Skjemainformasjon

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Host

Nome of control		
Name of centre	Innovative Teaching of	
	Information Technology (2-IT)	
Host institution	NTNU	
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Contact person

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About the centre

About the centre	
is the centre already	No
established at the time of	
application	

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

The centre, if given funding, will be established in early 2014. It is a collaboration between NTNU and HiNT, and key persons are (from the NTNU:) Guttorm Sindre, Monica Divitini, Birgit Krogstie, Alf Inge Wang, (from HiNT:) Line Kolås, Robin Munkvold, Hugo Nordseth, and Håvard Sørli. The centre will be organized as a unit under the IME faculty at the NTNU. For further details, please see the attached 10 page application document.

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

The vision for the 2-IT centre of excellence is to become a lighthouse for IT as an attractive study and career choice for both genders, communicating to Norwegian youth the many exciting opportunities of IT for jobs and society. We will achieve this by (1) making IT studies more motivating and yielding better learning by increased use of project-based teaching and by close collaboration with industry to demonstrate the relevance of all courses (project based and others); (2) making the studies and their motivational aspects visible to pupils in lower education to make them aware of IT as an attractive path before they make educational choices that exclude many IT-related studies (e.g. avoiding high school math). Initially, the work of the centre will focus on improving the partners' own study programs with respect to motivation and learning outcomes, but our results will be communicated to facilitate easy reuse and adaptation by other educational institutions, contributing to increased student satisfaction in IT studies in Norway. If we succeed in promoting the attractiveness of IT studies to Norwegian youth, this will improve our own recruitment and that of IT studies in other Norwegian universities and colleges, some of which have severe recruitment problems. For more details about the planned activities, please see the 10 page application document.

Application Document

Application Document

profile_2IT-SFU-ApplicationDocument.pdf

Timeline and budget

Timeline and budget Upload planned timeline and the activities to be conducted

Upload plan for financial resource acquisition

timeline_Timeline.pdf

financial_2IT_Finance.pdf

Upload budget

budget_2IT_Budget.pdf

Attachments

-Attachments-

- HiNT_Letter_of_Intent.pdf
- Support_letter_from_KID_enterprise_network.pdf
- FRIKT_study_plans.pdf
- CV_Line_Kolaas.pdf
- CV_Alf_Inge_Wang.pdf
- CV_Birgit_Krogstie.pdf
- CV_Monica_Divitini.pdf
- CV_Guttorm_Sindre.pdf
- Relevant_publications_from_HiNT.pdf
- Relevant_publications_from_IDI____NTNU.pdf
- budget_2IT_Budget.pdf
- financial_2IT_Finance.pdf
- timeline_Timeline.pdf
- profile_2IT-SFU-ApplicationDocument.pdf

Comments

Comments to the application form (maximum 1500 characters)

The form worked fine.

2·IT - Innovative Teaching of Information Technology

As emphasized both in Digital Agenda for Europe¹ and Digital Agenda for Norway², IT is vital for supporting innovation, growth, and sustainability. The need for IT professionals in Norway is much higher than the number of IT candidates graduated, and the Digital Agenda for Norway observes that the number of graduates was halved from 2004 to 2010. The entire STEM field (Science, Technology, Engineering, Manufacturing) suffers from a shortage of graduates, and the shortage is most severe in computing. US prognoses indicate that more than half the available STEM jobs by 2018 will be computer jobs³. ComputerWorld, citing figures from the US Bureau of Labor Science, indicates that computing will have a 22% employment growth until 2020⁴, with some areas such as software development having a growth rate of 30% - and these figures do take into account the fact that some programming is being outsourced from the US to low cost countries like India, as also happens in Norway.

Many youngsters seem reluctant to pursue IT studies, partly from a biased belief that computer jobs are best fit for nerdy loners, and girls are especially deterred from IT studies for such reasons. In reality, most such jobs are team-oriented, and many IT professionals address user needs rather than just the technology. If Norway is not able to increase its output of IT graduates, lack of IT personnel may be an obstacle to innovation and growth both in the private and public sector, and cause Norwegian companies to lose out in international competition or move many of their jobs abroad to find the necessary personnel. In its Digital Agenda for Norway, the government explicitly wants to increase recruitment to IT studies. Our project proposal 2-IT is a direct response to this need.

Profile and vision

The vision for the 2-IT centre of excellence is: <u>2-IT shall become a lighthouse for IT as an</u> <u>attractive study and career choice for both genders, communicating to Norwegian youth the</u> <u>many exciting opportunities of IT for jobs and society</u>. We will achieve this by (1) making IT studies more motivating and yielding better learning by increased use of project-based teaching and by close collaboration with industry to demonstrate the relevance of all courses (project based and others); (2) making the studies and their motivational aspects visible to

¹ http://ec.europa.eu/digital-agenda/digital-agenda-europe

http://www.regjeringen.no/pages/38268786/PDFS/STM201220130023000DDDPDFS.pdf

³ http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/stem-complete.pdf (p.18)

http://www.computerworld.com/s/article/9225673/IT_jobs_will_grow_22_through_2020_says_U.S.

pupils in lower education to make them aware of IT as an attractive path before they make educational choices that exclude many IT-related studies (e.g. avoiding high school math).

Initially, the work of the centre will focus on making our own studies more motivating. Our results will be communicated to facilitate easy reuse and adaptation by other educational institutions (see the Dissemination work package), contributing to increased student satisfaction in IT studies in Norway. If we succeed in promoting the attractiveness of IT studies to Norwegian youth, this will improve our own recruitment and that of IT studies in other Norwegian universities and colleges, some of which have severe recruitment problems.

Quality in established educational activities

The Department of Computer and Information Science (IDI) at the Norwegian University of Science and Technology (NTNU) has more than 800 full time students (bachelor and master), its main study programs being a 5 year integrated master in computing (siv.ing. Datateknikk) and two programs (Bachelor and Master) in informatics. Nord-Trøndelag University College (HiNT) with its institute for Media Technology in Steinkjer has bachelor programs in Game Development and Media Technology, each admitting more than 40 students annually.

Result factors:

The following results support our claim for excellence: <u>Good student recruitment</u>: With respect to admission threshold by high school grades, IDI/NTNU has the best students in Norway in computer science / informatics⁵. <u>High educational productivity</u>: IDI produces more than 900 study years annually, and the 5 year Datateknikk program is the biggest study program at the NTNU when it comes to study credits from its courses⁶ and its students⁷. <u>High research production</u>: For 2012 IDI scored 153,6 publication points with 117,9 man-years employed⁸ (all positions, incl. administrative), i.e., 1,3 points per man-year which puts us in the top 10% of Norwegian university departments regarding this metric. <u>High student satisfaction</u>: IDI run student surveys every semester. For overall satisfaction of the course

⁵ In 2012, our 5 year program in Computer Science required 52.3 points for admission directly from high school in the joint Norwegian study admission system (Samordna opptak, the ORDF quota), being the most applied program in this field in Norway, and our three year Bachelor program in Informatics was in second place, requiring 45.9 points. No other 3 year bachelor program in IT in Norway was above 40 admission points for the ORDF quota (i.e., directly from high school, without any extra points for work, military service, exam retakes etc.), cf. http://www.samordnaopptak.no/arkiv/statistikk/12/poenggrenser_vara_hoved_12.html Source: DBH, http://dbh.nsd.uib.no/dbhvev/student/eksamen_emne_rapport.cfm, and click

Universiteter, then Norges teknisk-naturvitenskapelige universitet and scroll down to Datateknikk

⁷ Source: DBH, http://dbh.nsd.uib.no/dbhvev/student/eksamen_rapport.cfm , and click Universiteter, then Norges teknisk-naturvitenskapelige universitet and scroll down to Datateknikk

Again, the source is DBH, web pages for scientific publication and for employees

offerings (on a 5 point scale), more than 70% of the students are either very satisfied or satisfied, around 20% neutral, and less than 10% dissatisfied or very dissatisfied (the latter typically just 1-2%). <u>High job relevance:</u> A NTNU candidate survey (Rud 2010) revealed that from the four faculties surveyed, the candidates from our faculty (IME) were the ones finding their education most in demand in the job market and were the most satisfied with their education. IDI/NTNU has run alumni surveys (2007, 2011) asking what topics candidates had most needed in their careers. The results indicated good alignment between study programs and job needs. Most of our graduates secure a job well before delivering their master thesis.

Process factors:

Innovative teaching methods: IDI has a long track record of pioneer efforts in project-based teaching, having large team projects with real customers in the 6th / 7th semester (Krogstie 2009; Andersen, Conradi et al. 1994; Sorge 2000). The 4th semester has a team project across all the four courses of that semester (Sindre, Stalhane et al. 2003). At HiNT students have projects already from the first semester. Within the Bachelor program Games and Experience Technology, a company simulator (GameLab) gives students a real world experience in a form resembling a regular job in a video game development company. One day per week is «GameLab Day», and all team members are required to show up for work. Students in the Multimedia program are also set to work on real projects, some of which are show-pieced on the web as information to youth considering to study at HiNT⁹. There is a strong focus on innovation and entrepreneurship, and HiNT has attracted funding from Norgesuniversitetet¹⁰ for a number of projects on novel e-learning such as active participation of students in videoconference-based teaching, online "flipped classroom", game-based learning, LMS, and multimedia-supported maths. Research, reflection, and dissemination about teaching: Over the last 20 years, IDI has published more than 100 international peer reviewed papers discussing teaching of IT, or by means of IT (cf. appendix A). For a department whose domain of research is technology and engineering, not pedagogics, this is an excellent track record of didactically related publications, showing high commitment towards research on own teaching practices and disseminating the lessons learnt to a wider audience. HiNT, much smaller in size, also have a good number of peer-reviewed papers on teaching-related topics (cf. appendix B). Involving students in research and publication: Students participate actively in IDI's research, in particular during their work with the master thesis, but also earlier, for

⁹ http://mmt.hint.no/

¹⁰<u>http://norgesuniversitetet.no/prosjekter/</u> and select "Hogskolen i Nord-Trøndelag" for "Institusjon" in the search box on the right.

instance participating in various scientific experiments and trials of new technology. Strong efforts in recruitment and retainment: IDI has made pioneering efforts for the recruitment of girls to ICT studies. The department started a project called "Jenter og Data" (Girls and Computing) in 1997 to improve the recruitment of female students. The success inspired the IME faculty to take over the project and extend it to all its ICT study programs, renamed as "Jenteprosjektet Ada". The project has several recruitment activities, e.g. a Technology Camp where high school girls are invited to the NTNU from all over Norway to learn more about study opportunities in ICT. The project also has activities for retainment, offering a social network among the female ICT students and a career network of ICT companies who provide opportunities for excursions as well as female mentors who are alumni of the same study programs. Recently, we have initiated similar efforts for all students at IDI, together with the Telematics department forming a network of enterprises that are employers of our candidates. The enterprises will contribute guest lectures, excursions and mentorship resources to highlight the relevance of early theory courses and make students aware of the variety of work-roles available to computing graduates. A web site ("Inspiring Window to the Future") is being developed to show how IT can address societal problems and how the solutions rely on knowledge from various courses. NTNU collaborates with industry on the national level, whereas HiNT has a more targeted collaboration with industry in its own region, especially in the Steinkjer area. The two partners complement each other in this respect. Drive towards improvement: As part of the IME faculty, IDI is involved in the faculty's project FRIKT (Future ICT studies) to renew the study program portfolio and teaching. We have several ongoing projects funded under FRIKT to improve teaching quality, e.g., looking at open online courses, other digital resources, and IT support for teaching. One result of FRIKT is new study plans from 2014 onwards, increasing project-based teaching (cf. Appendix C).

Input factors:

We have three major input factors: (1) <u>Strength both in research and education</u> (cf. result factors): IDI is one of NTNU's biggest departments, having around 40 permanent faculty in six research groups (computer architecture and design, algorithms / HPC / graphics, intelligent systems, data and information management, information systems, and software engineering), forming a sound basis for research-based education in a broad range of courses needed for computing candidates. HiNT has less resources for research, but contributes better understanding of practice-oriented teaching, using innovative methods. (2) <u>Clever students with well-organized student associations:</u> At the NTNU, the student associations Abakus (for

the 5 year integrated Computer Science students, as well as for Communication Technology) and Online (for the Informatics students) have a number of activities for their members. This includes social events, seminars where companies present themselves for recruitment purposes, and courses on relevant topics within IT (some given by students, some by companies) which supplement the more academic courses offered by the department. We have a huge potential in even better collaboration between faculty and students, to achieve a synergy between activities. (3) <u>Industry support:</u> Norwegian IT industry is in dire need for employees and would like to see us succeed in increasing the output of candidates.

The key persons at IDI/NTNU are Guttorm Sindre (centre leader), Monica Divitini, Birgit Krogstie, and Alf Inge Wang, all strong researchers with a good international standing, known for having tried out many new approaches to teaching over the years, and publishing didactic articles about their teaching experiences. The key persons at HiNT are Line Kolås, Robin Munkvold, Hugo Nordseth, and Håvard Sørli, all with experience in project-based teaching and e-learning. Both partners have enough persons with strong interests in teaching to make the centre robust in case of key persons changing jobs.

Potential for innovation and dissemination

As mentioned in the introduction, a major goal of the centre is to improve recruitment, student motivation, learning and throughput in Norwegian IT studies. We believe that this can be achieved through a well-founded approach to project-based teaching, and by increased visibility of IT competence as a path to a wide variety of interesting jobs. In an engineeringoriented field like ours, project-based teaching is more appropriate than problem-based teaching, as projects are representative of the way engineers work and fit the hierarchical nature of engineering syllabus (Mills and Treagust 2003; Perrenet, Bouhuijs et al. 2000). IT studies have a clear advantage for project based teaching as software artifacts can be developed without expensive materials or equipment. While students in marine or civil engineering will not be able to make a real ship or building early in their studies, only scaled down models, IT students can make applications for real stakeholders to perform useful tasks, which has clear advantages for motivation (Blumenfeld, Soloway et al. 1991). Improvement of student learning does not only rely on better teaching methods, but also on increasing the students' own effort, and some students tend to develop habits of not attending lectures, copying exercises, reading little in the textbooks, etc., which lead to poor results and increased likelihood of dropout. Both at HiNT and NTNU it has been observed that students often devote more time to projects than to traditional lecture courses, hence a further

increased focus on projects even in early study years can improve student commitment to their studies. Literature also supports the view that students learn better when they are well motivated and can clearly see the usefulness of the topic (Bransford, Brown et al. 2000), which is easier with industry-inspired projects. Moreover, obligations to their peers (project team) and milestones make students feel more obliged to show up.

We envision the following work packages in our centre:

WP1: Framework for project-based teaching (WP leader: Kolås, HiNT)

Information technology is becoming ever more complex and heterogeneous, ranging from small mobile apps for personal use to large organizational systems. Development happens on a number of different platforms and with different project structures, sometimes offshoring parts of the development to other countries, sometimes reusing open source code, etc. To remain competitive in the IT sector, companies must be highly innovative. For IT courses this means that one cannot give the same project year after year, but must come up with new and sometimes fairly open project assignments every time a course is offered. One must take into account students' background competence, the type of learning goals, technologies to be used, the wanted team size, time-frame, available teaching resources, the course and study program context, all in all many factors that make good project selection a difficult task.

Task 1.1: Guidelines for project design: <u>Objective:</u> Provide guidelines to help teachers design good team projects for students, or to help students themselves design them in case the assignment is quite open. The guidelines will be based on own experience at NTNU and HiNT, a literature survey, contacts with other education institutions who are strong on projects, as well as input from enterprises and students. The guidelines will be pilot tested in developing our new project courses and new project assignments in existing courses. <u>Outcome:</u> a set of guidelines publicly available on the web, together with example projects resulting from the guidelines. Guidelines will be continuously improved during the life-time of the center and beyond, based on experiences with their use.

Task 1.2: Project assessment and reflection: <u>Objective</u>: Be able to assess the learning outcome of each student even if deliverables are team-based, and stimulate reflection after projects. In this task, we will utilize IDI's scientific competence in the area of reflection in student projects (Krogstie and Divitini 2009) and computer-supported reflective learning in the workplace (Krogstie, Prilla et al. 2012). <u>Outcome</u>: Guidelines on how student projects can

include a stage for post-delivery reflection on, and documentation of, the learning that occurred in the project.

Task 1.3: Student e-portfolio: <u>Objective:</u> Encourage students' longitudinal learning and reflection inside and across courses, by offering the students an infrastructure for building e-portfolios (Attwell 2007), together with tips on how to use it. The portfolio need not be restricted to learning from university courses, but could also include reflections on learning from arenas such as part-time or summer jobs, courses and company presentations in the student associations. <u>Outcome:</u> An infrastructure for student e-portfolios, with guidelines for its use and evaluations of its effect on student satisfaction and learning.

WP2: IT tools for project-based teaching (WP leader: Wang, NTNU)

Projects can be instructionally heavy, as different student teams encounter different problems, at different times. Digital resources (e.g., video instruction and IT tools to support learning) can alleviate this. There are many such resources available world-wide and no need to reinvent the wheel where a solution already exists. Hence this work-package will mainly be about <u>using</u> available tools and do research on the resulting learning effect and student satisfaction. However, our employees and students also have the competence to develop new IT tools if no solution exists for a certain need, or if the project comes up with a concrete idea for something better, as shown in our previous work, e.g., (Divitini, Haugalokken et al. 2005; Wang and Morch-Storstein 2008; Sindre, Natvig et al. 2009; Wang 2011)

Task 2.1: Games and gamification: <u>Objective:</u> Try out new concepts in game-based teaching and e-learning tools with gamification aspects (e.g., quiz applications or simulators where students score points for effort and performance), to motivate students and improve teaching. <u>Outcome:</u> A set of tools, plus reported evaluations and experiences with their use.

Task 2.2: Communication and collaboration tools: <u>Objective:</u> Make project work run more smoothly by offering good collaboration tools both for student-student and student-teacher collaboration, as well as student-mentor vs. involved companies. <u>Outcome:</u> A set of available tools, and experiences with using them, and evaluations of their contributions to learning.

WP3: Effective quality assurance of teaching (WP leader: Sindre, NTNU)

Some university teachers see quality assurance as a chore, feeling it is documentation for documentation's own sake rather than improvement. NTNU's standard approach for getting feedback from students is reference groups, which work well in some courses but not always.

Some IDI teachers have tried another approach with promising results (Stålhane, Bratsberg et al. 2012), and IT support could make this approach more effective. Similarly, our alumni surveys could be supplemented with other means to get feedback from work-life whether our candidates have the appropriate knowledge.

Task 3.1: IT applications for student feedback and QA documentation. Objective:

Getting feedback more effectively from students, and help teachers do a better job at QA. <u>Outcome:</u> A set of IT tools for feedback and reporting (may be self-made or use something existing if appropriate), together with guidelines for the use of these tools, to be gradually improved based on experiences.

Task 3.2: More systematic feedback from employers. <u>Objective:</u> Get more systematic feedback on the alignment between the candidates' competence and job needs, to inform decisions about study program improvement. <u>Outcome:</u> Methods and tools to get feedback from employers and alumni, gradually improved based on experience with their effectiveness.

WP4: Dissemination (WP leader: B. Krogstie, NTNU)

As a major goal of 2-IT is to improve the image of IT studies and careers as perceived by. Norwegian youth, dissemination is a key challenge in the project.

Task 4.1. Dissemination to universities and colleges. In line with long tradition of publishing about our teaching, we will keep on making peer-reviewed publications. If given the extra funding of a centre, this can be intensified, targeting more high prestige journals in addition to the current main focus on conferences. Moreover, while our main focus has previously been international publication, as a national centre, we will also be visible on national arenas in conferences like NKUL, NIK, and NOKOBIT. There will be a project web site containing popularized summaries of all important results and a lot of material freely available for other institutions to reuse or adapt. For instance the project design guidelines of task 1.1 will be freely available together with specific examples of project assignments developed according to the guidelines (so that other institutions can use the same or slightly modified project assignments if they wish) and examples of student solutions.

Task 4.2 Dissemination to lower education: There are two major groups we want to reach: the teachers and the pupils. Many teachers of IT in high school struggle, having limited or out-of-date competence falling short of the most clever pupils. This has given high school IT courses a bad reputation with many teenagers, which again may hurt recruiting to IT studies.

To some extent, digital resources made available for our own students may also be appropriate for high school teachers who want to update their knowledge. Simplified versions of early student projects could be viable as projects in high school. The centre will initiate a "Best app" contest for Norwegian junior and senior high schools, where pupils can participate in teams to submit proposals for smart phone / tablet apps (sketching the functionality, no tech knowledge required). The winning teams can be invited to the NTNU and HiNT to discuss the app in more detail with teams of students who will develop the apps, communicating with the high school teams via the internet for further clarifications. In the end, the high school students would be able to run the app on their own devices and show it to friends.

Task 4.3 Dissemination to Norwegian society at large: The centre has an ambition to be visible to the Norwegian public at large, for instance communicating through newspapers, blogs and other media the importance of strengthening IT education in Norway. If the "Best app" contest is successful, it should be possible to get substantial media interest.

WP6: Leadership and administration (WP leader: Sindre, NTNU)

Administration is to be kept at a minimum. As much of the resources as possible should go to educational improvement and knowledge generation and dissemination. But some budgeting and reporting will be necessary, as well as coordination between the work packages.

Organizational plan

The centre will be organized as a unit within the IME faculty at the NTNU. The NOKUT funding (75% to NTNU, 25% to HiNT) will be used for employing a full time coordinator, phds/postdocs as well as buying faculty off part of their ordinary tasks to perform centre activities. Also, students will be employed part-time by the centre in positions resembling Teaching Assistant positions in normal courses, but where the task is to work with evaluation and improvement of IDI's and HiNT's teaching rather than with the daily running of courses. We will have a board with representatives from NTNU, HiNT, students, and industry.

Collaborative partners

The NTNU - HiNT collaboration is ideal for the project in question. The two institutions complement each other, both in size, mandate (national vs regional) and focus (academic vs practice-oriented), thus both can learn a lot from the other. For instance, HiNT already has projects from the 1st semester, which IDI / NTNU is now going to introduce as a result of the FRIKT project. The partners share interests in project-based teaching, games and e-learning, and already have some collaboration (e.g., Line Kolås at HiNT recently having taken her phd

at NTNU). With two partners, the centre avoids the overly internal focus that could result from a single partner proposal, yet at the same time limits the coordination overhead. Partners separated by an easy two hour train ride, meetings can be achieved with small travel costs.

We will also have collaboration with industry (cf. support letter from the enterprise network KID), and with international educational institutions, both some we already have a collaboration with through EU projects (e.g., MIRROR, where Divitini and Krogstie have participated) and others which are known to be strong in project-based education. Especially, we will seek collaboration with the worldwide cdio initiative¹¹ and try to have our educations accredited there due to their heavy use of team projects. We will also like to collaborate with other SFU's with activities related to IT and learning (ProTed, and new ones) but will await further investigation of such collaboration possibilities until we know if we get funded.

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¹¹ http://www.cdio.org/

2·IT

Innovative Teaching of Information Technology

IME v/IDI (Project leader: Guttorm Sindre) Budget

COST PLAN (in thousands NOK)	2014	2015	2016	2017	2018	SUM
Personal and indirect costs (exluding Master students)	5 468	5 714	5 971	4 113	4 298	25 563
Master Students	200	200	200	200	200	1 000
Operating costs - PhD & Postdocs	210	210	210	70	70	770
Purchase of R&D services	0	0	0	0	0	0
Equipment	0	0	0	0	0	0
Other operating costs	550	550	550	550	550	2 751
Total funding:	6 428	6 674	6 931	4 933	5 1 1 8	30 084

2·IT

Innovative Teaching of Information Technology

IME v/IDI (Project leader: Guttorm Sindre) Plan for financial resource acquisition

	2014	2015	2016	2017	2018	SUM
3 000 3 000	3 000	3 000	3 000	3 000	3 000	15 000
- 75 % of funding from NOKUT transferred to NTNU (c/o IME/IDI): 2250	2 250	2 250	2 250	2 250	2 250	11 250
- 25 % of funding from NOKUT transferred to HiNT:	750	750	750	750	750	3 750
NTNU (own financing) 700	700	700	700	700	700	3 500
IME/IDI (own financing) 2 153	2 153	2 399	2 656	658	843	8 709
HiNT (own financing) 575	575	575	575	575	575	2 875
Total funding: 6 428	6 428	6 674	6 931	4 933	5 118	30 084

2·IT: Timeline of activities, and milestones

The work packages are WP1 Framework for project-based teaching, WP2 IT tools for project-based teaching, WP3 Effective quality assurance of teaching, WP4 Dissemination, and WP5 Administraton and Leadership.

All the workpackages will be performed in parallel, throughout the entire life-time of the centre – which is natural since this is a centre, not a mere project application. Milestones are only outlined for the first five years, since if extended to ten years it is likely that the centre would also consider to come up with entirely new work packages.

As can be seen below, the work packages and tasks generally follow a scheme of iterative improvement, i.e., making a first version of a new teaching approach or tool, trying out this and evaluating it, making a new improved version based on these experiences, etc. From the internal perspective of improving the partner's own teaching, this could be seen as an *action research* method, from the external perspective of producing artifacts that other education institutions could pick up and use (e.g., guidelines, example project assignments, tools etc. available on the web) it could rather be seen as a *design science* research method.

The following milestones are envisioned:

WP1 Framework for project-based teaching

T1.1 Guidelines for project design

<u>Month 6:</u> First version of guidelines (report and web site), based on own experience, literature study, and interviews with international universities with strength in project education

<u>Month 18:</u> Experience report for guidelines, after developing project courses based on them, and running and evaluating these courses, getting input from students who took the courses, etc.

<u>Month 24:</u> Revised version of guidelines, based on experiences (guidelines may of course be revised gradually as soon as improvement possibilities can be seen, but this is meant as a major revision). By this stage, example project assignments, with example solutions, will also be added to the guidelines web site, and we will make a strong efforts towards having other education institutions also try out our guidelines (and, if relevant, partially reuse example assignments). To make this happen, we will not only make the resources freely available on the web, but also actively contact institutions that might be interested and offer tutorials or other assistance if needed. <u>Month 36:</u> Experience report for revised guidelines, as new rounds of project assignments have been developed based on them. Here of course including experiences from education institutions outside the consortium as well as our internal experiences.

Month: 42: New major revision of guidelines

Month 60: Final wrap-up of guidelines and experiences with using the guidelines.

T1.2 Project assessment and reflection

Month 6: Literature survey of assessment practices (worldwide) for team projects

<u>Month 12:</u> First version (report and on web site) of method / advice for how to support student reflection about project learning, based on own experience and literature study

Month 24: First experience report from using the methods for reflection (i.e., based on evaluations of student satisfaction and learning outcome)

Month 30: Revised version of reflection method

Month 36: Guidelines (report and web site) on how to assess team projects, taking into account the reflection method and assessment of the outcome from this in addition to the normal project artifacts

Month 54: Revised version of reflection guidelines and assessment guidelines, based on experiences of use (own, and from outside the consortium) Month 60: Final wrap-up report

T1.3 Student e-portfolio

<u>Month 18:</u> Initial survey report on e-portfolios, presenting methods and experiences from universities internationally who have tried this out (based on literature study and interviews with universities, teachers, and students who tried it), as well as available tools and infrastructures for supporting e-portfolios

<u>Month 36:</u> First experience report after trying out e-portfolios at the partner institutions

<u>Month 48:</u> Revised approach to e-portfolios, based on experiences <u>Month 60:</u> Wrap-up report on e-portfolio approaches and experiences

WP2 IT tools for project-based teaching

T.2.1 Games and gamification

<u>Month 12:</u> Initial catalog of games and gamification tools to be tried out in the work package (based on survey, experiences, and availability, e.g. freely available open source tools preferred to other tools). The catalog consists of pointers to tools that we have not made ourselves or that must be purchased, and the code for the tools if this is open source code made by the centre. In addition to (pointers to) the tools, the catalog also contains descriptions and evaluations of the tools, such as indications of what they should be used for, what learning they can support, etc.

Month 24: First experience report with using selected tools

<u>Month 36:</u> Revised catalog of tools (either picking new tools, or improving those from the first round, if relevant and possible for us to improve, e.g., if the tools were made by the partner institutions or were open source, and improvement is technically and economically feasible)

Month 48: Experience report with second round of tools

Month 54: New revision of tool catalog

Month 60: Wrap-up report, joint for T2.1 and T2.2

T.2.1 Collaboration tools

<u>Month 6:</u> Initial catalog of collaboration tools specifically meant to support project based teaching, plus indicators for use (i.e., suggestions when to use a certain tool, what needs it might cover)

<u>Month 18:</u> First experience report with using selected tools, e.g., based on student satisfaction with tools and teacher insights about learning effects resulting from or facilitated by tool usage

Month 42: Revised catalog of tools, revised guidelines for which tools to use in which

circumstances

Month 54: Experience report with second round of tools Month 60: Wrap-up report, joint for T2.1 and T2.2

WP3 Effective quality assurance of teaching

T3.1: IT applications for student feedback and QA documentation

Month 6: Initial specification of tool for student feedback

Month 9: Initial specification of tool for QA documentation support

Month 12: First prototype of tool for student feedback

Month 15: First prototype of tool for QA documentation

Month 18: Experiences from first usage of student feedback prototype (e.g., student and teacher satisfaction from trial usage)

Month 24: Experiences from usage of QA doc prototype

Month 30: Second prototype of tool for student feedback

Month 36: Second prototype of tool for QA documentation

Month 42: Experiences from second student feedback prototype, internally and from other universities who have chosen to use our tools

Month 48: Experiences from second QA doc prototype

Month 54: Revised versions of both tools

Month 60: Wrap-up report

T3.2: More systematic feedback from employers

<u>Month 12:</u> Developing new and improved instrument for alumni surveys (based on experiences with previous ones conducted in 2007, 2011, plus literature survey of international practice in this area)

Month 24: Report on results from new alumni survey, and experiences from usage of the survey instrument

<u>Month 36:</u> Instrument for survey towards work-life (employers, potential employers) to investigate satisfaction with candidates and opinions on what should be taught Month 48: Report on results from employer survey

Month 54: Interview study with employers to further elaborate on validity of survey findings, follow-up on unclear issues, etc.

Month 60: Revised versions of alumni survey and employer survey, based on experiences

WP4 Dissemination

<u>Month 1:</u> Centre web site up and running. Produced reports guidelines, example projects, pointers to tools, open source code for self-made tools, etc., will gradually be added to this web-site as they emerge (see milestones of other work packages). <u>Month 6:</u> Detailed dissemination plan

<u>Repeatedly:</u> Contributions to national conferences like NKUL, NOKOBIT, NIK, NFF, NUV... as these take place, as well as to international conferences and journals each time there are project results of appropriate quality.

Most dissemination activities will be continuous or related directly to milestones already presented for other WPs (i.e., disseminating results as soon as we have them). This will be particularly so for dissemination to other universities and colleges, who should be able to make use of the reports and guidelines on the web page fairly directly, but we will also offer seminars, tutorials etc. to make it easier for others to utilize what is available on the web site. However, we can specifically mention:

T4.2 Dissemination to high school

Month 12: Design of first version of «Best app» contest concept (rules, guidelines for participating, infrastructure for organizing the contest)

Month 24: First run of contest, including experience report. Subsequent runs to be done annually

<u>Month 36:</u> Analysis which of our results produced so far (in other work packages, i.e., apart from contest) might be particularly relevant for high school (teachers or students)

<u>Month 42:</u> Simplification / adaptation of these results to improve high school utility <u>Month 48:</u> Report on experiences with Best App contest after 3 years of running it. Contest will continue further if deemed sufficiently successful to mandate the costs. <u>Month 54:</u> Analysis of feedback from high school teachers and students who have used the resources provided in month 42

Month 60: Wrap-up report

WP5 Administration and leadership

This WP will contain annual reporting, coordination between workpackages, staffing decisions, etc., not flagging these activities as milestones since these are continuous efforts.

<u>Month 60:</u> Synthesis report for the entire centre activity (if not continued), or for the first half if there is a continuation for five more years. Suggestions for further work / new work packages for the continuation.



Saksbehandler: Rolf Wensbakk E-post: rolf.wensbakk@hint.no

Telefon: 74112152 Kontoradresse: Vår dato: 06.05.2013 Vår ref.:

Deres dato: Deres ref.:

LETTER OF INTENT

Nord-Trøndelag University College (HiNT) hereby declares intent to participate in the 2-IT Centre of Excellence proposal coordinated by the Norwegian University of Science and Technology (NTNU) if the centre gets funding from NOKUT.

We confirm that we have read the document on NOKUT's homepage "Requirements and guidelines for the centers and criteria for assessing the applications", and we accept the terms.

HiNT will contribute 575 000 NOK to the to the budget per year from 2014 to 2018 (175 000 NOK in cash and 400 000 NOK to compensate for hours of work).

Our contact is Study Coordinator Robin Munkvold, robin.munkvold@hint.no

Steinkjer, Norway

Date 06. May 2013

Rolf Wensbakk Dean Høgskolen i Nord-Trøndelag

Postadresse: Høgskolen i Nord-Trøndelag Postboks 2501 7729 Steinkjer

Fakturaadresse: Høgskolen i Nord-Trøndelag Fakturamottak Postboks 376 Alnabru 0614 Oslo Kontakt: (+47) 74 11 20 00 (tlf.) (+47) 74 11 20 01 (faks) postmottak@hint.no www.hint.no Organisasjonsnr: 971 575 905

Næringslivsnettverket KID, NTNU

Oslo, 2. mai 2013

Regarding the Department of Computer and Information Science's "Center of Excellence" (SFU) application 2013

The "KID" network is a collaborative initiative between NTNU and a number of close industry partners with particular interest in candidates graduating from the computer science and telematics-related study programs.

Through KID the Department of Computer and Information Science (IDI) is integrating collaborative activities with industry/enterprise partners into its daily operation of their Bachelor and Master programs. On behalf of the industry in Norway we have expressed satisfaction based on our experience with candidates coming from these NTNU programs, as well as concern related to the obvious need to increase the number of such graduates in the years to come. The "2:IT" Center of Excellence application's emphasis on involving enterprises in continuous improvement initiatives, joint projects, activities to motivate the students etc. will represent great synergies with what we want to accomplish through our efforts in the KID network. Through such joint efforts we believe that the students will gain inspiring and relevant insight into their future career opportunities, as well as a valuable understanding of working-life situations that confirm the need for competence and skills that they develop through their science and engineering education.

NTNU is considered the leading university in Norway within these engineering diciplines and we want to give IDI's Center of Excellence (SFU) application our strongest recommendation and support. Should IDI be granted an opportunity to establish such a Center of Excellence, we will be there as their partner from day one.

Sincerely,

Olav Folkestad Chairman of the KID network and CEO of BEKK Consulting AS

Appendix C: Planned study program changes from the FRIKT project

This document briefly illustrates the planned changes to the 5 year integrated Master program in computer science and the 3 year Bachelor program in Informatics at the NTNU, as proposed in the IME faculty's FRIKT project. (FRIKT = Fremtidens IKT-studier = ICT studies of the future) The purpose of the FRIKT project is to improve recruitment, motivation, learning, and throughput of candidates. The new study plan will be effectuated from 2014 onwards.

The figure on the next page shows the 5 year integrated Computer Science program, starting from the first semester (bottom) to the tenth and final semester with the master thesis (Masteroppgave, top). The two main changes from the existing study program are the introduction of two new project courses, one in the 2nd semester (*Programmeringsprosjekt 1*, rightmost column), and one in the 3rd semester (*Programmeringsprosjekt 2*). This yields an "engineering ladder" of courses directly relevant to the students' chosen field of interest (blue courses), achieved by moving some general theory courses (Math 4D and Physics, in orange in the 5th and 6th semester) higher up in the study plan than they were before.

In addition to the two new project courses that are hence proposed, the study plan already had a number of projects from before, namely:

- In the 4th semester, a team project cross-cutting all the four courses taken in that semester (TTM4100 Communication, services, networks, TDT4145 Databases and data modelling, TDT4180 Human-computer interaction, and TDT4140 Software engineering). The purpose of this project, rather than having isolated compulsory exercises in each of the four courses, is to provide the students with a more holistic learning experience, seeing how topic material from the different courses fit together in building an IT system. Experiences from this project have been published in (Sindre, Stalhane et al. 2003).
- In the 7th semester a team project with real customers from industry (TDT4290 / TDT4295, grey box across the two leftmost columns of the 7th semester. The size of this box reflects the fact that this course is twice as big as a normal course, i.e. 15 ECTS credits. Experiences from this project have been published in (Andersen, Conradi et al. 1994; Sorge 2000).
- In the 8th semester, an inter-disciplinary team project (Experts in Team, rightmost white box). This project is not specific to the CS program but common to all master programs at the NTNU. Here, teams are composed of students from different study programs, and trying to define project where each student can be able to utilize their expertise in the project. There is also a strong focus on reflection about the project process. Experiences from one such project course offering have been published in (Jaccheri and Sindre 2007).
- Finally, TDT4501 is a pre-project for the master thesis, this normally done individually, and more research oriented than the previous projects.

As can be seen, there was a lot of project courses in the study plan already, but the main changes resulting from FRIKT is an additional focus on project <u>early in the studies</u>, which has been found to be a critical period for student motivation and learning, and therefore also for retention.



Proposed study plan for the 5 year integrated CS studies at IDI / NTNU

The proposed new study plan for the Bachelor studies in Informatics is shown in the figure below, again starting with the first semester at the bottom, and ending with the 6th semester on the top. The study program utilizes some of the same courses as the 5 year CS program, but the Informatics study program has a lot more elective freedom.

Project 4		Elective	Elective
Elective	Elective	Elective	Elective
Comm/networks	Databases	HCI	Software engineering
Elective	Algorithms	Computers	Project 3
Discrete Maths	Elective hum/soc.sci. topic	OO Programming	Project 2 (ny)
Maths (calculus)	Philosophy	Intro to IT	Project 1 (ny)

Proposed new study program for Bachelor in Informatics

Project courses are shown in **bold face** in this diagram. Again, there are two new project courses introduced, with labels <u>underlined</u>, one in the first semester and one in the second semester. In addition there were three more projects existing already in the old study plan: a programming project in the third term, a project cross-cutting four courses in the fourth term (same as for the 5 year integrated program), and a customer-driven project in the 6th term (resembling the one that the CS students have in the 7th semester), experiences with the latter one published in (Krogstie 2009). In addition, on master level (not shown in this diagram) the Informatics students will have the Experts in Team project (same as for CS students), and of course a master thesis.

- Andersen, R., R. Conradi, et al. (1994). Project courses at the NTH: 20 years of experience. <u>Software</u> <u>Engineering Education</u>. J. Díaz-Herrera, Springer Berlin Heidelberg. **750:** 177-188.
- Jaccheri, L. and G. Sindre (2007). <u>Software engineering students meet interdisciplinary project work</u> <u>and art</u>. Information Visualization, 2007. IV'07. 11th International Conference, IEEE.
- Krogstie, B. (2009). A Model of Retrospective Reflection in Project Based Learning Utilizing Historical Data in Collaborative Tools. <u>Learning in the Synergy of Multiple Disciplines</u>. U. Cress, V. Dimitrova and M. Specht, Springer Berlin Heidelberg. **5794**: 418-432.
- Sindre, G., T. Stalhane, et al. (2003). <u>The cross-course software engineering project at the NTNU: four</u> <u>years of experience</u>. Software Engineering Education and Training, 2003.(CSEE&T 2003). Proceedings. 16th Conference on, IEEE.
- Sorge, M. (2000). Evaluering av prosjektundervisningen ved Institutt for datateknikk og informasjonsvitenskap, NTNU. Trondheim, Norway, Program for lærerutdanning, Seksjon for universitetspedagogikk, NTNU.

Curriculum Vitae: Kolås, Line

Education

Year:	Degree:
2010:	PhD from Department of Computer and Information Science at NTNU:
	"Implementation of pedagogical principles into the software design process of e-learning applications".
1999:	Master degree in informatics (Cand. scient.) at NTNU: «ICT in the learning
	process».
1997:	Practical pedagogical education, NTNU.

Work

2010	Associate professor at the Nord-Trøndelag University College.
2007	Researcher at LiKT (Programme for learning with ICT), NTNU.
2003-2010	PhD research fellow at Department of Computer and Information Science,
NTNU.	
1999- 2010	Assistent professor at Nord-Trøndelag University College.

Research

- Kolås, L., Munkvold, R. og Nordseth, H. "Evaluation of EPE videos in different phases of a learning process", IADIS CELDA 2012.
- Kolås, L., Munkvold, R. og Nordseth, H. "Evaluation and Categorization of Educational Videos", AACE E-learn 2012.
- Kolås, L., Munkvold, R. og Nordseth, H. "Added values of EPE videos". Presentation at Workshop on Social Mobile Video and Panoramic Video, Stanford University.
- Kolås, L., Brørs, K.H., Eide, K.O., Nordseth, H. og Solsem, S.M. "Low-effort' use of mobile technologies and video in the classroom". Proceedings of AACE Ed-Media 2011.
- Kolås, L., Munkvold, R. og Thorshaug, A. «Social interaction types experienced among preschool-children (age 3-5) using touch screen technology". Proceedings of AACE E-learn 2010.
- Kolås, L. 2010. "Multiple pedagogical methods in an LMS a qualitative study" in: Guerrero, J. (ed), Proceedings of the 2nd IADIS international conference on mobile, hybrid and on-line learning. (eL&mL 2010), IEEE Computer society,
- Kolås, L. 2010. "Implementation of pedagogical principles into the software design process of e-learning applications". Doctoral thesis at NTNU, 2010:150
- Kolås, L. og Staupe, A. 2010. "The E-learning Circle A holistic software design tool for e-learning". E-learning and Education, 2010.
- Kofod-Petersen, A., Petersen, S.A., Bye, G.G., Kolås, L. og Staupe, A. 2008. "Learning in an Ambient Intelligent Environment - Towards Modelling Learners through Stereotypes". Revue d'intelligence artificielle: Revue des Sciences et Technologies de l'Information, 2008 ;Volum 22.(5) p. 569-588.
- Kolås, L., Edvardsen, L.F.H. og Hokstad, L.M. 2008. "Bruk av It's learning ved NTNU", NTNU report (in Norwegian).
- Kolås, L. og Staupe, A. 2007. "The PLExus Prototype: A PLE realized as Topic Maps" ICALT 2007 (The 7th IEEE International Conference on Advanced Learning Technologies), The ICALT 2007 Proceedings, IEEE Computer Society Press.

International projects:

- ActivEd (2011-13). Erasmus Intensive programme: Bootcamp Using film in the classroom. Cooperation with Tallin University Haapsalu College (EE), Winchester University (UK) and University College Syddanmark (DK).
- **CoTech** (2010-12): NordPlus project focusing on educational videos. Cooperation with Tallin University Haapsalu College (EE) and University College Syddanmark (DK).
- QUIS (2005-06): QUIS Quality, Interoperability and Standards in e-learning. (EU-project under "The eLEARNING programme", DG EAC/26/04). http://www2.tisip.no/quis/index.php.
- E-LEN (2003-04): E-LEN (EU-project under the Socrates programme, ref.nr: 101421-CY-2002-1-CY-minerva-mmp): http://www2.tisip.no/E-LEN/.

National projects:

- Å tolke et gevir (2013-14). Online language teaching with focus on communication and visualization, developing an online version of «the flipped classroom». Partners: Universitetet i Nordland, Julev film og TMM. Funded by Norgesuniversitetet.
- VisPed (2012-13). Student active learning while teaching through video conference technology. Partners: HiNT, NTNU, Folkeuniversitetet Midt-Norge and Stiftelsen Kompetanseheving i Nord-Trøndelag. Funded by Norgesuniversitetet.
- **PLN Personal learning Networks** (2012-13). Partners: HiST and HiNT. Funded by Norgesuniversitetet.
- Nærproduksjon av video (2011-12). EPE videos in learning and teaching. Partners: Høgskolen i Sør-Trøndelag and BI. Funded by Norgesuniversitetet.

CV for Dr. Alf Inge Wang

Personal information:

Name:Alf Inge Wang, born 10th April 1970, Levanger, Norway.Citizenship:Norwegian.Marital status:Married, three kids.Email:alfw@idi.ntnu.no.Webpage:http://www.idi.ntnu.no/~alfw



Current position/commissions:

Professor in Game Technology at the Dept. of Computer and Information Science, NTNU Founder/Inventor of MobiTroll – EdTech company that develops the game-based learning environment Kahoot! Teaching courses: IT introduction, Software architecture, Game development Chairman of JoinGame Resource Network on Computer Games (<u>www.joingame.org</u>) Editor in ACM Computers in Entertainment (Calendar)

Education:

• B.Sc. in Micro Electronics, M.Sc. and Ph.D. in Software Engineering, NTNU, Trondheim, Norway

Research interests:

Game-based learning, Software Engineering Education, Social Computing, Software Engineering.

Highlights:

- Disseminator of the Year Award 2011 of the Faculty of IME at NTNU.
- Second place in Innovator 2010 for invention MOOSES.
- 90+ peer-reviewed international publications, where 20+ are on game-based learning and education.
- Initiated and designed a specialization study program on game technology at NTNU
- Explored/researched game-based learning in several courses at NTNU and across the world.

Brief CV and list of publications for Birgit R. Krogstie

Name	Birgit Rognebakke Krogstie
Nationality	Norwegian
Born	1969
Present position	Post doc fellow

Academic degrees

- MSc in Computer Science, NTH, 1994
- Master (Hovedfag) in Education, University of Oslo, 2001
- PhD in Computer Science, NTNU, 2010

Work experience

- 1994-1997: Research scientist, SINTEF
- 2001-2004: Assistant professor, NITH
- 2005-2010: PhD candidate, NTNU
- 2010: Researcher, NTNU
- 2010-present: Post doc fellow, NTNU

Teaching and research experience

Birgit Krogstie has been involved in education-related activities over many years, working as student and teaching assistant (including lecturing) in computer science while studying at NTH. At SINTEF she did research on educational software. She has taught software engineering and project work at NITH and computer-supported cooperative work at NTNU. She has been supervising project groups, has written a software engineering compendium (internal, NITH) and has been external advisor (tilsynssensor) in several project courses at NITH since 2007. Krogstie's PhD research addressed work and learning in software engineering student teams, based on qualitative studies with a focus on tool support for learning and on reflective learning. As a post doc fellow, Krogstie is work package lead in the EU project MIRROR (http://www.mirror-project.eu/). The project is about reflective learning in the workplace, and Krogstie is responsible for a conceptual model of reflective learning, covering learning in different settings and aided by different technologies. This research has relevance also for educational settings, in which reflection can be considered essential to learning outcomes.

Selected publications

The following publications address software engineering project courses (with a focus on tools and techniques to support collaborative work and reflective learning) as well as reflective learning more generally

1. Bygstad, B., B. Krogstie, and T.-M. Grønli. Scaffolding Project Based Learning with the Rational Unified Process. Experience from 5 years of Student Projects in Software

Engineering. in NOKOBIT. 2006. Molde, Norway: Tapir.

- 2. Bygstad, B., B.R. Krogstie, and T.M. Grønli, *Learning from achievement: scaffolding student projects in software engineering* International Journal of Networked and Virtual Organizations, 2009. **6**(2).
- 3. Kristiansen, A., et al. *Mobile and Collaborative Timelines for Reflection.* in *International Conference on Mobile Learning.* 2012. Lisbon, Portugal: IADIS Press.
- 4. Krogstie, B. Power through brokering. OSS participation in SE projects. in International Conference on Software Engineering (ICSE) 2008. 2008. Leipzig: IEEE Computer Society.
- 5. Krogstie, B. and B. Bygstad. *Introducing a Virtual Classroom in a Master Course: Lessons Learned.* in *EISTA.* 2005. Orlando, Florida, USA.
- 6. Krogstie, B. and B. Bygstad. Cross-Community Collaboration and Learning in Customer-Driven Software Engineering Student Projects. in Twentieth Conference on Software Engineering Education and Training (CSEE&T). 2007. Dublin: IEEE Computer Society.
- 7. Krogstie, B., et al., Computer support for reflective learning in the workplace: A model., in International Conference on Advanced Learning Technologies (ICALT) 20122012, ACM: Rome.
- 8. Krogstie, B.R. *The wiki as an integrative tool in project work*. in *COOP*. 2008. Carry-le-Rouet, Provence, France: Institut d'Etudes Politiques d'Aix-en-Provence.
- 9. Krogstie, B.R. Using Project Wiki History to Reflect on the Project Process in 42nd Hawaii International Conference on System Sciences. 2009. Big Island, Hawaii: IEEE Computer Society.
- 10. Krogstie, B.R. A model of retrospective reflection in project based learning utilizing historical data in collaborative tools. in *EC-TEL* 2009. 2009. Nice, France: Springer.
- 11. Krogstie, B.R. *Do's and dont's of instant messaging in students' project work.* in *NOKOBIT* 2009. 2009. Trondheim, Norway: Tapir.
- 12. Krogstie, B.R. and M. Divitini, *Shared timeline and individual experience: Supporting retrospective reflection in student software engineering teams*, in *CSEE&T 2009*2009, IEEE Computer Society: Hyderabad.
- 13. Krogstie, B.R. and M. Divitini. *Supporting Reflection in Software Development with Everyday Working Tools*. in COOP. 2010. Aix-en-Provence, France: Springer.



Member of Scientific Staff: Prof. Monica Divitini

I. A brief CV and list of publications for Prof. Monica Divitini

Name:	Monica Divitini
Nationality: Italian	
Born: 21 Sept 1964	
Present position:	Prof. of Cooperation Technology

Academic degrees:

- M.Sc.in Information Science, University of Milano, Italy (1991)
- Ph.D. (European Doctorate) in Computer Science, University of Aalborg, Denmark (1999)

Work experience:

September 2002- : full professor at the Department of Information and Computer Science, NTNU

(December 2000-August 2001): Maternity leave

Employed since 1997 at IDI, NTNU – Previous positions as researcher at IDI, NTNU; University of Milano and Milano Bicocca, Italy; Risø National Laboratory, Denmark

Monica Divitini is prof. of Cooperation Technology at IDI. She holds a PhD in Computer Science from Aalborg University, Denmark, and a master in Information Technology, from University of Milano, Itlaly. She has more than 20 years active experience in research with focus on technology enhanced learning, cooperation technology, mobile and ubiquitous computing, user centred design. She has extensive experience as participant and manager of EU and national projects. She is currently project leader for the national VERDIKT-FABULA project (http://www.fabula.idi.ntnu.no/), on city-wide collaborative learning; unit responsible for EU FP7 IP MIRROR (http://www.mirror-project.eu/), of EU LLP2010 CoCreat (http://let.oulu.fi/cocreat/), on development of Collaborative Spaces for Creativity. She was also unit responsible for EU IST FP6 FET ASTRA (http://www.astra-project.net/), on end-user development of pervasive awareness systems. Prof. Divitini is a strong advocate of research-based teaching and of project based education. She is coordinator of the capstone project course at the bachelor level (it2901). She has numerous publications in international journals, antologies, and conferences about e-learning and other teaching-related topics.

Name:	Guttorm Sindre
Nationality:	Norwegian
Born:	1964
Present position:	Professor (and Head of Department)

I. A brief CV and list of publications for Professor Guttorm Sindre

Academic degrees:

- MSc Computer Science, NTH, 1987
- Cand.mag. Humanities, Univ. Trondheim, 1989
- Dr.ing. (phd) Computer Science, NTH, 1990

Work experience:

- 1988-90: phd fellow, Norwegian Institute of Technology (NTH)
- 1990-91: Military service in the Norwegian Navy, developing software in C
- 1991-92: researcher, SINTEF
- 1992-95: assoc.prof., Norwegian Institute of Technology (NTH)
- 1995-99: freelance writer
- 1999-2003: assoc.prof., NTNU
- 2003-: professor, Dept Computer and Information Science, NTNU

Teaching, research and leadership experience

Over his academic career Sindre has taught courses across all stages of the department's course portfolio, from the introductory IT course, through programming (1st year), software engineering (2nd year), information systems (3rd year), modelling techniques (4th year), project and master theses (5th year), and phd courses. Sindre's research has been mainly within the fields of information systems modelling and software requirements engineering, as well as IT education. He has been project manager of the projects WISEMOD (Norwegian Research Council, VERDIKT programme) and ReqSec (Norwegian Research Council, FRITEK programme). He has been NTNU's representative in the working committee of Norsk Fagråd for Informatikk (Norwegian Informatics Council) 2009-2013. Sindre is currently Head of Department at the Dept of Computer and Information Science (IDI) at the NTNU 2009-2010 and 2012-2013 (and vice Head 2010-2012), this has given useful leadership experience to be a potential centre leader. Sindre's period as Head will finish 1st August 2013, thus freeing the necessary time to be heavily involved in the 2-IT centre.

Publications

In total, Prof. Sindre has published 128 peer-reviewed international papers, whereof 21 journal papers, 12 scientific book chapters, and 95 conference/workshop papers, for details see www.idi.ntnu.no/~guttors/bibliography.html.

Citation data (checked in Google Scholar, 6 May 2013): citations: 3008, h-index = 22.

Selected publications:

Here focussing only on publications specifically related to teaching

- Guttorm Sindre, Lasse Natvig, Magnus Jahre: "Experimental Validation of the Learning Effect for a Pedagogical Game on Computer Fundamentals", *IEEE Transactions on Education*, 52(1):10-18, Feb 2009
- 2. Lasse Natvig, Guttorm Sindre, Asbjørn Djupdal: "A Compulsory yet Motivating Question/Answer Game to Teach Computer Fundamentals", *Computer Applications in Engineering Education*, 17(2):167-179, June 2009.
- 3. Guttorm Sindre, Daniel L. Moody, Terje Brasethvik, Arne Sølvberg: "Introducing Peer Review in an IS Analysis Course", *Journal of Information Systems Education*, 14(1):101-119, 2003.
- Letizia Jaccheri, Guttorm Sindre: "Software Engineering Students meet Interdisciplinary Project work and Art", Proceedings 11th International Conference on Information Visualisation, Zurich, Switzerland, 2-6 July 2007.
- 5. Guttorm Sindre: "Teaching Oral Communication Techniques in RE by Student-Student Role Play: Initial Experiences", Proc. 18th Conference on Software Engineering Education and Training (CSEE&T'05), Ottawa, Canada, 18-20 April 2005.
- 6. Daniel L. Moody, Guttorm Sindre: "The Use of Quality Reviews in Teaching Requirements Analysis", In Proc. 8th Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE 2003), Thessaloniki, Greece, 30 Jun - 2 Jul 2003.
- Guttorm Sindre, Daniel L. Moody, Terje Brasethvik, Arne Sølvberg: "Students' Peer Review in Modelling Exercises", In Proc. Informing Science + Information Technology Education Joint Conference (InSITE 2003), Pori, Finland, 24-27 Jun 2003.
- Daniel L. Moody, Guttorm Sindre: "Evaluating the Effectiveness of Learning Interventions: An Information Systems Case Study", In Proc. 11th European Conference on Information Systems (ECIS 2003), Naples, Italy, 18-21 Jun 2003.
- Guttorm Sindre, Steinar Line, Ottar Viken Valvåg: "Positive experiences with an open project assignment in an introductory programming course", In Proc. 25th International Conference in Software Engineering (ICSE'03), Portland, OR, USA, 3-10 May 2003.
- Guttorm Sindre, Tor Stålhane, Gunnar Brataas, Reidar Conradi: "The cross-course software engineering project at the NTNU: 4 years of experience", In Proc. 16th International Conference in Software Engineering Education and Training (CSEET'03), Madrid, Spain, 20-22 Mar 2003.
- Daniel Moody, Guttorm Sindre: "The Learning Effectiveness Survey (LES): An Instrument for Evaluating and Improving the Effectiveness of Learning Interventions", In Proc. Hawaii International Conference on Education (HICED'03), Waikiki, HI, USA, 7-10 Jan 2003.
- Rudolf Andersen, Reidar Conradi, John Krogstie, Guttorm Sindre, Arne Sølvberg: "Project courses at the NTH: 20 years of experience", In Proc. 7th SEI Conference on Software Engineering Education (CSEE'94), San Antonio, 5-7 Jan 1994, Springer Verlag (LNCS 750).
- John Krogstie, Guttorm Sindre: "Introducing social and ethical concern in the computer science curriculum: why and how", In Proc. 16th conference on Informatics Research in Scandinavia (IRIS'16), Copenhagen, Denmark, Aug 7-10 1993.
- Guttorm Sindre, Even-André Karlsson, Tor Stålhane: "Software reuse in an educational perspective", In Proc. 6th SEI Conf. on Software Engineering Education (CSEE'92), San Diego, CA, USA, Oct 5-7 1992, Springer-Verlag (LNCS 640).

Appendix B: HiNT publications about IT didactics and e-learning

This list shows relevant publications from the research group at HiNT which will be involved in the 2-IT centre.

Kolås, Line.

Multiple pedagogical methods in an LMS - a qualitative study. I: The Second International Conference on Mobile, Hybrid, and On-Line Learning eL&mL 2010. IEEE Computer Society 2010 ISBN 978-1-4244-5718-2. s. 41-46

Kolås, Line; Brørs, Kjell Helge; Eide, Kurt Ole; Nordseth, Hugo; Solsem, Sissel Marie. "Low-effort" use of mobile technologies and video in the classroom. I: Ed-media 2011 : world conference on educational multimedia, hypermedia & telecommunications. Association for the Advancement of Computing in Education 2011 ISBN 1880094355. s. 3043-3050

Horgen, Svend Andreas; Nordseth, Hugo.

Hvordan lykkes med wiki som pedagogisk verktøy?. I: Læringsmiljø på nett: erfaringer fra forsøk og prosjekt. Tapir Akademisk Forlag 2009 ISBN 9788251925204. s. 217-230

Nordseth, Hugo. Adopting Digital Skills in an International Project in Teacher Education. Seminar.net : Media, technology and lifelong learning 2012 ;Volum 8.(2)

Kolås, Line; Munkvold, Robin; Nordseth, Hugo.

Evaluation and Categorization of Educational Videos. I: Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2012. World Conference on E-Learning in Corporate, Government, Healthcare & Higher Education 2012 ISBN 1-880094-98-3. s. 648-657

Kolås, Line; Munkvold, Robin; Nordseth, Hugo. Evaluation and Categorization of Educational Videos.. World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education (ELEARN) 2012; 2012-10-09 - 2012-10-12

Kolås, Line; Munkvold, Robin; Nordseth, Hugo. Evaluation of EPE videos in different phases of a learning process. Cognition and exploratory learning in digital age (Celda) 2012; 2012-10-19 - 2012-10-22

Kolås, Line; Munkvold, Robin; Nordseth, Hugo. Evaluation of EPE videos in different phases of a learning process. I: Iadis international conference Celda 2012 - cognition and exploratory learning in digital age. IADIS Press 2012 ISBN 978-989-8533-12-8. s. 99-106

Kolås, Line; Munkvold, Robin; Thorshaug, Arve.

Social interaction types experienced among preschool children (age 3-5) using touch screen technology. I: Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education (2010). Association for the Advancement of Computing in Education 2010 ISBN 1-880094-83-5. s. 2365-2372

Nordseth, Hugo; Ekker, Sonja; Munkvold, Robin.

Tools for peer assessment in an e-learning environment. Seminar.net : Media, technology and lifelong learning 2010 ;Volum 6.(3) s. 324-338 HINT

Appendix A: IDI publications about IT didactics and e-learning

This list, extracted from entries in Cristin (the Norwegian system for documenting academic output) demonstrates the huge amount of publicatons that the Department of Computer and Information Science (IDI) at the NTNU has been involved in over the years. NB: Not all the authors below are affiliated with IDI, but each paper has at least one author who either is affiliated with IDI or was affiliated with IDI at the time the paper was published. In total there are more than 100 publicatins. Also, as the list indicates, there are a lot of different IDI employees involved, so the interest in evaluating, reflecting upon, and publishing about teaching is not limited to just a few person but an integral part of department culture.

1. Andersen R, Conradi R, Krogstie J, Sindre G, Sølvberg A (1994) Project courses at the NTH : 20 years of experience. Paper presented at the 7th Conference on Software Engineering Education (CSEE'7), San Antonio, USA

 Michael Bedek, Sobah Abbas Petersen, Tuija Heikura. From Competence Models to Assessment – The Role of Contextual Factors, ICALT 2011, Athens, Georgia, USA, July 2011.

- Bygstad, Bendik; Krogstie, Birgit; Grønli, Tor-Morten. Learning From Achievement. Scaffolding Student Projects in Software Engineering. *International Journal of Networking and Virtual Organisations* 2009 ;Volum 6.(2) s. 109-122 NITH NTNU
- Bygstad, Bendik; Krogstie, Birgit; Grønli, Tor-Morten. Scaffolding Project-Based Learning with the Rational Unified Process. Experience from 5 years of Student Projects in Software Engineering. I: Norsk konferanse for organisasjoners bruk av informasjonsteknologi : NOKOBIT 2006, Høgskolen i Molde 20. - 22. november 2006. Tapir Akademisk Forlag 2006 s. 141-153 NITH NTNU
- Carver, Jeffrey; Jaccheri, Letizia; Morasca, Sandro; Shull, Forrest. A checklist for integrating student empirical studies with research and teaching goals. Empirical Software Engineering 2010; Volum 15.(1) s. 35-59 NTNU
- Carver, Jeffrey; Jaccheri, Letizia; Morasca, Sandro; Shull, Forrest. Issues in Using Students in Empirical Studies in Software Engineering Education. 9th International Software Metrics Symposium; 2003-09-05 NTNU

7. Carver, Jeffrey; Jaccheri, Letizia; Morasca, Sandro; Shull, Forrest.

Using Empirical Studies during Software Courses. I: Reidar Conradi and Alf Inge Wang (Eds.): Empirical Methods and Studies in Software Engineering -- Experiences from ESERNET project, Springer Verlag LNCS 2765, Aug. 2003, chapter 6.. Springer 2003 ISBN 3-540-40672-7. s. 81-103 NTNU

 Cerinsek, Gregor, Sobah Abbas Petersen, Tuija Heikura. Competence Modelling for Context-sensitive Technology Enhanced Learning Environments in the field of Sustainable Manufacturing, *Journal of Intelligent Manufacturing*, 2011, DOI: 10.1007/s10845-011-0554-0.*pdf*

- **9.** Cowley, Ben, Michael Bedek, Claudia Rabeiro, Tuija Heikura, Sobah Abbas Petersen. The QUARTIC process model to support serious games development for contextualized competence-based learning and assessment, *Handbook of Research on Serious Games as Educational, Business, and Research Tools: Development and Design*, IGI Global Publishers.
- Dingsøyr, Torgeir; Jaccheri, Letizia; Wang, Alf Inge. Teaching software process improvement through a case study. *Computer applications in engineering education* 2000; Volum 8.(3/4) s. 229-234 NTNU
- Dingsøyr, Torgeir; Jaccheri, Maria Letizia; Wang, Alf Inge. Teaching software process improvement through a case study. International Conference on Engineering and Computer Education, 9-12 August 1999; 1999 NTNU
- 12. Duin, Heiko; Manuel Oliveira, Sobah Abbas Petersen and Klaus-Dieter Thoben. The Challenge of Learning for Networked SMEs to Increase Competitiveness in Virtual Enterprises", PRO-VE 2012, Bournemouth, UK.
- 13. Edvardsen, Lars Fredrik Høimyr; Sølvberg, Ingeborg Torvik; Aalberg, Trond; Trætteberg, Hallvard.

Using Automatic Metadata Generation to reduce the knowledge and time requirements for making SCORM Learning Objects.. I: *Proceedings from the Third IEEE International Conference on Digital Ecosystems and Technologies (IEEE DEST* 2009). IEEE Computer Society 2009 ISBN 978-1-4244-2346-0. s. 392-397 NTNU

14. Fominykh, Mikhail.

Collaborative Work on 3D Educational Content. Norges teknisk-naturvitenskapelige universitet 2012 199 s. Doktoravhandlinger ved NTNU(88) NTNU

15. Fominykh, Mikhail; Prasolova-Førland, Ekaterina; Leong, Peter. Formal and Informal Collaborative Learning in 3D Virtual Campuses. I: 6th International Conference on Collaboration Technologies (CollabTech). : Information Processing Society of Japan 2012 ISBN 978-4-915256-86-8. s. 64-69 NTNU

- 16. Fominykh, Mikhail; Valjataga, Terje; Vallivaara, Venla; Divitini, Monica. Creative Collaboration on a Media Handbook for Educators: Design of a Joint European Course. Mobile Learning and Creativity Workshop MLCW@EC-TEL; 2012-09-19 - 2012-09-19 NTNU
- 17. Fominykh, Mikhail; Prasolova-Førland, Ekaterina; Morozov, Mikhail; Gerasimov, Alexey.
 Virtual Campus in the Context of an Educational Virtual City. *The Journal of Interactive Learning Research* 2011 ;Volum 22.(2) s. 299-328
 NTNU
- 18. Giannakos, Michail; Chorianopoulos, Konstantinos; Jaccheri, Maria Letizia; Chrisochoides, Nikos.

"This Game Is Girly!" Perceived Enjoyment and Student Acceptance of Edutainment. Lecture Notes in Computer Science = Lecture notes in artificial intelligence 2012 ;Volum 7516. s. 89-98 NTNU

19. Jaccheri, Letizia; Morasca, Sandro. Involving Industry Professionals in Empirical Studies with Students. *Lecture Notes in* *Computer Science = Lecture notes in artificial intelligence* 2007 (4336) s. 152-152 NTNU

- 20. Jaccheri, Letizia; Sindre, Guttorm. Software Engineering Students meet Interdisciplinary Project work and Art. Information Visualisation 2007 NTNU
- 21. Jaccheri, Letizia; Østerlie, Thomas.

Open Source Software: A Source of Possibilities for Software Engineering Education and Empirical Software Engineering. *Proceedings / International Conference of Software Engineering* 2007 s. -NTNU

22. Jaccheri, Letizia.

On the Importance of Dialogue with Industry about Software Engineering Education. Proceedings / International Conference of Software Engineering 2006 NTNU

23. Jaccheri, Letizia; Sørtland, Bjørn; Æsøy, Knut Ove.

About Facilitation in an Interdisciplinary University Course. I: *1st International Conference on Interdisciplinarity in Education Book of Abstract.* : National Technical University of Athen and European Commission, DG Education and Culture, Socrates, Leonardo & Youth TAO 2005 s. 48-49

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24. Jaccheri, Letizia; Østerlie, Thomas.

Can we teach empirical software engineering?. Proceedings of the IEEE International Software Metrics Symposium (METRICS) 2005; Volum 11. NTNU

25. Jaccheri, Letizia.

A software quality and software process improvement course based on interaction with the local software software industry. *Computer applications in engineering education* 2002 s. 265-272 NTNU

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Software architecture project course. *FASE: Forum for Advancing Software Engineering Education* 2001 NTNU

27. Jaccheri, Letizia; Stålhane, Tor; Torchiano, Marco.

Lessons learnt from developing and changing an educational three tier system. OOPSLA'2001 workshop #23 on "The Three-Tier Architecture Pattern; 2001-10-15 NTNU

28. Jaccheri, Letizia; Lago, Patricia.

How Project-based Courses face the Challenge of educating Software Engineers. Joint World Multiconference on Systemics; 1998 NTNU

29. Kjos, Bård; Mikalsen, Arne B.; Tepfers, Camilla Ac; Davidsen, Claude Marie; Hestmann, Einar; Maribu, Geir; Sindre, Guttorm; Haugen, Nils Erland Leinebø; Borgersen, Per.

Innføring i informasjonsteknologi. : TAPIR 1998 (ISBN 82-519-1316-0) 356 s. HIST NTNU

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Learning at your Leisure: Modelling Mobile Collaborative Learners, Proc. of the 4th International Workshop on Modeling and Reasoning in Context (MRC 2007), Roskilde, Denmark, 20-24 August 2007, ISSN 0109-9779.

31. Kofod-Petersen, S. A. Petersen, G. G. Bye, L. Kolås, A. Staupe.

Learning in an Ambient Intelligent Environment - Towards Modelling Learners through Stereotypes, Revue d'intelligence artificielle : Revue des Sciences et Technologies de l'Information, Vol. 22, No. 5, October 2008.

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A personalized E-learning Interface. I: EURONCON 2007 - The International Conference on "Computer as a Tool". IEEE Computer Society 2007 ISBN 1-4244-0813-X.

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33. Kolås, Line; Staupe, Arvid.

The E-learning Circle – a holistic software design tool for e-learning. E-learning and Education 2010

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Kolås, Line; Staupe, Arvid.

The PLExus Prototype: A PLE realized as Topic Maps. I: The 7th IEEE International Conference on Advanced Learning Technologies. IEEE Computer Society 2007 ISBN 076952916X. s. 750-752

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Kolås, Line; Staupe, Arvid; Sterbini, Andrea; Temperini, Marco.

The QUIS Requirement Specification of a next generation e-learning system. I: IADIS International conference proceedings E-learning 2007 Volume II. IADIS Press 2007 ISBN 9789728924423. s. 188-193

34. Kristiansen, Anders; Storlien, Andreas; Mora, Simone; Krogstie, Birgit R.; Divitini, Monica.

Mobile and Collaborative Timelines for Reflection. I: Proceedings of the International Conference Mobile Learning 2012. IADIS Press 2012 ISBN 978-972-8939-66-3. s. 213-221

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35. Krogstie, Birgit R..

Representations of a project process as a means for reflection. International Reports on Socio-Informatics (IRSI) 2010; Volum 7.(1) s. 308-320 NTNU

36. Krogstie, Birgit R.; Divitini, Monica.

Supporting Reflection in Software Development with Everyday Working Tools. Computer Supported Cooperative Work 2010 s. -NTNU

37. Krogstie, Birgit R..

The work-reflection-learning cycle in software engineering student projects: Use of collaboration tools. : NTNU 2010 (ISBN 978-82-471-2025-5) 212 s. NTNU

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A model of retrospective reflection in project based learning utilizing historical data in collaborative tools. I: Learning in the Synergy of Multiple Disciplines - 4th European Conference on Technology Enhanced Learning, EC-TEL 2009, Proceedings. Springer 2009 ISBN 9783642046353. s. 418-432 NTNU

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Do's and dont's of instant messaging in students' project work. I: Proceedings fra NOKOBIT 2009 - Norsk konferanse for organisasjoners bruk av informasjonsvitenskap. Tapir Akademisk Forlag 2009 ISBN 9788251924931. s. -NTNU

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Using Project Wiki History to Reflect on the Project Process. I: *Proceedings of the* 42nd Hawaii International Conference on System Sciences. IEEE Computer Society 2009 ISBN 978-0-7695-3450-3.

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Shared timeline and individual experience: Supporting retrospective reflection in student software engineering teams. I: *Proceedings of the 22nd IEEE Conference on Software Engineering Education and Training*. IEEE Computer Society 2009 ISBN 978-0-7695-3539-5. s. -

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The Wiki as an Integrative Tool in Project Work. the 8th International Conference on the Design of Cooperative Systems; 2008-05-20 - 2008-05-23 NTNU

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Power through brokering: open source community participation in software engineering student projects. *Proceedings / International Conference of Software Engineering* 2008 s. 791-800 NTNU

44. Krogstie, Birgit; Bygstad, Bendik.

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Moody, Daniel; Sindre, Guttorm. Evaluating the Effectiveness of Learning Interventions: An Information Systems Case Study. 11th European Conference on Information Systems (ECIS 2003); 2003-06-21

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Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE 2003); 2003-07-02

- 50. Moody, Daniel; Sindre, Guttorm. The Learning Effectiveness Survey (LES): An Instrument for Evaluating and Improving the Effectiveness of Learning Interventions. 1st Annual Hawaii International Conference on Education; 2003-01-10
- 51. Morken, E.M., Divitini, M., Haugaløkken, O., and Petersen, S.A. Learning Pedagogy in the Field: Social Structures, Interactions, and Mobility, HCI International 2005, Lawrence Erlbaum Associates, Inc, Las Vegas, Nevada, USA, 2005.
- 52. Natvig, Lasse; Line, Steinar. Age of computers: game-based teaching of computer fundamentals. SIGCSE Bulletin inroads 2004 ;Volum 36.(3) s. 107-111
- 53. Natvig, Lasse; Line, Steinar; Djupdal, Asbjørn. AGE OF COMPUTERS: AN INNOVATIVE COMBINATION OF HISTORY AND COMPUTER GAME ELEMENTS FOR TEACHING COMPUTER FUNDAMENTALS. 34th Annual Conference Frontiers in Education; 2004-10-20 - 2004-10-23

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Challenges and Opportunities in Evaluating Learning in Serious Games: A look at Behavioural Aspects. SGDA 2012. Bremen, Germany, September 2012.

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Connectedness in Practice-Based Education: The Why, Who, What. I: *MLearn2010 Mobile Learning Conference Proceedings*. Malta: University of Malta 2010 ISBN 978-99932-0-937-9. s. 92-99

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From University Students to a Community of Learners: Can Blogs Support this?, IADIS International Conference on Web-based Communities 2007, Salamanca, Spain, February 2007.

58. Petersen, Sobah Abbas; Anandsivakumar Ekambaram. Learning by playing - the role of serious games in competence development in project management, 26th IPMA World Congress, October 2012, Greece.

- 59. Petersen, Sobah Abbas; Tuija Heikura. Modelling Project Management and Innovation Competences for Technology Enhanced Learning. eChallenges 2010, Warsaw, Poland, October 2010.
- Petersen, Sobah Abbas; Emma Procter-Legg; Annamaria Cacchione. LingoBee – Crowd-sourced Mobile Language Learning in the Cloud. IADIS Mobile Learning, 14-16 March, Lisbon, Portugal. *To be presented*.
- 61. Petersen, Sobah Abbas; Emma Procter-Legg; Annamaria Cacchione. Creativity and Mobile Language Learning using Lingobee. Special edition of *International Journal of Mobile and Blended Learning* on Mobile Learning and Creativity. *Submitted*.

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Mobile Language Learning and Creativity". Mobile Learning and Creativity Workshop MLCW@E-TEL, Saarbrucken, Germany, 19-21 September 2012.

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Personalised Language Learning on Mobile Devices, Proc. of 5th International Conference on Wireless, Mobile and Ubiquitous Technologies in Education (WMUTE2008), Beijing, China, 23-23 March 2008.

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Mobile Community Blog: Enhanced Blogging Capabilities for Mobile Collaborative Learners, Technical Report No. 07/06, IDI, NTNU, ISSN: 1503-416X, December 2006.

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Language Learning: from Individual Learners to Communities, IEEE International Workshop on Wireless and Mobile Technologies in Education WMTE 2005, Tokushima, Japan, 28-30 November 2005.

74. Petersen, Sobah Abbas, Kofod-Petersen, A.

Learning in the City: Context for Communities and Collaborative Learning, 2nd International Conference on Intelligent Environments IE06, 5-6 July, Athens, Greece.

- 75. **Prasolova-Førland, Ekaterina; Fominykh, Mikhail; Wyeld, Theodor G.** Virtual Campus of NTNU as a place for 3D Educational Visualizations. I: Global Learn Asia Pacific (Global Learn) 2010, proceedings of. Association for the Advancement of Computing in Education 2010 ISBN 1-880094-79-7. s. 3593-3600 NTNU
- 76. Prasolova-Førland, Ekaterina; Wyeld, Theodor G; Fominykh, Mikhail. Virtual Campus of NTNU as an Arena for Educational Activities. Software Engineering and Applications 2010; Volum 688. s. 244-251 NTNU
- 77. Procter-Legg, Emma; Annamaria Cacchione, Sobah Abbas Petersen. Lingobee and Social Media: Mobile Language Learners as Social Networkers. CELDA 2012, Madrid, Spain, September 2012.

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Distance Education in the Maldives: Learner Support for Students in Island Communities, IEEE 4th International Workshop on Technology for Education in Developing Countries TEDC 2006, Iringa, Tanzania, July 10-12, 2006.

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Experimental Validation of the Learning Effect for a Pedagogical Game on Computer Fundamentals. *IEEE Transactions on Education* 2009 ;Volum 52.(1) s. 10-18 NTNU

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Experience. 16th Conference on Software Engineering Education & Training (CSEE&T 2003); 2003-03-22

85. Staupe, Arvid.

Experiences from Blended Learning, Net-based learning and Mind Tools. Seminar.net : Media, technology and lifelong learning 2010 ;Volum 6. Suppl. 3

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