Technucation

Technology and innovation in nurses and teachers education and workplace activity

Bilag B. Technucation: Technological Literacy and new employee driven innovation through education

1. **Scientific summary (20 lines)**

How can education provide skilled practitioners capable of using and driving technological innovation within the public sector? The basic idea of the "Technucation"-project is that new knowledge of how employees learn to understand, use, tinker with, innovate or reject technology in their everyday work life can be used to improve the technological literacy of future employees in the public sector and thus prepare them better as drivers of technological use and innovation in the public (and private) sector. The project results will be an answer to the future challenges of the public welfare system in Denmark and Europe and point the way for global changes within education strategy in the face of technologically influenced practice. According to the EU2020-plan, developing competencies in using and innovating technologies is decisive for the continued growth of society. The theoretical focus of the project is on how practice-based learning processes embedded in situated and embodied human-technology interaction can be used to develop a new concept of technological literacy (e.g. socio-technological literacy).

Methodologically the project will experiment with new forms of knowledge production connecting university based research, professional education, workplace practice and technological innovation in the establishment of a Living Lab. The relation between practice-based learning, technological literacy and innovation will be examined through two basic questions: A) How can knowledge of how technology is used in the everyday practice learning of the workplace improve technological literacy and capacity for innovation in professional education within two welfare areas – nursing and teaching? B) How can we theoretically develop the concept of technological literacy though research in practice-based learning at the workplace and in professional education?

 (20 lines)

The main objective of the Technucation-project is to strengthen the quality of the technological literacy teaching in teachers and nurses' education by using insight from practice-based learning so they learn to meet the future requirements of constantly changing new technological innovations in the private as well as public sector with improved technological literacy and potential innovation capacities. This objective can be achieved by making the 'black box' of professionals everyday practice based and embodied learning experiences with technology available for educational purposes. The project aim at a better understanding of the ways everyday socio-material relations with technologies influence the learning and practice of teachers and nurses and development of a Living lab methodology on how can we rethink professional education to account for technological influences upon practice learning and so accommodate employee driven innovations. In order to enhance technological literacy and innovation capacity the project also aims at finding better theories (mainly on practice-learning of situated and embodied human-technology interactions) and use these to create and test educational tools furthering creativity, entrepreneurship and capacities to generate innovation through research based knowledge of technological literacy from education and workplace.

 (15 lines)

In the Technucation project, a carefully selected group of institutions, researchers, educators and consultants expect to:

1. Establish a basis for cross-institutional research resulting in the development and test of general teaching tools (e.g. computer simulation and textbooks) as well the development of an improved concept of technological literacy which includes knowledge of practice-based learning. The new approach will enhance nurses and teachers capacities for using and innovating workplace technology through an inclusion of research based knowledge of real-life human-technology interactions at the workplace everyday life.

2. Establish a new methodology for Living Lab which will engage academic researchers with skilled practitioners and other stakeholders in the public sector (nursing and teaching) to directly influence the quality of Danish education of public sector workers across sectors through a Living Lab.

3. Establish new assessment tools for a systematically assessment of how general knowledge of practice-based learning in human-machine interactions can improve professional education of nurses and teachers in relation to technological literacy and potential innovation capacities.

4. New and improved general theoretical knowledge of practice-based learning in human-machine interactions, which is drawing on empirical research comparing likenesses and differences in nurses and teachers everyday real-life understanding, use, tinkering with, innovation of or rejection of technology.

The basic hypothesis of the project is:

That an improved concept of technological literacy (e.g. 'socio-technological literacy'), which includes general knowledge of everyday situated and embodied practice-learning, will help future nurses and teachers to develop a relevant technological literacy enhancing professional knowledge, capability, critical thinking and decision-making when encountering and designing new kinds of technological solutions to problems considered relevant from an everyday professional point of view.

As judged from study plans and Danish ministerial orders concerning professional education of nurses and teachers there is no systematic teaching of technological literacy and none which include knowledge of practice-based learning (e.g. BEK nr 29 af 24/01/2008 and BEK nr 408 af 11/05/2009). Technology is primarily referred to as a tool for communication. Technological literacy is, however, far more than the ability to use technological tools. It involves the application of both knowledge and abilities to real-world situations as well as changes in attitude, values and beliefs that develop confidence for ongoing learning (e.g. Phelps, Graham and Kerr 2004; Garmire & Pearson 2006). For the purposes of this project, we use the definition proposed by Garmire and Pearson in *Tech Tally*, where technological literacy is described as having three interrelated dimensions. The "knowledge dimension" of technological literacy includes both factual knowledge and conceptual understanding. The "capabilities dimension" which relates to how well a person can use technology (defined in its broadest sense) and carry out a design process to solve a problem. And the "critical thinking and decision-making dimension" which has to do with one's approach to technological issues (Garmire & Pearson 2006, 1-18). Technucation will add to this definition a research-based focus on the cultural, embodied and practiced-based learning putting a spotlight on the changing cultural-historical tacit dimensions of sustainable use and potentials for new designs in real-life situations. Technological literacy must take into account that employee driven innovation of technology is an important form of embodied everyday practice-based learning (Fenwick 2003). Innovation can be defined as the everyday creation of "new solutions, new approaches or new ideas" (Fenwick 2003, 123). All employees have potential capacities for innovation (Høyrup 2010) but cultural barriers also play a part in relation to whom and what is recognized as innovative at the workplace (Hasse & Trentemøller 2008). Practice-based learning is the processes by which human capacities are expanded (Engeström 2001); it is what happens when we try to make sense of our available world, and workplace, as it changes (Edwards 2002). In a practice-based learning theory working, learning and innovating are closely bound up with each other in a work setting, in local practices, and in the culture of those practices (Gherardi, Nicolini & Yanow 2003). Technological innovation must be translated into embodied techniques (Ihde 2010). Complex understandings of everyday practice-learning can be theorized and understood (Chaiklin & Lave 1993). To integrate technology into everyday practices, the employees must not simply learn to read a manual but learn to relate to human-machine reconfigurations in general (Suchmann 2007).

In the public sector action plans and earmarked funding from the Danish Government have generally favored research in the development of innovative technology seeking to transform the public sector in the years to come, but surprisingly often research in employees understanding, using and innovating technology are disregarded not only adversely affecting the efficiencies and use of the technologies but importantly changing the nature of established practices and their consequences in unforeseen ways. A higher degree of employee driven innovation combined with a more adequate education in innovation and technology skills has, however, been demanded in some state-documents on welfare technology (e.g. Velfærdsteknologi – på vej til ny vækst, Dansk

Vækstråd, 2009). International research show how technological literacy can improve students' understandings of technological solutions (ITEA 2000). Nevertheless, as yet, the relation and interrelation between technological literacy, technology driven and employee driven innovation at teachers' and nurses' education and workplaces constitute an unexplored area. In terms of developing human resources and competencies, innovation management in the public sector has been accentuated. Very little has been done to explore the area of employee driven innovations (Høyrup 2010). Even less has been done to enhance employee driven innovation in the public sector through enhanced technological literacy in professional education. Our knowledge of the general technological literacy of in-service teachers and nurses technological literacy is dismal apart from some studies of the practical (or lack of) use of IT-communication. Knowledge of technological literacy in professional teachers and nurses' education is, also internationally, at its infancy. The scarce available research indicate however, that education is not in sufficient measures teaching future professional nurses and teachers to keep up with and possibly be ahead of the changing technological conditions and challenges of a globalized and perpetually technologically dominated world (see e.g. Garmire & Pearson 2006).

Several studies have indicated that unreflective and unabashed enthusiasm about
the necessarily transformative nature of new information technologies is both naïve and historically unfounded (e.g. Watson 2006, Cuban 1986, 2001, Kozma, 2003 and PISA, OECD, 2006, Krumsvik 2008). The studies indicate the difference between the rhetoric for change using technology (primarily ICT) and the reality of the actual use. In the public sector many employees, also among nurses and teachers, rather experience science anxiety than technological literacy in their everyday life (e.g. Dakers 2006, deVries, Custer, Dakers, Martin, 2007). Raw data material from The Danish Technological Institute, Center for Human Resource (CA), show that even when innovative technology is tested on the users, many of the employees at schools, hospitals and nursing homes are not prepared for the anticipated technological development. A few studies have also indicated that implementation of new technology in the public sector forms comprehensive barriers in the Danish society (e.g. Strategi for styrket innovation i den offentlige sector, 2008 and Voss 2009). Thus, research based knowledge of everyday barriers and potentialities is needed to enable future employees to become drivers of technological implementation and innovation in ways that account for changing practices and their impact upon fundamental issues of for example learning or healthcare.

(1,5 side)

The Technucation project offer groundbreaking research in an area where systematic research based knowledge is both scientifically and societally needed. It is in itself a new aspect on innovation to focus on nurses and teachers education in relation to technological literacy which often is confounded to science teachers and students. It is also an innovation in the project to use education as a lever for making future nurses and teachers better users and drivers of technological design. The project is also a novelty in its use of the Living Lab-methodology which is addressing the development of educational prototypes rather than more narrowly technological products. Theoretically the project will add to existing knowledge of practice-based learning and learning and educational theory in general. It will also add to a deeper understanding of the relatively new concept of employee driven innovation. Not least the project will contribute with a development of assessments and improvements of the concept of technological literacy which obviously will bring innovation to the formal-education community (e.g. Garmire & Pearson 2006, 3). Comparisons between teachers and nurses fields are inherent in the project as a whole to exploit the differences and likenesses of particular professional needs in relation to general aspects of technological

literacy making the new conceptualization more generally applicable. This new approach to enhance innovative capacity of the future public sector in the Danish Welfare state by building research-based knowing about everyday barriers and potentialities into the teaching of pre-service teachers and nurses can bring about a new sustainable technological literacy in the Danish employers capacity to change and innovate in relation to ever changing global cultural environments and technologies. Real progress in technological literacy in the workplace will, however, require a decade or more of sustained effort. In that respect the project might be contributing to some of the first international research in this area and thus be considered a lever for future research. The expected impact of the research will be threefold: 1) Increase in technological literacy and competence in professionals through research-based education which place Denmark in the forefront of this research. 2) Increase in future professionals' pro-activity and competent dealing with the technological influx that is expected to solve predicted problems of lack of workforce and an aging population in welfare societies in EU2020 3) Reduction of waste of technological investments and incitement of the creation of new innovations in the public sector with spin-off to the private sector. As a side effect, the project is expected to help spur an interest in STEM-related areas among nurses and especially teachers who interact with pupils every day wherefore the project may be an efficient means of making young people engage in and study natural sciences. **(1/2 side)**

The research is conducted at 6 different sites; teachers- and nurses' education at two university colleges (UCC - teachers and Metropol - nurses), 2 schools and 2 larger hospital units. Researchers and project participants from UCC, MET, TI and DPU create on the basis of this research suggestions for new teaching tools which are developed into prototypes in the Living Lab where different stakeholders have their say. In our (renewed) version of the Living Lab we make small experiments with prototypes simulations to be used in teaching based on the researcher's general findings in hospitals and schools. Our simulations will as examples concentrate on two initial technological focal points: simulations on telecare and simulations on whiteboards (unless other examples are considered more relevant during research). We shall in the project as a whole take a point of departure in the basic literature on technological literacy and methodologies for its assessment – such as *Tech Tally* (Garmire & Pearson 2006) and Standards for Technological Literacy: Content for the Study of Technology developed by the International Technology Education Association (ITEA). We shall, as recommended in *Tech Tally*, also make use of simulations for assessing technological literacy as well as participatory and anthropological design. These assessments will supplement the surveys conducted by TI and they will also be tested in the Living Lab as well as on students as well as teachers in educational settings. Regarding the understanding of technological literacy and innovative technology, the project will draw on technological staff from the two university colleges and The Danish Technological Institute as well as summoned experts on technological literacy such as expertise Elsa Garmire and Lucy Suchman (se budget notes). In terms of developing an understanding of employee driven innovation, the project will draw on the DPU-based network for employee driven innovation (www.dpu.dk/edi) as well as several of the Danish and International researchers who are members of this network. In relation to practice-based and embodied learning, which is at the basis of the renewal of the concept of technological literacy in teachers and nurses' education, the project draws on a number of renowned international researchers especially Don Ihde, Anne Edwards, Tara Fenwick and Seth Chaiklin. As a novelty the project shall combine the Change Lab methodology developed by Yrjö Engeström with that on Living Lab.

Methodology of Change Lab
To develop and test a new teaching methodology and new technological literacy teaching tools, which focus on a renewed theoretical understanding of technological literacy as it unfolds in everyday life, the project will in the first phases create research data in an way as described by Engeström as an 'expansive cycle' at schools and hospitals (expected at Rigshospitalet and schools in Ballerup municipality). The 'Change lab' methodology is especially designed to enunciate and work on otherwise tacit knowledge of everyday life and in subsequent phases do collaborative work to improve a particular workplace (Engeström *et al.*1996). In the first phase researchers create data-material involving (video-filmed when possible) situations involving use of technology at nurses and teachers workplaces and educational institutions. The project will especially focus on interactive whiteboards (in Ballerup municipality SMARTboards are installed in almost all schools) and use of mobiles and of telecare technologies as e.g. heart meassuring devices or telecare diagnostics (used in different sites at Rigshospitalet) in the workplace research. Through follow-up interviews in this phase clarification are made as to what is observed and misunderstandings on the researchers part cleared as far as possible. Around 60 usable and video-taped situations and 60-100 subsequent interviews are expected as an outcome of the research as well as extensive field-notes. In the methodology of the Change Lab the workplace would further be enhanced by expansive learning through seminars with employees, e.g. schoolteachers or nurses, discussing past, present

and future in relation to the development of a new shared object of workplace activity (Engeström 1987). We will apply the first phases of the Change Lab to this project and if possible also include shared meeting with the employees at the respective workplaces and educations. The main objective is different, however, as our intention is not to develop particular *workplaces* (educational institutions or other workplaces) or particular *technologies* but to improve general technological literacy in education through knowledge of everyday practice-learning. Therefore we combine the Change Lab methodology with that of the Living Lab where it is the aim to bring together different stakeholder from different workplaces, backgrounds and educations to experiment together.

Methodology of Living Lab
In our project the Living Lab methodology will be used to broaden and challenge established ways of thinking about socio-technological relations within contexts of learning and healthcare in ways that can offer actionable new insight and forms of practice through the Living Lab. Living Lab we understand as a shared activity which in our case involves researchers, teachers, nurses, educators, students, patients, study-leaders, government representatives, managers and representatives of SME's and larger enterprises and other stakeholder who will participate in the development and testing of prototypes based on the research. Here we shall initiate the development of prototypes in Living Lab methodology by discussion of what prototypes of educational tools for developing technological literacy could look like when the research results of the first phase of the project are taken into account. There is an inherent gender-aspect to the project which will be included in discussions and experiments when needed. A Living Lab is a developmental research methodology, promoted by the European Research Area, which embed novel technologies in real-life settings and aspire to reveal learning through ongoing conversations and debates between participants (Eriksson et al. 2006). As a learning environment Living Labs comprises multiple stakeholders and actors. Fluid, evolving goals, sense-making and negotiations are key features of the Living Lab approach. The concept of Living Labs is evolving, but an emerging trend is to see Living Labs as a way to explore the creative potential of the users of innovation. Instead of being recipients of the outcome of innovation and development, users may be engaged in co-creative innovation processes of a Living Lab "sensing, validating and refining complex solutions in multiple and evolving real life contexts" (Schumacher & Feurstein 2007:1, see also Peltomäki 2009, Følstad 2008, Markopoulos & Rauterberg 2000). Where and how the actual Living Lab methodology will be applied will depend on the initial phase of ethnographic research in the change labs, which will make tacit knowledge explicit through social interaction (Brown & Duguid 1996). We plan, however, to gather stakeholders at MET to work on the development of simulations of how everyday life practices-based learning and tacit knowledge explicated could be used to improve the technological literacy of nurses and teachers understanding, use and development telecare and SMARTboard technologies. The simulations will be produced as small 'incidents' with an actor and involve computer-based 'try-for-yourself' situations where participants have to struggle with real-life dilemmas in relation to technology as well as written text-book material.

Quantitative methods
The project aims at making assessment which can show the effects of the project results on real-life students as well as in-service teachers and nurses. To assess the present level of technological literacy in teachers and nurses education in a baseline study we shall apply the method used by Garmire & Pearson and chose from the relevant 28 instruments they propose to build assessment on (Garmire & Pearson 2006). Building on the *Tech Tally* recommendations adapted to the assessment of teachers and nurses technological literacy the project construct a relevant net-based survey that can function as a baseline study as well as the construction of an effect measurement of the

enhanced understanding of technological literacy and potential for employee driven innovation in the teachers' and nurses' education after applying project teaching tools. This survey will be conducted among all the nurse and teachers students and teachers of UCC and Metropol as well as on the in-service teachers and nurses connected to educational practices and facilitated by the study-leaders and therefore a high percentage of answers are expected.

Furthermore the project will use the Living lab methodology on site at TI to develop new prototype assessment tools. To assess the level of technological literacy, after the project has produced prototype simulations, we shall apply the same method of a net-based survey supplemented with new instruments made relevant by research. These second-phase assessments of technological literacy aim at testing what kind of difference the project-based teaching tools make in relation to technological literacy in teachers and nurses basic education as well as in one or two in-service training courses offered by the project staff for in-service teachers and nurses at the project's workplace sites.

Challenges and alternatives

Diversity: It will be a challenge for the project design as well as the assessment design that levels and types of technological literacy are bound to differ among people from different social, cultural, educational, and work backgrounds. It might on this background be difficult to conduct Living Lab as well as create a workable assessment guide. The project will to solve possible problems draw on manifold experiences of project partners, and enroll experts on Living Lab when needed as well as draw the Tech Tally assessment guide developed by Garmire and Pearson with recommendation for a rigorous and systematic design of assessment of technological literacy (Garmire & Pearson 2006).

Accountability: How well or poorly students or teachers perform on an assessment can be the basis of decision making about a variety of issues. We shall, through Living Labs, ensure that the assessment instruments are designed to meet the specific purposes of the project. The purpose influences both the interpretation of the results and the design of the instrument, including the type of items included and their distribution among the dimensions of technological literacy.

Resistance: Another important constraint is the possible resistance to research and assessment from teachers and nurses as well as students. The problem of research and assessing students and teachers in general will however be eased by the project design, where teachers and nurses to be researched and assessed can be found in a specific *location*— at their schools, hospitals and educational institutions — where research and assessment can be organized by the local administration. Many project participants have formerly conducted sensitive fieldworks also involving video filming and interviews among teachers and nurses with good results. It will also help the project that the institutions under investigation are also to some extent partners in the project. If the chosen research-sites prove un-collaborative new can and will be found.

Simulation-choice: We have initially chosen to look specifically at SMARTboards and heart meassuring devices or telecare diagnostics. As research proceeds we might want to exchange these for other technologies more appropriate for our purposes such as the use of mobiles in teaching.

Change and Living lab: Though some project-members have extensive knowledge of conducting change laboratories the combination of Living Lab and Change-lab is new. We shall include relevant experts as we go along to sort out any difficulties in relation to possible problems such as difficulties of 'translating' between everyday life situations and Living Lab experiment. Apart from regarding difficulties as problems to be solved we, in general regard, and use, problems as part of our research investigation.

Management: It could be a danger that DPU is involved in most work packages as well as managing the project. The responsibility for the described work in the project is however divided between the four main partners (DPU, UCC, MET, TI), and representatives from all the main

partner institutions + the international researchers will participate actively in all the work packages and form a consortium where a consortium agreement will be signed. **(3 sider)**

The project emphasizes interdisciplinary approaches and draws on Living Lab-methodology, ethnographic, comparative and collaborative methods, philosophy of science, technology and ethics. Moreover, it explicitly seeks to further the dialogue between universities, GTS organizations, workplaces, university colleges and research communities for mutual successful growth.

To reach the expected results the project expects to develop a new methodology of the Living Lab-approach. We will connect it with the more ethnographic approach of Change Labs (as developed and tested by Yrjö Engeström) which emphasize ethnographic studies of everyday interactions. We shall use this fieldwork based approach to develop experiments in a Living Lab on how employees and different stakeholders through new insight into practice-based situated and embodied learning processes can learn to understand, interact, transform and tinker with technology in new ways in everyday work life. The result of this combined approach will be new Living Lab methodology prototypes on teaching and assessment tools.

The Project Phases

The project runs through different (to some extent overlapping) phases each adding to the main objective of the Technucation-project strengthening the quality of the technological literacy of teachers and nurses education by using insight from practice-based learning.

1. Phase one: Literature review and assessment of the existing level of technological literacy among teachers and nurses at selected workplaces as well as teachers and nurse educators and students at the professional educations at UCC and Metropol.
2. Phase two: Change Lab inspired ethnographic research in workplaces and educational institutions.
3. Phase three: Living Lab methodology practiced with many different stakeholders piloting and testing prototypes of teaching and assessment tools.
4. Phase four: Testing teaching and assessment tools in real-life educational situation in nurses and teachers education – at basic level courses and in-service vocational training.
5. Phase five: Assessment of the level of literacy among teachers and nurses at selected workplaces as well as selected teachers and nurse educators and students at the professional educations at UCC and Metropol *after* using the teaching tools in students' courses and in-service vocational training.
6. Phase five: Dissemination of project results

P1 (DPU):

WP1 Management: DPU holds the overall administrative and managerial responsibility. This includes establishment of the consortium + draft for consortium agreement, establishment of calling for meetings, general overview of project proceedings and results (including reports and simulations) as well as communication procedures and the establishment of a website and other web-facilities, opening event and conference. Furthermore this work package also includes the responsibility of the international researchers and external experts' participation and contributions to the project.

WP2 Educational and workplace research: DPU hold the responsibility for supervising and carry out the phase 1 research including a review, which gives an overview of existing literature on project relevant topics, connecting the research with relevant international research networks (e.g. on learning and employee driven innovation) and guides the research and initial analysis (including comparisons) of the data from the 6 research sites as well as knowledge of selected technologies, telecare and whiteboards and their different relations to practice-based learning in schools, hospitals and educational institutions. Three DPU senior researchers (including the coordinator) will conduct research at workplaces and educational institutions. One DPU-based post.doc, with an educational as well as engineer-background, will be conducting research in both educational institutions and schools and hospitals focusing on the innovation and design aspect of improved technological literacy. Two PhD. students (connected to UCC and Metropol respectively) will concentrate their research on

teachers- and nurses education and work and also focus on conducting 'simulations' assessing teachers and students technological literacy using of whiteboards (teachers) and telecare (nurses) as living examples. Søren Riis from RUC contributes with insights of technology and ethics. International researchers who will be especially connected to the work-package of the phase one research are: Silvia Gherardi, University of Trento; Tara Fenwick, University of Stirling; Don Ihde, University of Stony Book to help analyze and elicit new knowledge of practice-based learning – including embodiment, ethics, values, emotions and workplace culture- in human-machine relations as well as teacher-nurse comparisons and gender aspects. The overall comprised writing of project results including the renewed concept of technological literacy also falls within this work package.

WP6 Dissemination and Evaluation: DPU hold the responsibility for the dissemination of project results in forms of reports, seminars and a closing conference. Furthermore this work package is also responsible for carrying out the formative evaluation of the project and facilitates the consortium in finding summative evaluators.

P2 (TI):
WP3 Assessments: The Center for Human Resources (CA) at TI is responsible for carrying out an internet-base baseline survey of technological literacy as well as testing new assessment tools and conduct a systematically assessment of how general knowledge of practice-based learning in human-machine interactions can improve professional education of nurses and teachers in relation to technological literacy and potential innovation capacities based on a new prototypes for assessing technological literacy tested by the Living Lab methodology and used to assess teaching tools at basic level courses and in-service vocational training. TI staff also participate in and contribute to the Living Labs. International researcher particularly connected to the work package is: Seth Chaiklin, University of Bath.

P3 (UCC):
WP4 Teaching Tools: UCC has the overall responsibility for the development of prototypes of new educational tools for technological literacy which can bring the situated and embodied knowing of the employees (i.e. teachers and nurses) back into use in the educational system by means of for instance 'simulations' and 'replay' of selected episodes from the workplace replayed, instructed and filmed by professional filmmakers as well as supervision of interventions in the education of teachers and nurses at selected departments of university colleges. Furthermore this work package also includes a seminar, and connecting researchers with appropriate and cooperative research sites. International researcher connected to this work-package is: Anne Edwards, University of Oxford.

P4 (MET)
WP5 Living Lab: MET has the overall responsibility for ensuring the development of a prototype of a general new methodology of the Living Lab which include a Living Lab methodology for exploring how capacities to understand, use, tinker with, innovate or reject technology are furthered in professional education, workplace environments and enterprises as well as for bridging university based research, professional education and technological innovation. Furthermore this work-package will be responsible for the combination of Change Labs with the Living Lab methodology. International researcher connected to this work package is: Yrjö Engeström, University of Helsinki. (2 sider)

Time schedule (Gantt)
(Red lines for main milestones: M1=Establishment of consortium agreement + web facilities, M2: Research guideline specifications for phase 1+2, review + hiring of PhD's. , M3= Assessment Specifications in phase 1, M4= Living Lab Specifications for phase 3, M5= Testing of Educational

and Assessment Tools in phase four, M6= Assessment of Educational Tools for phase five, M7= Conference for phase five, M8=Dissemination of a new concept of technological literacy, teaching and assessment tolls for phase 6, M9= Evaluation of the project).

8. Project's international dimension (Projektets internationale dimension), <mark>maks. ½ side</mark> ..

Beskrivelse af de internationale aktiviteter, der indgår i projektet, de internationale partnere og samarbejdet med disse samt den forventede effekt af de internationale aktiviteter – herunder betydningen for dansk forskning.

→ skriv her …

The project will contribute to international research fields in practice-based and educational learning, technological literacy and employee driven innovation with research made in Denmark, which will be a strength in gaining international recognition of the project results as the public sector and the Danish society in general is recognized as supporting the public sector and employees potentials for innovation and thus will be recognized as a particularly good example of how professional education can allow for employee driven innovation to facilitate, challenge or expand technology driven innovation (Kristensen 2010). The project collaborates closely with six carefully chosen internationally known educationalists who in different ways will contribute to ensure the project reach its main objective. They are all (apart from the philosophers Ihde and Riis) experts on practice-based learning combined with at least one other aspect of importance to the project e.g. Fenwick on innovation, professional education and workplace research, Gherardi on methodology and workplace research, Chaiklin on quantitative methodology and nursing, Edwards on methodology and teaching, Ihde on embodiment and technology and Engeström on Change and Living Labs. Other international researchers have already shown interest in the project by mail (such as Lucy Suchman and Elsa Garmire) and will be included on a consultancy basis. The project collaborates closely with the network of employee driven innovation which originated from the department of learning at DPU and today counts more than 40 international researchers as members (www.edi.dpu). Almost all work packages have been assigned international researchers chosen for their specific skills to be unfolded in the particular work-task. All of the above will contribute on the development of the projects theoretical framework and the international dissemination through participation in the writing of journal articles with the project researchers.

To secure that all project material reaches the same high standard the project develops a coherent shared methodological understanding of what can be termed qualitative research, a shared interview-guide and a shared understanding of how to approach the field. This includes a shared understanding of how to approach employees, teachers and students, how to obtain knowledge of practice-based learning without violating the employees right to privacy, how to deal with anonymity in relation to research material and published analysis and a set of guidelines for ethical questions connected to this kind of qualitative research.

Technucation raises sensitive issues about the protection of personal data or sensitive data for partners when Technucation results become public including personal data from qualitative research (interview, focus groups, etc.) as well as Living Labs. Data will be anonym zed through the use of different first names and the absence of surnames. Any contextual elements providing indirect information on particular individuals will be submitted to the concerned persons before publication. Before 'shadowing' ethnographic research, interviews, focus groups, observation etc. people will be informed about confidentiality issues and anonymization procedures. After fieldwork persons will be asked for consent in case of publication, the person will sign an acceptance form. In case of refusal some elements will be removed till the person is satisfied with the published in formations. The project coordination will stress the possible sensitive aspects of the publication and ask for a written permission when needed. Furthermore:

- The project researchers will be responsible for confidentiality of personal data and will ask for specific written consent before publication
- No data will be sold to third party

- Data will be stored securely, according to academic criteria used for the maintenance of libraries, computer facilities etc.

Anticipated results related will be disseminated to both science and society in various and somewhat overlapping ways. The topics and interrelation of technological literacy and innovation has a general interest for the wider audience of policymakers, politicians and journalists as well as educationalists from nursing, teaching and related disciplines – in Denmark, the Nordic countries and probably also in the EU and the wider international communities. The project will reach out to these groups through an opening event in Denmark where the project and its respected results are conveyed together with the launch of a public homepage, which continually will publish news from the project. Before the project closes a two day conference in two parts: The first days focus on the project results impact on innovation-policies in EU with a number of invited international speakers, the second day in Denmark with invited Danish politicians, representatives from the university colleges and unions as well as colleagues from the Nordic countries. The more specific scientific discussions of project results will be conducted through researcher's participation in international conferences and workshops, where project results will be presented and debated. Scientific results will further be disseminated in a number of publications (e.g. textbooks, PhD dissertations and international articles in renowned journals) as well as on the project website. At this website we shall also publish at least one of the prototypes developed for assessing technological literacy (an improved version of the Tech Tally suggestions) for the benefit of the general audience.

In relation to the special interest the project results will have for university colleges and vocational training institutes a particular seminar will be held presenting and debating the teaching tools (textbook and simulations of real-life human-machine interaction assessing technological literacy to match). Project results will further result in a short film (where the selected real-life situations are replayed) serving both as a teaching tool in its own right and selected scenes are included in the developed prototypes for simulations, where people are faced with real-life problems to be solved through technological literacy and innovative ideas. If project results are promising it is finally the plan to employ project results in an EU-application involving more European researchers in a similar project. If new innovations are actually made during the project TI will facilitate meetings with enterprises ready to take over the ideas for commercial purposes.

Specific outcomes of the project will include:

1. New prototypes of Living Lab-methodology, of assessment of technological literacy and of teaching tools (including texts, simulations and a short film on telecare and whiteboards) to be used in teachers and nurses education to enhance technological literacy.
2. Two Ph.D.studies and post.doc. Publications.
3. (At least) 10 international peer-reviewed articles written by project researchers (Danish and International)
4. Recommendations for further research – including possible new quantitative questionnaires.
5. A Danish opening event, a seminar and a conference presenting and discussing project results for interested parties in education, policymakers as well as commercial enterprises and the press.
6. Presentation of results in e.g. the international EDI-network as well as on a number of international conferences and networks.

Intellectual Property Rights (IPR)

The project results will be placed on a website with open access to any interested party. Anybody is free to exploit project results. Raw-data belongs to the project. Details will be specified in the written consortium agreement signed by all partners at project start.

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Participants and management

The major project decisions are made by a project consortium representing the projects four main partners DPU, UCC, Metropol and TI + a representative for the international partners. Management of the project on a daily basis is undertaken by the coordinator and her DPU staff.

The partners:

The partners are chosen from three criteria:

1) *Reasons of knowledge of teaching and learning:* to cover the challenge of developing new teaching material which includes perspectives on educational and everyday practice-based learning

2) *Reasons of expertise of technology in professional education:* to combine in the project the different technological learning competences needed to improve technological literacy in professional education.

3) *Reasons of expertise on methods and methodology:* to ensure the project capability for developing the project with the ascribed methods and methodologies according to the plan – including expertise in quantitative, qualitative and cross-disciplinary experimental methodologies.

For each of the participating partner institutions, a consortium member will coordinate activities as well as secure that the institutions specific expertise-areas in the above-mentioned fields are brought into the project to match and complete the expertise of the other institutions in the partnership. The expertises needed to obtain project results are: expertise in everyday practice-based learning, expertise in methods and methodology to explore and experiment with practice-based learning in real-life settings in relation to mundane technologies, expertise in methodology concerning quantitative and qualitative studies, expertise in technological literacy in professional education to ensure the best possible approach and analysis of technological competences, expertise in educational learning teaching material to ensure the best possible methodological approach to develop new teaching material and analysis of learning in everyday life and education, expertise in Science and Technology Studies and design to ensure the best possible approach and analysis to studies of tacit knowledge and design of technology and expertise in developmental work research (to ensure knowledge of educational research and change). These competences are included in the consortium and their cooperation with the international researchers as well as consultants brought in when needed.

Competencies of the Consortium:

The four project partners are represented in the consortium by the following representatives:

Methodology of Science and Technology in Education and work: Professor Cathrine Hasse is the coordinator of Technucation. She has an overall knowledge of all of the above-mentioned themes. She has received her Ph.D. in psychological anthropology from the University of Copenhagen studying cultural learning processes in physicists' education (2000) and a cand. scient. from the Institute of Anthropology, University of Copenhagen (1994). She further obtained an M.A. in Communication, The Danish School of Journalism (1984). She has recently completed the coordination and management of an EU-project which came out with balanced accounts. It included coordinating research of 15 researchers of different nationalities and resulted in three international publications, a praised homepage (www.upgem.dk) and a number of international journal articles. She has extensive experience in working with interdisciplinary seminars and conferences with different stakeholders and in educational research of relations between everyday learning, education, gender, science, culture, technology, students' technological literacy as well as comparative methods. She has written books and articles on physics culture, of technology and embodiment, and qualitative methods – especially on doing fieldwork on gender in academic

institutions in Europe. This work focuses on how to study everyday practice learning of physics in a gender sensitive way. Apart from cross-cultural gender studies she has been working with science and technology studies and psychological issues connected to learning, competence, tacit knowledge and cultural learning processes. Through her experience with all of the issues in the project she can contribute an overview of the complex research in the project and be the go-between communicator between partners, which will be useful in all phases of the project implementation. She furthermore has many contacts in the area of physics, and science and technology studies in general and good relations with groups of physicists and engineers (especially their women's groups) in several of the project partner countries and with the partners in former the EU-project. She has an extensive knowledge of gender studies which will be brought to bear in the project when needed. Finally this member of the consortium has a long time relationship with all of the international experts connected with the project and will ensure that at least one international member is present at the consortium meetings to ensure the international standard of consortium decisions.

Technological expertise in nurses education: Maria Wahlbom is center-coordinator of TechnaScience, Center of applied research in health- and welfare technology, at Metropolitan University College. TechnaScience focuses on user-driven innovation of new technological solutions that will be used by the welfare professions educated at University College Metropolitan. Maria Wahlbom has a cand. pharm. (2002) from Uppsala University, Sweden, and obtained her PhD in 2007 at Institute of Laboratory medicine, Lund University, Sweden. She has extensive experience of project management of projects concerning user-driven technological innovation and development of new technological solutions in the welfare society.

Educational teaching material: Lise Tingleff Nielsen is head of Department for Applied Research and Development at UCC (University College Copenhagen). UCC has apart from teachers and nurses education also specialized in short courses for teachers in need of teaching tools. Lise Tingleff Nielsen has several years of experiences as a consultant in the field of professional development and organisational learning especially among schoolteachers and has done research and development projects on topics as action learning, problem based learning and organisational learning. She has done a PhD study (on learning in teams) at The Danish School of Education and finishes her PhD thesis autumn 2010. She is engaged in facilitating applied research in partnerships between universities, university colleges and the private and public sector – with a specific emphasize on developing new methods for applied research of high analytic quality.

Technological design and quantitative methods: Henrik Vejen Kristensen, Center for Human Resource (CA), The Danish Institute of Technology is project manager and consultant at CA with a background as cand. scient.soc in technology planning from Roskilde University (2007). He has four years experience in empowering and engaging methods for better organization and sustainable technology development in both public and private sector. He has recently edited a new catalogue with concepts, methods and tools to facilitate diversity driven innovation.

The total human resources deployed for the implementation of the project will be as follows:
DPU: A project coordinator who is responsible for overall project management (together with the International Office and Institute for learning at DPU) as well as calling for and making minutes of consortium meetings, coordinating data collection in the overall project design as well as the filmed video-installations used for the teaching of technological literacy and the contact with the international researchers as well as conducting (in limited amount) research. Two senior researchers with specific expertise in qualitative research, who are responsible for coordinating and supervising

data collection in the chosen teachers and nurses' field sites in workplaces, bringing specific expertise on employee driven innovation and workplace practice-based learning and analytic capacity into the project, participating in the Living Labs, and writing up project results. One post.doc. who will work full-time for the project for three years (one contributed by DPU) carrying out data collection and analyses in the areas of in-service teachers and nurses at workplaces and technological literacy in pre-service education as well as write up project results. This post-.doc. has a PhD. from Institute of Learning (defended in October 2010) as well as expertise in technology design, is trained as an engineer, and will also play an important part in Living Lab and comparative analysis as well as writing up of project results.

RUC: One senior researcher (RUC) who is responsible for input on tacit embodied knowledge, ethics and philosophy in science of technology.

DPU/MET/UCC: Two PhD's (partly financed by MET/UCC) who will work full-time for the project and carry out data collection and analyses. One concentrates on research of workplaces on teachers use of SMARTboards used in schools in Ballerup municipality and teachers technological education at UCC. One concentrates on research of workplaces on nurses' use of Telecare at Rigshopitalet/Herlev hospital and nurses technological education at Metropol. They analyze as well as write up project results and participate in Living Lab. Both work closely together with the other DPU based researchers and partners at UCC and MET. The PhD. studying nurses will be connected with MET and help develop Living Lab methodology. The PhD. studying teachers will be connected with UCC and help develop teaching tools.

MET: One senior researcher (head of TechnaScience) will with another researcher and the PhD. connected to MET develop the Living Lab methodology and make Living Lab arrangements as well as involve study leaders and policy makers connected with nurses education in the project. They both participate in analyze as well as write up project results and participate in Living Lab.

UCC: One senior researcher will with the PhD. connected to UCC and the head of Department for Applied Research and Development develop the teaching tools and make a seminar and testing arrangements as well as involve study leaders and policy makers connected with teachers' education in the project. They participate in analysis as well as write up project results and participate in Living Lab.

TI: One project manager who is also consortium member will with two colleagues from Center for Human Resource supervise and make preliminary analysis of one net based survey of technological literacy which function as a baseline survey of technological literacy among in-service teachers and students and pre-service teachers and nurses *before* the project results are put to use. This staff will also develop new methods of assessment of project results *after* the project results have been applied in (at least) one in-service vocational training course as well as on teachers and nurses basic courses.

International experts: 6 international researchers contribute with expertise on practice-based learning, embodiment and technology, laboratory experimental practices, technological literacy and international research in teaching in teachers and nurses education and professional practices as well as knowledge of science and technology studies. Consultants from the network of employee driven innovation, as well as consultants with technical expertise of technology (on e.g. simulations) such as Elsa Garmire and human-machine interactions such as Lucy Suchman (se budget notes), as well as experts from ATV and Living Lab methodology are brought into the project when needed.

The common project language in the Living Labs will be English, and it is stipulated that all project partners (including PhD's) master this language. The project results will be published in Danish and

English. Therefore no budget for translation is foreseen unless decided by the Consortium in relation to specified work tasks.

The PhD's will be enrolled at the Doctoral School of Educational Research at DPU, which aims to create a research environment of high academic standard for PhD. students focusing on pedagogy, didactics, learning, learning cultures and identity, competence and organizational development, education systems and/or educational policy. The PhD's + post.doc and other researchers will at DPU be connected to the 'innovation force field' belonging to the programme "Organization and Learning", Institute of Learning, which hold weekly seminars on issues relating to learning and innovation (including technological design theory). The research staff will also participate in the international conferences held by the DPU-based network for employee driven innovation (www.dpu.dk/edi).

UCC: University College UCC is Denmark's biggest provider of in-service training courses and has specialized in e.g. short courses for teachers in new teaching tools (http://www.ucc.dk/cfu/) which will be a useful resource in the project. UCC also provides basic education of nurses and teachers and is engaged in a range of international projects within the Nordic and European internationalization programmes, and professional development activities through NGOs and consultancy work which will contribute to and help disseminate project results. UCC can provide the PhD students different options of fruitful relationships with the educational programmes for teachers and nurses. UCC has experience in qualifying the outcome of the PhD study by facilitating an ongoing interaction between the theoretical studies, the empirical work and the perspectives for applying the research process and results in the field of education and professional practice.

MET: Metropol provides of in-service courses for nurses, which will be a useful resource in the project as well as basic education of nurses and teachers (www.phmetropol.dk/Videreuddannelser). MET also takes a special interest in education in nature and technology and has in TECHNA Science a special resource to contribute to the project as this knowledge centre is particularly specialized in health- and welfare technology. This centre also takes a special interest in Living Lab methodology combining education, research, practice and innovation. Internationally Metropol is engaged in a number of useful networks on teachers and nurses education. Metropol can also give the PhD students different options of fruitful relationships with the educational programmes for especially nurses' education and technology.

TI: The Danish Institute of Technology has a long history of developing, assessing and testing innovative technologies and is in possession of many resources which will be of great importance for the project, which will be drawn in when needed. These include as strong expertise in conducting quantitative studies as workplaces, help to develop, implement and test technologies. The Center for Human Resource (CA) at TI already have published several studies of how employees engage with novel technologies but also possesses a hither though unpublished extensive data material on employee-machine interactions which will be put to use in the project. The project can provide researcher and PhD. students with important insights by putting this material at the projects disposal as far as it is possible in relation to other considerations.

International collaboration-partners (apart from the ones engaged in the project) and networks (apart from the ones mentioned in this application) can be found on the Danish and International participants CVs, and will include European Network of Living Labs, FIE, Frontiers in Education Clearing House as well as 4S on Science and Technology Studies.

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<u>Dansk abstrakt</u>

Sygeplejerske og lærer-studerende lærer ikke altid en brugbar teknologiforståelse. Undersøgelser peger på at manglende forståelse i nogle tilfælde kan besværliggøre brug af ny teknologi i den offentlige sektor. Forskerne i dette projekt vil derfor arbejde med at forbedre den teknologiske kompetence og forståelse - den teknologiske literacy - gennem en dybere forståelse af læringsforhold mellem menneske og teknologi i hverdagens praksis. Projektets navn er Technucation, en sammentrækning af technology og education - teknologi og uddannelse. Udgangspunktet er studier af læreres og sygeplejerskers daglige arbejde på skoler og hospitaler. Studierne vil sammen med en spørgeskemaundersøgelse blandt studerende og færdiguddannede, danne grundlag for et forskningsværksted (Living Lab), hvor alle interessenter sammen udvikler og tester prototyper af nye undervisningsværktøjer. Værktøjerne skal dels hæve teknologiforståelsen gennem undervisning af lærer- og sygeplejerskestuderende, dels gennem efteruddannelse af lærere og sygeplejersker. Technucation vil give de første pejlemærker og svar på hvordan vi kan uddanne professionsbachelorer med den nødvendige viden, forståelse og kompetencer til både at kunne bruge, og også være innovative i forhold til ny teknologi i deres arbejdsliv - at lave medarbejderdreven innovation. Projektets resultater er et svar på EU's 2020 plan, hvor udviklingen af kompetencer i at anvende og udvikle nye teknologier beskrives som afgørende for fortsat vækst.

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