Skjemainformasjon

Skjema	SFU
Referanse	1006280
Innsendt	10.05.2013 13:46:58

Host

Information about host institution and center

Name of centre	NTNU Centre for multimedia based learning environments.
Host institution	Norges teknisk-naturvitenskapelige universitet
PO Box address	Dragvoll
Postal code / City/place	7491 TRONDHEIM
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Contact person

Contact person

Name	Dag Atle Lysne
Title	Associate professor
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About the centre

About the centre

Is the centre already established at the time of application	No

Describe briefly the plans for establishing the centre (maximum 1500 characters)

The Center of Excellence in Multimedia-based learning environments at NTNU will be operative beginning 1. January 2014. Its vision is "Enhancing student learning outcome through the use of multimedia-based technology". Basic courses in Mathematics will play a key-role together with courses in Science, Physics and Chemistry, since these are central in NTNUs Master of Technology programs and comprise the basis for NTNU's core activity; they are thus central in NTNU's strategic plan.
It is also in these subjects that we see the most serious challenges among students at NTNU based on lack of competence among students from their upper secondary experience. This leads to our second argument for focusing the basic courses in STEM-subjects. These courses are part of NTNU's five-year integrated teacher education (ITE) and also a part of many disciplinary master programs, in which a significant portion of the students engage, becoming teachers themselves. Also, in order to strengthen teachers´ competence in Norway, linguistic subjects in Nordic and English will be included in the Center together with courses offered to teachers as in-service training.
Staff will be cross-disciplinary with a Center leader in a full-time position, one researcher in a 50% position and one researcher in a 25 % position, from each of the involved faculties. In addition, the Center will have a 50% position for administrative support and a 100% position at NTNU's Multi Media Center.

Describe briefly the aims and current as well as planned activities of the centre (maximum 1500 characters)

The aim is to a) improve students´ conceptual understanding and b)to facilitate for students´ life-long learning processes. This will be achieved by i)giving students the option to set up individual learning plans, ii)moving from listening to discussing during lectures, iii)increasing time spent on inquiry and review of literature, iv)supporting students´ production of learning objects, v) utilizes the possibility to give instructions on tasks by videos on the Internet. A 7.5 mill NOK project on multimedia-based learning environments will be started at NTNU in Aug 2013. From 2014 onward, this project will be included in the Center. The Center will produce a significant number of short (5-15 minutes) high quality videos on various subject matters. These will be used in variable settings on subject web sites and linked to teaching on campus in many different ways in order to reveal how student learning outcome can be improved. The effect of the use of videos will be evaluated by research tools developed for the project. The production of videos will include variation in how the videos are organized, the setting, scientific level, explanatory models as well as the web-based and Physics context in which the videos are presented. Students will have the possibility to set up individual learning plans, both with reference to how much time he or she uses on each part in the learning process, the level of scientific complexity (basic to advanced) as well as the ability for repetition.

Application Document

Application Document

Upload application document	profile_1 NTNU-SVT Project description Center for Multimedia based learning environments.pdf

Timeline and budget

Timeline and budget

Upload planned timeline and the activities to be conducted	timeline_2a NTNU-SVT timeline.pdf
Upload plan for financial resource acquisition	financial_2b NTNU-SVT Funding final.pdf
Upload budget	budget_2c NTNU - SVT Budget final.pdf

Attachments

Attachments

- References.pdf
- Letter_of_Intent___University_of_Agder.pdf
- Letter_of_Intent___University_College_Finnmark.pdf
- CV_Rolf_Jonas_Persson.pdf
- CV_Per_Odd_Eggen.pdf
- CV_Frode_Roenning.pdf
- CV_Dag_Atle_Lysne.pdf

Comments

Comments to the application form (maximum 1500 characters)

NTNU Center for Multimedia based learning environments

- Enhancing quality and flexibility in learning through the use of multimedia based technology

1. Profile and Vision

We propose establishing a centre of excellence in *Multimedia*-based learning environments employing quality and flexibility at NTNU within the STEM- and linguistic subjects. The vision of this Center is: *"Enhancing student learning outcome through the use of multimedia based technology"*. A key role will be played by the basic courses in mathematics together with courses in science subjects such as Physics and Chemistry, since these are central in NTNU's Master's Degree in Technology education; they are also the basis for NTNUs core activity and thus are central in NTNU's Strategic Plan. It is also in these subjects where we can see the most serious challenges among students at NTNU, primarily due to lack of competence among students from their upper secondary educational experience.

This leads to our second argument for focusing on basic courses in STEM-subjects. These courses are a part of NTNU's five-year Integrated Teacher Education (ITE) and are also a part of many disciplinary masters programs in various disciplines where a significant portion of the students become teachers themselves. Also, in order to strengthen teachers' competence in Norway, linguistic subjects such as Nordic and English will be included in the Centre together with courses offered to teachers as in-service training.

The success of the Center will be achieved through demonstrating how a video can become a high-quality learning object for the individual student. This will include variation in how the videos are organized, the setting, scientific level, use of explanatory models as well as the web-based and physic context in which the videos are presented. The possibility to set up an individual learning progress, both with reference to how much time students use on each part in the learning process, the level of scientific complexity (basic to advanced) as well as the ability for repetition will be important key functions.

The Center will produce a substantial number of short (5-15 minutes) high-quality videos on various subject matters. These will be used in various settings on subject websites linked to teaching on campus. Each video will focus on a specific topic and it will be possible to search for it on the Internet; thus the videos can be used in a range of courses both within NTNU and other universities and university colleges as well. The videos and their web-based context may even be used in MOOCs (massive open online courses), but the aim of the Center is to enhance the learning outcome for students that are on campus on a daily basis or come in two or three days a week for intensive teaching sessions.

Even though the project is limited to the production and use of videos, we will also research the parameters of what makes these videos high quality learning objects. These parameters include the internet

context. Therefore, this knowledge would make it possible to develop high quality videos within almost all subjects in higher education. And the potential is huge for reforming how teaching is organised so that student engagement in learning activities is increased. The effect of the use of videos and the context they will be placed into will be evaluated, with reference to student conceptual understanding, by research tools specifically developed for the project. Publications describing the development and impact of innovative use of videos in teaching and learning will be published in highly ranked international scientific journals.

2: Qualities in established educational activities at NTNU

NTNU is a key institution in both the Masters of Technology and in teacher education at the university level in Norway.

Result factors

Among students, there is stiff competition to enter both of these programs at NTNU, with 3.0 (4069/1380) and 2.6 (584/225) first choice applicants admitted to each position in 2013 within the Masters of Technology and the five-year Integrated Teacher Education (ITE), respectively. This raises the admission limit close to an average of 48.9 school points on average for the Master's of Technology, with up to 52.7 points in, for example, Nano-technology, and 44.8 points for teacher training. These figures are the highest in Norway[i].

Students have given consistently good feedback on the academic quality and learning environments of the programs, based on criteria set by the NTNU quality assurance system[ii]. This picture was confirmed by Universells 2012-study on the learning environment (Læringsmiljøundersøkelsen)[iii]. Typically, surveys among students show that they experience subject courses as demanding, but at the same time appreciate their depth. The students' learning outcomes are documented through exams and candidate studies, and match the high point scores required for admission. For example, the proportion of students with and "A" on their Master's is among the highest in Norway at the ITE[iv]

The attractiveness in the job market of a Master's of Technology and teacher education demonstrates its current relevance as well as being an important indicator of quality. A Master's of Technology degrees is, in general, very attractive in Norway and in NTNU's Master of Technology programs up to 95 %[v] of the students have a job offer when they finish their education. At NTNU's teacher training, approximately 25 % of the students have gained positions at the school where they have their practical training during the final part of their education, which is very high for the Trondheim area, where the job market for teachers is increasingly tight.

Process Factors

Several faculties are responsible for the Master of Technology and teacher training programs. NTNU has therefore developed a clear management structure for these educational areas in the Executive Committee of the Master of Technology (FUS) and the Executive Committee of the Teacher Education (FUL) respectively. With the Rector at NTNU as its Chair, both executive committees are responsible for strategic development of their respective programs, including coordination and quality assurance. FUS and FUL approve the structure and specializations in the curricula. The Rector appoints the Head of FUL and FUS, and the involved faculties are represented in FUL and FUS by their Vice Deans for Education.

Students take an active part in developing the programs, promoting quality teaching and education through both giving responses to evaluations and participating in management bodies. Their commitment is highly appreciated by the boards at various levels, where they contribute new ideas and initiate discussions about NTNU's institutional policies.

The systematic quality assurance of the NTNUs programs follows the yearly cycle described in KVASS[ii], which is now under revision. The departments are responsible for the teaching and evaluation of individual courses. As part of this process, a majority of the courses have student reference groups that provide evaluations; these evaluations are generated in writing and through meetings of student representatives with course leaders. This feedback is used to develop the quality of the courses and programs within the semester, and to further develop the curriculum.

Teaching and learning quality

All teaching at NTNU is expected to be research-based. The high quality of research within the academic subject areas is one of NTNU's key advantages in developing research-based teacher education. The academic staff teaches topics close to their areas of research, and students' thesis topics match their supervisors' research profiles. Students study and adopt scientific research methods in all courses. There is also a continuous focus on how courses might benefit from research performed by academic staff. Several of the staff participates by giving lectures on their research projects and how results are conveyed through scientific articles, popular science journals and other media. Finally, as part of all teacher training programs at NTNU, the students perform a limited R&D-project where methods and results are presented at a conference where scientific staff, teachers, school leaders and owners are invited.

An evaluation of the Engineering Education at NTNU in 2008[vi] stated that the engineering faculties at NTNU provide a sound engineering education based on the lengthy experience gathered as NTH and maintained in the new structure as NTNU. The review team met committed students and professors and formed a very good learning and teaching environment. But the report also pointed out that, in general, very conservative teaching methods are used. New approaches like project- and problem-based learning are recommended to be applied more frequently than currently

in place. In addition the use of ICT in teaching and learning (experiments, simulations, examples, exercise, etc.) should be developed and integrated. In a recent study, *Senantio* Research for Universitas, documented that more than 40 % of students regarded NTNU as the best university in Norway. This is the double of number two on the list[vii].

For almost 20 years NTNU has developed methods for distance learning, gradually involving e-learning methods to a large extent (for example *Take Credit,* for English language acquisition). Since 2009, NTNU has evolved a set of courses especially designed for teachers' in-service training. Much of the teaching and learning activities in these courses are performed on Internet with only a limited number of seminars on campus.[viii] . To develop videos on different subject topics has been an important part of the evolution of these courses. Also, at ordinary campus courses, videos have been used at an increasing rate by some professors, for example in some of the basic courses in mathematics. Some of these videos at NTNU hold a quality level and a design that match what we find on MIT OpenCourseWare.[ix]

In 2011, the disciplines of Norwegian and English received NOK 750,000.00 from Norway Opening Universities to develop new forms of technological interaction between students and teachers. This emphasis on the innovative technological development of academic strategies directly influences other aspects of the departments' mission at NTNU, and the process thus becomes influential and inspirational for the entire academic community. NTNU has, in recent years, developed a cross-disciplinary research program in learning with ICT (LIKT).[x]

Input Factors

Staff Quality

NTNU's Unit for University Pedagogy (UniPed) ensures that all academic staff teaching in the programs has appropriate teaching qualifications, via the Educational Development Program. Most academic subject departments also have staff with research competence in Didactics.

Both the Master of Technology and teacher training programs involve academic departments carrying out research of high quality at an international level. An example is the Department of Mathematical Sciences (IMF). In an evaluation of higher education quality by the Center for Higher Education Excellence, which seeks to identify the best Masters and Ph.D programmes in Europe, IMF was the only Norwegian member of the ranking list with excellent mathematics programs. [xi] An expert evaluation of the programs in Physics and Mathematics in 2008 states that "*The courses are taught at a very high level with emphasis on abstraction and understanding of the subjects. The curriculum in mathematics at NTNU is at the absolute forefront internationally*".[xii] In a 2010 evaluation of physics research in Norway conducted by the Research Council of Norway, three of the research groups in the Department of Physics were rated as "excellent". [xiii] Further examples are the Department of Scandinavian

Studies and Comparative Literature, one of Norway's most active research Departments with a strong record of high quality publications and the research group at the Language Acquisition and Language Processing Laboratory at the Department of Modern Foreign Languages, which has been recognized internationally for the high quality of its research in language development and language processing.

NTNUs Multi Media Center

NTNU and the Multi Media Center (MMC) started in 2007 as one of the two first in Scandinavia to offer free thematic videos on iTunes U. In January 2011, the video number 100,000 was downloaded. At present MMC, has six full-time employed technicians and new high-tech studios as well as full portable recording possibilities.

Educational Research and PhD programs

NTNU/PLU has a Ph.D program in teacher education, unique to Norway, and PLU is also the Coordinator for a Nordic research network in Science Didactics. Ph.D students in Didactics have also graduated from the Departments of Chemistry and Mathematical Sciences.

NTNU has established a research unit (NTNU *Skole- og Læringsforskning*), whose mission is to study teaching, learning and the school system in Norway.

NTNU has recently terminated the coordinating of the S-TEAM (Science-Teacher Education Advanced Methods) project, in EU Framework Programme 7, with the participation of 26 universities from 15 countries. S-TEAM is disseminating inquiry-based science teaching methods through innovative teacher professional development programs, in order to increase engagement with STEM (Science, Technology, Engineering, and Mathematics) subjects.

Center's Academic Staff

Dag Atle Lysne, Associate Professor of Natural Science Didactics, and will be the Center's Leader. For more than a decade, he has led several R&D projects on the development of teaching and learning at several levels in the Norwegian school system, from primary school to university level. Lysne has published the results from the projects in refereed journals both nationally and internationally. He also has diverse teaching experience, including both disciplinary subjects and subjects in teaching and learning natural science subjects.

Jonas Persson, Associate Professor of Physics Education, and will hold the 50 % research position in the Center. The other 50 % will be to develop and give courses for teachers and professors at the university level, based on the research results evolved by the Center. Persson has over 25 years teaching experience at universities, and has developed many courses in Physics, often trying different methods and new technologies. He has been working with distance studies and on how to make use of ICT in teaching, in addition to researching conceptual understanding and attitudes towards study.

Per-Odd Eggen, Associate Professor of Chemistry Education, will hold a 25 % research position in the Center. He is now working at the School Laboratory at NTNU and has a Ph.D in Chemistry Education. He is currently working both as a lecturer in Chemistry (general Chemistry and Biochemistry) and as a researcher in Chemistry Education.

Frode Rønning, Professor of Mathematics and Mathematics Education, will, beginning 1 August 2013, be employed as a full Professor at the Department of Mathematical Sciences, NTNU. He has a long record of research experience in both Mathematics and Mathematics Education and he has worked in teacher education for more than 20 years. He has experience from teaching and supervising at all levels up to a Ph.D in Mathematics and Mathematics Education. He has been involved in, and has also led, several research projects in Mathematics Education. Rønning will hold a 25 % position in the Center.

Collaborators

University of Agder (UiA) has a history of trying different multimedia-based approaches in their engineering education. They plan a complementary project and have an approach also based on experience in lower secondary school and up in Mathematics. Collaboration with UiA will be important as its approaches come from different directions, down-up and up-down.

Finnmark University College (HiF) has a four-year teacher training program for primary and lower secondary school and there are plans for a program in engineering education. Collaborative researchers at HiF will use selected videos produced by the Center at NTNU in their teaching and use the same methods as the Center for research on effect. The collaboration with HiF is of special interest since HiF is very different from NTNU. For example, the range of professors and associate professors versus university teachers are very different as HiF has less than one first choice applicant for each position at their teacher training program. We therefore assume that the learning environment at HiF differ s from NTNU.

3: Potential for Innovation and Dissemination

Even though much of the teaching at NTNU exemplifies high levels of quality, there are also challenges. Both the programs in Master of Technology education and Integrated Teacher training experience a significant number of drop outs - and in some of the basic courses - especially in Mathematics where a high percentage of the students fail the examinations. By the use of multimedia-based teaching and learning we will provide several variations in the professional approach to this problem both in terms of theoretical depth, methodical approach and complementary explanations. The students will then be able to adapt their approach to the subject

matter individually in terms of time spent, the time and place for preparation and revision, and in terms of theoretical depth. We believe that it will contribute to the students' motivation and efforts if, during the early phases of their study, the use of thematic videos would show applications of the current academic themes, both from actual workplaces and from further studies at NTNU.

The majority of video lectures on the Internet today are direct recordings of ordinary lectures and last typically for more than 100 minutes. This means that there are a lot of distractions in them, such as classroom noise, and the camera is often not directed towards the area where the students have their attention compared with ordinary lectures. This material is mainly technology-focused and seems not to focus on Didactics. This is partly evident from the fact that the videos often focus on the lecturer when it should have been focused on the whiteboard or the presentation.

By contrast, the Center will focus on the didactical part of videos as learning objects and will examine what facilitates student learning outcomes when videos are used as a central part of the teaching. Through the development and testing of videos and the research on effects we will evolve knowledge on what makes a video to a high-quality learning object. Based on this knowledge, a substantial number of high-quality videos will be made, typically 5-15 minutes each, on specific topics, which have the aim of increasing student learning outcomes. The videos will be produced based on the need from selected courses in Mathematics, Chemistry, Physics and linguistic subjects, but each video will be searchable and set into both a course-independent and course-dependent context on Internet. The videos will therefore be usable in a wide range of courses at NTNU and at other universities and university colleges.

The problem is that we do not know what makes a video become high-quality learning object. There is some research on audio-based learning objects, but from our knowledge, we do not have high-quality research on videos. In order to reveal what makes videos as excellent learning objects, we plan to produce identical videos (as far as possible). By changing the visual presentation, we intend to find the presentation that maximizes student attention and subjective experience. We will produce videos with and without the lecturer in the frame all the time, with and without animations, smart board versus ordinary blackboard, with and without subtitles and so on. We will also change the setting; the lecture can be recorded in the studio, in a lecture hall, with or without students, in the studio with a "fake" lecture situation and so on. Also, a personal dialogue form between two people will be tested. We will also include student production of videos.

Based on the results of this testing, we can move on with several different settings for the same lecture. Both variation in the manner of presentation and the scientific level will be tested and evaluated, for example basic, moderate and advanced. Different Lecturers present the material in different ways and this variation may be used by students for increased learning outcomes. We also

have to consider different students having different learning styles that we need to adapt in the variation.

The development of videos as learning objects will not be limited to lectures but also include other types of teaching. This may involve problem solving, demonstrations, instructions and demonstrations of laboratory tasks and use of equipment, descriptions of computer programs and programming and so on. This will also include student-made videos.

With this type of technological development, it will be possible to go further and create interactive videos where we can include a quiz during the video lecture to test students' understanding. This can then give students the opportunity to explain the mistake and go back for revision. A natural progression will be the creation of more game-like resources where it may be possible to see the lectures (videos) in a "game" and to collaborate with other users in an online within the academic environment.

The primary tasks for the Center will be within five fields, A-E below, and the targeted actions and activities for each of these five main fields will be as follows.

A. Produce High Quality Videos in Collaboration with Lecturers

In order to reveal what makes a video, and the digital and physical context within which they are set, into a high-quality learning object, we will produce videos where we change factors along three dimensions, including the variables described as follows:

- How videos are organized; for example, with the focus on the lecturer versus on the white board, with or without subtitles and so on.
- The setting of the videos; for example, in the studio with and without students, in laboratories, in society outside the university, student-made videos and so on
- The theoretical approach; for example, at a basic, moderate and advanced level, as well as variation in explanatory models.

In these three dimensions we will also have variation related to the Lecturers' personal style and how these appeal to each student's learning process. And we will have to consider variation in the digital and physical context within which the videos are set.

B. Produce Web Sites for Courses and Manuals for Lecturers and Students on the Use of Videos

The videos that are produced need to be set into a context in order to facilitate student learning. This will be done in two ways. We will produce learning sites on the Internet which are course-independent and where all the material within a subject area is gathered, including supporting material for students and Lecturers. In addition, we will produce web sites specific for selected courses where the videos and supporting material will be set into a course context. This

will include a variety of learning tracks and will be available for students in order to run an individualized learning process based on variation and revision. This will include suggestions on material that should be revised from previous courses.

On the course-specific websites we also find university pedagogic and didactic support for the Lecturers. With this arrangement it will be easy to use both videos and supporting material in different contexts.

C. Inspire and Support Lecturers to Innovative Teaching

Among Lecturers the target group will be those who want to develop their teaching by the use of multimedia-based technology. They will need guidance and supervision on the production of videos and on the variation of these, as well as on the use of the videos in the management of the course and in setting up a digital and physical context where students have the opportunity to choose several tracks based on individual preferences.

D. Evaluate the Effect of Multimedia-based Teaching

It is very hard to find good ways to measure quality in teaching and in particular to measure changes in the learning outcome due to actions implemented. This is due to the complexity of a teaching situation which includes a large number of co-factors that come into play at the same time, and some of these are of a personal nature, relating to both the Lecturer and the students and their interaction. In this study we evaluate the effect of actions in three areas:

- Students' academic conceptual understanding
    - Measured through interviews and questionnaires and tests
- Student experience of videos evaluated through:
    - "Likes" supported by comments from students
    - Questionnaires
    - Interviews of students
- The use of the videos
    - Eye-tracking on students' focus on the PC-screen
    - How many students have seen a video?
    - Do they see it repeatedly and do they see the whole video?

By evaluating the outcome from several actions we will get a relative view on which action is more and less effective. Exam result is a bad indicator for change in student learning outcome since exams change over time. We do, however expect a rise in average student marks and a drop in the percentage of failure on examinations due to the use of multimedia-based learning environments.

E. Dissemination Plan

The Center will conduct dissemination within NTNU through:

- The Center researchers' link to their respective departments and faculties
- The existing systems of educational development at NTNU, including an annual presentation of the results for the Executive Committee of the Master of Technology (FUS) and Executive Committee of the Teacher Education (FUL) and Unit for University Pedagogy (UniPed)
- A minimum of one seminar per semester for staff on exemplary teaching and project results
- Dissemination of results from the Center to students in formal and informal forums

Regionally the Center will:

- Present results at the annual student teacher *FoU i Praksis* conference
- Disseminate results to the public through a minimum of five actions per semester.

Nationally, the Center will:

- Host a national workshop every second year; the first will be in 2015
- Present thematic elements in plenary at the annual "*FOU i Praksis*" Conference in Trondheim

Internationally, the Center will:

- Exchange PhD-students and academic staff through NTNU's international contacts
- Present research at international conferences and in peer-reviewed scientific journals
- Host an international conference on university Didactics in 2018

4: Organisational Plan

There will be an unbroken line of reporting on the Centers' activity, progress and economy from the leader of the Center to the Dean of the Faculty of Social Sciences and Technology and further to the Vice Rector for Education. The Center leader will report annually on the results for the Executive Committee of the Master of Technology (FUS), the Executive Committee of the Teacher Education (FUL) and Unit for University Pedagogy (UniPed). These units are responsible for strategic development of their respective programs, including coordination and quality assurance.

The Center will have an *Advisory Board* with the Vice Deans of Education from the included faculties, two students from different subject area and three external representatives, one from the private sector, one from the school system and one researcher on an international level within university Didactics. The board will meet on a regular basis to review progress and to ensure that the work of the Center is made available through international publications and other channels.

NTNU Center for Multimedia based learning environments

- Enhancing quality and flexibility in learning through the use of multimedia based technology
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References:

[i] Databasen for høyere utdanning, rapport 12 (http://dbh.nsd.uib.no/)

[ii] KVASS: http://www.ntnu.edu/studies/education-quality

[iii] Læringsmiljøundersøkelsen 2012 (http://www.universell.no/sitepageview.aspx?sitePageID=1345)

[iv] Databasen for høyere utdanning, rapport 11 (http://dbh.nsd.uib.no/)

[v] Diplomundersøkelsen 2012 (Bindeleddet NTNU, http://www.bindeleddet.ntnu.no/about/undersokelser.asp)

[vi] Steinbach *et.al.* 2008 (http://www.ntnu.no/siving_evaluering_08)

[vii] Sentio Research for Universitas (http://universitas.no/nyhet/54977/studentene-har-talt-ntnu-er-best)

[viii] NTNU KOMPiS (http://ntnu.no/kompis)

[ix] MIT OpenCourseWare (http://ocw.mit.edu/high-school/introductory-mit-courses/physics/)

[x] LIKT: Læring og Informasjons- og kommunikasjonsteknologi: http://www.likt.ntnu.no/

[xi] http://www.excellenceranking.org/eusid/EUSID

[xii] Hansen et al (2008, s6). Evaluation of the Study Programs in the Mathematical and Physical Sciences at NTNU

(2008, s6) italic

[xiii] NOKUT review of physics departments:
http://www.forskningsradet.no/no/Artikkel/Evaluering_av_grunnleggende_forskning_i_fysikk/1235469194096

Budget								
Personnel	**Wage grade**	**Employment rate**	**2014**	**2015**	**2016**	**2017**	**2018**	**Total costs**
Center manager	76	100 %	1 018 286	1 069 200	1 122 660	1 178 793	1 237 733	**5 626 673**
Researcher		50 %	362 667	380 800	399 840	419 832	440 824	**2 003 962**
Administrative support	60	50 %	373 929	392 625	412 257	432 870	454 513	**2 066 194**
Researcher - SVT	65	25 %	205 500	215 775	226 564	237 892	249 787	**1 135 517**
Researcher - IME	65	25 %	205 500	215 775	226 564	237 892	249 787	**1 135 517**
Researcher - NT	65	25 %	205 500	215 775	226 564	237 892	249 787	**1 135 517**
Researcher - HF	65	25 %	205 500	215 775	226 564	237 892	249 787	**1 135 517**
Researcher - UiA	65	25 %	205 500	215 775	226 564	237 892	249 787	**1 135 517**
Researcher - HiFM	65	25 %	205 500	215 775	226 564	237 892	249 787	**1 135 517**
Guidance, ph.d. 1, 2, 3, 4 og 5		70 hours/year	63 583	319 200	416 500	364 583	91 000	**1 254 867**
Technicians MMS		100 %	641 000	673 050	706 703	742 038	779 140	**3 541 930**
Total wage costs			**3 692 465**	**4 129 526**	**4 417 342**	**4 565 467**	**4 501 928**	**21 306 729**
40% indirect costs			**1 476 986**	**1 651 810**	**1 766 937**	**1 826 187**	**1 800 771**	**8 522 691**
Ph.d. 1 - SVT		100 %	354 167	890 000	930 000	565 833		**2 740 000**
Ph.d. 2 - SVT		100 %	354 167	890 000	930 000	565 833		**2 740 000**
Ph.d. 3 - SVT		100 %		890 000	930 000	970 000		**2 790 000**
Ph.d. 4 - SVT		100 %		890 000	930 000	970 000		**2 790 000**
Ph.d. 5 - IME		100 %			930 000	970 000	1 010 000	**2 910 000**
Total wage and indirect costs			**5 877 784**	**9 341 336**	**10 834 279**	**10 433 321**	**7 312 700**	**43 799 420**
Operating costs			**2014**	**2015**	**2016**	**2017**	**2018**	**Total costs**
Operating costs, ph.d. 1 - SVT			21 250	52 000	53 000	31 500		**157 750**
Operating costs, ph.d. 2 - SVT			21 250	52 000	53 000	31 500		**157 750**
Operating costs, ph.d. 3 - SVT				52 000	53 000	54 000		**159 000**
Operating costs, ph.d. 4 - SVT				52 000	53 000	54 000		**159 000**
Operating costs, ph.d. 5 - IME					53 000	54 000	55 000	**162 000**
Purchase of equipment			500 000					**500 000**
Other operating costs			500 000	754 000	500 000	500 000	500 000	**2 754 000**
Total operating costs			**1 042 500**	**962 000**	**765 000**	**725 000**	**555 000**	**4 049 500**
Total costs SFU			**6 920 284**	**10 303 336**	**11 599 279**	**11 158 321**	**7 867 700**	**47 848 920**

Funding plan						
Source of funding	**2014**	**2015**	**2016**	**2017**	**2018**	**Total funding**
NOKUT	3 000 000	3 000 000	3 000 000	3 000 000	3 000 000	15 000 000
NTNU	4 040 590	6 380 555	7 684 781	6 538 549	4 224 997	28 869 472
NUV	266 667	266 667	266 667			800 000
UiA	287 700	302 085	317 189	333 049	349 701	1 589 724
HiFM	287 700	302 085	317 189	333 049	349 701	1 589 724
Total funding SFU	**7 882 657**	**10 251 392**	**11 585 826**	**10 204 646**	**7 924 399**	**47 848 920**

Timeline for the NTNU *Center for Excellent Education (CEE)* with activities and milestones *(in bold italic)* through the first five-year period

YEAR	*1. quarter*	*2. quarter*	*3. quarter*	*4. quarter*
2014	- ***official opening of the CEE*** - first year plan; dissemination, press profile, plan for video production the first year - pilot video production - researchers established from each of the involved faculties - members for an Advisory Board	- ***Advisory Board meeting; strategic plan (tasks A-E in the application) for the first 5-year period*** - CEE website established - the conference "FOU i Praksis" - ***presentation of CEE's strategic plan for FUS and FUL (tasks A-E in the application) for the first 5-year period*** - ***presentation of CEE's strategic plan for UniPed*** - video production starts on a systematic scale - design of evaluation of effects - structure and system for video storing decided	- internal dissemination seminars at NTNU with focus on the first results from development of videos – what we are trying out - evaluation on videos starts - pilot on infrastructure on Internet starts - first and second PhD starts	- pilot on infrastructure on Internet finished
2015	- Advisory Board meeting on annual report and activity plan for the next 12 months - Annual report on results and discussion on dissemination in FUS and FUL – plan for action in Master of Technology and teacher education - Annual report on results and discussion on dissemination in	- The Conference "FOU i Praksis" - Annual report from Center leader to Dean of the Faculty of Social Sciences and Technology Management - evaluation starts on the whole package; videos and the web sites they are presented on	- internal dissemination seminars at NTNU with the first results on the *research* on development of videos	- ***workshop with invited academics on university Didactics*** - international student and researcher exchange for the next year initiated

	UniPed - internal dissemination seminars at NTNU with focus on the first results from development of videos – what we are trying out - infrastructure on internet operative - third and fourth PhD starts			
2016	- Advisory Board meeting on annual report and activity plan for the next 12 months - Annual report on results and discussion on dissemination in FUS and FUL – plan for action in Master of Technology and teacher education - Annual report on results and discussion on dissemination in UniPed - fifth PhD starts	- The Conference "FOU i Praksis" - 2,5 year evaluation - Annual report from Centre leader to Dean of the Faculty of Social Sciences and Technology - internal dissemination seminars at NTNU	***- Advisory Board meeting; 2.5-year evaluation and revised strategic plan***	- international student and researcher exchange for the next year initiated - internal dissemination seminars at NTNU
2017	- Annual report on results and discussion on dissemination in FUS and FUL, including the 2.5 year evaluation– plan for action in Master of Technology and teacher education - Annual report on results and	- The Conference "FOU i Praksis" - Annual report from Center leader to Dean of the Faculty of Social Sciences and Technology Management - Annual report from Center	- Advisory Board meeting; activity and dissemination - internal dissemination workshops at NTNU,	***- workshop with invited academics on university Didactics*** - international student and researcher exchange for the next year initiated - internal dissemination

	discussion on dissemination in UniPed ***- first and second PhD finish***	leader to Dean of the Faculty of Social Sciences and Technology Management - internal dissemination seminars at NTNU		seminars at NTNU ***- third and fourth PhD finish***
2018	- Annual report on results and discussion on dissemination in FUS and FUL – plan for action in Master of Technology and teacher education - Annual report on results and discussion on dissemination in UniPed	- The Conference "FOU i Praksis" - summary evaluation on the first 5-year period - results achieved - strategy plan for the 5-10 year period - internal dissemination seminars at NTNU	***- Advisory Board meeting; based on the summative 5-year evaluation - the board discuss the 5-10 year strategic plan*** - Annual report from Center leader to Dean of the Faculty of Social Sciences and TechnologyManagement; including summative evaluation on the first 5-year period and strategy plan for the 5-10 year period	***- strategy plan for the 5-10 year period approved by the Deans at all involved faculties and by Rector for education*** ***- International conference on university Didactics*** ***- fifth PhD finish***

Letter of Intent for collaboration between:

The Norwegian Universty of Science and Technology (NTNU) and University of Agder (UiA)

May 7, 2013

Introduction

The project "Multimedia based learning environments for quality and flexibility" at The Faculty of Social Sciences and Technology Management, Norwegian University of Science and Technology (NTNU) and the project "Research, innovation and coordination of mathematics teaching" at the Faculty of Engineering and Science, University of Agder (UiA) recognize the opportunity and are open for collaboration and establishing a partnership in STEM (Science, Technology, Engineering and Mathematics) education.

- UiA/NTNU has been informed about the SFU proposal submitted by NTNU/UiA.
- Proposers at NTNU and UiA recognize essential differences between the proposals, the proposed centres are complementary addressing different aspects and challenges in teaching mathematics and natural sciences in user group programmes.
- If NTNU is successful in the proposal then UiA intends to collaboration with the Centre at NTNU.
- If UiA is successful in the proposal then NTNU intends to collaboration with the Centre at UiA.
- If both proposals are successful we recognize that there is great opportunity for synergy between the two Centres and the two Centres will establish structures that will facilitate collaboration and complementarity.
- If neither proposal is successful we will continue to seek collaboration based on the limited funding available.

Desired Outcome

To develop and maintain an effective NTNU - UiA collaborative partnership that pools developed material, research results and human resources, allowing successful communication, research and education.

Summary

The NTNU - UiA partnership will effectively enhance STEM education at a national and international scale.

Dean,
Faculty of Social Sciences and Technology Management, Norwegian University of Science and Technology

Dean,
Faculty of Engineering and Science, University of Agder

Letter of Intent

To whom it may concern

Finnmark University College (HiF)

hereby confirms that we participate in the SFU-application to NOKUT for establishing a Center of Excellence in Higher education; "Centre for Multimedia based learning environments" at Norwegian University of Science and Technology (NTNU), on the following conditions:

- We accept the conditions as layed out by NOKUT in the call.
- In case the application is successful in obtaining funding from NOKUT, we will contribute to the center as described in the proposal and attached budget and funding plan, dated May 10, 2013.
- We agree to negotiate a Consortium agreement should the proposal be successful.

Finnmark University College (HiF)
Signature: Ola Mathisen, University College Director
Date: 9.5.2013

2013/05/06

Curriculum vitae

Name: Rolf Jonas Persson

Education and qualifications:

Fysikerlinjen 1983-1987, *Göteborgs Universitet.*
Phil.Lic., 14.03.1990, *Göteborgs Universitet*
Ph.D. degree, 07.04.1993, *Göteborgs Universitet*
Docent, Dep. of Physics, University of Jyväskylä, Finland, 01.05.1997

Position: Lecturer, Dep. of Physics, NTNU

Teaching experience:

Since 1987, Laboratory supervision, tutorials.
Since 1991, Lectures, over 55 courses.
Developed new or reformed over 15 courses
Developed over 70 new laboratory assignments

Teaching material, books:

- Persson, Jonas (2003). Fysikexperiment Optik, Alega Skolmateriel AB.
- Persson, Jonas (2005). Fysikexperiment Akustik, Alega Skolmateriel AB.
- Persson, Jonas (2007). *Vågrörelselära, akustik och optik.* ISBN 978-91-44-01997-0
- Persson, Jonas (2008). Fysikexperiment Värme, Alega Skolmateriel AB.
- Angell, Carl , Bungum, Berit, Henriksen, Ellen K., Kolstø, Stein Dankert, *Persson, Jonas* , Renstrøm, Reidun (2011). *Fysikkdidaktikk.* ISBN 978-82-7634-878-1
- Persson, Jonas (2012). *Videoanalys i Fysikundervisningen.* ISBN 978-82-7923-061-8
- Persson, Jonas (2013). *Astronomi - Laborativa Moment.* ISBN 978-82-7923-063-2
- A huge amount of Lecture notes, Solved problems and Laboratory assigments

Teaching projects:
Animations in Physics- A project where java based animations in mechanics were produced and teaching-modules using these animations was written and published as lecture notes. The notes make extensive use of the animations to illustrate physics. These animations may be used as illustrations in lectures as well as in videos

ICT based laboratory exercises – A project where the use of video analysis were tested and videos were produced to be used in Physics education. The main idea was to be able to do advanced physics experiments off-campus. Video analysis turned out to be an excellent tool for this. A number of videos (>120) has been produced for students to use. Three articles in Phys. Education and a book (*Videoanalys i Fysikundervisningen)* has been published.

Experimental exercises in Astronomy – A project where planetarium software and observations has been used to devise a number of experimental exercises in Astronomy and Astrophysics. Started as part of an off-campus course in Astronomy and Astrophysics. A book (*Astronomi - Laborativa Moment.*) has been published and a paper is in preparation.

Video lectures – A project within the KOMPiS courses in Physics, Where different video lectures, software-instructions and problem solving were produced. The experiences from this project together with *ICT based laboratory exercises* and *Animations in Physics* form part of the basis in the project *Multimedia based learning environments for quality and flexibility.*

Research:

Atomic and Nuclear Physics.
Laser and rf- spectroscopy studies of hyperfine structure and isotope shifts in stable and unstable isotopes.
Nuclear spectroscopy.
Theoretical calculations in both Atomic and Nuclear Physics.
Approx 30 papers published.

Studies of Attitude and Conceptual understanding for Physics and Engineering students.
Project consists of two parts;
A longitudinal study how attitudes and beliefs about physics change during university studies. Students' beliefs and attitudes influence their motivation and approaches they adopt towards study. The project aims at understanding if and how these change during the studies for high-achieving students in Physics.
A study of the conceptual understanding amongst students in Physics, and using different diagnostics tools to evaluate the effect of different approaches in teaching. This project will form the basis for the diagnostics in Physics within the project *Multimedia based learning environments for quality and flexibility.*
4 papers in preparation within these projects.

CURRICULUM VITAE 2013 Per-Odd Eggen

Personal information
Name: Per-Odd Eggen
Date of birth: 31.03.59
Nationality: Norwegian

Formal qualification
B.Sc (1982), Chemistry, Biology
Teacher Training Certificate, one year, full time (1997)
M.Sc. (1991) Chemistry
Ph.d. (2010) Institute of Chemistry, NTNU *Current Chemistry, Experiments and practice in electrochemistry education*

Language
Norwegian and English.

Work experience

1993-2009	Highschool teacher (Grong videregående skole) Norway.
2002-2003	Developing courses at NTNU School Laboratory of Science and Technology (chemistry, biology and mathematics)
2002-2008	Member of the National highschool biology exam commity.
2002-2004	Parttime job in different projects at Department of Chemistry, NTNU
2005-2006	Leader of national commity for chemistry curriculum in Norway.
2006-2010	Scholarship holder at Department of Chemistry, NTNU
2009-2010	Lecturer at Programme for Teacher Education (PLU)
2010-2014	Postdoc, SVT, NTNU

International contributions with referee (IR= International/Referee)

Eggen, P.O. and Kvittingen, L (2004) "Electrolysis of water. Small-scale and low-cost apparatus" *Journal of Chemical Education* **81**, 1337-1338

Eggen, P.O., Grønneberg, T.O. and Kvittingen, L. (2005) "Galvanic cells. Small-Scale and Low-Cost" *Journal of Chemical Education* in print August 2006

Eggen, P.O., Grønneberg, T.O. and Kvittingen, L. (2006) "Small-scale and low-cost electrodes for "standard" reduction potential measurements", accepted by *Journal of Chemical Education*

Eggen, P.O. (2009) "*A simple Hydrogen electrode*" *Journal of Chemical Education,* 86, 352-354.

Eggen, P.-O., Kvittingen, L., Lykknes, A. (2007). *Yesterday's collections in today's courses. On the experience of reconstructing two iconic experiments in the history of chemistry,* Proceedings to the conference *19th Century Chemistry: Spaces and Collections*, Lisabon.

Du Toit, Maria; Eggen, Per-Odd; Kvittingen, Lise; Partali, Vassilia; Schmid, Rudolf.
Normal- and reverse-phase paper chromatography of leaf extracts of Dandelions. *Journal of Chemical Education* 2012; Volum 89. (10) pp 1295-1296
NTNU

Eggen, Per-Odd; Kvittingen, Lise; Lykknes, Annette; Wittje, Roland.
Reconstructing Iconic Experiments in Electrochemistry: Experiences from a History of Science Course. *Science & Education* 2012; Volum 21.(2) pp 179-189
NTNU

Other international contributions

Participation in international conferences in Istanbul with workshop (2004), Mexico City, poster (2005), Lesotho, oral presentation (2008), Regensburg (2009), Stockholm (2011), Roma, oral presentation (2012)

Norwegian contributions

A number of articles in papers (without referee), textbook contributions. Several chemistry courses for teacher in various counties and lectures for chemistry teacher at national conferences.

Course lecturing and assessment

Chemistry teaching KJ2090, KJ6007 and PPU2442, General chemistry (KJ6001 and 6003) and biochemistry (KJ6005) at NTNU

Assessment of various exams at the University of Bergen, The University of Oslo and NTNU.

Supervision of master students in chemistry teaching.

Curriculum Vitae – Frode Rønning

Personal data

Education

1989	Awarded degree of Dr.Scient in mathematics (complex analysis)
1982	Teacher training (PGCE)
1980-1982	Master studies (Cand.Scient) in mathematics (complex analysis)

Employment

2013-	Professor of mathematical sciences, NTNU, Dept. of Mathematical Sciences
2011-2013	Professor 2 of mathematics education, NTNU, Dept. of Mathematical Sciences
2000-2013	Professor of mathematics, Sør-Trøndelag University College, Faculty of Teacher and Interpreter Education (HiST-ALT).

Selected publications last 10 years

1. Rønning, F. (in press). Making sense of fractions given with different semiotic representations. To appear in *Proceedings of the Eighth Conference of the European Society for Research in Mathematics Education,* Antalya, Turkey, February 2013.
2. Rønning, F. (in press), Making sense of fractions in different contexts. Current Report, *Research in Mathematics Education.*
3. Rønning, F. (2013). Children working with fractions in different contexts. In B. Grevholm, P. S. Hundeland, K. Juter, K. Kislenko, & P.-E. Persson (Eds.), *Nordic research in didactics of mathematics: Past, present and future* (pp. 483-507). Oslo, Norway: Cappelen Damm.
4. Rønning, F. (2012). Making sense of fractions in different contexts. In C. Smith (Ed.), *Proceedings of the British Society for Research into Learning Mathematics, 32*(3), 161-166. Retrieved from http://www.bsrlm.org.uk/IPs/ip32-3/BSRLM-IP-32-3-Full.pdf
5. Rønning, F. (2012). Symmetrisation of an asymmetric multiplication task. In G. H. Gunnarsdóttir, F. Hreinsdóttir, G. Pálsdóttir, M. Hannula, M. Hannula-Sormunen, E. Jablonka, U. T. Jankvist, A. Ryve, P. Valero, & K. Wæge (Eds.), *Proceedings of NORMA 11, The Sixth Nordic Conference on Mathematics Education* (pp. 553-563). Reykjavik, Iceland: University of Iceland Press.
6. Rønning, F. (2011). Epistemological and semiotic issues related to the concept of symmetry. In M. Pytlak, T. Rowland, E. Swoboda (Eds.), *Proceedings of the Seventh Congress of the European Society for Research in Mathematics Education* (pp. 1366-1375). Rzeszów, Poland: University of Rzeszów and the European Society for Research in Mathematics.
7. Rønning, F. (2010). Tensions between an everyday solution and a school solution to a measuring problem. In V. Durand-Guerrier, S. Soury-Lavergne, & F. Arzarello (Eds.), *Proceedings of the Sixth Congress of the European Society for Research in*

Mathematics Education. January 28th - February 1st 2009, Lyon (France) (pp. 1013-1022). Lyon, France: INRP. Retrieved from http://www.inrp.fr/editions/editions-electroniques/cerme6/working-group-6

8. Rønning, F. (2009). Å regne i kunst og håndverk. In J. Fauskanger, R. Mosvold, & E. Reikerås (Eds.), *Å regne i alle fag* (pp. 186-189). Oslo: Universitetsforlaget.
9. Rønning, F. (2009). Children's early work with multiplication and division. In C. Bergsten, B. Grevholm, & T. Lingefjärd (Eds.), *Perspectives on mathematical knowledge. Proceedings of MADIF6, The 6th Swedish Mathematics Education Research Seminar*, Stockholm, January 29-30, 2008 (pp. 85-96). Linköping, Sweden: SMDF.
10. Rønning, F. (2009). Young children's perception of geometric objects. In C. Winsløw (Ed.), *Nordic research in mathematics education. Proceedings from Norma08 in Copenhagen, April 21-April 25, 2008* (pp. 45-53). Rotterdam: Sense Publishers.
11. Rønning, F. (2009). Islamic patterns and symmetry groups. *Philosophy of Mathematics Education Journal, 24*. Retrieved from http://people.exeter.ac.uk/PErnest/pome24/ronning%20_geometry_and_Islamic_patterns.pdf
12. Ponnusamy, S., & Rønning, F. (2008). Integral transforms of a class of analytic functions, *Complex Variables and Elliptic Equations, 53*(5), 423-434.
13. Måsøval, H. S., & Rønning, F. (2005). An inductive approach to conceptual development in the area of functions. In C. Bergsten & B. Grevholm (Eds.), *Conceptions of mathematics. Proceedings of NORMA01, The 3rd Nordic Conference on Mathematics Education, Kristianstad, June 8-12, 2001* (pp. 278-281). Linköping, Sweden: SMDF.
14. Rønning, F. (2004). On the preservation of direction convexity under differentiation and integration, *Rocky Mountain Journal of Mathematics, 34*(2), 1-10.
15. Rønning, F. (2004). Language and concept development in geometry, In M. Johnsen-Høines & A. B. Fuglestad (Eds.), *Proceedings of the 28th Conference for the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 137-144). Bergen, Norway: PME.

Other relevant activities

- Leader of Working Group 9 (Language and Mathematics) at *CERME 8 – the Eighth Conference of the European Society for Research in Mathematics Education,* Antalya, Turkey, February 2013.
- Editor of *Nordic Studies in Mathematics Education, NOMAD* (http://ncm.gu.se/nomad)
- Editor of *Tidsskriftet FoU i praksis* (2007-2013) (http://www.akademikaforlag.no/fou) (a Norwegian journal for research in education)
- Reviewer for a number of journals in Mathematics, Mathematics Education and Education (e.g. *Educational Studies in Mathematics, Mathematical Thinking and Learning, Scandinavian Journal of Educational Research)*
- Local project leader for Teaching Better Mathematics at HiST ALT, 2006-2009.
- Local project leader for TEDS-M (Teacher Education Study, Mathematics) at HiST ALT, 2006-2008.
- Member of national steering board for ICT-based in-service education in mathematics for teachers (SOFF/NUV) from 2002-2004 and 2005-2006.
- Project leader for the research part of *IKT-støttet allmennlærerutdanning* at HiST ALT 2000-2001.

CURRICULUM VITAE FOR DAG ATLE LYSNE

Personal Information

Birth: 03.08.59
Position: Associate Professor in Biology, specializing in the teaching and learning of science at The Norwegian University of Science and Technology (NTNU)
e-mail: dag.atle.lysne@plu.ntnu.no
Address: Program for Teacher Education, Låven, Dragvoll, NTNU, 7491 Trondheim, Norway
E-mail: dag.atle.lysne@plu.ntnu.no
Tel.: 97189556

Education

Dr. scient., (PhD) University of Tromsø, 1999
Cand. scient, (PhD Candidate) University of Tromsø, 1993
Teacher - Adjunkt, Sogndal Lærerhøgskole, 1988
Teacher, Sogndal Lærerhøgskole, 1981
Higher secondary, Sogndal Gymnas, 1978

Project Management Experience

From 2009 until the present, I have managed NTNU's program, "Kompetanse i Skolen" ("Competence in School"). Previously, during my tenure at Finnmark University College, I was involved in a total of eight projects and I was the leader on five of those projects. Two of the projects have included Phd-students holding scholarships. The largest of these projects terminated in 2012 and was founded by The Norwegian Research Council in which I managed three million Norwegian kroner (516,000 USD); the project has a total budget of more than six million Norwegian kroner (1.03 million USD). In addition, I also led three projects which will help to develop the teacher training program at Finnmark University College. I was also the secretary of a project at University of Tromsø, "Pilot in nord" ("Pilot Project in the North").

Research Projects in the Teaching and Learning of Science

(selected from the year 2000 until the present)

"Technology and Design Creates the Future in Northern Norway"
Chief-investigator: Dag Atle Lysne
Co-investigators HiF: Stig Misund, Saeed Manshadi, Birgitte Berntsen, Liv Byrkjeflot
Co-investigators external: Berit Bungum and Halvor Hoveid, both NTNU, Margareth Lloyd, Queensland University of Technology (Brisbane, Australia)
Project Period: 01.10.07 – 31.07.12
Budget: 6.1 million Norwegian kroner
Funding Agency: The Norwegian Research Council and Finnmark University College (50 % allocated from each institution).

"Fra ord til handling" ("From Words to Actions")
Leader: Trond Einar Persen, RSK Vest-Finnmark
Co-worker at one of four schools: Dag Atle Lysne
Project Period: 2007-2009
Total budget approx. 2.0 million Norwegian kroner
Funding Agency: Norwegian Directorate for Education and Training

"IKT-støttet undervisning i teknologi, design og naturfag" ("ICT in the Teaching of Technology, Design and Science")
Chief-investigator: Dag Atle Lysne
Co-investigators: Andy Sortland (Høgskolen i Tromsø), Frank Vedal (Høgskolen i Narvik), Rolf Håkon Rensaa (Høgskolen i Narvik), Bjørn Tore Esjeholm (Høgskolen i Finnmark), Stig Misund (Høgskolen i Finnmark)
Project Period: 2005-2007
Total Funding: 1.2 million Norwegian kroner
Founding Agency: Norwegian Opening Universities and Finnmark University College (50 % allocated from each institution).

"IKT i natur- og miljøfag" (ICT in Science)
Chief-investigator: Dag Atle Lysne
Co-investigators: Bjørn Tore Esjeholm and Stig Misund
Project Period: 2003-2004
Total Funding: 290,000 Norwegian kroner
Funding Agencies: Norwegian Directorate for Education and Training (190,000 kroner) and Finnmark University College with (100,000 kroner).

Projects Developing Teacher Training Programs

"Skolebasert kompetanseutvikling" ("School-based Development of Competence")
Leader: Dag Atle Lysne
Co-workers: May Britt Postholm, Kjersti Wæge, Anne Berit Emstad, Henning Fjørtoft and Gunnar Engvik (all NTNU)
Project Period (pilot): 20.04.12 – 30.06.13
Total funding: 1.0 million Norwegian kroner
Funding Agency: The Norwegian Directorate for Education and Training

"NTNU Kompetanse i skolen" ("NTNU: Compentence in Schools")
This is NTNU´s response to a national strategy for education of teachers through in-service training. At present, 14 courses with 30 credit points each are included in the program.
Leader: Dag Atle Lysne
Project Period: 01.08.2009 – present

"Ny lærerutdanning ved HiF" ("A New Teacher Training Program at Finnmark University College")
Leader: Dag Atle Lysne
Co-workers: Aksel Pedersen (HiF), Charlotte Tingelstad (HiF), Gørill Johansen (HiF) and Mari-Ann Pettersen (rector Komsa Primary School)
Project Period: 01.01.09 – 30.05.09

"Nye modeller for samarbeid med skole og barnehageeier i lærerutdanningene" ("New Models for Collaboration in Teacher Training with the Owners of Schools and Kindergartens")
Leader: Dag Atle Lysne
Project Period: 01.08.08 – 01.06.09

"Pilot i nord" ("Pilot Project in the North")
Leader: Lecturer Torunn Klemp, Høgskolen i Sør-Trøndelag
Secretary: Associated professor Dag Atle Lysne, Høgskolen i Finnmark
Co-workers: Professor Sven-Erik Hansèn (Åbo Akademi), docent Per Ramberg, NTNU, rector Kristin Skaalvik, Workinnmarka Primary School, Tromsø
Project Period: 01.02.08 – 03.09.08
Report Published at:
http://www2.uit.no/ikbViewer/Content/79165/Laererutdanning_forslag.pdf

"Utinor - pilot for å profilere lærerutdanning ved HIF" ("Out in the North – a Pilot Project to develop a Profile at the Teacher Training Program at Finnmark University College")
Co-workers: Carsten Rolland (HiF), Gudlaug Jørgensen (HiF), Olav Tveiteråas (HiF), Geir Zakariassen (HiF). In addition, June Larsson (Gakori Primary School) and Svein Hansen (rector Elvebakken Primary School participated in the program.) between 01.01.07 and 01.08.07.
Project period: 01.01.07-01.06.09

Scientific publications

My research has been focused in two different areas. Before 2006, I published papers within the field of Ecology. I had, however, gradually been changing my research focus towards the teaching and learning science - especially after I was appointed Associate Professor at the Teacher Training Program at Finnmark University College (HiF) in 1999. Since then, I have published at an international level within both of these areas. All publications were refereed, which contributed to my receiving the research award at HiF in 2002, the first time it was awarded.

My research within teaching and learning has focused on how learning of conceptual knowledge in science can be contextualized. A special focus has been put on technology and design and the use of ICT and how to bridge the gap between students' life both in and outside of school.

Book Chapter

Lysne, D. A. & Hoveid, H. (2013). "A Practical Approach in Technology and Design in a School for All" in *Hoveid, M. & Grey, P. (eds.), Inquiry in Science Education and Science Teacher Education. Research on teaching and learning through inquiry based approaches in science (teacher) education.* Akademika Publishing, Trondheim, ISBN 978-82-519-2933-2/ISBN 978-82-519-2934-9 (pdf), pp. 239-262.

Scientific Papers on the Teaching and Learning of Science (all refereed)

Esjeholm, B. T. & Lysne, D. A. (2013) "Norwegian D&T classrooms in terms of knowledge content - a case study." *Full paper ready for submission to NorDina.*

Bungum, B., Manshadi, S. & Lysne, D.A. (2013) "Mathematical speech and practical action: a case study of teachers' and students' expressions of purposes when working with mathematics in a practical technology project." *Submitted to International Electronic Journal of Mathematics Education: http://www.iejme.com.*

Bungum, B., Esjeholm, B. T. & Lysne, D. A. (2013) "Students' use of science and mathematics in practical projects in design & technology: A Case Study from Norwegian schools." *Short paper accepted for ESERA.*

Lysne, D. A. & Esjeholm, B. T. (2013). "How to make teaching in natural science more authentic?" *Short paper accepted for ESERA.*

Bungum, B., Esjeholm, B. T. & Lysne, D. A. (2013) "Science and mathematics as part of practical projects in technology and design: An analysis of challenges in realising the curriculum in Norwegian schools." *Full paper submitted to NorDina.*

Bungum, B., Esjeholm, B.-T. og Lysne, D.A. (2013). "Teknologiprosjekter som læringsarena og betydningen av hensikt og kontekst." ("Technology projects as area of learning and the

consequence of purpose and context.") in Pareliussen, I., Moen, B.B., Reinertsen A., Solhaug, T., *FoU i praksis 2012 conference proceedings,* Akademika forlag, Trondheim, pp. 37–43. *http://tapironline.no/fil/vis/1127.*

Lysne, D.A. (2013). "Hvordan bidrar elevenes erfaringer til arbeidet med teknologi i skolen?" ("Can the use of students experience evolve the schools meaning making?") in Pareliussen, I., Moen, B.B., Reinertsen A., Solhaug, T., *FoU i praksis 2012 conference proceedings,* Akademika forlag, Trondheim, pp. 155–162. *http://tapironline.no/fil/vis/1141.*

Manshadi, S. og Lysne, D.A. (2013). "Meningsdanning i matematikk basert på arbeid i teknologi og design." ("Meaning making in mathematics based on work in technology and design") in Pareliussen, I., Moen, B.B., Reinertsen A., Solhaug, T., in *FoU i praksis 2012 conference proceedings,* Akademika forlag, Trondheim, pp. 163 - 171. *http://tapironline.no/fil/vis/1142.*

Bungum, Berit; Esjeholm, Bjørn-Tore; Lysne, Dag Atle (2012) "Technology & design as contexts for science and mathematics? An empirical study of the realisation of curriculum intentions in Norwegian schools." in PATT 26 conference: Stockholm, Sweden 26–30 June 2012, *Technology Education in the 21st Century*, Linköping University Electronic Press 2012 ISBN 978-91-7519-849-1. 978-82-519-2933-2/ISBN 978-82-519-2934-9, s. 105 -110.

Byrkjeflot, L. og Lysne D.A. (2012) "Bloggen; en lite utnytta mulighet?" ("Blogs; an unused opportunity?") *Rapport fra konferanse om praksisrettet FoU i lærerutdanning. Trondheim, 26 and 27April 2011.* Tapir Akademisk Forlag 2012 ISBN 978-82-519-2918-9.

Lysne, D.A. & Bungum, B. (2012) Praktisk arbeid på tvers av fag, sløsing med tid eller godt læringsarbeid? (Practical work across subjects, waste of time or good learning activities) *Rapport fra konferanse om praksisrettet FoU i lærerutdanning. Trondheim, 26. og 27. april 2011.* Tapir Akademisk Forlag 2012 ISBN 978-82-519-2918-9. s. 287-295.

Byrkjeflot, L., Lloyd, M. & Lysne, D.A. (2011). Discussions on conceptual knowledge and the use of blogs. *Conference Proceedings STEM 2010, pp. 1-10.* http://stem.ed.qut.edu.au/images/stories/abst/131b.

Byrkjeflot, L.; Lysne, D.A. & Lloyd, M. (2010). "The Use of Blogs in Discussions on Conceptual Knowledge" *in Contemporary Science Education Research: Teaching*. Tyrkia: Pegem Akademi 2010 ISBN 978-605-364-030-1. pp.169-172.

Lysne, D. A., Nykvist, S. og Lloyd, M. (2009). "Kan web-logg brukes for å koble praktisk arbeid til arbeid med teoretiske begreper?" ("Can a web-log be used to link practical work to the learning of conceptual knowledge?") *Proceedings fra Det 9. nordiske symposium i naturfagdidaktikk.* 11 through 15 Juni 2008: *http://symposium9.khi.is/webbook/6_resources_in.pdf.*

Vedal, F., Esjeholm, B. T. & Lysne, D. A. (2008). "How do ICT related attitudes vary among teachers?" in *Technology education through open ended teaching strategies associated with practical learning tools*. Palme Publications 2008 ISBN 9786055829162. pp. 237-242.

Lysne D. A., Misund, S. og Esjeholm, B. T. (2006). "Hvilke faktorer påvirker aktivitetsnivå når elever i 3. klasse (8 - 9 år) arbeider med teknologi?" ("What factors influence the level of activity when students are in year 3 (8-9 years old) work in technology?") in Bering L., Dolin J., Krogh L.B., Sølberg J., Sørensen H., Troelsen R. (red.). "*Naturfagsdidaktikkens mange fasetter: Proceedings fra Det 8. nordiske Forskersymposium om undervisning i naturfag",* Danmarks Pædagogiske Universitets Forlag. København NV, ISBN 87-7684-087-5.

Conference Contributions on Teaching and the Learning of Science (selected from year 2008 until present)

Lysne, D.A. (2012) "Kan bruken av elevenes erfaringer å utvikle skolens meningsdannelse?" ("Can the use of students experience evolve the schools meaning-making?") *FOU Conference i praksis 2012. Nordisk konferanse om praksisretta FoU i utdanninga,* Trondheim 2012-04-23 gjennom 2012-04-25.

Manshadi, S. and Lysne, D.A. (2012) "Meningsdanning i matematikk basert på arbeid i teknologi og design?" ("Meaning making i mathematics-based one work in technology and design") *FoU Conference i praksis, 2012. Nordisk konferanse om praksisretta FoU i utdanninga,* Trondheim 2012-04-23 gjennom 2012-04-25.

Bungum, B., Esjeholm, B. T. and Lysne, D. A. (2012) "Teknologiprosjekter som læringsarena og betydningen av hensikt og

kontekst" ("Technological Projects which are a Learning Arena: the Meaning of Purpose and Context" in *FoU i Conference i praksis 2012. Nordisk konferanse om praksisretta FoU i utdanninga,* Trondheim 2012-04-23 gjennom 2012-04-25.

Lysne, D.A. (2011) "Teknologi og design i skolen" ("Technology in the School"). *The School and Kindergarten Research Conference,* Finnmark, Alta, 2011.

Lysne, D.A. (2011) "Spør lærere om hva elevene tenker?" ("Do teachers ask for the students reflections?") *NFSUN Conference,* Linkøbing, Sverige, 2011.

Lysne, D.A. and Bungum, B. (2011) "Praktisk arbeid på tvers av fag, sløsing med tid eller godt læringsarbeid?" ("Practical work across subjects, waste of time or good learning activities?") *FOU Conference i Praksis,* Trondheim, 2011.

Byrkjeflot, Liv, Lloyd, Margaret and Lysne, Dag Atle (2010) "Discussions on conceptual knowledge and the use of blogs." *STEM in Education Conference,* 2010-11-26 - 2010-11-27.

Byrkjeflot, Liv, Lysne, Dag Atle, and Lloyd, Margaret (2008) "The Use of Web-logs in Discussions on Conceptual Knowledge." *ESERA 2009 Conference. The 9th European Science Education Research Association,* 2009-08-31 - 2009-09-04.

Lysne D. A., Nykvist, S. and Lloyd, M. (2008) "Kan web-logg brukes for å koble praktisk arbeid til arbeid med teoretiske begreper?" ("Can Web-Logs be used to Link Practical Work to the Learning of Conceptual Knowledge?) *Det 9. nordiske symposium i naturfagdidaktikk.* 11. – 15. juni, 2008.

Vedal, F., Esjeholm, B. T. and Lysne, D. A., (2008). "How do ICT related attitudes vary among teachers?" in *Technology education through open ended teaching strategies associated with practical learning tools*. Palme publications 2008 ISBN 9786055829162, pp. 237-242.

Scientific Papers on Ecology (Selected from work prior to 2006; all refereed publications)

Lysne D. A., Hemmingsen W. and Skorping A. (2006), "Is Reduced Body Growth of Cod Uninfected with the Gill Parasite *Lernaeocera branchialis* the Cost of Resistance?" in *Journal of Fish Biology*, Vol. 69, pp. 1281-1287.

Lysne D. A. and Skorping A. (2002). "The Gill Parasite *Lernaeocera branchialis* in Caged Cod: Infection Pattern is Caused by Differences in Host Susceptibility." in *Parasitology*, Vol. 124, 69-76.

Lysne D. A. and Skorping A. (2002). "Variation in infection levels in natural populations due to differences in host susceptibility." - *Proceedings of the 10th International Congress of Parasitology – ICOPA X, August 4-9.*

Lysne D. A., Skorping A. and Hemmingsen W. (1998), "Transmission of *Cryptocotyle lingua* Cercariae in Natural Environments: a Field Experiment" in *Journal of Fish Biology,* Vol. 53, 879-885, 1998.

Lysne D.A., Hemmingsen W. and Skorping A. (1997). "Regulation of Infra-populations of *Cryptocotyle lingua* on Cod" in *Parasitology,* Vol. 114, 145-150.

Non-Scientific Publications on the Teaching and Learning of Science

These publications are all based on close collaboration with teachers in primary and lower secondary school in order to develop student projects where school scientific discussions are linked to practical actions.

Lysne, D. A. and Esjeholm, B. T. (2013). "Hvordan bidrar elevenes erfaring til arbeidet med teknologi og design?" ("How does student experience contribute to work in technology and design?") in *Naturfag*, Vol. 1. pp. 101-103. http://www.naturfagsenteret.no/binfil/download2.php?tid=1997814

Bungum, B., Hoveid, H., Lysne, D. A., Esjeholm, B. T., Byrkjeflot, L., Bentsen, B. and Manshadi, S. (2012). "Et forskningsprosjekt om teknologi og design i skolen" ("A Research Project on Technology and design in School") in *Naturfag* (2) pp. 16-17. http://www.naturfagsenteret.no/binfil/download2.php?tid=1994861

Lysne, D. A., Esjeholm, B. T., Byrkjeflot, L., Bentsen, B. and Manshadi, S. (2012) Fire elevprosjekter innenfor teknologi og design. (Four Student Projects in Technology and Design.) *Naturfag* 2012; Volum 2. pp. 18-21. http://www.naturfagsenteret.no/binfil/download2.php?tid=1994861

Utsi, T., Lysne, D. A. and Bongo, M. I. (2008). "Reinens skinn og gevir" ("The skin and the antlers of the reindeer") http://www.naturfag.no/uopplegg/vis.html?tid=910970

Lysne, D. A. (2006). "Hvordan revitalisere realfagene – tanker etter et forskningsopphold i Queensland" ("How to Revitalize Science – Ideas After a Research Visit to Queensland). Bestilt av redaktør til høstutgaven av tidsskriftet in *Bedre Skole*.

Lysne, D. A., Esjeholm, B. T. and Misund, S. (2005). "Datastyrt mikrodrivhus" ("An ICT monitored micro green house") http://www.naturfag.no/_ungdom/uopplegg/vis.html?tid=74225

Lysne, D. A., Misund, S., and Esjeholm, B. T., (2005). "Teknologi sammen med uteskole i naturfag" ("Technology and learning outside the school area") in *Naturfag nr. 1. Naturfagsenteret. http://www.naturfagsenteret.no/tidsskrift/Naturfag_1_05.pdf*

National and International Conferences

Chair and organizer: Workshop in Alta with four invited international researchers
Chair: FOU i Praksis 2011; accepted symposium
Chair: 21st symposium of the Scandinavian Society for Parasitology, Bergen 2003.
Chair: 18th symposium of the Scandinavian Society for Parasitology, Bornholm 1997.

Mentoring PhD-students

Internal Project Supervisor for Bjørn Tore Esjeholm, PhD student 2008 – 2012.
Internal Project Supervisor for PhD student Odd Leknes in the period between 2003 and 2005.

Teaching, Supervision and Grading

My teaching at Universities and University Colleges has been within different aspects of science. I have taught both Ecology and Zoology as well as Didatics in Science (or the Norwegian "naturfag") within the teacher training programs. I have a breadth of experience in teaching in this field and have, for the last ten years, focused on use of ICT in order to facilitate learning activities. In 2008, I received the teaching award at Finnmark University College.

Finnmark University College (HiF)

Associated Professor in Science ("naturfag") from 1999 – 2009.

At bachelor in natural resource management my teaching has been given within ecology and zoology. At the teacher training program I have taught field related biology and ecology as well as didactics.

University of Tromso and Tromsø University College

Fellowship at University of Tromsø 1995 - 1999.

This position included participating in the supervision of four master's students and the running of laboratory and field courses in Ecology and Zoology. I have also given lectures in Zoology and Ecology at the basic bachelor's level.

Lecturer in science ("naturfag") at the teacher training program for kindergarten at Tromsø University College, 66 % stilling, 1994 - 1995.

Scientific assistant at University of Tromsø 1993 - 1994.

Grading in courses in biology/"naturfag"

University and University College Level

Bio-100Z Zoology, University of Tromsø: 1999 - 2005.
Elementary Zoology, B-100 Z, Nesna University College, 1999, 2000 and 2001.
Ecology and Evolution, Bio-1005, University of Tromsø, 2001-2004.
Science/Naturfag teacher training program for Kindergarten, 10 vt, Tromsø University College, 2000, 2001.
Outdoor activities, teacher training program for kindergarten, 30 sp, Tromsø University College, 2002-2005.
Marin Parasitology, Bodø University College, 2001, 2003.
BZL 270 – Parasitology, University of Bergen: 2000-2002.
Cand. Scient. (PhD) in Ecology at University of Tromsø: Inger Kristine Larsen, 1997.

Cand. Scient. (PhD) and Master's Degree in Ecology at University of Bergen:

- 2003: Olav Moberg
- 2004: Espen Schei
- 2005: John Moen Stensland

Primary and Lower Secondary School

Teacher in primary and lower secondary school, 1982-1986. Part of my job was to teach science, but also mathematics, arts and handicraft, history and other subjects.

Kindergarten

I worked with children age 3-7. Full time job in 1986-1987, 10% position in 1987-1988.

Administration

In addition to the administrative work associated with being the leader of a given course or the coordinator at a year level in the teacher training program, my administrative experience also consists of the following:

- Associated Professor at NTNU (first at a 20 % position between 01.01.09 - 30.06.09 and thereafter in a 100 % permanent position) where I established "NTNU Kompetanse i skolen" ("NTNU Competence in School") which is NTNU's response to the national strategy towards education of teachers in-service.

- From 2003 until 2007, I was a member of the Board of Finnmark University College.

- From August 2003 until the end of 2004, I was the professional Leader for the section that organized the teaching of and research in science at Finnmark University College.

- From August 2003 until end of 2004, I also was a member of the Board at the Faculty of Business and Social Work at Finnmark University College.

- Between October 2004 and October 2006, I lead the organization that gathered together most of the Universities and University Colleges in Norway in order to give teacher training programs that

included natural science culminating in the Nasjonalt Nettverk for Naturfagundervisning (National Network for Natural Science Teaching) (http://www.naturfagnett.no/).