract

This thesis offers an empirical contribution to research on content issues in environmental education. One way of approaching content issues is to study the socialization content. Socialization content forms an educational context in which subject matter content can develop into meaning. Through their different actions teachers communicate companion meanings to students, which together constitute the socialization content. These are messages *about* the subject and *about* education, such as the importance of students' participation.

One important starting point for this thesis is that the learning of subject matter and socialization content is simultaneous. Learning is often regarded as an inner individual process, while socialization is more often understood as an external fostering. By using the concept of meaning making, learning and socialization can be regarded as both simultaneous and mutual.

The thesis has two main purposes, namely, methodological development and a more substantial study of socialization content. An interview method and analytical tool for researchers has been developed as a result of conducting a literature review and interviewing upper secondary school teachers involved in a general science course. This tool can be used to study the qualitative aspects of socialization content by examining shifts in five important educational aspects, and has been applied to the empirical data collected from teacher and student interviews.

The analytical tool can also be transformed into a reflection tool for teachers to render their educational habits more visible. Teachers' collective habits can develop into selective traditions in environmental education. Socialization content can be regarded as an important value-laden content that needs to be critically examined in an open democratic school system. These discussions could facilitate the development of a more pluralistic environmental education, which in turn could be further developed into an education for sustainable development.

Language: Swedish summary in English
ISBN: 978-91-85485-88-8
Contact: per.sund@mdh.se
Download: English summary available after contact

RECENT DISSERTATIONS

MARIA ÅSTRÖM, 2008

Defining Integrated Science Education and Putting It to Test

Nationella forskarskolan i Naturvetenskapernas och teknikens didaktik (FONTD), ISV, Linköpings universitet, 601 74 Norrköping.
Studies in Science and Technology Education No 26.

Abstract

The thesis is made up by four studies, on the comprehensive theme of integrated and subject-specific science education in Swedish compulsory school. A literature study on the matter is followed by an expert survey, then a case study and ending with two analyses of students' science results from PISA 2003 and PISA 2006. The first two studies explore similarities and differences between integrated and subject-specific science education, i. e. Science education and science taught as Biology, Chemistry and Physics respectively. The two following analyses of PISA 2003 and PISA 2006 data put forward the question whether there are differences in results of students' science literacy scores due to different types of science education.

The expert survey compares theories of integration to the Swedish science education context. Also some difference in intention, in the school case study, some slight differences in the way teachers plan the science education are shown, mainly with respect to how teachers involve students in their planning.

The statistical analysis of integrated and subject-specific science education comparing students' science results from PISA 2003 shows no difference between students or between schools. The analysis of PISA 2006, however, shows small differences between girls' results with integrated and subject-specific science education both in total scores and in the three scientific literacy competencies. No differences in boys' results are shown on different science educations.

Language: English
ISBN: 978-91-7393-770-2
Contact: maria.astrom@edmeas.umu.se
Download: www.ep.liu.se/smash/record.jsf?searchId=1&pid=diva2:114056

RECENT DISSERTATIONS

STINNE HØRUP HANSEN, 2008:

Fortællinger i Naturvidenskab – en empiribaseret undersøgelse af videnskabsteaterforestillinger i Den Magiske Kugle og dens forankring i gymnasiepraksis.

Center for Science and Mathematics Education, Department of Mathematics and Computer Sciences. University of Southern Denmark.

Abstract

The Magic Bullet (in Danish: Den Magiske Kugle) is a Science Theatre Play which communicates a research narrative. The present dissertation documents the various effects resulting from the application of the play as a tool to communicate science to students of the Upper Secondary School. The Magic Bullet is a fairy tale about biophysics embedded within the real world of research. The play conveys to the audience state of the art research as it is put to use in the quest of finding a cure for cancer.

The scope of the dissertation is, through empirical studies, to investigate the students' perception and reception of the instance of being told about science – an instance which in this dissertation is labeled narrative reception. The narrative reception analysis reveals three topical determinants for how the play is received: The students' specific interests, which is closely related to their educational prerequisites for receiving and understanding the play, their general expectations of a science theatre play, and finally what they actually think of the performers.

In relation to the play, two different teaching materials were designed, applied and evaluated. The methodological basis of the project is design - based research, and a range of qualitative methods were applied in the collection of empirical data. Five classes from Upper Secondary School have watched The Magic Bullet: Three classes with a scientific profile and one with a social scientific profile comprising a total of 90 students.

Data obtained from the analysis of the teaching materials show that the students feel that the sequences helped them to process the scientific content of the play through collective learning, which in turn resulted in a more thorough understanding of play.

Based on the results of this study it can be concluded that The Magic Bullet is applicable for students in Upper Secondary School for three purposes: First, as a means to boost the interest for science among young people. Second, the play has proved itself as an excellent tool for both students and teachers to create thorough and logical coherence between subjects. Third, the play is capable of repeating the knowledge, and adds on more to the knowledge, already acquired by the students - thereby supporting their self definition as scientifically literate. These characteristics of the play are more pronounced with regard to students that already have some interests in science which proves the play to be widely applicable irrespective of subject preferences.

Language: Danish with an abstract in English
Contact: Stinne@sdu.dk
ISBN: 9788792321060

RECENT DISSERTATIONS

PIRKKO KÄRNÄ, 2009:

Holistic physics education in upper secondary level based on the optional course of physics. University of Helsinki, Department of Physics, Helsinki, Finland
Report Series in Physics HU-P-D157, Helsinki: Helsinki University Print

Abstract

The goal of this research was to improve teaching and to widen the perspective on how physics is taught. Holistic physics education means in this research teaching, in which all goals of the curriculum are taken into account. These involve knowledge, skills and personal value and attitude goals. Research task was to clarify how the educational goals involving student's values and attitudes can be carried out through the subject content of physics. How does the physics teacher communicate the modern world view through the content of the physics class?

The teacher-researcher planned and delivered an optional course where she could study the possibilities of holistic physics education. In 2001-2002 ten girls and two boys of the grade 9th class participated in that elective course. Research method was content analysis that involved both analyzing student feedback, and relevant features of the teacher's knowledge, which are needed for planning and giving the physics lessons. In this research that means taking into account the subject matter knowledge, curriculum, didactic and the pedagogical content knowledge of the teacher. Among other things, the researcher constructed the contents of the curriculum and abstracted sentences as keywords, from which she drew a concept map. The concept maps were tools for studying contents which are included in the holistic physics education. Moreover, conclusions were reached concerning the contents of physics domains by which these can be achieved.

According to this research, the contents employing the holistic physics education is as follows: perception, the essence of science, the development of science, new research topics and interactions in physics. The starting point of teaching should be connected with the student's life experiences and the approach to teaching should be broadly relevant to those experiences. Since such contents is not employed by teaching the physics included in the standard curriculum, supplement relevant teaching material that includes such topics are needed.

The students reported that the goals of holistic physics education were achieved in the course. The discourses of the students indicated that in the experimental course they could express their opinions and feelings and make proposals and evaluations. The students had experiences about chances to affect the content of the course, and they considered the philosophical physics course interesting, it awakened questions, increased their self-esteem and helped them to become more aware of their world views. The students' analytic skills developed in the interactive learning environment.

Language: Finnish with summary in English
ISBN: 978-952-10-4225-6
Contact: pkarna@kolumbus.fi
Download: <http://per.physics.helsinki.fi/kirjasto/ont/pkarna/index.html>

RECENT DISSERTATIONS

CARL-JOHAN RUNDGREN 2008:

Visual Thinking, visual speech - a Semiotic Perspective on Meaning-Making in Molecular Life Science.

Swedish National Graduate School in Science and Technology Education Research (FONTD), Department of Social and Welfare Studies, Linköping University, Sweden. studies in Science and Technology Education No 20

Abstract

Molecular life science has become one of the fastest-growing fields of scientific and technical innovation. An important issue for tomorrow's education is to meet the challenge posed by various facets of molecular life science. This thesis highlights four aspects of molecular life science education: the rapid production and flow of information, its multi- and interdisciplinary character, the complexity of life phenomena and our knowledge of them, and the high level of abstraction of the knowledge produced. Images, diagrams and other forms of visualization are playing increasingly important roles in molecular life science teaching and research, both for conveying information and as conceptual tools, transforming the way we think about the events and processes the subject covers. This study examines how upper secondary and tertiary students interpret visualizations of proteins. The participating upper secondary students were taking different variants of the natural science program in the second (grade 11) or third (grade 12) year. A set of 20 upper secondary students were interviewed in semi-structured, revised clinical interviews. Furthermore, 31 university students participated in a group discussion and answered a questionnaire, and four third-year biochemistry students were interviewed. The interviews were structured around 2D illustrations of proteins and an animated representation of water molecules being transported through a channel in the cell membrane. Three critical features of the ability to visualize biomolecular processes were identified: the complexity of biomolecular processes, the dynamic and random nature of biomolecular interaction, and extrapolation between 2D and 3D. The results also indicate that the students may possess an understanding of a process which they cannot express in words. Furthermore, the results indicate that beginner students use a kind of intermediate language when learning a new content area, frequently making use of metaphors, some that they have obtained from their teaching and some that they create themselves, i.e. spontaneous metaphors. They also make use of words that seemingly have no meaning, such as "plupp" and "flopp". These words are here referred to as *help-words*. The results from this study indicate that spontaneous metaphors and help-words do take on a meaning in learning situations and that they play a role in the meaning-making of the students. Moreover, the results indicate that difficulties in science education may to a large degree be connected to the problems of communicating the preciseness of scientific terms.

Language: English, one article in Swedish
ISBN: 978-91-7393-859-4
Contact: carru@isv.liu.se

RECENT DISSERTATIONS

RAGNHILD LYNGVED, 2008:

Somatic embryogenesis in *Cyclamen persicum*. Biological investigations and educational aspects of cloning.

Department of Biology, Norwegian University of Science and Technology, Norway. Doctoral theses at NTNU, 2008: 296.

Abstract

Cyclamen persicum, one of the most important ornamental plants in the European market, is propagated via seeds. This generative propagation poses difficulties due to heterogeneity and high prices for seeds, and the ultimate goal is now to produce synthetic seeds via somatic embryogenesis. In order to meet the needs of industrial-scale clonal mass production, quantity and quality modifications of the production system are necessary. The purpose of this doctoral study was to improve the propagation method, by contributing new insights into plant growth in bioreactors and signalling pathways. Mathematical models of the potential effects of oxygen concentration, daily mean temperature, the difference between day and night temperature (DIF), and daily light integral to the development of proembryogenic masses in bioreactors have been developed. Potential molecular markers for *Cyclamen* somatic embryogenesis have been identified using two-dimensional differential gel electrophoresis (2-D DIGE) and MALDI-TOF-MS. The present study also included a didactic section, directed towards students in upper secondary school. The aim of the didactic work was to make the results obtained through the somatic embryogenesis studies available to students, to introduce students to cloning technologies in general, to illustrate that science is a process, that new knowledge develops as a result of ongoing research, and that science has a societal dimension. A context-based digital teaching unit, "Cloning plants" (<http://viten.no>), was designed. The research laboratory and the work performed in the present study were used as the learning context. Norwegian biology students' learning outcomes and the development of their interest in cloning from using the unit have been analysed.

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ISBN: 978-82-471-1294-6
Contact: ragnhild.lyngved@hist.no
Download: <http://urn.kb.se/resolve?urn=urn:nbn:no:ntnu:diva-5180>

RECENT DISSERTATIONS

CHRISTEL PERSSON, 2008:

Symphony of the spheres in change? Learning in environment for sustainable development in primary school with a scientific and longitudinal approach.

Department of Social Welfare Studies, Linköping University, Sweden.

Studies in Science and Technology Education No 14. Norrköping: The Swedish Graduate School in Science and Technology Education, FontD

Abstract

This research deals with learning in science, including learning in environment for sustainable development. These are obligatory perspectives in science as well as in other school subjects. The study, concerning 28 pupils nine years of age, started in a city in southern Sweden, in 2003. In order to analyse the pupils' development of concepts in science and in environment for sustainable development, I have videotaped sequences from the pupils' science lessons and followed up with questionnaires and questions in interviews. Stimulated recall is used to find the teacher's intentions and reactions on the outcome of the lessons. The results are analysed according to the Earth System Science (ESS) model. It is a model, which describes the relations and interactions between the natural spheres: atmosphere, hydrosphere, lithosphere as well as biosphere, including man, and technosphere/anthroposphere.

The concepts found among the pupils in this study are *the hydrological cycle; life; soil; water in every day life; pollution; non-polluting busses* as well as *waste; collecting batteries; corrosion; greenhouse and the increasing greenhouse effect*. Some concepts e.g. *the hydrological cycle, life and soil* can from the beginning be classified as concepts used in science, but also to describe what happens in the environment. Concepts as *pollution; non-polluting busses; collecting batteries; corrosion; greenhouse and increasing greenhouse effect* are used by the pupils to express relations and interactions in and between the natural spheres including man. The relation between man and nature is for the pupils an area of conflicts through the entire study when the pupils from a scientific approach will be aware of the impact on living ecosystems including themselves, today and in the future. The longitudinal approach resulted in important findings regarding the changes in the pupils' answers over time. The concepts are often connected to each other in a more or less complicated network, 'concepts webs'. My obtained results indicate that the Socratic dialogue is a possible and successful method to use for the development of pupils' concepts in environmental questions and issues.

Another finding in the study, which ended in 2006, is how different methods, e.g. *Play and learning*, support environmental learning and learning for sustainable development during the science lessons. Play is important in integrated learning and gives opportunity to understand others' perspectives, *Theory of mind*. The results indicate an integrated learning process by the pupils, implying in what way they express human impact on nature.

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ISBN: 978-91-85895-02-1

Contact: christel.persson@hkr.se

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RECENT DISSERTATIONS

PERNILLA NILSSON, 2008:

Learning to Teach and Teaching to Learn – Primary science student teachers' complex journey from learners to teachers.

Linköping Studies in Science and Technology Education No 19.

Abstract

The journey of primary science teachers from learners to teachers is often quite complex. On the way they absorb scientific pedagogical content knowledge (PCK). If student teachers are encouraged to identify and reflect on critical incidents in their own teaching practice, either in primary schools or science learning centres, then they are more likely to conceptualise aspects of their practice that may be of concern. This thesis reports on and discusses four studies that have looked at the experience of primary science student teachers as they deal with critical incidents in the course of learning to be teachers. The overall purpose of the thesis is to study the process through which primary student teachers learn to teach primary science during their teacher education. The thesis is based on four studies involving primary science student teachers and their mentors during their teacher education program. The overall question that the thesis intends to investigate is in which ways student teachers' learning about teaching can be illustrated and understood in terms of the critical aspects that are experienced within their teaching and learning practices. The four papers in the thesis purposefully explore student teachers' complex journey from learners to teachers and illustrate the processes of learning to teach by highlighting important aspects within that process. Further to this, the thesis brings into focus the importance of teacher educators' professional knowledge and how that knowledge must impact teacher education practice. The first paper explores four student teachers' learning to teach in a primary school context. In connection to their teaching they were interviewed as they reflected on the video in order to portray their knowledge needs and how they impacted their abilities to handle classroom situations. The second paper investigates a group of primary science student teachers' experiences from planning, teaching and reflecting on a science lesson with pupils aged between six and eleven in a science learning centre at the university. These student teachers identified critical incidents within their teaching which led them to further portray their own concerns for teaching and their teaching needs. The third paper investigates the joint learning between two primary science student teachers and their mentors during a four week school based practice. Finally the fourth paper investigates primary science student teachers' development of subject matter of, and a positive attitude towards, physics in a specific physics course at the university, and further discusses the importance of subject matter knowledge and self-confidence in teaching primary science. In making explicit student teachers' experiences and concerns for teaching and learning science, the practices and processes highlighted in this thesis help to inform how to involve student teachers in developing a knowledge base for primary science teaching.

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ISBN: 978-91-7393-825-9
Contact: pernilla.nilsson@hh.se

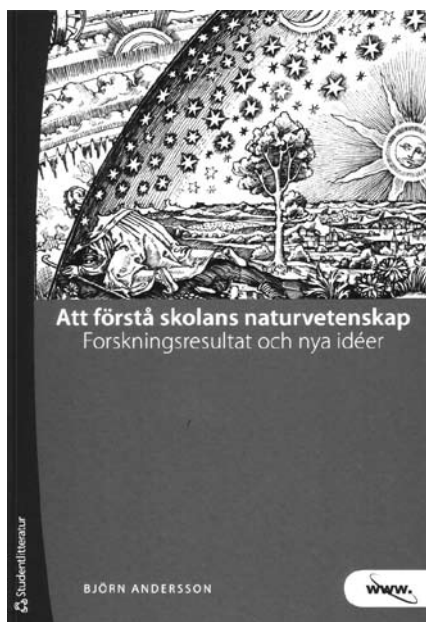


Grundskolans naturvetenskap

BJÖRN ANDERSSON

Vad skall skolans naturvetenskap innehålla och varför? Hur kan man åstadkomma en lämplig progression? Boken ger utförliga och personliga svar på dessa frågor. Författaren pläderar för en helhetssyn, som ges två innebörder. Den ena är att inte bara fokusera naturvetenskapen som sådan utan att även se den som en del av skolans undervisning om världen. En viktig fråga blir då hur naturvetenskapen kan medverka till att ge överblick och sammanhang. Den andra är att berörda aktörer har en översiktlig bild av skolans hela naturvetenskap och kan relatera undervisning i en viss årskurs till denna. Några kapitelrubriker i boken är *Integration*, *Människan och klimatet*, *Människan och ekosystemen* och *System jorden*. Till boken hör en webbplats med många resurser för fördjupning.

ISBN 978-91-44-05077-5 (228 s.) **204 Kr**



Att förstå skolans naturvetenskap

BJÖRN ANDERSSON

Sedan 1980-talet har ämnesdidaktiska forskare världen över undersökt hur elever uppfattar, och resonerar om, åtskilliga naturvetenskapliga företeelser, såsom jorden i rymden, ljus, el-kretsar, temperatur och värme, materiens omvandlingar, fotosyntes, organismers samspel med varandra och sin omgivning, och evolution. Boken är en aktuell sammanfattning av denna forskning, som gäller elever både på grundskola och gymnasium. Vunna resultat kan hjälpa läraren att navigera i klarare sikt då han eller hon planerar och genomför sin undervisning. Nya perspektiv på elevernas möjligheter att begripa skolan naturvetenskap kan öppnas. Boken består av 19 kapitel, grupperade under rubrikerna *System jorden*, *Biologi* samt *Fysik och kemi*. En webbplats med fördjupande artiklar ingår också.

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